

To Amy Suehrie
with compliments and thanks
Harold St. John

Monograph of
CYRTANDRA
(GESNERIACEAE)
on Oahu, Hawaiian Islands

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(195 figures in text)

INTRODUCTION

Cyrtandra is a conspicuous element in the wet forests of the Hawaiian mountains. It has long been known as one of the larger genera of higher plants, containing 64 species previously described, as well as numerous varieties and forms. To this total the writer adds from Oahu 89 species, and changes the status of 6, making a total of 159 species in the Hawaiian Islands. The next largest genera, with their number of indigenous species are: *Pelea*, 84; *Cyanea*, 64; *Peperomia*, 48; *Bidens*, 43; *Asplenium*, 35; *Dubautia*, 30; *Stenogyne*, 29; *Lipochaeta*, 26; *Phyllostegia*, 24; *Panicum*, 22; and *Polypodium*, 17.

All collectors and taxonomists have difficulties with Hawaiian *Cyrtandra*, both from the complexity of the genus, and from the inadequate presentation in the taxonomic literature. Though the species have been much studied and publications are numerous, there is no modern, usable key. The last one was that by Hillebrand in 1888. The need for a fuller and better organized treatment of the genus stimulated the research which is here presented. It was begun in 1930 by W. B. Storey,¹ when a student at the University of Hawaii, under the direction of H. St. John. Many trips were made into remote, unexplored gulches in the mountains. In 1935-1936, the writer studied and photographed important type specimens of the genus in Berlin, Vienna, Paris, Kew, Cambridge, and Washington, and subsequently the work was continued and completed by him.

This monograph was completed and submitted in June, 1958, and the few changes and additions made since then have been of a minor nature.

HISTORY

The genus *Cyrtandra* was established by J. R. and G. Forster in 1776. As summarized by T. Hosokawa (1935),² the genus extends from Siam and Botel Tobago (near Formosa) through Malaya, Malaysia, the Philippines to Queensland, Tahiti, and Hawaii. He estimates 500 species in the genus and tabulates the areas, those with the largest representations being New Guinea, the Philippines, Borneo, Hawaii, and Sumatra. He credits 57 species to

¹ Section on "Chromosome Numbers in *Cyrtandra*," pp. 31 to 33, by W. B. Storey.

² Dates in parentheses refer to Bibliography, p. 460.

Hawaii, which total should then have been 64, and now is raised to 159. It will be seen that Hawaii, though at the northeastern extreme of the generic range, has a notable development of species.

Gaudichaud in 1826-1830 described six Hawaiian species, all now known to be from Oahu, though he did not specify the island. They were well described and sumptuously illustrated, and all are still maintained. Later explorers have increased the total, the following adding to the known species from Oahu: A. Gray in 1862, H. Mann in 1867, H. Wawra in 1872, C. B. Clarke in 1883, W. Hillebrand in 1888, H. Léveillé in 1911-1912, J. F. Rock in 1917-1919, C. N. Forbes in 1920, C. Skottsberg in 1936 and St. John and Storey in 1950. Other botanists are omitted from this list as the Oahu species they published as new are all synonyms.

The important recent studies are by C. B. Clarke, Hillebrand, and Rock. Clarke (1883) published a world monograph of the family, which besides descriptions, contained a synoptical key to the sections of *Cyrtandra*, but no key of any kind to the species. He included, from Oahu, 16 species and 2 varieties, of which only two species were new Oahu ones; some of his species were based on Hillebrand collections received years before. Hillebrand in his later years traveled much in the hope of regaining his wife's and his own health. He apparently did not have late communications with Clarke of Kew. Hillebrand died in 1886, and his book was published posthumously in 1888. It contained from Oahu 14 species, and 10 varieties (including the named ones, and the lettered ones). This treatment was quite independent of the slightly earlier one by Clarke, contained more species and a more detailed record of their occurrence. It divided the genus into sections and gave a good key to the species.

The first botanist to summarize the almost simultaneous publications on *Cyrtandra* of Clarke and of Hillebrand was E. Drake del Castillo. In 1892 he enumerated (1886-1892: 251-257) the Pacific species of *Cyrtandra* and reduced several of Hillebrand's names to synonymy. He also published as a new species *C. glauca* from Kauai, based on Rémy no. 440 bis. The revision by Rock (1917-1919a) is an extensive one, including from Oahu 16 species, 12 varieties, and 1 form. Rock, who had studied the types of both Clarke and Hillebrand, did much to straighten out the confusion resulting from their almost simultaneous, independent publications. He included numerous new species and varieties based mostly on recently collected material. He accepted Hillebrand's sections, but gave no key to the species.

The present revision includes, for Oahu, 118 species, 7 varieties, 1 form, and 2 hybrids, a total of 126 taxa, excluding the hybrids. Most species of the earlier botanists are accepted unchanged, and the large number of novelties here announced are based, in most instances, on plants not previously collected. Many of the changes of status are due to fuller knowledge of the older type specimens.

GENERIC RELATIONSHIP AND TYPIFICATION

Cyrtandra J. R. & G. Forster belongs in the *Gesneriaceae*. Bentham and Hooker (1876: 994, 1,012-1,013) separated it on having only the two anterior stamens perfect, the same distinction being accepted by all later botanists. They placed it in the tribe *Cyrtandreae*, subtribe *Eucyrtandreae*, and did not indicate any closely related genus.

In C. B. Clarke's arrangement of 1883, it was a member of subtribe *Eucyrtandreae* but being the only genus with two instead of four stamens, is not closely related to the other genera. These were eight genera of southern Asia and the Pacific islands, and four genera of South America.

In 1895 the family was summarized by Fritsch in Engler and Prantl, *Natürliche Pflanzenfamilien* (1895: 162-165). He separated *Cyrtandra* from the other genera and put it all alone into the section *Cyrtandroideae-Cyrtandreae*.

Typification seems to be a necessary step. The first account of the genus, when published by J. R. and G. Forster (1776), included the new name, a generic diagnosis, a single figure, Plate 3, and the following treatment of the two species:

"Biflora. 1. *C. involucris bifloris*.

Cymosa. 2. *C. pedunculis nudis*."

Though in reversed order, with the specific epithet preceding the numeral and the abbreviation of the generic name, it is indubitable that *C. biflora* and *C. cymosa* are scientific binomials. Also the last two words of each line are the Latin diagnoses of the species. Those authors designated no type species. In 1786 G. Forster, the son, published an expanded treatment of their South Sea collections. In this article (1786: 43-44) he reduced their own genus *Cyrtandra* to the synonymy of the Linnaean genus *Besleria*, an American genus with four stamens in the flowers. In this transfer he gave no indication of typification, but he did expand slightly the description of *Cyrtandra* (or *Besleria*) *biflora*, and *cymosa*. His treatment was as follows:

Besleria

"236. *B. biflora*, pedunculis bifloris, involucro caduco inflato, foliis ovatis, integerrimis. F. *Cyrtandra biflora*. Forst. *Charact. gen.* 3. n. 1.

Taheiti.

237. *B. cymosa*, pedunculis cymosis, pedicellis bracteolatis, foliis ovatis crenatis. F. *Cyrtandra cymosa* Forst. *Charact. gen.* 3. n. 2.

Tanna."

In this, the significant character added was that *C. biflora* had the leaves entire, while *C. cymosa* had them crenate. This character was not mentioned by the two Forsters in the original description of the genus or of the two species, nor were the leaves shown on the plate. In their 1776 publication, the

Forsters included an excellent line drawing of a *Cyrtandra*, obviously made from fresh material, which shows life-sized flowers, pistil, fruits, and seeds. The illustrations of minute parts at life size, such as seeds 0.2 mm. long, caused some contemporary derisive comments on the book. In this instance, as with their other new genera containing several species, they illustrated one of the species but refrained from mentioning which of the species was represented by the plate. By using more recent, fuller information, the identity of the species represented in the Forsters' Plate 3 can be deduced. Incidentally, there is another isotype of *C. cymosa* in the München Herbarium. In C. B. Clarke's monograph (1883) there are expanded descriptions of both species with more details, based on his study of an holotype, two isotypes each, and other collections, for both species, as follows:

C. cymosa J. R. & G. Forst. of Tanna, New Hebrides, has the blades crenate, peduncles long, umbellate-cymose, many-flowered, and the corolla 1 cm. long, with a straight tube.

C. biflora J. R. & G. Forster of Tahiti, has the blades entire, the peduncles 2-7 cm. long, with a spathaceous involucre, 2-8-flowered, and the corolla 3 cm. long, having a gently curved tube.

In the original generic diagnosis, the Forsters said, corolla . . . "dein parum inflexus," thus specifying a curved corolla tube. Their Plate 3, with three drawings of the corolla, shows a noticeably curved tube. The drawing was made natural size, and shows the corolla 3.8 cm. long (or if straightened out, 4.8 cm.). Fresh corollas shrink on drying about 20 percent. Clarke measured the dried corollas as 3 cm. long. The Forsters' original Plate 3, from the size and the curvature of the corolla, surely was a drawing of their *C. biflora* of Tahiti. Incidentally, Clarke (1883: 271) lists this plate as an illustration of *C. biflora*, so he had arrived at the same correlation, but he attempted no typification of the genus.

The designation of taxonomic types was not mandatory and no one did it until early in the 19th century. The practice became more common, and now is universal, and is required by botanical law. A wide search has been made for any papers dealing with the typification of the genus *Cyrtandra*. No selection of a type is made in the important contributions by Gray (1854), Clarke (1883), Hillebrand (1888), Drake del Castillo (1892), Kränzlin (1906), Schlechter (1921, 1923), or Rock (1917-1919). The only past attempt to designate a type was by De Candolle (1845: 311) when he described the new "Untergattung I. *Eucyrtandra* . . . zu denen die Typen der Gattung *C. biflora* Forst. und *C. cymosa* Forst. gehören." His name for the subgenus indicated that it was the true *Cyrtandra*. Then he named the only two original species of the Forsters as types. That is illegal by our present International Code, as a genus must have as its type a single species.

Since only *C. biflora* J. R. & G. Forster, of the two original species, has the specified curved corolla tube, and since the Forsters' single Plate 3 is of

that species, it is here and now chosen as the lectotype of *Cyrtandra* J. R. & G. Forster.

GENERIC SUBDIVISIONS

In a large genus, grouping of the species into sections or subgenera has a phyletic value and is of practical assistance to botanists.

Alphonse de Candolle (1845: 280-285) revised the known species of the genus. He accepted as good 37 species and divided them into three numbered but unnamed sections, which were defined on the basis of the habit, whether herbaceous or shrubby, and of the fruit, whether oblong or ovate. His section no. 3 was restricted to the Sandwich (Hawaiian) Islands. He amplified the descriptions of the species published by Gaudichaud, Hooker and Arnott, Nees, and Meyen, but did not describe any new species.

C. B. Clarke in his epochal monograph of the tribe Cyrtandreae (1883) divided the 167 species of *Cyrtandra* then known into two subgenera and thirteen sections. The subgenus *Brachycyathus* was distinguished by having the calyx persistent, the tube broadly funnelform to almost hemispheric, the teeth exposed in bud. The subgenus *Macrocyathus* had, in most species, the calyx deciduous, the tube cylindrical, ovoid, or campanulate, subspathaceous or closed in bud, lobes valvate or connivent.

The thirteen sections delimited by Clarke were based principally on the leaves, their shape and their petioles, and whether alternate, or opposite and equal or one reduced, on the size and coalescence of the bracts, on the lobing of the calyx and the size of its teeth, on the type of inflorescence, and on the relative size and shape of the berry.

Though a few botanists, as J. W. Moore, and A. D. E. Elmer, have described new species without formally assigning them to definite sections, most students of the flora of Oceania have accepted Clarke's subgenera and assigned their new species to his various sections. These include such authorities as F. Reinecke, E. D. Merrill, F. Kränzlin, W. A. Setchell, E. Quisumbing, J. W. Gillespie, F. B. H. Brown, and A. C. Smith.

Kränzlin while publishing on five new species from Malaysia (1906: 275-282) accepted Clarke's sections. However, in treating the "vast section Polynesiae," he began "the process of subdividing large sections into more or less clearly defined groups of species . . ." On p. 278 he proposed a new subsection *Heteroblastae* for *C. rhizantha* Kränzlin from the Celebes, separating it from other species of the section *Decurrentes*, by having the "flowers produced on separate short branches arising directly from the subterranean stem or rhizome, whilst the leaf-bearing stem is flowerless."

In notable disagreement was J. F. Rock who, between 1917 and 1919, published an elaborate revision of the Hawaiian species of *Cyrtandra*. Since his

study was careful and detailed, his two discussions of the sections of the genus are worth quoting. He stated (1918: 260), "For the Hawaiian species the writer has adhered to the sections of Hillebrand rather than those of C. B. Clarke, who places together heterogeneous species and separates related ones. Clarke's section name *Macrosepalae* might be adopted for *C. cordifolia* and *C. Wawrai* and perhaps for *C. tintinnabula* but not for the other species. Much more satisfactory is Hillebrand's grouping based upon depth of division of the calyx." Then later he added (1919: 203), "Hillebrand's system has been adhered to rather than that of C. B. Clarke, who includes foreign species with Hawaiian species in some of his sections. The latter arrangement does not seem to be a satisfactory one, for what must be recognized as a variety of a species is to be found in a different section from that to which the species is referred. Krauflein [= Kränzlin] in his paper on the Philippine *Cyrtandrae* says that C. B. Clarke's arrangement is for the present still quite satisfactory, which of course may be true for the Philippine and Malayan species, but certainly not for the Hawaiian species."

Another dissenter from the Clarke system was R. Schlechter who described nearly 55 new species from Papua or New Guinea, in addition to the 39 previously known. He gave a detailed discussion of the sectioning of the genus (1923: 308-311) and argued that the form of the corolla, whether strongly or not evidently 2-lipped, is the most fundamental character, and so upon it he created two new subgenera. He argued that the persistence or falling of the calyx was less important and, at most, of sectional value. For the 96 species in Papua he made 16 sections, all new, and all restricted to Papua. No part of Clarke's system was satisfactory to Schlechter and so he rejected it as a whole. Schlechter continued to use his new system of sections in other publications on Micronesia and Papua (1921, 1927).

If we test Schlechter's system for its application to the Oahu species of *Cyrtandra*, we find that they fit into his subgenus *Eucyrtandra*. Within that, there are three sections which might apply to our plants—*Rhabdocyrtandra*, *Phaeotrichium*, and *Pachycyrtandra*. Close checking of the diagnoses, however, reveals that characters in the salverform, yellow or reddish corollas, numerous switchlike branches, etc., prevent the inclusion of any of the species from Oahu in any of these Papuan sections. So, it is clear that Schlechter's system is inapplicable to our local species.

There are marked differences in the cleavage and the irregularity of the corollas, but they occur in many degrees and are not easily or clearly definable. On the other hand, the formation of a calyx which splits down one side and is caducous from the fruit is a change of real evolutionary importance. The writer agrees with Clarke that this is a fundamental and practical basis for the major division of the genus. It seems to provide the best basis for subgenera, so the two described by Clarke are accepted. The fusiform shape in

the bud and the caducous habit of calyx are usually correlated. It should be noted, however, that in *C. ambigua* (Hbd.) St. John & Storey the bud and calyx are campanulate, but the calyx splits down one side while maturing. Ripe fruit has not been collected, but the calyx seems to be persistent. It will be seen that Hillebrand also felt this was of major importance, for his first grouping of his sections was on this basis, though he did not name subgenera to contain the sections with these characters. Schlechter disagreed and considered the calyx character as of only sectional value. The writer agrees with Clarke and Hillebrand that these calyx characters are the most fundamental, and in consequence, adopts the use of Clarke's two subgenera.

The choice of sections in *Cyrtandra* is not so easy. Clarke's synopsis of his thirteen sections mentions characters of the leaves, inflorescence, flowers, and fruit. It has been accepted by most subsequent botanists, especially those describing only a few local species and not concerning themselves particularly with sectioning of the genus as a whole. Clarke's synopsis is brief and, at first sight, appears workable. On the contrary, careful examination reveals that the statement of sectional characters is not consistent or comparable. For one section the nature of the peduncle will be emphasized, for another the coalescence of the bracts, for another the shape of the berries, while for another the shape of the leaf. Further on, in the systematic treatment of the species, he gives fuller descriptions of the sections. These expanded descriptions include many more details, but they are not any more comparable for all sections or any more clearly diagnostic. Fritsch (1895: 163) adopted C. B. Clarke's sections unchanged, though admitting that his sections were weakly delimited from each other. They were retained temporarily until the knowledge of the very numerous species should be more complete. Like Rock, the writer is forced to the conclusion that Clarke's sections are poorly conceived and their diagnoses unsatisfactory. Though they are the earliest ones proposed, they are unsatisfactory and confusing, so the writer, also, rejects them. Hillebrand's five sections were adopted unchanged by Rock in his revision. He added a few more details to their diagnoses, but made no material changes. The present writer also is satisfied with Hillebrand's five sections for the local species, and adopts them, adding one new one, for use in this paper. Many years after these sentences were first written in manuscript, a similar opinion was published by A. C. Smith in relation to the species in Fiji (1953: 37), that Clarke's thirteen sections "have seemed to most subsequent students highly artificial." Smith also rejected Clarke's sections and published his ten new species without assigning them to sections.

One new section, the *Verticillatae*, is described here, to make a place for members of the subgenus *Macrocyathus*, with verticillate leaves. One of these, *C. latebrosa* Hillebrand was described by Hillebrand, and included in his section *Cylindrocalyces*. Clarke (1883: 277) placed this plant as *C. longifolia*

Hillebrand var. *degenerans* (Wawra) C. B. Clarke, without mention of its whorled leaves. He put it in section *Polynesiae* which he allowed to have either opposite or whorled leaves, though in his generic description only opposite or alternate leaves were allowed.

In an interpretation of phylogeny, the subgenera and sections are of special importance. The subgenus *Cyrtandra* is clearly the most highly evolved, and is characterized by a calyx which splits laterally, then is circumscissile and deciduous at base. This is clearly a late development and not the ancestral type. So section *Cylindrocalyces* is highly evolved, not simple. Even more divergent is section *Verticillatae* with whorled leaves. Opposite leaves are usual throughout the genus, though one line of evolution in Malaya leads through species with opposite, dissimilar leaves to ones actually alternate. The other line of evolution is toward a multiplication of leaves into a verticillate arrangement, a grouping considered as indicative of the most highly evolved section.

Of the Oahu species, subgenus *Brachycyathus*, with a persistent, non-splitting calyx, would include the simpler types. The sections differ especially in the calyx structure. Section *Crotonocalyces* with the broad, shallowly lobed calyx, in some species saucer-shaped, and reflexed in fruit, represents the most extreme development, the most highly evolved type. Both deeply parted calyx and a calyx tube with shallow lobes occur commonly not only in *Cyrtandra*, but in the adjacent genera. It is difficult to be sure, but it is postulated here that the calyx with a definite tube represents the simpler type. That would eliminate the *Schizocalyces*, and to a lesser degree the *Chaetocalyces*. That leaves the section with a calyx lobed to the middle into narrow lobes, the *Microcalyces*, as the most primitive section. It also has the flowers numerous in open cymes, which seems simpler in nature than those with subcapitate arrangements and coalescent bracts which form an involucre. In this section *C. Garnotiana* is designated as the most likely simple, ancestral type.

MORPHOLOGICAL CHARACTERS OF TAXONOMIC VALUE

Roots. The roots of these small or large shrubs are doubtless extensive, but they are seldom collected and are little observed. They have furnished but little in the way of diagnostic characters. A few of the cauliflorous species produce flowers under the leaf mould, so far down on the stem that they spring from the region where stem and root blend or even from the upper part of the roots. No proof of cleistogamy appears here, and from the structure of the flowers themselves, it is improbable.

Stems. The stems are large and, when young, somewhat fleshy. Later they become definitely woody, but the large area of pith makes them weak. Each species has a characteristic stem habit, but few diagnostic characters have been chosen from these, though to one who knows the species in the wild, they make excellent field characters.

Leaves. The leaves provide numerous important and useful characters. Most of the Hawaiian species have opposite leaves, and none have the partial or complete reduction of one of the pair to make the arrangement alternate or partly so. However, in most of the species, there is a reduction in the size of one leaf of a pair or a whorl. Some leaves are sessile, others petioled, and numerous sizes and shapes occur. The margin is entire or variously toothed.

Several species have a remarkable development of the petiole bases, which are fleshy and enlarged and connate with the opposite one. The result is a fleshy ring around the node connecting petiole base to petiole base. When the time of leaf fall comes, this fleshy ring is also deciduous. As a result the two leaf scars are connected by a ring and the leaf scars are thus annular. This structure is found in one species of the section *Microcalyces*, four of the *Chaetocalyces*, and eight of the *Schizocalyces*. It is seen in a high degree of development and is conspicuous in *C. tristis* and *C. kaneoheensis*.

Pubescence. The indument is wanting or present on young shoots or persistent on stems, leaves, or inflorescence. The pubescence may be puberulent, pilose, villous, or sericeous, white or often ferruginous even when fresh, and glandular or not. Diagnostic characters occur in the pubescence, though the divergence between the meaning of the terms as used by the describer and the understanding of them by the reader, make such characters not wholly practical.

Inflorescence. It is cymose, but loose and much branched, or condensed, or little branched, or few flowered, or even reduced to a peduncle with a single terminal pedicel and flower. The bracts differ in size and shape, are free or coalescent.

Calyx. The best diagnostic and the most practical characters are found in the calyx, which is persistent or caducous, broad and campanulate or fusiform with connivent lobes, the lobes are parted or divided to various degrees toward the base. These are the primary characters chosen as a basis for sectioning the genus. Though not constant for all, the usual shrinkage of the calyx on drying is about 20 percent.

Corolla. All of our species but one have white corollas, which are subcylindric or funnelform, of various sizes, glabrous or pubescent. *C. viridiflora* is the first species in the whole genus known to have green flowers.

Stamens. They show differences in various species, but they are enclosed within the corolla tube and are not easily observed, except by the botanist in the field.

Stigma. In the Hawaiian species, the stigma is 2-lobed, the lobes flattened. Schlechter stressed the value of stigmatic differences in the Papuan species, but they all seem similar in Hawaii. Also, they are seldom obvious in herbarium specimens.

Style. This is glabrous or glandular, smooth or pubescent. These are fundamental differences, but not the most practical, as the style is visible only after the corolla falls and it too soon falls as the fruit begins to ripen. Then, in some species the style is lacking.

Ovary and Fruit. The size and shape of the white fruit is important. Most of our species have an ovoid or ellipsoid berry, but *C. brevicornuta*, *C. calpidi-carpa*, and *C. cornuta* have a unique, slender, curved cucumberlike fruit from 3.5 to 12.5 cm. long. The ovaries and fruit are glabrous, glandular, or pubescent.

UNUSUAL STRUCTURES

Basal inflorescences characterize several of the species. The tall shrubs have a cluster of leaves near the end of each branch, then are naked below. To the uninitiated they are sterile, but if the humus and litter on the forest floor is raked away, compact cymes of flowers or fruit are found near the base of the stems or on the longer roots. This basal cauliflorous habit is characteristic of *C. stupantha* and *C. kaulantha*. This same habit is found in *C. basiflora* C. B. Clarke of Borneo.

Late developing pubescence occurs in several species. Plants with pubescence usually have it in greatest quantity in the young state. As they or their parts age, the pubescence actually lessens by falling or in part being worn off, or apparently lessens by the hairs becoming more widely spaced due to the intercalary growth of the stems or leaves concerned. Many of the species of *Cyrtandra* grow in just this manner, having the young shoots densely pubescent, while the mature stems and leaves are more sparsely pubescent. Several of our species have the ovary perfectly glabrous in anthesis, but in young fruit the surface begins to develop hairs, and by the time the fruit is mature it is densely hairy. Examples are: *C. Christophersenii*, *C. crenata*, *C. kahanaensis*, *C. laxiflora*, *C. sandwicensis*, *C. triflora*, and *C. stupantha*. Such a late forming pubescence on the fruit which develops from a glabrous ovary is very unusual, but other instances have come to notice in exotic plants, as in *Disporum maculatum* (Buckl.) Britton of the southeastern U. S. and in *Ixora biflora* Fosberg of northern Queensland, Australia. The remarkable connate petiole bases have been discussed under the paragraph on leaves.

DIFFICULTIES IN COLLECTING

There are technical difficulties in collecting *Cyrtandra* specimens. Many of the species grow in gulches or deep stream gorges in the far recesses of the mountains. As nearly all the trails follow the dry crests of the ridges, access to the *Cyrtandra* habitats requires long and exhausting cutting or breaking trail, and traversing of wet and dangerous, precipitous slopes. Many of the species have large leaves, and are bulky to carry and press. Because of the

fleshiness of their tissue, they dry slowly, and only by the use of ventilators and artificial heat can good specimens be prepared. Herbage, flowers, and fruit are necessary for an understanding, and often, for an identification of a species. Flowers and fruit are often present simultaneously on a bush, but not so often on a herbarium specimen. The corollas are caducous, and all except the youngest will fall and decay while the specimen is being carried to the laboratory. Then, in press, more of the corollas fall. The older corollas turn brown and seem to deliquesce during the drying. The berries are soft and fall easily either when being carried or pressed. Because of these characteristics, special attention and methods, as bottling fresh flowers and fruit in the field, are necessary to insure the successful gathering and preserving of adequate specimens of *Cyrtandra*.

DISTRIBUTION OF SPECIES AND SUBDIVISIONS

There has been little mapping of the distribution of Hawaiian plants. The species of *Cyrtandra* are an excellent subject for such phytogeographic study. The species are numerous, a few are widely distributed on the island, and one of the Oahu species, *C. paludosa* Gaud., occurs on other islands. However, most of them are narrowly precinctive, growing in only one or in a few adjacent valleys, often only on one side of one mountain range. In order to bring out the details of these distributions, nearly all are shown on the accompanying maps. *C. Pickeringii* Gray has not been rediscovered since the type was obtained by the Wilkes Expedition in 1840-1841. The only locality stated was "Mountains of Oahu," which is also on the type sheet at the U. S. National Herbarium. The clastotype in the Gray Herbarium is without locality data. However, Gray's original manuscript which is still in the Gray Herbarium library, adds the information, "frequent on the mountains behind Honolulu, at the elevation of 1500 feet."

C. triflora was collected and described by Gaudichaud, the locality being the Sandwich Islands (100-300 fathoms alt.). He was in the archipelago 20 days and had 7 days on shore, this brief time being divided between Hawaii, Kauai, and Oahu. No other collector has found the genuine *C. triflora*. Of the six species described by Gaudichaud, five still occur in the valleys behind Honolulu; and Gaudichaud is known to have collected extensively there. Hence, it seems certain that *C. triflora* also once grew there, but is now extinct.

C. polyantha C. B. Clarke var. *ambigua* (Hillebrand) Rock was described merely as from Oahu.

C. grossecrenata St. John & Storey has been collected only once, and is without locality, though it probably came from Oahu. It is represented in the Bishop Museum by a single collection by Mann & Brigham. The sheet contains two branches, one of *C. Lessoniana* Gaudichaud var. *Lessoniana* and the other, the crenate one, of this new species. For the two is but a single label with two

collecting numbers, 441, and 723, and no indication which applies to which plant.

Other species known only from the type or from two early collections and now doubtless extinct are: *C. gracilis* Hillebrand, *C. honolulensis* Wawra, *C. laxiflora* Mann, *C. oulophylla* St. John & Storey, and *C. waiolani* Wawra var. *capitata* Hillebrand. All the other species and subdivisions are mapped. Exact localities are listed. These are based on collections giving the "ahupuaa" (small land division), or the valley, the locality, altitude and habitat. Such locality data were not recorded by the early explorers and botanists, not even by relatively recent ones. A few of the specimens collected in 1922 by Skottsberg have complete data. Since 1929 the writer and his students, and other recent collectors have made large collections and recorded for them detailed, exact data. These localities can be definitely located on a contour map.

Of the 126 species, varieties, and forms, only three cross the treeless Schofield Saddle and occur in both the Koolau and the Waianae mountain ranges. These three species are *C. Garnotiana*, *C. kalichii*, and *C. Macraei*.

Four species have been found at very low altitudes: *C. stupantha* at 190 to 200 ft., below Kaliuwaa (Sacred Falls, Kaluanui); *C. cordifolia* var. *cordifolia* at 600 ft. in Kalihi; *C. Garnotiana* at 600 ft. in Kalihi and at 630 ft. in Kahana; and *C. propinqua* at 700 ft. in Punaluu. The Kaliuwaa locality is a narrow gorge, moist and shaded, and well watered, on the rainy windward shore. These are the stations at exceptionally low altitudes. Aside from these records, the genus has seldom been noted below 1,000 ft. altitude. It occurs from there all the way to the flat swampy plateau, the summit of the highest mountain, Mt. Kaala, at 4,025 ft. The habitats are in the Koa Zone, Ohia Zone, and Cloud Zone of Hosaka (1937: 202-207, 227), and Egler (1939: 52-54). Most of the species are found in the Ohia Zone, the dense tropical rain forest of the middle slopes of the mountains. Many are localized in a single or in a few adjacent valleys. Widely distributed in the moist woods of the Koolau Range are others, such as: *C. cordifolia*, *C. degenerans*, *C. Garnotiana*, *C. grandiflora*, *C. kalichii*, *C. Lessoniana* var. *Lessoniana*, *C. Macraei*, and *C. waiolani*.

The Schofield Saddle is a barrier against the migration of these species into the Waianae Mountains, the other range of wooded mountains. It forms a low pass, now in continuous pineapple fields. Whether or not these plains were ever forested has not till now been established. An extensive search of old journals and narratives did not reveal any careful descriptions of this area. At present they are treeless and open and they make a broad sweep of gently sloping land at from 900 to 950 feet altitude. They are deeply trenched by numerous major stream gulches draining the western slope of the Koolau Range, by minor gulches draining the eastern slope of the Waianae Mts., and by Kaukonahua Stream which, starting in the middle of the Koolau Range, runs across the plains and sweeps northward past the foot of Mt. Kaala in the Wai-

anae Mts. and receives its principal streams. A neighboring stream to the south, Waikakalaua, starts in the Koolau Range, runs parallel to Kaukonahua to the far edge of the Schofield plain, then turns southward to Pearl Harbor, receiving the intermittent drainage of a large part of the southern dry section of the Waianae Mts. All principal gulches have patches of forest and possible habitats for *Cyrtandra* at lower altitudes than the 1,000-foot contour line. In earlier times, before the white man undertook intensive agriculture here, species of *Cyrtandra* might well have migrated from one range of mountains to the other. Even if the plains were then open, grassy, and too dry, the gulches, at least, were doubtless wooded and moist. Kaukonahua Gulch and its two sets of tributaries could have furnished a continuous migration route, as Waikakalaua Gulch may have for the southern section. For species able to extend into new areas, these routes should have made easy the colonization of both mountain ranges.

Are there any evidences today of former forests on the Schofield Saddle? The writer has traversed this area repeatedly and made numerous botanizing trips up its gulches. His immediate reaction was, no, there is no evidence. To make more sure, a search was made for any present evidence. Sure enough, there were remnants of forest, not in the cultivated fields, but in the gulches which streams have cut, mere narrow canyons, from 100 to 200 feet deep. Their sides are too rocky and precipitous for cultivation, though the narrow strips of alluvium that occur scattered along the bottoms are cultivated. The sides of the gulches are not, however, in virgin condition, as they are grazed by stock. In the gulches the hardy "kukui," *Aleurites moluccana* (L.) Willd. grows singly or in small groves. The search was rewarded by the finding of three groves of "koa" trees, *Acacia Koa* Gray. One was in Poamoho Gulch, at 900 feet elevation just north of Camp 9, near Brodie Junction, Paalaa. The second was in Waikakalaua Gulch, at 600 feet elevation, southeast of Dole Siding, Waikele. There were numerous trees making small, compact groves, near the upper rim of the gulch. The third was a single small grove at 800 feet altitude on the brink of the east rim of Kaukonahua Gulch, Wahiawa, $\frac{1}{4}$ mile north of the reservoir dam and above the bench mark 766. None of the trees in this grove were either very large or very old, but they appeared to be natural stands. In the center was a 15-foot bush of sandalwood, *Santalum ellipticum* Gaudichaud.

Acacia Koa is an aggressive species, spreading by seed, and rapidly extending the area of each grove by numerous vigorous root suckers. It has repossessed much of the upper, marginal pineapple fields which were abandoned about 1932. It is possible that these two groves represent new colonies, established in the last four or five decades. Even, if so, it does not alter their significance. On leaving the Schofield Saddle and traveling east into the Koolau Range or west into the Waianae Mountains, one encounters as the lowest

forest a rather open or savanna type, made up of an almost pure stand of *Acacia Koa*. With it as minor elements are the "iliahi" or "sandalwood," *Santalum Freycinetianum* Gaudichaud, the "naupaka kuahiwi," *Scaevola Gaudichaudiana* Chamisso, "aalii," *Dodonaea sandwicensis* Sherff, the sprawling "uulei," *Osteomeles anthyllidifolia* Lindley, and beautiful patches of the fern "palaa," *Stenoloma chinensis* (Linnaeus) Beddome.

The gently sloping expanse of the Schofield Saddle is only slightly lower (as little as 100 feet) than the forested mountain ridges of the Koolau Range. It receives an adequate rainfall of from 39 to 50 inches, and the soil is deep and good. There is no apparent factor to prevent the growth of a forest. It will be recalled that there are still patches of "koa" forest in the area at altitudes of 900 feet and 600 feet, the latter being on the leeward, drier slope with a rainfall of only 35 inches. Whether these colonies are remnants of former forest or only recent colonies is immaterial. They prove that the "koa" forest will develop on this saddle between the two mountain ranges. It is deduced that before the white man brought his agriculture and his grazing animals, the Koa Zone extended as a continuous forest from the Koolau Range to the Waianae Mountains, with perhaps the moister areas near Wahiawa developing areas of Ohia Zone. It is interpreted that the major gulches were well watered and developed a dense wet forest. Its moist, shady draws or side gulches would be suitable habitats for *Cyrtandra*, and there may even have been moist, shady, favorable habitats in parts of the Koa Zone on the more level parts of the plateau.

Cattle were introduced by Captain George Vancouver in 1793. From this and later introductions, the cattle multiplied and ran wild in the mountains. There is frequent and unanimous testimony that their grazing and trampling caused a widespread destruction of the native forests. In fact, in most areas the low, dry forest was completely destroyed.

By the time of Hunnewell's traverse of the Schofield Saddle in 1818, and certainly by the time of the observations by Rich and Brackenridge of the Wilkes Expedition in 1840, the destruction of the native forests had changed the Schofield Saddle from an area with continuous forest to a grassland with "abundance of food for cattle in three or four kinds of grasses," and a few "scraggy bushes of sandalwood and other shrubs now scattered over a soil fit for cultivation of sugar-cane and indigo." Now the forest is so completely destroyed that prolonged research was needed to reveal that it once existed.

Of the numerous species and varieties of *Cyrtandra* only *C. Garnotiana*, *C. kalichii*, and *C. Macraei* are found in both mountain ranges. These bicentric species have their greatest range in the Koolau Range, with few and restricted occurrences in the Waianae Mountains. There is one exception; *C. Garnotiana* is common and widely dispersed in both ranges, occurring for 22 miles along the Koolau Range and for 12 miles along the Waianae Mountains. Thus, *C.*

Garnotiana, when tested by the age and area hypothesis, should be the oldest species, being the one which has attained the widest distribution.

Mt. Kaala, the highest peak of the Waianae Mountains, has a large area of well watered rain forests on its slopes and various radiating ridges. Of the 16 species found in the Waianae Mountains, 14 are found on Mt. Kaala: *C. alnea*, *C. charadraia*, *C. cupuliformis*, *C. Frederickii*, *C. Garnotiana*, *C. hirsutula*, *C. kaalae*, *C. kalichii*, *C. longiloba*, *C. Macraei*, *C. Mannii*, *C. Vanioti*, *C. waianaensis*, and *C. Wilderi*. Northwest from Mt. Kaala the forest soon is pinched into a narrow strip along the descending, drying ridge. Towards the south there is Kolekole Pass, where a dry, grassy, treeless area occurs. The forest begins again on the upper slopes of Puu Hapapa and continues as a narrow belt on the eastern slope, just below the crest, all the way to Palikea, beyond Mauna Kapu. Only this narrow strip of territory receives enough rainfall to support a forest. There are no permanent streams or wet gulches, so the habitats for *Cyrtandra* are few indeed. In this southern part of the range are found *C. Christophersenii*, *C. fusiformis*, and the two widespread species, *C. Garnotiana* and *C. waianaensis*, the latter being found from the Piko trail northwest of Mt. Kaala to Palehua, 11 miles away at the south end of the range. The bicentric *C. Garnotiana* and *C. waianaensis* both occur for nearly the whole length of the Waianae Mountains. The former is widespread in the Koolau Range, while the latter is known only in the Waianae Mountains.

The Koolau Range shelters most of the species and varieties of *Cyrtandra*, 110 of the 126 being found there. As stated, there are a few localities in moist, sheltered valleys as low as 190 ft., but the usual lower limit is 1,000 ft. altitude. Above this level is the great expanse of mountain forests, dry on the lower areas of the leeward slopes (Koa Zone), wet, dense, tangled rain forests on the wide middle slopes (Ohia Zone), and dwarfed, wind-beaten, wet forest or scrub on the higher crests (Cloud Zone). A few species such as *C. cordifolia*, and *C. Garnotiana*, grow in wet gulches, here and there in the drier Koa Zone. These two also occur abundantly in the Ohia Zone at higher, moister levels. On the precipitous eastern face of the Koolau Range several species are found below 1,000 ft. These are *C. kalichii* which descends to 800 ft. in Kahana and in Waikane; *C. degenerans* which descends to 860 ft. in Kahana; *C. propinqua* which descends to 700 ft. in Punaluu; *C. stupantha* which descends to 190 ft. and apparently *C. waianuensis* also does so. This is not as exceptional as the low altitude stations on the leeward side, listed just previously. On the windward side, even at low altitudes there are permanent streams, wet gulches, moister conditions, and more rainfall. On the windward side from Heeia and Waiahole northwestward there are numerous valleys, some deep and extensive. In these ideal habitats many species of *Cyrtandra* are found. From Kaneohe southeastward, the windward slope of the mountains is even more precipitous, forming an almost continuous "pali" (precipice). Here there are no deep valleys, instead, in most places, there are series of mere

flutings on the face of the pali. Hence, with few suitable habitats, but few species of *Cyrtandra* are to be found.

In the high, wet Cloud Zone the species of *Cyrtandra* are few. Because of the uniform wetness, the species are not confined to gulches, but are found more generally throughout the wet forests. This is true for *C. paludosa* and *C. brevicalyx* which are the most abundant ones. Also are found *C. latebrosa*, *C. kalichii*, *C. tristis*, and *C. Lessoniana* var. *angustifolia*. The only exclusively high montane species is *C. viridiflora* which, though rare and seldom collected, occurs for 16 miles along the ridge of the Koolau Range in the exposed, wind-swept treeless crest where only herbs and depressed shrubs can withstand the buffeting of the trade winds, clouds, and rain.

The length of Oahu along the eastern side, where the Koolau Range forms an axis, is 36 miles. The length of the region above an altitude of 500 feet is 35 miles, of that above 1,000 feet is 31 miles, of the forested part of the mountains 32 miles. The generic range for *Cyrtandra* along this axis is 30 miles, extending from Kaunala Gulch at 1,000 ft. altitude to Hahaione. Several species approach this maximum extension along the mountain range: *C. cordifolia* for 28 miles, *C. kalichii* for 24 miles, *C. latebrosa* for 23 miles, *C. Macraei* for 21 miles, *C. degenerans* for 19 miles, *C. waiolani* var. *waiolani* for 17 miles, *C. viridiflora* for 16 miles, and *C. Garnotiana* for 16 miles.

Several species in addition to those just mentioned have an extended distribution over a considerable part of the length of the range: *C. brevicalyx*, *C. calpidicarpa*, *C. calycoschiza*, *C. grandiflora*, *C. Lessoniana* vars. *Lessoniana* and *koolauloaensis*, *C. paludosa*, and *C. propinqua*.

The Koolau Range is divisible into different halves. The southeastern part contains the highest peak, Puu Konahuanui, 3,150 ft. altitude, but has the conspicuous precipice on its windward side, while its leeward side with gentler sloped secondary ridges is dissected by large, deep valleys, and the crest line is jagged with sharp toothlike peaks and deep passes between them. The northwestern half on the windward side has long secondary ridges and a minimum of cliffs, whereas the leeward side has long, gradual secondary ridges separated by narrow V-shaped valleys that have not cut back to disturb the continuous, gentle profile of the mountain crest. This has been well described by H. S. Palmer (1955) who designates the southeastern part as K1 and interprets it (see Fig. 1) as the older and much more eroded part. The northern boundary is about on a line crossing the mountains between Kipapa and Wai-anu. The northwestern half he designates as K2, a younger, less eroded section of the mountains.

As already indicated there are 8 species of *Cyrtandra* of extended distribution on the Koolau Range, four of them occurring abundantly and continuously for nearly its whole length, while the other four are found sporadically with marked intervals, but with total distribution along much of the range's length.

The distributions of all the Oahu species have been studied, and some of them are definitely correlated with the two geologic areas K1 and K2 of Palmer (1955: Fig. 19; and our Fig. 1).

Occurring only in the K1 area on both windward and leeward sides of the mountains are: *C. Garnotiana* (which is also in the Waianae Mountains) and *C. grandiflora* f. *grandiflora*. Others of this same area, but occurring only on the leeward side are: *C. kipapaensis*, *C. Lessoniana* var. *Lessoniana*, and *C. tristis*. It is of interest that *C. Garnotiana*, which the writer postulates as the ancestral one here, and which is widespread in the still older Waianae Moun-

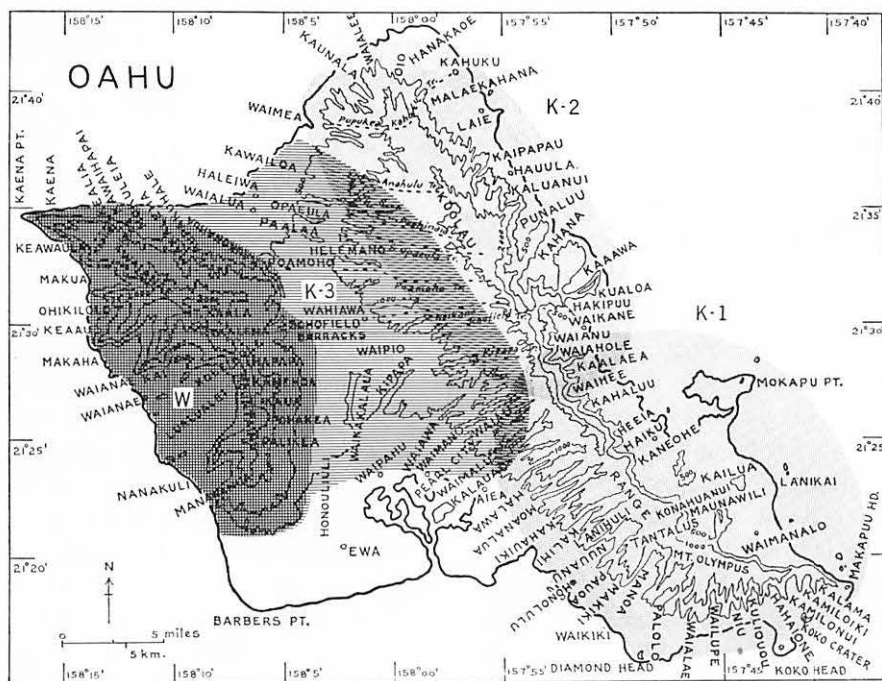


FIGURE 1.—Geologic areas of Oahu (after Palmer, 1955).

tains, is to be found in the Koolau Range almost wholly in the K1 section. Also restricted to the K1 region, but with a range of only intermediate length (one of several valleys or ridges) and only on the leeward side, are three more: *C. niuensis*, *C. paloloensis*, and *C. sandwicensis*.

Restricted to the northwestern end from Waianu northwestward, the K2 area, occurring commonly and nearly throughout and on both sides of the range are found: *C. brevicalyx*, *C. calpidicarpa*, *C. calycoschiza*, *C. Lessoniana* var. *koolanloaensis*, *C. leucocalyx*, *C. propinqua*, and *C. stupantha*. Besides the forementioned species which are distributed for nearly the whole length of the

K2 region, there are others, also restricted to that area. They have a considerable north-south distribution, but do not cover the whole area. These occur only on the windward slope of the mountains. They are: *C. axilliflora*, *C. cornuta*, *C. rivularis*, and *C. subumbellata*. One other, *C. basipartita*, is found on both sides of the range. None of the species with wider ranges are restricted to the leeward side. As pointed out by Palmer (1955: 315-316) there are no significant rainfall differences between the K1 and the K2 sections, each receiving abundant rainfall throughout the upper parts of the whole range. The rocks in both K1 and K2 are basalt, and the derived soils are similar. The climatic and edaphic characteristics are similar in both. It seems that the only real difference between the two areas is their age, K1 being the older, K2 being the younger. Another group contains 10 species with ranges of intermediate length. They are found on both sides of the range. These are *C. adpressipilosa*, *C. atomigyna*, *C. calycoschiza*, *C. hyperdasa*, *C. intonsa*, *C. oblanceolata*, *C. perstaminodica*, *C. pubens*, and *C. pupukeaensis*.

The species of *Cyrtandra* on Oahu are in great majority narrow endemics which have not the ability to gain wide dispersal. Out of the 110 taxa in the Koolau Range, only 21 have wide ranges. Of these 8 occur throughout the length of the range. Of the others, 6 occur only in the southeastern K1 section; and 7 only in the northwestern K2 section. Then one can add to the K1 region 3 species there restricted, but with ranges of intermediate length. Also there can be added to the K2 region 5 species with ranges of intermediate length. This adds 8 more species to the 21, giving a total of 29 species whose ranges fall within the boundaries of the K1 or the K2 regions. This seems to be a significant correlation between plant distributions and the geologic age of the two sections, especially as there is no barrier to plant migration at the boundary between K1 and K2 which abut to form a continuous and straight range of mountains. Summing up all of these species with wider ranges, the total is 39 in the Koolau Range, besides the 16 in the Waianae Mountains. The residue of species in the Koolau Range is 70 species. These are the narrow endemics, occurring in a single valley or on a single lateral ridge with its two adjacent valleys. Of these, the following 30 are restricted to localities on the windward side of the range: *C. alata*, *C. arcuata*, *C. brevicornuta*, *C. campaniformis*, *C. caudatisepala*, *C. crassior*, *C. crenata*, *C. elliptisepala*, *C. ferrocolorata*, *C. Fosbergii*, *C. infundibuliformis*, *C. kahanaensis*, *C. kahukuensis*, *C. kaluanuiensis*, *C. kaneoheensis*, *C. kaulantha*, *C. koolauensis*, *C. longicalyx*, *C. oahuensis*, *C. partita*, *C. Pearsallii*, *C. plurifolia*, *C. Rockii*, *C. sessilis*, *C. subumbellata* var. *intonsa*, *C. turbiniformis*, *C. villicalyx*, and its variety *pubentigyna*, *C. villosa*, and *C. waianuensis*.

The following 40 species are the narrow endemics of the leeward side: *C. ambigua*, *C. Bryanii*, *C. carinata*, *C. chartacea*, *C. collarifera*, *C. cordifolia* var. *brevipilata*, *C. dentata*, *C. ellipticifolia*, *C. ferruginosa*, *C. Garberi*, *C. gracilis*,

C. grandiflora f. *verticillata*, *C. Hosakae*, *C. infrapilosa*, *C. intrapilosa*, *C. intravillosa*, *C. kailuaensis*, *C. laevis*, *C. laxiflora*, *C. Lessoniana* var. *angustifolia* and var. *intrapubens*, *C. linearis*, *C. megastigmata*, *C. nubicolens*, *C. olivacea*, *C. opeaulae*, *C. oulophylla*, *C. piligyna*, *C. poamohoensis*, *C. polyantha*, *C. pruinosa*, *C. reflexa*, *C. scabrella*, *C. Skottsbergii*, *C. subcordata*, *C. subintegra*, *C. subrecta*, *C. villosiflora*, *C. waiolani* var. *capitata*, and *C. waiomaensis*. So, of the 110 species in the Koolau Range, 70 are narrow endemics; of the 16 species in the Waianae Mountains, 13 are narrow endemics. These narrow endemics total 83 species and varieties (65 percent of the total taxa). The remainder are more widely distributed but all endemic to Oahu. This is a

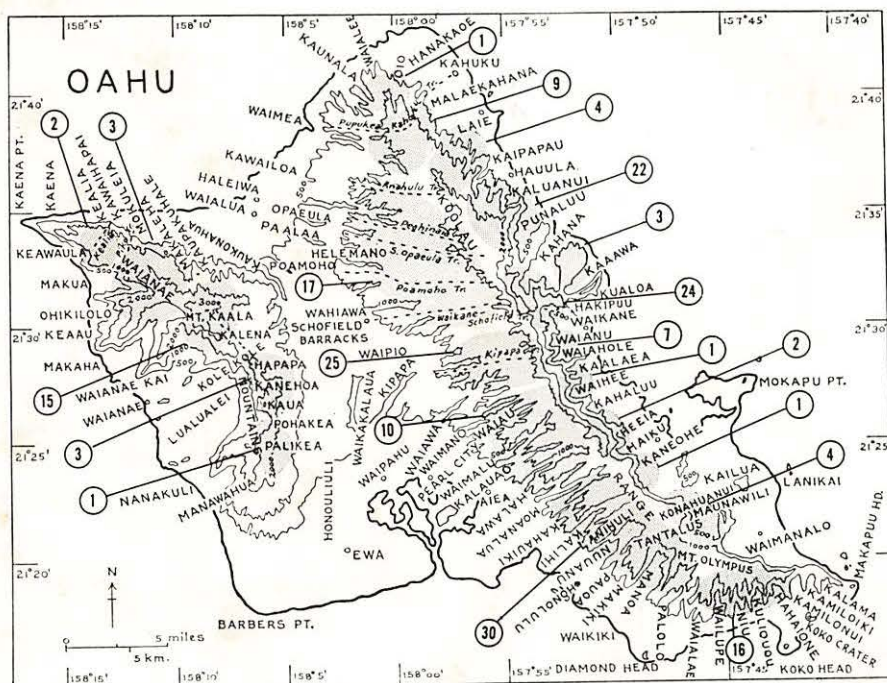


FIGURE 2.—*Cyrtandra* of Oahu, with the number of species in each area.

spectacular example of speciation and the formation of narrow endemics on a tropical island. The high degree of endemism in the Hawaiian plants has long been known, as it has in the animals. There, the example of the terrestrial mollusk *Achatinella* has been often presented. In it the taxa are species or more commonly subspecies.

Included is a map summarizing the distribution of all the species (Fig. 2). This shows by a number the total of species, varieties, and forms occurring in the area marked by stiple shading surrounded by white. Starting from the north

there are in the Waianae Mountains, 2 in the Kealia area, 3 in Makua Valley and on the Piko trail, 15 on Mt. Kaala, 3 on Puu Hapapa and Puu Kanehoa and Puu Kaua, and 1 at Palehua. At the northern point of the Koolau Range in Kaunala and Hanakaoe are 3 species. In the Koolau Range on the windward slope there are the following assemblages of species: 3 in Kahuku, 4 in Laie, 22 in Kaipapau, Hauula, Kaluanui, and Punaluu, 3 in Kaaawa, 24 in Waikane and Kahana, 7 in Waianu and Waiahole, 1 in Waihee, 2 in Heeia, 1 in Kaneohe, and 4 in Maunawili.

On the leeward (or western) slope of the Koolau Range we find the following groups of *Cyrtandra* species: 9 in Pupukeya; 17 in Anahulu to Opaehula, and the Poamoho trail; 25 in Kipapa Gulch; 12 in Waimano to Halawa; 30 from Moanalua to Palolo behind Honolulu; and 16 from Waialae to Hahaione.

As stated, 110 of the 126 species and varieties of *Cyrtandra* are found in the Koolau Range. The region of greatest representation is that of Waikane and Kahana, on the windward side, with 24, and that of Kipapa Gulch just opposite on the leeward side with 25. In Kaaawa, on the projecting headland, are 3 species, of which 1 is additional to the 24. The grand total for this central mountain is 48 species. The mountain forests here cover an area 9 miles wide (see Judd, Low, and Krauss, 1927). It has varying conditions of exposure and drainage, and receives the heaviest rainfall, the Koolau divide at from 2,300 to 2,600 ft. with from 229 to 306 inches annual rainfall. At the windward base of the mountains at 800 ft., the rainfall is from 156 to 245 inches annually (Hawaii Planning Board, 1939). Also, these areas have been well explored by many botanists for years. Hence, it is not surprising that this central portion of the mountains has the greatest concentration of *Cyrtandra* species.

DISTRIBUTION OF SECTIONS AND SUBGENERA

Geologists have demonstrated that the Waianae Mountains are the older of the two mountain ranges on Oahu. The Koolau Range is less dissected, and its western slopes have buried the base of the eastern slopes of the Waianae Mountains. Hence, any indications of the relative age of the two floras is of interest.

The subgenus *Brachycyathus* from its relative floral simplicity is accepted as the more primitive group. This subgenus contains four sections, each of which occurs on both mountain ranges. The section *Microcalyces* has, in the Koolau Range, 10 species, in both ranges 1 species, in the Waianae Mountains 1 species and without locality 1 species (Fig. 3). The *Chaetocalyces* has in the Koolau Range 14 taxa, and in both ranges 1 species (Fig. 4). The *Schizocalyces* has in the Koolau Range 25 species, in the Waianae Mountains 7 species, and in both ranges 1 species (Fig. 5). The *Crotonocalyces* has in the Koolau Range 20 taxa, in the Waianae Mountains 1 species, and without lo-

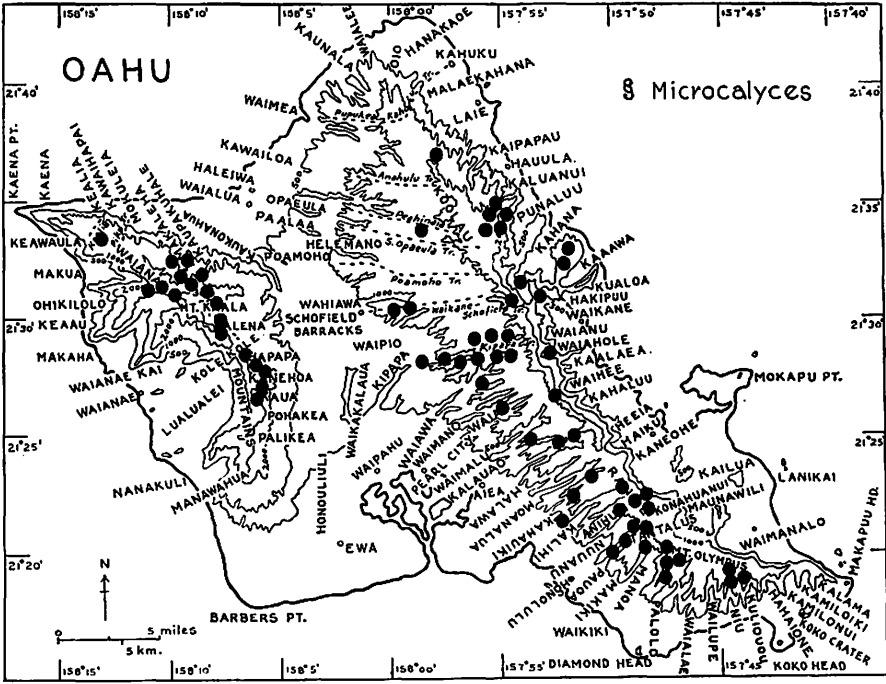


FIGURE 3.—Distribution of section *Microcalyces* on Oahu.

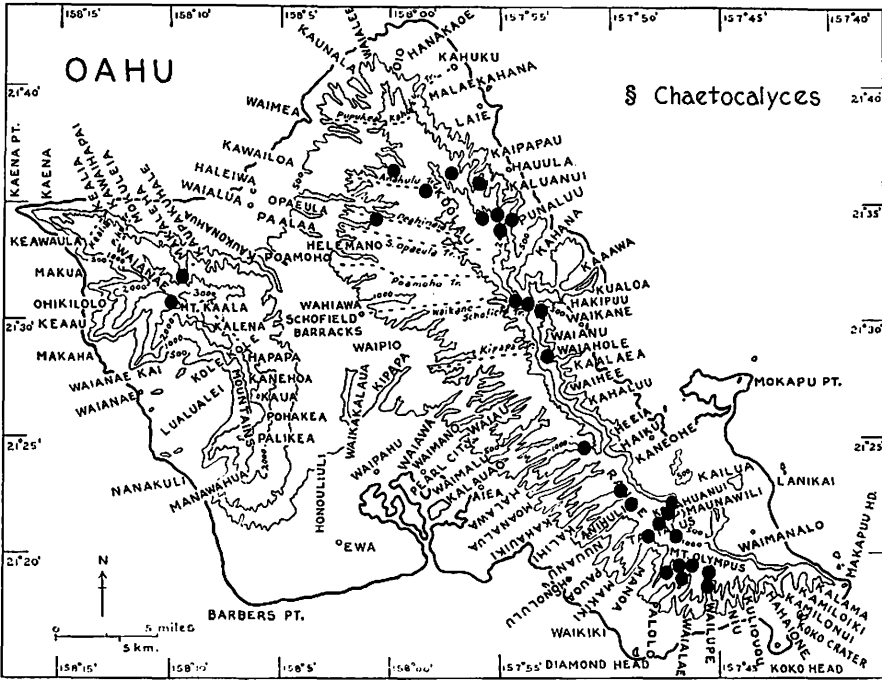


FIGURE 4.—Distribution of section *Chaetocalyces* on Oahu.

than 1,000 feet, the trade winds bearing their moisture and clouds would strike full on the eastern face of the Waianae Mountains, and give a large and adequate rainfall. This would certainly allow the development of extensive forests on both sides of the range, supply numerous streams and wet gulches and moist habitats. Under these conditions, the *Cyrtandra* species could have a wide distribution and an extensive development. When the Koolau Range was built up to a height of several thousand feet, it certainly caused marked changes in the climate. The two ranges are parallel and each forms a fairly straight

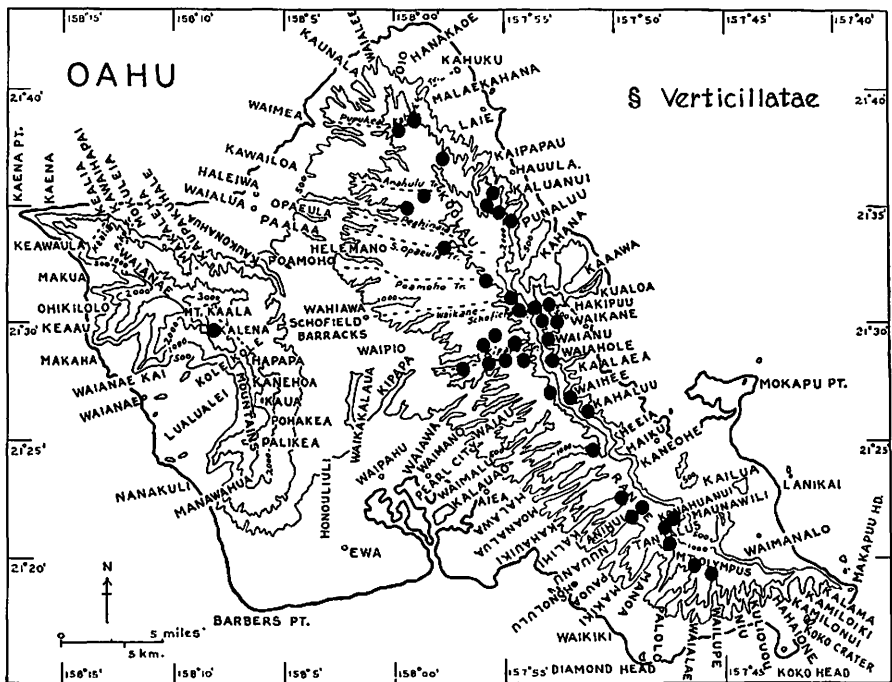


FIGURE 8.—Distribution of section *Verticillatae* on Oahu.

line, running from northwest to southeast. The northern third of the Koolau Range, from a point between Punaluu and Helemano Streams, still preserves a crest, 2,600 feet altitude, and with a gentle slope to the north. The slope is smooth, gentle, and little dissected, and may well represent the form and relative height of the volcanic ridge. The southern extension of the Koolau Range is a serrated, ragged ridge with alternating passes and peaks. Nuuanu Pali, the pass between Nuuanu and Kaneohe, is as low as 1,186 feet altitude, while the adjacent peak, Puu Konahuanui, is 3,150 feet, this being the highest peak of

the range. From its topography and eroded condition, this portion of the mountains formerly must have attained an elevation even higher than its present 3,150 feet. It probably presented a more continuous and higher barrier without passes as low as the present ones, since the present streams have cut valleys back into the ridge until it is an almost continuous knife-edged ridge.

The rain-producing northeast trades, which are almost continuous throughout the year, blow from the north-northeast, and deviate only slightly from that direction. They skirt the northern forehills of the Koolau Range without losing all of their moisture, then hit the windward side of Mt. Kaala in the Waianae Mountains. Kaala, the highest peak, 4,025 feet, has a flat plateau summit 0.1 square mile in extent. It has an average annual rainfall of 91 inches. The only high-level rain gauge for the range is on this peak. For the southern part of the Waianae Mountains there are no rain gauge measurements. For this region the isohyetal lines are interpolated to indicate a rainfall of 40 inches (Hawaii Terr. Planning Bd., 1939: 116). This is a generous estimate, judging by the general aridity and the meager line of forest occurring just below the windward crest. All who have explored the Waianae Mountains know that when the trade winds are bringing heavy rains to the Koolau Range, it is safe to climb in the southern part of the Waianae Mountains and find clear dry air, and warm sunshine. These present conditions demonstrate clearly how the Koolau Range prevents rainfall from reaching the Waianae Mountains. When the Koolau Range was higher, it would have preempted even more of the rain. Hence, the flora of the Waianae Mountains, first developing on a well-watered range of mountains, has suffered an increasing aridity. On the upper slopes and summit of Mt. Kaala there is still a dense, extensive mossy rain-forest, but elsewhere there remains today but only a meager remnant of native forest. During this progressive dessication of the area, what happened to the shade and moisture-loving genus *Cyrtandra*? Except on Mt. Kaala, their favorable habitats have almost disappeared. When moist forests developed on the Koolau Range, it is apparent that some species succeeded in crossing the Schofield Pass barrier and colonizing the newer mountains. It is improbable that moisture-loving species could adapt themselves to arid conditions. The *Cyrtandra* species of the arid parts of the Waianae Mountains are more likely to be recently derived species which by chance have a survival factor for aridity. The deductions concerning the age of the Waianae flora appear to be that in mesophytic or moist mesophytic genera, endemic species of the southern Waianae Mountains are probably recent species; such a species is *C. Christophersenii*. This does not apply to xerophytes of considerable altitudinal tolerance, which may formerly have existed on dry lower, leeward slopes, but with progressing aridity, have ascended to higher levels in the mountains. Species endemic to the moist woods

of Mt. Kaala are probably conservative species, a part of the old, pre-Koolau flora. Those species indigenous to the moist forests of both ranges may be either pre-Koolau species, vigorous and with effective dispersal, which have spread to the newer mountain range, or they may be recently evolved species, developed in either area and spread to the other. Such species, restricted to Mt. Kaala, are: *C. alnea*, *C. charadraia*, *C. cupuliformis*, *C. Frederickii*, *C. hirsutula*, *C. kaalae*, *C. longiloba*, *C. Mannii*, *C. Vaniotii*, and *C. waianaeensis*. Such species, occurring on both ranges, are: *C. Garnotiana*, *C. kalichii*, and *C. Macraei*.

POLLINATION

Cyrtandra flowers are protandrous, with the two good stamens borne on the lower side of the corolla tube but the filament tips spirally ascending to the upper side of the throat. The two anthers are placed in and more or less blocking the throat of the corolla. They have shed their pollen and withered before the shorter stigma matures, and opens the two flat stigmatic lobes, ready for pollination. The flowers have a large open subcylindric tube. Surrounding the ovary, at base, is a disk which is glandular and secretory. So, it is seen that the flowers produce nectar, have a conspicuous white, open tubular flower large enough to receive a bee or even a larger insect. Because of their protandrous mechanism and long pistil, they need the services of insects for cross pollination, but daytime observations in the mountain woods have not revealed any insects visiting the flowers. Search of entomological literature and inquiry of the leading entomologists of the islands have produced no clues. There is little or no fragrance to the flowers.

There are native bees, of the endemic genus *Nesoprosopis*, with some 50 species. They are honey, not pollen, collectors and they lack any pollen collecting apparatus. Their larval food contains but little pollen. In search of honey they visit *Metrosideros*, *Myoporum*, *Scaevola*, *Acacia*, *Sida*, *Vitex*, and *Tribulus*. It is not likely that these bees are the pollinating agents. However, the logical suggestion is that the flowers are visited and pollinated by some of the numerous night-flying moths endemic in the mountain woods. Nights in these mountains are cold and damp, but night work with traps or lights would seem the only way to a solution of this pollination mystery.

SEED DISPERSAL

Cyrtandra produces berries. The Oahu species all have white juicy berries with numerous small seeds. The berries are harmless and insipid, and birds do not seem to eat them, but occasionally berries are observed with a bit of one side missing, probably the work of slugs or snails. These slow-moving animals could scarcely be effective in transporting the seeds for any consider-

able distance. No other animals are known to feed on the ripe berries when on the bush.

The berries ripen fairly quickly, and fall to the ground. Most of them are ovoid or ellipsoid in shape. If the parent bush is growing in a steep gulch or on a slope, the berries might roll quite a distance down hill before lodging. If berries fall or roll into a stream they may be water-borne many yards before being stranded. These methods would accomplish dispersal down a single valley as long as the habitat was sufficiently moist. Also a strong gust of wind might blow a ripe berry a short distance up hill. Other animals may well play a part. Ripe, fallen fruit may have been carried or eaten and the seeds voided by the allegedly native Hawaiian rat and later by the pigs, and by the introduced brown rat, and black rat, and Alexandrine rat. None of these animals seems to have arrived on the Hawaiian Islands early enough to have been a potent agent in this dispersal. The pig and the Hawaiian rat are considered to have arrived with the Hawaiians, not more than 1,000 years ago, and the other rats to have arrived via the white man's ships since 1788. By rolling or floating, the fruits could easily be dispersed from either mountain range to the saddle between them, but the uphill journey from there into the other mountain range would be difficult and very slow. Before the strong and often boisterous trade winds it would be much easier to make the journey from the saddle into the Waianae Mountains. Unfortunately for the theorist, the journey, it seems, must have been in the other direction, from the Waianae Mountains to the younger Koolau Range. It will be seen from this discussion that but little is actually known about the seed dispersal.

SPECIATION

The species of *Cyrtandra* as described and accepted here are believed to be conservatively defined, the "Linnaean species." The writer considers that they are not the work of extreme "splitters," that they are not "Jordonian species" or "microspecies." The writer's specific concept is not materially different from that of his predecessors. Nearly all of the species of Gaudichaud, Gray, Mann, Wawra, C. B. Clarke, Hillebrand, C. N. Forbes, and Rock are maintained by the writer unchanged as species, and some of their few varieties are likewise maintained. The status of a few of these older species and varieties is here changed, usually due to the availability of complete material or to the discovery of new morphological characters.

The prolific speciation of *Cyrtandra* on Oahu (as well as on other Pacific islands) presents a challenging problem. Oahu is about 30 miles in diameter, and has an area of only 604 square miles. The suitable habitats are principally in the moist mountains at altitudes above 1,000 feet. This area is only 178 square miles, of which 58 are in the Waianae Mountains and 120 in the Koolau Range. Within this small area there have developed 118 species, 8 varie-

ties, and 1 form, all endemic. This is not the only such example; numerous other genera of plants and animals have spawned a swarm of species on each of the Hawaiian Islands. In the other plant genera, however, not quite so many species have been evolved, as it will be remembered that *Cyrtandra* is our largest genus.

Oahu is volcanic and not ancient, as it is believed to have originated in the Pliocene. Exact dating of the age of the island is difficult because of the lack of fossil evidence. Is the time since the Pliocene sufficient to allow a genus to colonize the two mountain ranges? The answer is surely positive. Is the time long enough to allow for the evolution of 118 species and 9 varieties or forms within a genus? There were doubtless at least two original immigrant stocks, representing the two subgenera, *Brachycyathus* and *Cyrtandra*. Even from two stocks, there has been an extensive and notable specific development. How long does it take, on the average, for the creation of a species in nature? If we could give a definite answer to this rhetorical question, we would have botanical knowledge that is eagerly desired. We cannot provide the answer. Some little evidence is perceptible in the percentage of endemism in the flora of Sable Island by the writer (1921). It is an island wholly of sand dunes, 150 miles east of Halifax, Nova Scotia, the only dry land on the summit of Sable Island Bank. This is of sandy material, one of the series of submerged banks between Cape Cod, Massachusetts, and the Grand Banks of Newfoundland, forming a northward submerged extension of the coastal plain. Sable Island is believed to have been formed during the Pleistocene glaciation, not less than 25,000 years ago. Its climate now shows no great extremes of temperature, but many days of fog and prevalent high winds. The average wind velocity for four years is 18 miles an hour, and the average number of gales a month is 10. During these storms the winds usually blow from 40 to 65 miles an hour. The loose sand from the dunes is often blowing. This natural sand blast is so effective that every pane of glass that has been exposed in a window frame for a year has been altered from clear to ground glass. These conditions are too severe to allow tree growth. There are no native trees, and introduced ones exist only in shelter. The flora of Sable Island has three elements: a northern one, like that of Newfoundland, a Canadian one, like that of adjacent Nova Scotia, and a southern coastal plain one, like that of Cape Cod. The native flora totals 147 species, varieties, and forms. There are 9 endemic plants, all of them of minor status, classified as varieties or forms, and only one, a *Rubus*, distinct enough to be classed as a species. The original flora of Sable Island doubtless arrived by a migration along the then elevated coastal plain during the Pleistocene, then was isolated by the erosion and submergence of this sandy or gravelly, unconsolidated strip. For some 25,000 years these plants of 127 genera have suffered the effects of the poor and shifting soil and the rigorous climate. In this natural habitat, under what are almost experimental

conditions, the evolutionary product has been eight endemic minor subdivisions of species, and a single species in the changeling genus *Rubus*. From this we can deduce that the average time for the creation of a species in nature is to be measured in units larger than 25,000 years. It is not certain that this figure, based on the North Temperate Zone, would be directly applicable to the Tropical Zone. Still it does suggest that for the evolution of the 118 species, 8 varieties, and 1 form, all endemic to Oahu, that a very long period of time was required.

PHYLOGENY

It is postulated that species with persistent calyx, with nearly symmetrical campanulate calyx, lobed only part way to the base, corolla white and villous, inflorescence axillary, leaves petioled opposite and equal are more like the simple ancestral type than those with laterally splitting dehiscent calyx, with fusiform and asymmetric calyx or a campanulate one lobed to the base, corolla green, with cauliflorous habit, leaves sessile, opposite but one much reduced or leaves whorled. The criteria have been selected partly from analyses of the *Cyrtandra* species of Oahu, partly from exotic species, and partly from consideration of other genera of the *Gesneriaceae*. Using these criteria, the subgenus *Brachycyathus* and its section *Microcalyces* appear to be the simplest groups. There the simplest species seems to be *C. Garnotiana* Gaud., which is also one of the most widely distributed species, growing naturally nearly the whole length of both mountain ranges. With more highly evolved structure are the *Schizocalyces*, *Chaetocalyces*, to the *Crotonocalyces*, the most modified of all with its crateriform calyx reflexed in fruit.

The subgenus *Cyrtandra* is the more highly evolved as indicated by its fusiform dehiscent calyx. In this subgenus, the section *Cylindrocalyces* with opposite equal leaves is the simpler one. An ancestral type in the *Cylindrocalyces* may well be *C. paludosa*. Recent and highly evolved species are *C. calpidicarpa* with its elongate, cucumberlike fruit, and *C. kaulantha* with its flowers at the naked base of the stem. The higher section is the *Verticillatae* with its whorled subequal leaves. *C. latebrosa* with its petioled leaves appears simpler than *C. sessilis* with sessile auriculate leaves.

HYBRIDISM

The possibility of hybridism playing a large part in the production of the large number of species and varieties found on the small island of Oahu has been constantly kept in mind. In many localities several species are found growing side by side. No previous botanist has reported proven or suspected hybrids. In the mountains, the collector has little reason to suspect hybridization because each kind of *Cyrtandra* seems to be true to its kind and interme-

diates are not found even in localities where the species occur within a few meters of each other.

Two alleged hybrids are announced in this paper. The first seems to be a cross between the following, which are two of the commonest species of the Koolau Range. *C. cordifolia* Gaudichaud is abundant on the leeward (south-western) ridges and valleys from Pupukea, and the South Opaëula Ridge trail, Paalaa to Wailupe valley. It crosses over the divide and occurs on the windward (northeastern) slopes only in Kailua. *C. propinqua* Forbes occurs abundantly from the northern end of the Koolau Range at Kaunala to Kipapa Gulch, Waipio, on the leeward side and even more abundantly on the windward side to Punaluu. There are two collections, Fosberg 8,785, and Yoshioka in 1933, both from Waikane on the Waikane-Schofield trail. They are not identical.

The Fosberg 8,785 specimen resembles *C. cordifolia* in its abundant, shaggy villosity, in its large, cordate blades, in its broadly lanceolate calyx lobes, but it resembles *C. propinqua* in having the calyx cleft almost to the base, 25 mm. long, and in having the ovary glabrous.

The Yoshioka specimen resembles *C. cordifolia* in its shaggy villosity, its large, cordate blades, in the large bracts of the inflorescence, and in having the fruit pubescent, but it resembles *C. propinqua* in having the calyx cleft three-quarters way into lanceolate lobes. It is intermediate in that the calyx lobes are broadly lanceolate, and the fruit is only puberulent. It has no mature flowers or available buds. The Fosberg specimen likewise lacked flowers, and the one small bud when dissected failed to furnish anthers or pollen. Hence, it was not possible to apply the imperfect pollen test for hybridism.

The type collection (*W. B. Storey 123*, Paalaa-Kawailoa Divide) here described is intermediate in its characters. It resembles *C. cordifolia* except for having the 9-10 mm. calyx cleft almost to the base into lanceolate lobes, and in having the ovary only moderately villosulous. Of the three flowers, one has filaments without anthers, and the other two have abortive anthers. The fruiting branch has half-grown berries containing apparently normal seeds. This grew where *C. cordifolia* and *C. propinqua* are coincident. The three collections are not identical in appearance or structure, but combine in different degrees the various characters of the supposed parents. They grew in areas where the ranges of the two species touch or in areas close to them. The two species are in different sections of the genus, and as they differ in many fundamental characters, are not considered closely related species. Yet, these three collections are reasonably considered hybrids, and are classed as *C. cordifolia* × *propinqua*.

A second putative hybrid, *C. adpressipilosa* × *stupantha* combines various characters found in either parent, and it occurs in Kahana Valley, just where the ranges of the two parents touch.

CHROMOSOME NUMBERS IN CYRTANDRA

William Bicknell Storey³

The chromosome numbers of several species of *Cyrtandra* were determined to ascertain the value, if any, of cytology for delineating species, and to learn whether, as in *Crepis* (Bartlett, 1940) and a number of other genera, species falling into the different sections into which the genus has been classified have correspondingly different basic chromosome numbers.

Early attempts to determine chromosome numbers in *Cyrtandra* were unproductive, largely because of the relative inaccessibility of the plants and the difficulty of collecting root tip and flower bud material in the field suitable for cytological study.

Attempts to grow plants collected in the field to flower in the greenhouse failed because facilities were unsatisfactory for maintaining the reduced light intensity and high relative humidity of the atmosphere necessary for good growth. Later, when better facilities were provided, a method was developed for producing roots on stem cuttings and leaf petioles which could be prepared for counting chromosomes.

Young stem cuttings and the petioles of leaves were rooted in a shallow propagation bed containing vermiculite. Young leafy terminal cuttings about 5 inches long were planted vertically to about half their length. Mature leaves were planted with the petioles buried for the greater part of their length. The blades were placed flat on the surface of the vermiculite, with a small stone or an object of similar weight to keep them in place, if necessary.

The light in the greenhouse was reduced to about one-half the usual intensity by whitewashing the glass roof panes. Relative humidity was maintained at 85 to 100 percent with a number of mist nozzles which were kept in operation throughout the day. Temperatures in the house ranged from 72° to 90° F. throughout the year. Under these conditions, roots were initiated at the bases of the stem cuttings and leaf petioles in 3 to 6 weeks. The vermiculite permitted easy removal from the bed without breaking off the root tips desired for cytological study.

Root tips collected in the greenhouse and flower buds collected in the field were killed and fixed in Carnoy's alcohol-acetic acid-chloroform solution and stained with aceto-orcein for microscopic study as temporary mounts, following the methods employed by Kamemoto and Randolph (1949) for the study of orchid chromosomes.

Not all species rooted satisfactorily, and not always could satisfactory mitotic metaphase figures be located for counting chromosomes in those which did root. Only occasionally flower buds collected from plants in the field

³ This section only, "Chromosome Numbers," was written by Dr. Storey, now at University of California, Riverside.

contained pollen mother cells with stages of meiotic cell division suitable for counting.

Chromosome numbers were determined for nine species of *Cyrtandra*, as follows:

1. *C. cordifolia*, $n = 17$, diakinesis and meiotic metaphase I in pollen mother cells of flower bud, W. B. Storey, Manoa Cliff Trail, Sept. 13, 1949. $2n = 34$, from rooted leaves, Storey, same locality, Sept. 12, 1950.
2. *C. grandiflora*, $n = 17$, meiotic metaphase II in pollen mother cells of flower bud, Storey, same locality as above species, Sept. 12, 1950. $2n = 34$, rooted leaves collected at same locality and on same date as foregoing.
3. *C. sandwicensis*, $n = 17$, meiotic metaphase II in pollen mother cell of flower bud, Storey, slope of Mt. Tantalus along Pauoa Valley trail to Tantalus (Pauoa) Flat, Sept. 13, 1949. $2n = 34$, rooted leaf, same locality, same date as foregoing.
4. *C. latebrosa*, $2n = 34$, rooted cutting, St. John, unnumbered, Castle Trail, Punaluu, November 20, 1949.
5. *C. stupantha*, $n = 17$, meiotic metaphase I in pollen mother cell, Storey (with St. John, Horowitz, and MacLean), Kaliuwa Valley, Sept. 9, 1951. $2n = 34$, rooted cutting, St. John, same locality, same date as preceding species.
6. *C. ferruginosa*, $2n = 34$, adventitious root from plant in the field, about 1,800 feet, slope of Mt. Tantalus along Pauoa Valley Trail, Sept. 12, 1950.
7. *C. propinqua*, $2n = 34$, rooted leaf, St. John 24,706, Poamoho Trail, Paalaa-Wahiawa, November 4, 1951.
8. *C. paludosa*, $2n = 34$, rooted cutting, St. John 24,715, Waikane Valley Trail, December 2, 1951.
9. *C. Garnotiana*, $2n = 34$, rooted leaf, St. John 24,824, Mt. Kaala, May 25, 1952.

All nine of the *Cyrtandra* examined cytologically have gametic chromosome numbers of 17, and somatic chromosome numbers of 34, as noted in the listing above. Of the species given, *C. latebrosa* is in the Section *Verticillatae*, and *C. grandiflora* and *C. paludosa* are in the Section *Cylindrocalyces*, both of the subgenus *Cyrtandra*. *C. cordifolia* and *C. ferruginosa* are in the Section *Crotonocalyces*, *C. Garnotiana* and *C. sandwicensis* are in the Section *Microcalyces*, and *C. propinqua* and *C. stupantha* are in the Section *Schizocalyces* of the subgenus *Brachycyathus*.

Each of five sections of the genus *Cyrtandra* is represented by one to three species, although a nine-species sample admittedly is only a token representation of the entire genus. The section *Chaetocalyces* was not examined. The identical chromosome numbers suggest, however, that the various sections probably do not have different basic numbers and that 17 is the basic number for the entire genus. Chromosome numbers alone, therefore, appear to be of

no use as a cytotaxonomic tool for identifying or separating species. Differences in chromosome morphology between species were observed, but were not studied in sufficient detail to determine their value in taxonomy.

The identical chromosome number of the species suggests, also, that speciation in *Cyrtandra* has come about largely through accumulations of gene mutations over a long period of time.

Reported basic chromosome numbers (Darlington and Wylie, 1956: 317; Eberle, 1956) for other genera in the family Gesneriaceae are: *Saintpaulia*, $\times = 7$; *Sinningia*, $\times = 7, 13$; *Corytholoma*, $\times = 7, 13$; *Episcia*, $\times = 9$; *Columnea*, $\times = 9$; *Nautilocalyx*, $\times = 9$; *Alloplectus*, $\times = 9, 17-18$; *Klugia*, $\times = 10$; *Achimenes*, $\times = 11$; *Naegelia*, $\times = 12$; *Isoloma*, $\times = 13$; *Tydaea*, $\times = 13$; *Gloxinia*, $\times = 13$; *Aeschynanthus*, $\times = 14, 16, 32$; *Streptocarpus*, $\times = 15, 16$; *Ramondia*, $\times = 18$.

Cyrtandra, $\times = 17$, a number reported previously only in *Alloplectus*.

NATIVE NAMES

The Hawaiian people generally and especially their medical priest or "kahuna lapa'au" had an extensive and detailed knowledge of the identity and the properties of the native Hawaiian plants. Nearly every easily visible species had a native name, and it is not improbable that every one was named. Those now lacking names were ones for which the white stranger or "haole" failed to learn and record the Hawaiian name. Now the Hawaiian people are so thoroughly Americanized that there is little chance to record additional authentic native names. Many plant groups had a generic native name with a second descriptive word or adjective added to distinguish each species. In other genera the native names of the several species were individual and quite unconnected. *Cyrtandra* is one of the few large genera deficient in Hawaiian names. There is no common name for the genus and most of the species are nameless.

D. M. Kaaiakamanu (1922) recorded "Kanawao-ke'oke'o," and "pi'ohi'a" for *Cyrtandra* sp., white variety. These two names do not appear to be generic, but rather to apply to some unidentified species, not determinable by the compilers, translator, or botanical referee.

Of the many species from Hawaiian Islands other than Oahu, only the following have recorded native names:

Haiwale = *C. Menziesii* (Menzies, 1920: 5) [= Ha'i-wale] and *C. paludosa* var. *Gayana* (Rock, 1913: 5).

Iihipia = *C. begonifolia* (Rock, 1913: 5) [= 'Iihipia].

Mapele = *C. cyaneoides* (Rock, 1917: 620).

Ulumahele = *C. kauaiensis* (Rock, 1913: 15).

The three references to Rock are in his *List of Hawaiian Names of Plants* (1913). In his extensive revision of the Hawaiian species of *Cyrtandra* (1917-1919) he omits any consideration of native names and includes only the single name "Mapele."

For the numerous Oahu species of *Cyrtandra* no native names are listed by Gray, Mann, Wawra, Clarke, Hillebrand, Rock, or Forbes. This is passing strange, for each of these botanists (except Gray and Clarke) did extensive collecting in Hawaii and successfully collected and recorded native names of other plants.

The first botanist to record a native name for an Oahu species was Gaudichaud who collected and described six new species, now all believed to be from Oahu (1826:98, 446-447). In his enumeration he records under the first species, *C. cordifolia*, the native name "Fafara." In his observations on the vegetation (p. 98) he lists the five of these species that he illustrated and states that there were several additional ones all with the common name "fafara."

It is gratifying to find a recorded native name for *Cyrtandra* on Oahu, but linguistically this name is an embarrassment. The Hawaiian language as now written does not include the letter F, but for consonants only H, K, L, M, N, P, W, plus the glottal stop. The Hawaiian language was reduced to formal writing by the American missionaries in 1834 after 14 years of contact with it. They gathered in their missionaries from each island and met in convention. There were pronounced dialectic differences between the speech on the several islands, so marked that two missionaries who had learned their Hawaiian on different islands could not agree on the sounds or letters to represent them. Was the labial an L or an R? Was the dental a T or a K? They agreed to debate, vote, then all agreed in advance to accept the result of each majority vote. Some differences were argued bitterly, and decided by the majority of one vote; thus, for example, we have K instead of T in the written Hawaiian language. This Americanized, standardized Hawaiian was used in printing editions of the Bible, hymn books, and later newspapers, and other books. The only logical course is to use this standardized form of the Hawaiian language.

Gaudichaud did not record the native name on the labels of his type specimens in Paris, but printed the native name "fafara" twice in his book, once capitalized, once with a small letter. Such names are not included in his index. It does not appear to be a mistake, but it needs transliteration into modern, standardized Hawaiian. It is possible that some words in aboriginal Hawaiian did have the sound of the letter F. This letter F is a part of the Polynesian languages of the nearer island groups, such as Tahiti and Samoa. It is not impossible that this old usage of the letter F persisted in a few words in Hawaiian.

Gaudichaud was the pharmacist on Captain Freycinet's voyage which explored Hawaii in 1819. The corvette "Uranie" was in the archipelago twenty days, visiting Hawaii, Maui, and Oahu. Gaudichaud managed to get seven days on shore. No detailed journal is available, but it is clear that he climbed high in the mountains, brought back and preserved large collections. Towards

the end of the four-year voyage, on the homeward trip, the ship was wrecked and lost on the Falkland Islands. Half the bundles of plants were lost and the half saved were wet with sea water, but some of these were saved by being dried on the beach by a camp fire. What were lost, is not known, but Gaudichaud saved many. From these he published for the first time names and descriptions for a large number of our peculiar Hawaiian genera and species of plants. He records in his book native names for scores of the species. He obtained these names from native assistants in 1819, a year before the arrival of the first of the missionaries, so the Hawaiian language as he heard it was natural, not standardized or formalized. We have collated his book in search of evidence on this linguistic point. The letter F is not used by Gaudichaud in any other Hawaiian plant name. He uses the six consonants H, K, L, M, N, and P, thus employing all but one of those of the written language. He does not use the consonant W (or V), but he represents the sound by OU. It should be remembered that Gaudichaud was French, and that when he was told a native name he used those sounds and recorded them in French orthography. Our standardized writing is "wawae iole" (= rats foot) for *Lycopodium venustulum*. Gaudichaud wrote this "oua-oua-yole." We write "maile" for *Alyxia olivaeformis*, which Gaudichaud wrote as "maire." He used both K and T, both L and R, thus confirming that all were used in the ancient Hawaiian and that the voted elimination of the R and the T were foreigners' simplifications. Our problem of the "F" in "fafara" is not yet settled. One cannot prove today whether or not it was a mistake, so it is better to assume that it was not one. Gaudichaud doubtless had several native informants and obtained his native names at every opportunity on the several days on shore. We suggest that he may have recorded the same linguistic sound in two different spellings on successive days. Of course he should have been precise and consistent at all times, but it is too easy to enunciate these standards of accuracy when calmly sitting at a desk. The present author has had much experience in seeking and recording native names from Polynesian, Melanesian, and Micronesian informants. Different informants may pronounce the same word differently, or one less distinctly. Often a sound in one language is intermediate between two similar sounds in a second language, and cannot truly be written by any single or even any combination of letters in the second language. The writer has had the experience of being inconsistent himself in recording native sounds or words obtained in this manner, even on one small island within a period of a few weeks. It is suggested that there may be such an inconsistency in Gaudichaud's record. The F of other Polynesian languages is now written as H and the R as L in the standardized Hawaiian. It is concluded that the "fafara" of Gaudichaud should now be transliterated into "hahala."

Thomas Nuttall, who was on Oahu for several weeks in 1835, collected widely and in both mountain ranges. He obtained a specimen of *C. paludosa*

Gaudichaud variety *paludosa*, and recorded it on a label as "Moa of the Islanders." "Moa" is a Hawaiian word, meaning cooked, or fowl, or the plant species *Psilotum nudum*. Now we have an early and trustworthy record that the natives also called *C. paludosa* by the name of "moa."

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ABBREVIATIONS

If no herbarium is indicated, the specimen is in the B. P. Bishop Museum, Honolulu, Hawaii.

For abbreviations of the names of other herbaria in the citation of specimens, there are used the standardized abbreviations proposed by J. Lanjouw and F. A. Stafleu (*Index Herbariorum, Regnum Vegetabile* 2: 1-179, 1954).

TAXONOMY

GENERIC DESCRIPTION

Cyrtandra J. R. & G. Forster, *Characteres Generum Maris Australis*, 5-6, pl. 3, 1776.

Shrubs or rarely small trees; leaves opposite or whorled (rarely false-alternate); petioles distinct or their bases connected by a fleshy ring and perfoliate; inflorescences mostly from axils of leafy branches, but in a few species cauliflorous on the old, leafless stems, or even from the base of the stem or between the roots; cymes one- to many-flowered; floral bracts usually present and separate, but in a few species connate and involucrate; calyx fusiform to campanulate, 5-lobed (or 0-3-6-lobed), persistent or caducous; corolla in most species white, in others green, yellow, orange, or scarlet, or spotted or streaked with these colors; the tube cylindric, barrel-shaped, or funnellform, straight or deflexed, glabrous or pubescent; limb bilabiate, the upper lip 2-lobed, the lower lip 3-lobed; stamens 5, with their filaments adnate to the corolla tube for more than half its length; two distal stamens perfect, the free filament tips spirally up-curved bearing the connivent 2-celled anthers in the proximal mouth of the throat; anther cells oblong, longitudinally dehiscent; staminodia 2-3, with or without abortive antheridia; style present or absent; stigmatic lobes 2, mostly elliptic, more or less connate; ovary lanceoloid or ovoid, glabrous or pubescent, surrounded at base by a dark, cupulate disk; locules 2; placentae inflexed towards the axis, then revolute; ovules numerous; fruit a berry, from ovoid, ellipsoid, to linear, often beaked by the persistent style base; seeds numerous, minute, ellipsoid, reticulate.

SYNOPSIS OF SECTIONS IN HAWAII

Subgenus *Brachycyathus* C. B. Clarke, *De Candolle, Monogr. Phanerog.* 5 (1) : 202, 1883.

Calyx persistent with the fruit.

1. Section *Chaetocalyces* Hillebrand, *Fl. Hawaiian Is.*, 326, 1888.

Calyx green, persistent, lobed $\frac{3}{4}$ way or more into linear or subulate lobes; corollas white; inflorescences mostly subumbellate; leaves opposite, subequal, thin, large, ovate to oblong, decurrent at base, or acute at both ends.

The species on Oahu are: *C. axilliflora*, *C. collarifera*, *C. dentata*, *C. gracilis*, *C. kahanaensis*, *C. koolauensis*, *C. laxiflora*, *C. linearis*, *C. Macraei*, *C. oahuensis*, *C. subumbellata*, and var. *intonsa*, *C. waiolani*, and var. *capitata*.

2. Section *Crotonocalyces* Hillebrand, Fl. Hawaiian Is., 325, 1888.

Calyx green, persistent, lobed $\frac{2}{3}$ way or less into lobes that are lanceolate, broadly deltoid, ovate or broader; corollas white (but green in *C. viridiflora*); leaves opposite, subequal, broad, base generally rounded, cordate, or peltate, but in a few cuneate.

The species on Oahu are: *C. cordifolia*, and var. *brevipilata*, *C. crassior*, *C. ferruginosa*, *C. grossecrenata*, *C. honolulensis*, *C. infrapallida*, *C. kipapaensis*, *C. paloloensis*, *C. Pearsallii*, *C. Pickeringii*, *C. piligyna*, *C. scabrella*, *C. Skottsbergii*, *C. subcordata*, *C. Vanioti*, *C. villicalyx*, and var. *pubentigyna*, *C. villosiflora*, *C. viridiflora*, and *C. waianaeensis*.

3. Section *Microcalyces* Hillebrand, Fl. Hawaiian Is., 326, 1888.

Calyx green, persistent, mostly lobed to about the middle, but in some from $\frac{1}{2}$ - $\frac{2}{3}$ way, the lobes deltoid or narrowly lanceolate; flowers often many, in open cymes; corollas white; leaves opposite, broad obovate or elliptic; indument, when present, short, cinereous or pale ochraceous.

The local species are: *C. polyantha* which with its calyces cleft $\frac{2}{3}$ way is intermediate to section *Schizocalyces*. Species with large calyces are *C. Fosbergii* and *C. opaеulae*. The other species on Oahu are: *C. ambigua*, *C. campaniformis*, *C. cupuliformis*, *C. Fosbergii*, *C. Garnotiana*, *C. intonsa*, *C. kaluanuiensis*, *C. opaеulae*, *C. polyantha*, *C. rivularis*, *C. sandwicensis*, *C. triflora*, and *C. villosa*.

4. Section *Schizocalyces* Hillebrand, Fl. Hawaiian Is., 325-326, 1888.

Calyx green, persistent, large, lobed from $\frac{2}{3}$ way to near the base into lobes that are from broadly ovate to linear-lanceolate (calyx and even whole inflorescence white in some species); inflorescences mostly 1-3-flowered, axillary or cauliflorous; leaves opposite, from linear-lanceolate to suborbicular cordate.

Species on Oahu *C. propinqua* is intermediate to section *Chaetocalyces*. *C. tristis* has been removed and transferred to section *Chaetocalyces*. The species on Oahu are: *C. adpressipilosa*, *C. arcuata*, *C. basipartita*, *C. Bryanii*, *C. charadraia*, *C. chartacea*, *C. Christophersenii*, *C. elliptisepala*, *C. ferrocolorata*, *C. Forbesii*, *C. Frederickii*, *C. hirsutula*, *C. intrapilosa*, *C. kaalae*, *C. kailuaensis*, *C. kalichii*, *C. kaneoheensis*, *C. Lessoniana*, and three varieties, var. *angustifolia*, var. *intrapubens*, var. *koolauloaensis*, *C. leucocalyx*, *C. longiloba*, *C. Mannii*, *C. niuensis*, *C. partita*, *C. poamohoensis*, *C. propinqua*, *C. pruinosa*, *C. pubens*, *C. reflexa*, *C. Rockii*, *C. stupantha*, *C. subintegra*, *C. tristis*, and *C. Wilderi*.

Subgenus *Cyrtandra*.

A synonym is *Macroclythus* C. B. Clarke, De Candolle, Monogr. Phanerog. 5 (1): 202, 1883.

Calyx deciduous, its tube cylindrical or fusiform.

5. Section *Cylindrocalyces* Hillebrand, Fl. Hawaiian Is., 326, 1888.

Calyx in bud fusiform or cylindrical, deciduous before the fruit matures, fused to the tip and opening by a distal slit, or tardily parted from the tip into 3-5 lobes; inflorescences from the leafy axils, or cauliflorous, or basal; corollas white; leaves opposite, mostly glabrous.

The species on Oahu are: *C. alata*, *C. alnea*, *C. atomigyna*, *C. brevicalyx*, *C. carinata*, *C. grandiflora*, and its f. *verticillata*, *C. Hosakae*, *C. infundibuliformis*, *C. intravillosa*, *C. kahukuensis*, *C. kaulantha*, *C. laevis*, *C. longicalyx*, *C. olivacea*, *C. oulophylla*, *C. paludosa*, *C. pupukeaensis*, *C. turbiniiformis*, and *C. waianuensis*.

6. Section *Verticillatae*, sect. nov.

Foliis verticillatis 3-6, subaequalibus.

Calyx fusiform in bud, either strongly asymmetric and unevenly lobed or almost symmetric, deciduous before the fruit ripens; leaves from linear-oblongate to elliptic, petioled or sessile; fruits from ellipsoid to elongate cylindrical.

Holotype: *C. fusiformis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 82, 1950. A few species, for instance, *C. perstaminodica*, have the main and strong branches all with verticillate leaves, but some of the weak laterals with opposite leaves.

The species on Oahu are: *C. brevicornuta*, *C. calpidicarpa*, *C. calycochiza*, *C. caudatisejala*, *C. cornuta*, *C. crenata*, *C. degenerans*, *C. ellipticifolia*, *C. fusiformis*, *C. Garberi*, *C. hyperdasa*, *C. latebrosa*, *C. megastigmata*, *C. nubincolens*, *C. oblanceolata*, *C. perstaminodica*, *C. plurifolia*, *C. sessilis*, *C. subrecta*, *C. ternata*, and *C. waiomaoensis*.

KEY TO SPECIES OF CYRTANDRA

- Calyx fusiform, especially in bud, splitting distally, caducous from fruit; leaves opposite or verticillate.....Part I
 Calyx not fusiform, mostly ovoid in bud, soon campanulate or crateriform, not splitting laterally, persistent in fruit; leaves opposite.....Part II

Part I. Subgenus *Cyrtandra*

1. Bracts connate around the buds; berry 4-12 cm. long, cylindrical; leaves verticillate (rarely opposite on weak, secondary branches),
2. Calyx 23-37 mm. long, the beak 3-16 mm. long,
3. Leaves 3-4 at a node; beak of bud 10-16 mm. long; calyx upper lobes 13 mm. long; corolla lobes glabrous without; floral bract tips spreading....112. *C. calpidicarpa*.
3. Leaves 3-2 at a node, beak of bud 3 mm. long; calyx upper lobes 7 mm. long; corolla lobes with pilose strip from base to middle; floral bract tips ascending111. *C. brevicornuta*.
2. Calyx 40-62 mm. long, densely brown pilose, calyx tip 20-24 mm. long, hornlike, not splitting; corolla 40 mm. long; cymes 1-flowered.....115. *C. cornuta*.
1. Bracts free; berries less than 4 cm. long, mostly ovoid or ellipsoid,
4. Leaves verticillate, 3-5 at a node,
5. Leaves obviously petioled,

6. Corolla tube glabrous without,
7. Calyx glabrous or glabrate at anthesis,
8. Peduncles 2–15 mm. long, bracts lanceolate,
 9. Calyx lobes subulate acuminate; calyx 15–17 mm. long; corolla 22–25 mm. long; leaves ternate, lateral veins 14–17 on a side.....121. *C. hyperdasa*.
 9. Calyx lobes acute; calyx 22–25 mm. long; corolla 28–32 mm. long; leaves quaternate, the lateral veins 7–10 on a side.....124. *C. nubincolens*.
 8. Peduncles 20–50 mm. long; bracts ovate, 20–30 mm. long.....97. *C. grandiflora* f. *verticillata*.
7. Calyx more or less pubescent in anthesis,
10. Calyx in anthesis entire, the apex a single hornlike beak; calyx shaggy brown villous,
 11. Calyx splitting after anthesis into 3 lanceolate lobes.....119. *C. fusiformis*.
 11. Calyx beak entire,
 12. Calyx pilosulous; leaves in whorls of 3 to 4 on main branches but opposite on small lateral ones,
 13. Main blades in 3's, 5–14 cm. long, 23–43 mm. wide.....131. *C. waiomaoensis*.
 13. Main blades in 3's or 4's, 14–37 cm. long, 33–107 mm. wide.....125. *C. oblanceolata*.
 12. Calyx shaggy villous; leaves verticillate.....117. *C. degenerans*.
 10. Calyx in anthesis lobed into 3 or more teeth,
 14. Well-developed blades 7–10 cm. wide; pistil glabrous.....125. *C. oblanceolata*.
 14. Blades 13–60 mm. wide,
 15. Calyx evenly pubescent,
 16. Calyx at anthesis sparsely pilose; ovary pilose.....122. *C. latebrosa*.
 16. Calyx at anthesis shaggy villous; ovary glabrous.....113. *C. calycoschiza*.
 15. Calyx closely hirsute at base, very remotely so or glabrous above.....124. *C. nubincolens*.
6. Corolla more or less pubescent without; calyx glabrate to tomentose,
17. Calyx fusiform and beaked, not subequally 5-lobed at anthesis,
18. Leaves (3–) 4–6 in a whorl; blades narrowly elliptic or linear-ob lanceolate,
 19. Calyx densely villous; corolla tube sparsely pilose below throat; ovary glabrous.....113. *C. calycoschiza*.
 19. Calyx appressed pilose, then subglabrate; corolla tube funnelliform, more or less hirsute without; ovary sparsely pilose.....122. *C. latebrosa*.
18. Leaves 3–4 in a whorl; blades broadly elliptic,
 20. Calyx permanently shaggy pilose; corolla tube cylindric, shaggy villous without; ovary minutely glandular dotted or puberulous; petioles shaggy villous.....118. *C. ellipticifolia*.
 20. Calyx appressed pilosulous at base, sparsely so above it; corolla tube funnelliform, pilose without on a few spots; ovary glabrous,
 21. Petioles sparsely spreading pilosulous; leaves of main branches in whorls of 3.....126. *C. perstaminodica*.
 21. Petioles appressed pilose; leaves of main branches in whorls of 3–4.....125. *C. oblanceolata*.
17. Calyx in anthesis campanulate, subequally 5-lobed,
22. Blades oblanceolate,
 23. Style glabrous; calyx villous within; corolla deflected at middle at 15°.....123. *C. megastigmata*.
 23. Style hirsute or pilosulous; corolla deflected at middle at 35° to 40°,
 24. Calyx lobed $\frac{2}{3}$ way to base, campanulate, the lobes linear-lanceolate, long tapering; leaf scars interconnected.....130. *C. ternata*.
 24. Calyx lobed $\frac{2}{5}$ way to base, oblanceoloid,
 25. Lower calyx lobes broad oblique lance-deltoid; calyx 26 mm. long, glabrous within; leaf scars distinct; blades 17–45 mm. wide.....120. *C. Garberi*.

25. Lower calyx lobes oblique-lanceolate; calyx 37 mm. long, densely pilosulous within; blades 50-90 mm. wide.....129. *C. subrecta*.
22. Blades broadly lanceolate or broadly elliptic,
26. Style nearly glabrous, not glandular; calyx much exceeding corolla.....114. *C. caudatisepala*.
26. Style capitate glandular-puberulent or -pilose; calyx shorter than corolla tube,
27. Pedicels spreading pilose; corolla spreading white villous throughout; petioles and veins below spreading pilose; peduncles about 15 mm. long.....127. *C. plurifolia*.
27. Pedicels appressed brown villous; corolla glandular pilosulous; petioles and veins below appressed brown villous; peduncles 3-5 mm. long.....116. *C. crenata*.
5. Leaves sessile or subsessile,
28. Leaves sessile, auriculate at base, oblanceolate, gradually narrowing to a broadly winged base; corolla glabrous without; style glabrous.....128. *C. sessilis*.
28. Leaves subsessile, narrowly oblanceolate, crenate, abruptly narrowed to a long, cuneate, slender base; corolla pilose without; style pilosulous.....120. *C. Garberi*.
4. Leaves opposite,
29. Cymes many-flowered (7-25 or more); leaves sessile or subsessile, 30-60 cm. long,
30. Calyx villous without, subcylindric; inflorescence in leaf axils; stigmas 2, narrowly elliptic, distinct, divergent, separated by a broad U-shaped sinus 2.5 mm. deep; leaves broad based, sessile or subsessile.....110. *C. waiianuensis*.
30. Calyx lobes glabrous without; calyx at length campanulate; stigma obcordate, sinus 1.2 mm. deep, lobes oval; blades cuneate tapering at base; flowers on lower naked stems or upper roots.....102. *C. kaulantha*.
29. Cymes few-flowered, usually less than 7-flowered (occasionally 12); leaves petiolate, usually less than 25 cm. long,
31. Corolla glabrous without,
32. Peduncles 1-15 mm. long; bracts 4-11 mm. long; blades crenate,
33. Pedicels pilose or pilosulous; calyx 10-25 mm. long,
34. Pedicels densely appressed brown pilosulous; calyx 20-25 mm. long, within densely appressed brown pilosulous.....104. *C. longicalyx*.
34. Pedicels pilose but finally glabrate; calyx 10-20 mm. long in bud, brown pilose without, glabrous within, fusiform, beak 6-9 mm. long, lobes unequal, 2-10 mm. long, twisted to one side, early caducous.....107. *C. paludosa* var. *paludosa*.
33. Pedicels glabrous; calyx 7-14 mm. long in bud, glabrous, campanulate, the lobes subequal, 1-1.5 mm. long.....93. *C. brevicealyx*.
32. Peduncles 13-60 mm. long; bracts 20-30 mm. long; blades entire or subentire.....96. *C. grandiflora* f. *grandiflora*.
31. Corolla pubescent without,
35. Inflorescence and lower leaf surface pruinose; calyx lobed almost to base into linear lobes.....26. *C. subumbellata* var. *intonsa*.
55. Inflorescence and leaves not pruinose,
36. Calyx lobed almost to the base,
37. Calyx subequally lobed; inflorescence densely hirsute; blades ferruginous hirsute above,
38. Calyx lobes narrowly linear-lanceolate; upper corolla lobes 2.7 mm. long; style and ovary glabrous; petiole bases perfoliate connate.....43. *C. kaalae*.
38. Calyx lobes lanceolate; upper corolla lobes 5 mm. long; style and ovary sparsely hispid; petioles distinct.....31. *C. arcuata*.
37. Calyx 2-lipped, the lobes linear lanceolate, sparsely pilose; inflorescence sparsely ferruginous pilose to glabrate; blades glabrous or glabrate above.....101. *C. kahukuensis*.

36. Calyx lobed not more than $\frac{3}{4}$ way to the base,
 39. Style and apex of ovary pubescent or glandular,
 40. Ovary and fruit pilose or villous,
 41. Ovary pilose; blades broadly elliptic or broadly ovate, abruptly short decurrent; calyx subequally 5-lobed.....91. *C. alnea*.
 41. Ovary villous; blades linear-oblongate, long decurrent; calyx unequally 3-lobed.....100. *C. intravillosa*.
 40. Ovary and fruit glandular-puberulous or -atomiferous; blades elliptic or broader; calyx not villous within,
 42. Calyx lobes long acuminate; blades membranous, remotely pilosulous beneath, the principal ones 11–18 cm. wide, long decurrent on the 1–2 cm. petiole; ovary glandular atomiferous.....92. *C. atomigyna*.
 42. Calyx lobes not acuminate, but obtuse or abruptly acute; blades coriaceous, densely velvety pilose beneath, the principal ones 33–55 mm. wide, not or but shortly decurrent on the obvious petiole,
 43. Tip of calyx lobes with thick fleshy keel within; blades elliptic or ovate-elliptic, subacuminate, the margin shallowly flattened serrulate; ovary glandular atomiferous; leaf scars cuneiform or shield-shaped....94. *C. carinata*.
 43. Tip of calyx lobes not keeled; blades broadly oval or broadly obovate, abruptly acute, the margin prominently and saliently crenate-serrate; ovary minutely glandular puberulous; leaf scars sinuate suborbicular.....106. *C. oulophylla*.
 39. Apex of ovary glabrous,
 44. Calyx lobes deltoid to ovate-deltoid,
 45. Calyx in anthesis white, 14–17 mm. long, the lobes ovate-deltoid; blades with veinlets beneath appressed brown pilosulous.....98. *C. Hosakae*.
 45. Calyx in anthesis green, 9–12 mm. long, the lobes narrowly deltoid; blades with veinlets beneath spreading pilosulous.....108. *C. pupukeensis*.
 44. Calyx lobes lanceolate,
 46. Blades oval, not or but little decurrent; corolla twice as long as calyx.....91. *C. alnea*.
 46. Blades narrower or cuneate and decurrent at base,
 47. Style pubescent,
 48. Calyx lobes 15–19 mm. long; inflorescence shaggy brown villous.....62. *C. Rockii*.
 48. Calyx lobes 5–10 mm. long; inflorescence subappressed brown pilosulous,
 49. Calyx 17–18 mm. long; dried corolla 23–25 mm. long; blades 13–24 cm. long, elliptic-lanceolate, the base long decurrent.....90. *C. alata*.
 49. Calyx 12–14 mm. long; dried corolla 18–22 mm. long, blades 5–10 cm. long, asymmetric elliptic to oval, the base cuneate.....103. *C. laevis*.
 47. Style glabrous,
 50. Cymes ascending at 45°, 3–7-flowered,
 51. Blades sparsely pilose above; floral bracts 5–13 mm. long, foliaceous and green; calyx campanulate, lobed $\frac{3}{4}$ way into 5 lobes; corolla lower lobe 6 mm. long, suborbicular.....109. *C. turbiniformis*.
 51. Blades glabrous above,
 52. Floral bracts 6–10 mm. long; calyx fusiform, the tube elliptic-oblongate, 2–3-lobed, the distal slit opening $\frac{3}{4}$ way to base; corolla lower lobe 10 mm. long, broadly elliptic.....123. *C. megastigmata*.
 52. Floral bracts 15–17 mm. long; calyx with distal slit opening $\frac{1}{2}$ way to base; corolla lower lobe 9–11 mm. long, suborbicular.....125. *C. oblongata*.
 50. Cymes reflexed, 1–3-flowered; floral bracts 1–3 mm. long, lanceolate, closely brown appressed pilose; blades glabrate above; leaf scars connected and annular.....105. *C. olivacea*.

Part II. Subgenus *Brachycyathus*

54. Peduncles and pedicels glabrous, glabrate, or pruinose,
55. Corolla villous; style glabrous; inflorescence at first sparsely pubescent but early glabrate,
56. Leaves subcoriaceous, deeply impressed rugose, densely appressed sericeous pilosulous beneath; cyme 7–30-flowered; calyx tube 1–3 mm. long, short funneform, lobes glabrous from the first.....9. *C. polyantha*.
56. Leaves firm chartaceous, plane, when mature sparsely appressed pilosulous on veins, elsewhere glabrate beneath; cyme 4–8-flowered; calyx tube 4–7.5 mm. long, campanulate, the lobes sparsely pilosulous, finally glabrate.....1. *C. ambigua*.
55. Corolla pruinose without, especially in bud; style pruinose or puberulous; inflorescence pruinose,
57. Flowers solitary; calyx 12–21 mm. long, lobed almost to base into broadly lanceolate lobes; blades puberulent beneath; petiole bases perfoliate and leaf scars annular.....59. *C. pruinosa*.
57. Flowers in cymes; calyx lobes linear or narrowly lance-linear,
58. Calyx 2–4 mm. long; corolla 10–12 mm. long; pedicels 6–12 mm. long; blades pruinose beneath, and the veins pilosulous; petiole bases perfoliate with a low rim which is tardily dehiscent; leaf scars then annular.....22. *C. Macraei*.
58. Calyx 8–36 mm. long; corolla 23–25 mm. long; pedicels 1–7.5 cm. long; petioles not perfoliate, and leaf scars distinct,
59. Blades serrate, puberulent beneath; petioles slender, 1–2 mm. in diameter; peduncles 8–17 mm. long; pedicels 10–50 mm. long,
60. Blades lanceolate, gradually long acuminate, below subglabrate; peduncular bracts 14–17 mm. long; calyx 22–36 mm. long; corolla pruinose.....17. *C. gracilis*.
60. Blades broadly oval, abruptly short acuminate, below capitate glandular puberulent; peduncular bracts 5–7 mm. long; calyx 14–15 mm. long; corolla glandular puberulous.....21. *C. linearis*.
59. Blades crenate or doubly crenate; petioles fleshy, 3–5 mm. (rarely 2 mm.) in diameter; peduncles 5–10 mm. long; pedicels 5–25 mm. long,
61. Blades pruinose beneath and veins pruinose or sparsely minutely appressed puberulent; corolla lobes sparsely glandular puberulent within.....
-25. *C. subumbellata* var. *subumbellata*.
61. Blades with veins and veinlets of lower surface spreading puberulent.....
-26. *C. subumbellata* var. *intonsa*.
54. Peduncles and pedicels markedly pubescent,
62. Blades all cordate (or only a few rounded) at base,
63. Ovary and fruit pubescent,
64. Calyx cleft to the middle into lanceolate or lance-ovate lobes, 9–21 mm. long; ovary and fruit densely villous or pilose,
65. Plant shaggy villous; blades dentate; ovary villous; calyx accrescent.....
-68. *C. cordifolia* var. *cordifolia*.
65. Plant pilose,
66. Blades subentire; ovary glabrous towards the base; calyx accrescent.....
-69. *C. cordifolia* var. *brevipilata*.
66. Blades serrulate; ovary pilosulous; calyx not accrescent, not reflexed in fruit,
67. Upper calyx lobes lanceolate; corolla pilose without; blades with intervals below sparsely pilosulous.....82. *C. subcordata*.
67. Upper calyx lobes broad deltoid,
68. Corolla pilose without; blades with intervals below essentially glabrous; blade margins apiculate serrate or doubly so.....77. *C. Pearsallii*.
68. Corolla shaggy villous without; blade intervals below pilosulous; blade margins low serrulate.....87. *C. villosiflora*.

64. Calyx cleft to the base, into lanceolate, acuminate lobes, and in fruit 18–25 mm. long; ovary and fruit puberulent.....86. *C. villicalyx* var. *pubentigyna*.
63. Ovary glabrous; fruit glabrous (except in *C. leucocalyx*),
69. Calyx 10–40 mm. long, split to the base into linear-lanceolate lobes,
70. Calyx after anthesis diverging, soon reflexed,
71. Calyx 20–25 mm. long; corolla decurved at middle at about 40°; berry glabrous.....58. *C. propinqua*.
71. Calyx in anthesis 16–17 mm. long, the lobes lanceolate; corolla decurved at 15°; berry puberulous.....52. *C. leucocalyx*.
70. Calyx lobes spreading or at most rotate in fruit; calyx 15–25 mm. long, strongly accrescent, in fruit up to 40 mm. long, and with broad connate funnel-form base, lobes lanceolate.....85. *C. villicalyx*.
69. Calyx 10–12 mm. long, divided only to the middle into triangular ascending lobes; blades covered throughout with a dense velvety villosity; corolla lobes green.....88. *C. viridiflora*.
62. Blades rounded, cuncate, or decurrent at base,
72. Petiole bases broadly perfoliate and connate around node; leaf scars confluent, encircling the stem,
73. Leaves sessile or subsessile, winged to the base of the petiole, upper leaf surface hirsute; corolla tube included in the calyx, only the limb being free; calyx lobes 8–13 mm. long,
74. Calyx lobes 1 mm. wide, linear; ovary glabrous.....34. *C. charadraia*.
74. Calyx lobes 2.5 mm. wide, narrowly linear-lanceolate; ovary hirsutulous.....65. *C. tristis*.
73. Leaves petioled; upper surface scabrous hispid or hirsute; corolla exerted,
75. Calyx lobes linear or slightly lance-linear¹ or narrowly ligulate; styles pubescent,
76. Calyx subappressed puberulent, and the upper leaf surface sparsely so; calyx 9–11 mm. long, the lobes lance-linear.....18. *C. kahanaensis*.
76. Calyx and upper leaf surface hirsute or hispid; calyx 14–20 mm. long,
77. Calyx lobes narrowly ligulate, acute, sparsely hirsute to subglabrate; blades capitate glandular puberulent on the intervals beneath.....14. *C. axilliflora*.
77. Calyx lobes very narrowly lance-linear, densely villous; blades hirsute beneath,
78. Blades 8–30 cm. long, subacuminate, secondary veins 7–10 on a side, filaments adnate to corolla tube 4 mm. from the throat.....15. *C. collarifera*.
78. Blades 2–13 cm. long, acuminate, secondary veins 5–8 on a side; filaments adnate to corolla tube 9 mm. from the throat.....27. *C. waiolani*.
75. Calyx lobes lanceolate, linear-lanceolate, or narrowly elliptic,
79. Style, ovary, and fruit glabrous,
80. Corolla 25 mm. long; blade margins unevenly serrulate; calyx campanulate.....56. *C. partita*.
80. Corolla 20 mm. long; blade margins irregularly denticulate; calyx funnel-form.....43. *C. kaalae*.
79. Style pubescent,
81. Fruit glabrous,
82. Calyx hirsute or hirsutulous,
83. Calyx densely rough hirsute, the lobes lance-elliptic; blades hirsute below; corolla tube hirsute without.....45. *C. kalichii*.
83. Calyx hirsutulous, the lobes narrowly lanceolate; blades pilose below; corolla tube villous without.....46. *C. kaneoheensis*.
82. Calyx subappressed pilose without.....4. *C. Fosbergii*.
81. Fruit pilose,
84. Calyx lobes 8 mm. long, densely villous, lance-ovate; blades 12.5–19 cm. wide.....60. *C. pubens*.
84. Calyx lobes 10–13 mm. long, pilose; blades 2.8–4 cm. wide.....39. *C. Forbesii*.

72. Petiole bases not connate perfoliate, at most the intervals between the leaf scars merely ridged; leaf scars separate (or with their lateral points merely touching),
85. Inflorescences cauliflorous, often to the base of the stem; calyx whitish, lobed $\frac{2}{3}$ to $\frac{3}{4}$ way, the lobes lance-oblong, or linear-lanceolate, accrescent,
86. Calyx spreading hirsutulous or puberulent; calyx 5–7.5 mm. long; style pilose; blades membranous to firm chartaceous, above appressed pilose or hirsutulous; veins below loosely pilosulous.....**63. C. stupantha.**
86. Calyx appressed or semiappressed puberulent,
87. Style glabrous; blades chartaceous, above remotely appressed pustulate hirsutulous; veins below moderately appressed puberulent; dried calyx appressed puberulent, 5–8 mm. long in anthesis.....**30. C. adressipilosa.**
87. Style pilose; blades firm chartaceous, above appressed pustulate puberulent; veins below shaggy puberulent; calyx semiappressed puberulent, dried calyx 7–10 mm. long in anthesis.....**44. C. kailuaensis.**
85. Inflorescences in the leafy axils,
88. Calyx loose, not closely enclosing the corolla at base and white or whitish and parted almost to the base,
89. Calyx lobes lanceolate or ovate, the margins commonly revolute; blades ovate or narrower, cuneate at base,
90. Calyx lobe margins not revolute,
91. Ovary and fruit villous; style none.....**57. C. poamohoensis.**
91. Ovary and fruit puberulous; style slender, about 4 mm. long.....**52. C. leucocalyx.**
90. Calyx lobe margins revolute; ovary glabrous or sparsely hirsute,
92. Blades tomentose only on midrib and veins.....
.....**49. C. Lessoniana var. angustifolia.**
92. Blades below pubescent throughout; style none,
93. Blades closely appressed pilose sericeous beneath, lanceolate or lance-ovate, short acuminate; calyx lobes glabrous within.....
.....**48. C. Lessoniana var. Lessoniana.**
93. Blades semiappressed or spreading puberulent or pilosulous beneath,
94. Calyx lobes glabrous within,
95. Blades oblanceolate (rarely lanceolate), 3–22 \times 1.2–5.2 cm.; calyx 13–22 mm. long, the lobes 5–6 mm. wide; corolla 25–27 mm. long.....
.....**51. C. Lessoniana var. koolauloensis.**
95. Blades lance-elliptic, 3.5–6.1 \times 1.3–2.2 cm.; calyx 11 mm. long, the lobes 2.3–3.8 mm. wide; corolla 17 mm. long.....**37. C. elliptisepala.**
94. Calyx lobes appressed puberulent within.....**50. C. Lessoniana var. intrapubens.**
89. Calyx lobes narrowly lanceolate (or oblanceolate), pilose within, plane; blades broadly oval to suborbicular, rounded at base.....**58. C. propinqua.**
88. Calyx closely enclosing the base of the corolla and ascending, green, or the tissue green with white or ferruginous pubescence (or in *C. Garnotiana* whitish in flower but green in fruit), or, if white, lobed $\frac{3}{4}$ way or less,
96. Calyx lobes linear or very narrowly lance-linear,
97. Inflorescence appressed pilosulous; peduncles 1–11 mm. long,
98. Calyx lobed $\frac{1}{2}$ to $\frac{2}{3}$ way, densely ferruginous appressed pilose; leaves in whorls of 3.....**116. C. crenata.**
98. Calyx lobed to the base, sparsely appressed hirsutulous; leaves opposite
.....**19. C. koolauensis.**
97. Inflorescence with spreading hairs,
99. Inflorescence puberulent; calyx lobes glabrous within; berry pruinose.....
.....**18. C. kahanaensis.**
99. Inflorescence hirsute or villous; calyx lobes almost hidden by dense, coarse hirsute pubescence; berry glabrous; blades beneath sparsely hirsute on the veins, remotely so on the intervals,

100. Flowers 1 (-2) on the peduncles,
 101. Style glabrous; pedicels 3-8 mm. long; blades 9-39 mm. wide, firm chartaceous.....23. *C. oahuensis*.
 101. Style pilose; pedicels 5-22 mm. long; blades 12-56 mm. wide, thin chartaceous.....28. *C. waiolani* var. *waiolani*.
 100. Flowers 5-7 and subcapitate on the peduncles.....29. *C. waiolani* var. *capitata*.
 96. Calyx lobes lanceolate, deltoid, or broader,
 102. Calyx 6-11 mm. long, lobed to about the middle, the lobes narrowly deltoid or lance-ovate,
 103. Style pilosulous.....13. *C. villosa*.
 103. Style glabrous or none,
 104. Calyx lobes lanceolate; style 2-2.5 mm. long; berry sparsely puberulent44. *C. kailuaensis*.
 104. Calyx lobes narrowly deltoid-lanceolate; style absent or short (1.5 mm. long),
 105. Berry and young ovary glabrous,
 106. Blades firm chartaceous; calyx campanulate, lobes narrowly deltoid10. *C. rivularis*.
 106. Blades coriaceous; calyx cupulate, the lobes broadly deltoid.....3. *C. cupuliformis*.
 105. Berry puberulent, though ovary glabrous,
 108. Calyx densely spreading pilosulous,
 109. Blades 7-23 cm. long, 4-11.5 cm. wide, above sparsely puberulent, below pilosulous, mostly elliptic to lanceolate; flowers 3-20 in a lax, dichotomous cyme.....5. *C. Garnotiana*.
 109. Blades 3-15 cm. long, 1.6-5 cm. wide, above closely pilosulous, below densely canescent pilosulous, mostly ovate to oval, acute; peduncle 1-3-flowered.....11. *C. sandwicensis*.
 108. Calyx sparsely subappressed puberulent, lobes narrowly deltoid; blades tapering to both ends and cuneate decurrent at base, above appressed hirsute.....6. *C. intonsa*.
 102. Calyx mostly longer, or more deeply lobed, or the lobes lanceolate or broader,
 110. Calyx lobes lance-ovate or broader,
 111. Calyx lobes lance-ovate,
 112. Blades beneath and petioles appressed puberulent; calyx 22 mm. long80. *C. scabrella*.
 112. Blades beneath and petioles pilosulous; calyx 9-18 mm. long,
 113. Calyx lobes obtuse,
 114. Calyx campanulate, 12-13 mm. long; blades hirsute above.....7. *C. kaluanuensis*.
 114. Calyx broadly crateriform,
 115. Calyx 9-10.5 mm. long, $\frac{1}{2}$ as long as the corolla tube; style none; blade margin low serrulate but the teeth almost concealed by dense villosity.....55. *C. niuensis*.
 115. Calyx 13-16 mm. long, equaling or $\frac{2}{3}$ as long as the corolla tube; style present; blades above appressed puberulent; corollas 25 mm. long; petioles ascending pilosulous; blade margin evidently serrate or crenate,
 116. Corolla lobes sparsely villosulous within; corolla tube cylindrical; style hirsute; blades chartaceous, shallowly undulate serrate, acute81. *C. Skottsbergii*.
 116. Corolla lobes glabrous within; corolla tube ovoid-subglobose; style glabrous; blades thick, firm chartaceous, coarsely crenate, subacuminate.....72. *C. grossecrenata*.
 113. Calyx lobes acute,
 117. Calyx not reflexed,

118. Calyx lobes broadly ovate-deltoid or deltoid,
 119. Calyx 20–23 mm. long; blade base cuneate or rounded; blade pilose above.....76. *C. paloloensis*.
 119. Calyx 11–14 mm. long; blade base subcordate, rarely cuneate; blade subglabrate above.....77. *C. Pearsallii*.
118. Calyx lobes lance-ovate,
 120. Blades elliptic or broadly oval to suborbicular; calyx lobed $\frac{1}{2}$ way to base,
 121. Calyx crateriform,
 122. Ovary and style glabrous; corolla tube much inflated, ovoid-subglobose.....72. *C. grossecrenata*.
 122. Ovary and style pubescent,
 123. Peduncles and petioles shaggy villous; blades oval, acute, mostly rounded at base.....73. *C. honolulensis*.
 123. Peduncles and petioles moderately villosulous or pilose; blades elliptic to oval, acute, the base cuneate to decurrent.....75. *C. kipapaensis*.
121. Calyx funnelliform, moderately villosulous or pilose; peduncles and petioles moderately villosulous or pilose; blades elliptic to oval, acute, the base cuneate to decurrent,
 124. Calyx 8–15 mm. long,
 125. Ovary glandular pilose,
 126. Calyx lobes not equaling the corolla tube, not becoming revolute; blade margins low serrulate; calyx cleft $\frac{1}{2}$ – $\frac{2}{3}$ way to base.....87. *C. villosiflora*.
 126. Calyx lobes equaling the corolla tube but in fruit revolute; blade margins sharply dentate; calyx cleft $\frac{1}{2}$ way to base.....40. *C. Frederickii*.
125. Ovary glabrous; calyx lobes villous, not revolute, much exceeded by the corolla tube; blade margins shallowly undulate serrate.....81. *C. Skottsbergii*.
 124. Calyx 13–20 mm. long in anthesis, ascending white pilose, the lobes inflexed, broadest at base; corolla 18–30 mm. long; blades 15–25 cm. long.....71. *C. ferruginosa*.
120. Blades elliptic or oblance-elliptic; calyx lobed $\frac{3}{5}$ – $\frac{5}{6}$ way to base,
 127. Calyx lobed $\frac{3}{5}$ – $\frac{2}{3}$ way to base, 11–18 mm. long; ovary and style glabrous,
 128. Bundle scars 5; blades 8–11.5 cm. long, subentire; calyx 18 mm. long, narrowly campanulate, salient ridged, the lobes 6 mm. wide.....64. *C. subintegra*.
 128. Bundle scars 9; blades 11–18.5 cm. long, low serrulate; calyx 11 mm. long, campanulate, the base subtruncate, the lobes 3–3.8 mm. wide.....74. *C. infrapallida*.
127. Calyx lobed $\frac{5}{6}$ way to base; young shoots and petioles densely subappressed ferruginous villous, the villosity persisting on the branches,
 129. Ovary and fruit villous above; calyx within sparsely hirsutulous; blades below subappressed viscid pilose, the veins prominent.....33. *C. Bryanii*.
129. Ovary and fruit glabrous,
 130. Calyx glabrous within, 8–10 mm. long; style glabrous; blades below with dense appressed villosity concealing the veins.....55. *C. niuensis*.
 130. Calyx pilose within, 16–17 mm. long; style none; stigma glandular villous; blades below softly appressed pilosulous, the veins salient, prominent.....42. *C. intrapilosa*.

117. Calyx reflexed in fruit, lobed $\frac{2}{3}$ way to base.....89. *C. waianaensis*.
 111. Calyx lobes ovate-suborbicular, acute; blades villous beneath.....
78. *C. Pickeringii*.
 110. Calyx lobes lanceolate or elliptic,
 131. Berry pubescent,
 132. Blades rounded at base (or rarely a few of them cuneate); calyx lobed
 nearly to the base,
 133. Calyx lobes ovate-lanceolate, in anthesis erect, almost as long as corolla
 tube, deciduous in fruit.....76. *C. paloloensis*.
 133. Calyx lobes narrowly lanceolate, about $\frac{2}{3}$ as long as corolla tube, reflexed
 in fruit, persistent,
 134. Ovary puberulous from the middle upwards; style glabrous.....
52. *C. leucocalyx*.
 134. Ovary and style densely pilose,
 135. Calyx 8–15 mm. long, nearly equaling the corolla; style distinct,
 remaining on the fruit as a slender beak.....40. *C. Frederickii*.
 135. Calyx in anthesis 11–18 mm. long, about $\frac{1}{2}$ as long as the corolla;
 style scarcely evident, not persisting on the fruit as a beak.....
61. *C. reflexa*.
 132. Blades cuneate at base, or if rounded, the calyx lobed $\frac{1}{2}$ to $\frac{4}{5}$ way to base,
 136. Calyx lobed $\frac{1}{2}$ way to base; ovary glabrous.....20. *C. laxiflora*.
 136. Calyx lobed $\frac{2}{3}$ way or more towards base,
 137. Calyx lobed $\frac{2}{3}$ to $\frac{4}{5}$ way to base,
 138. Calyx lobes linear-lanceolate; blades narrowly oblanceolate or elliptic,
 chartaceous,
 139. Petioles spreading puberulent; blades above appressed pustulate
 puberulent; dried calyx hirsute without.....44. *C. kailuaensis*.
 139. Petiole and inflorescence appressed-pubescent,
 140. Calyx in anthesis, when dried, 5–8 mm. long; corolla tube hirsutu-
 lous but not hidden; blades above remotely appressed pustulate
 hirsutulous.....30. *C. adpressipilosa*.
 140. Calyx in anthesis, when dried, 11–14 mm. long; corolla tube hidden
 by the dense villosity; blades above appressed pilosulous.....
36. *C. Christophersenii*.
 138. Calyx lobes broadly lanceolate; ovary pubescent; blades oval,
 141. Blades short cuneate or somewhat rounded at base,
 142. Blades elliptic, short acuminate; calyx 14–15 cm. long; petioles 3–6
 cm. long; ovary densely ascending pilose; corolla 28 mm. long.....
54. *C. Mannii*.
 142. Blades oval 5.5–9.5 cm. long; petioles 16–29 mm. long; ovary
 densely villous; corolla 20 mm. long; calyx 11–13 mm. long.....
70. *C. crassior*.
 141. Blades unevenly subcordate or rounded at base, 10–17 cm. long;
 petioles 5–12 cm. long; ovary sparsely pilose at tip.....79. *C. piligyna*.
 137. Calyx lobed almost to the base,
 143. Calyx lobes widest near the middle, spreading white hirsutulous or white
 pilose; petioles shaggy villous or pilose,
 144. Style none; berry densely villous; blades elliptic-lanceolate to oval,
 margins serrate.....57. *C. poamohoensis*.
 144. Style slender; berry glandular puberulous; blades broadly oval, margins
 dentate,
 145. Style pilose; calyx in anthesis 9–14 mm. long, lobes abruptly sub-
 acute; corolla tube pilose.....16. *C. dentata*.
 145. Style glabrous; calyx in anthesis 16–17 mm. long, lobes acumi-
 nate; corolla tube puberulent.....52. *C. leucocalyx*.

143. Calyx lobes widest near the base, densely appressed ferruginous pilose; petioles appressed villous.....54. *C. Mannii*.
131. Berry glabrous (or in *C. oulophylla* with a few hairs near apex); blades cuneate at base,
146. Style glabrous,
147. Calyx in anthesis parted about $\frac{1}{2}$ way,
148. Calyx 7–9 mm. long (when dried); blades oval, elliptic, or obovate,
149. Blades 49–72 mm. wide, above sparsely appressed hirsute; calyx in anthesis funnellform.....63. *C. stupantha*.
149. Blades 19–41 mm. wide, above pilosulous; calyx in anthesis campanulate.....83. *C. Vanioti*.
148. Calyx 8–22 mm. long,
150. Calyx 20–22 mm. long; upper calyx lobes lanceolate.....
.....2. *C. campaniformis*.
150. Calyx 8–14 mm. long (when dried); blades narrowly elliptic or oblanceolate or obovate,
151. Upper calyx lobes narrowly deltoid; calyx surface obscured by the dense glandular spreading pilosity; corolla tube shaggy villous on exposed parts; blades 2.8–6.3 cm. long, above densely spreading pilose.....10. *C. rivularis*.
151. Upper calyx lobes with broad linear tips; calyx surface finely appressed pilosulous; corolla tube glabrous on lower $\frac{2}{3}$; blades 6.8–12.2 cm. long, above remotely appressed pilose.....12. *C. triflora*.
147. Calyx in anthesis parted $\frac{3}{4}$ way or more,.....106. *C. oulophylla*.
152. Calyx 3-lobed.....
152. Calyx 5-lobed,
153. Calyx strongly 2-lipped,
154. Calyx 32–36 mm. long, densely appressed villous.....62. *C. Rockii*.
154. Calyx 45 mm. long, hirsute.....114. *C. caudatisepala*.
153. Calyx almost equally 5-lobed,
155. Blades glabrous above, 9–16 mm. wide.....41. *C. hirsutula*.
155. Blades appressed pubescent above, 10–49 mm. wide,
156. Calyx 10–15 mm. long (when fresh); base of blade abruptly cuneate,
157. Calyx lobes lanceolate or broadly so, appressed pilose; corolla 23–25 mm. long; blades coriaceous.....66. *C. Wilderi*.
157. Calyx lobes elliptic; the lower half hirsutulous, the upper puberulous; corolla 17 mm. long; blades thin chartaceous.....
.....37. *C. elliptisepala*.
156. Calyx 20–25 mm. long,
158. Calyx 20–21 mm. long (when fresh), appressed pilose; base of blade long cuneate.....53. *C. longiloba*.
158. Calyx 20–25 mm. long, villous; inflorescence villous; blades oval to suborbicular.....58. *C. propinqua*.
146. Style pubescent,
159. Calyx cleft $\frac{1}{2}$ way to base, 22 mm. long (when dried), without sparsely appressed puberulent.....80. *C. scabrella*.
159. Calyx cleft $\frac{3}{4}$ way or more,
160. Calyx cleft $\frac{3}{4}$ way; blades oblanceolate; corolla tube deflexed at middle at 35°, shorter than calyx; calyx lobes lance-linear.....
.....38. *C. ferrocilata*.
160. Calyx cleft nearly to the base,
161. Blades long decurrent; calyx lobes subglabrous at tip....35. *C. chartacea*.
161. Blades moderately or abruptly cuneate,
162. Calyx lobes narrowly elliptic-oblanceolate; blade base abruptly cuneate.....39. *C. Forbesii*.

162. Calyx lobes lanceolate or linear lanceolate,
 163. Calyx glabrous within, equaling the corolla, the lobes lanceolate
31. *C. arcuata*.
163. Calyx pubescent within,
 164. Calyx 9-13 mm. long, shaggy pilose without, lobes broadly lanceolate, 4-5 mm. broad.....8. *C. opaeulae*.
164. Calyx 13-18 mm. long, hirsute, lobes linear-lanceolate, 2.5-3 mm. wide32. *C. basipartita*.

I. Subgenus *Brachycyathus* C. B. Clarke

1. Section *Microcalyces*

1. *Cyrtandra ambigua* (Hillebrand) St. John and Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 84, 1950. (Figs. 9, 10, 185.)
Cyrtandra triflora Gaudichaud γ var. *ambigua* Hillebrand, Fl. Hawaiian Is., 332, 1888.
Cyrtandra polyantha C. B. Clarke var. *ambigua* (Hillebrand) Rock, Am. Jour. Bot. 6: 209, 1919 (as *C. polyantha ambigua*, but stated to be a variety).

Description of All Specimens Examined: Shrub, about 1 m. tall; branches stout, with longitudinal ridges, the bark gray, the leaf scars corky, raised; internodes 5-25 mm., usually about 9 mm. long; leafy branchlets 2-5 mm. in diameter, quadrangular, sparsely appressed pilosulous but soon glabrate; young shoots closely appressed brown pilosulous; *leaves* opposite, equal, numerous and approximate; petioles 10-25 mm. long, appressed pilosulous, at length glabrate; *blades* 4-10 cm. long, 17-39 mm. wide, firm chartaceous, elliptic but tapering to an acute or subacuminate apex and a cuneate, short decurrent base, slightly asymmetric and subfalcate, plane, above dark green and somewhat shiny, glabrous except for appressed pilosity running a little ways up midrib, below pale green, not conspicuously hairy but the veins minutely appressed brownish pilosulous, the margin unevenly crenate-serrulate; *cymes* from leaf axils, 4-8-flowered, very sparsely pilose but early glabrate; peduncles 7-12 mm. long; pedicels 8-15 mm. long; bracts 3-6 mm. long, lanceolate, at first sparsely pilosulous, caducous; buds slender fusiform, the calyx lobes erect, approximate; *calyx* 9-12 mm. long, campanulate, at first sparsely pilosulous, later more or less glabrate, glandular punctate, obliquely and strongly 2-lipped, lobed $\frac{1}{2}$ - $\frac{2}{3}$ way to base, finally splitting down one side, cleft between lobes to within 7 mm. of base; upper lip 3-lobed, the lobes 6 mm. long, linear-lanceolate, acuminate; lower lip 2-lobed, lobes 3.5-7 mm. long, 2 mm. wide, linear-lanceolate, the tube 4-7.5 mm. long; *corolla* 14-20 mm. long, white, the tube 13-14 mm. long, 3-5 mm. in diameter, the lower half subcylindric, the upper expanding and funnel-form to the throat, the exposed part villous, the hairs decreasing towards the glabrous covered base, the throat open, pilosulous, the lobes unequal, the upper 2-3 mm. long, 4.5 mm. wide, transversely oval; the lower apparently spreading at about 60° from the axis of the tube, the outer side glabrous; lateral lobes 6.5 mm. long, 5.5 mm. wide, broadly but slightly obliquely elliptic; lower lobe 7.5 mm. long, 6 mm. wide, broadly elliptic; filaments fused to the corolla tube to within 3 mm. of the throat, the free portion 2 mm. long, incurved, subulate; anthers 1.5-1.8 mm. long, ovate-deltoid, flattened, asymmetric, one cell the smaller; *style* 3-5.5 mm. long, glabrous; stigma with two flattened, obovate stigmatic lobes, 2.5 mm. long, 0.9 mm. wide, spatulate, connate on one edge for a short distance; *ovary* 4.5 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk; half-grown fruit 8 mm. long, lanceoloid glabrous.

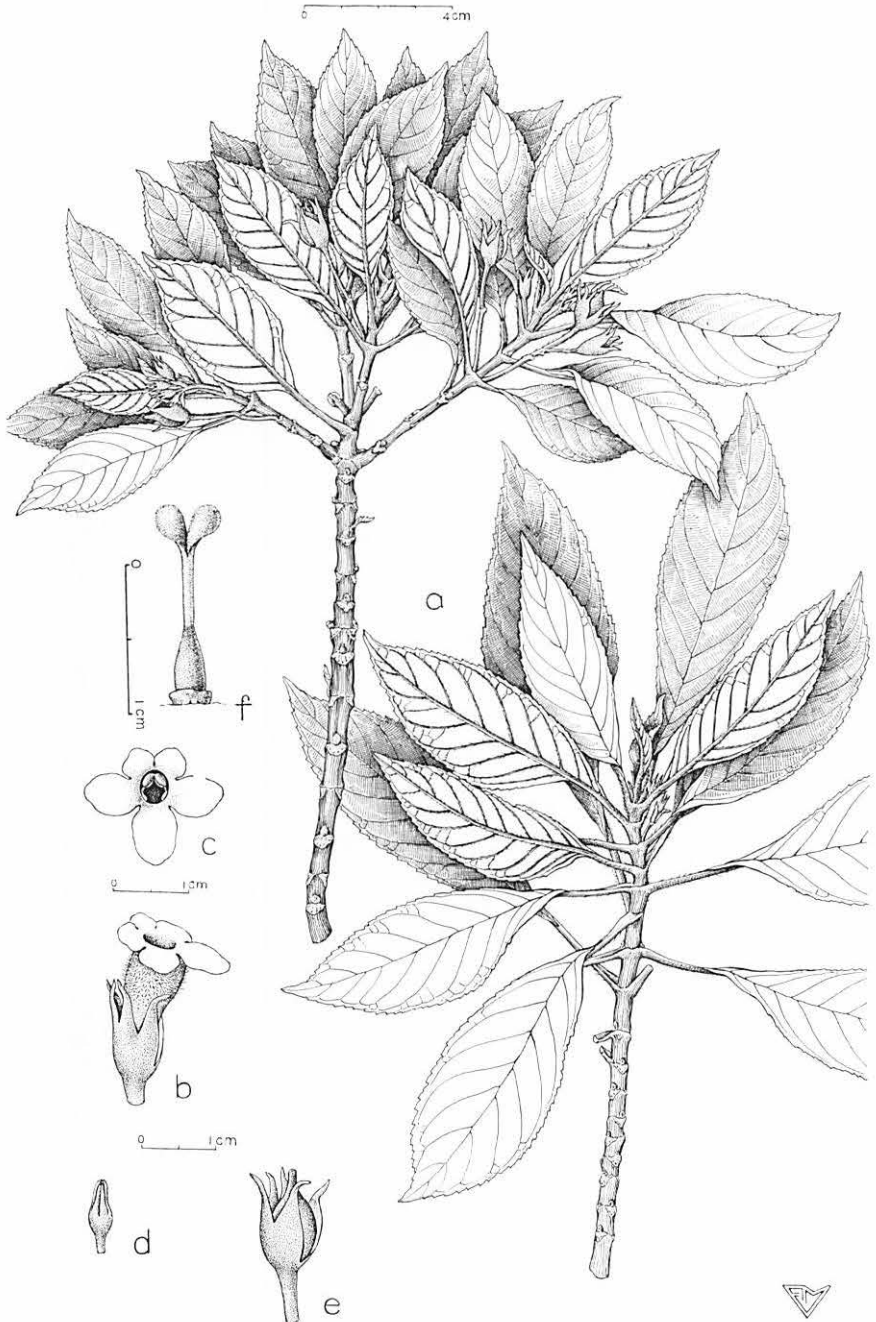


FIGURE 9.—*Cyrtandra ambigua*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, fruit, $\times 1$; f, pistil, $\times 2$. Niu, St. John 20,121.

Distribution: Koolau Range, leeward side, known definitely only from Niu, where it grows in the Ohia Zone on the crest of a steep ridge at 1,500 feet altitude.

Holotype: Oahu, *W. Hillebrand* (B) ; isotype (BISHOP MUS.).

Specimens examined: Koolau Range, leeward side: see type; Niu, Kule-

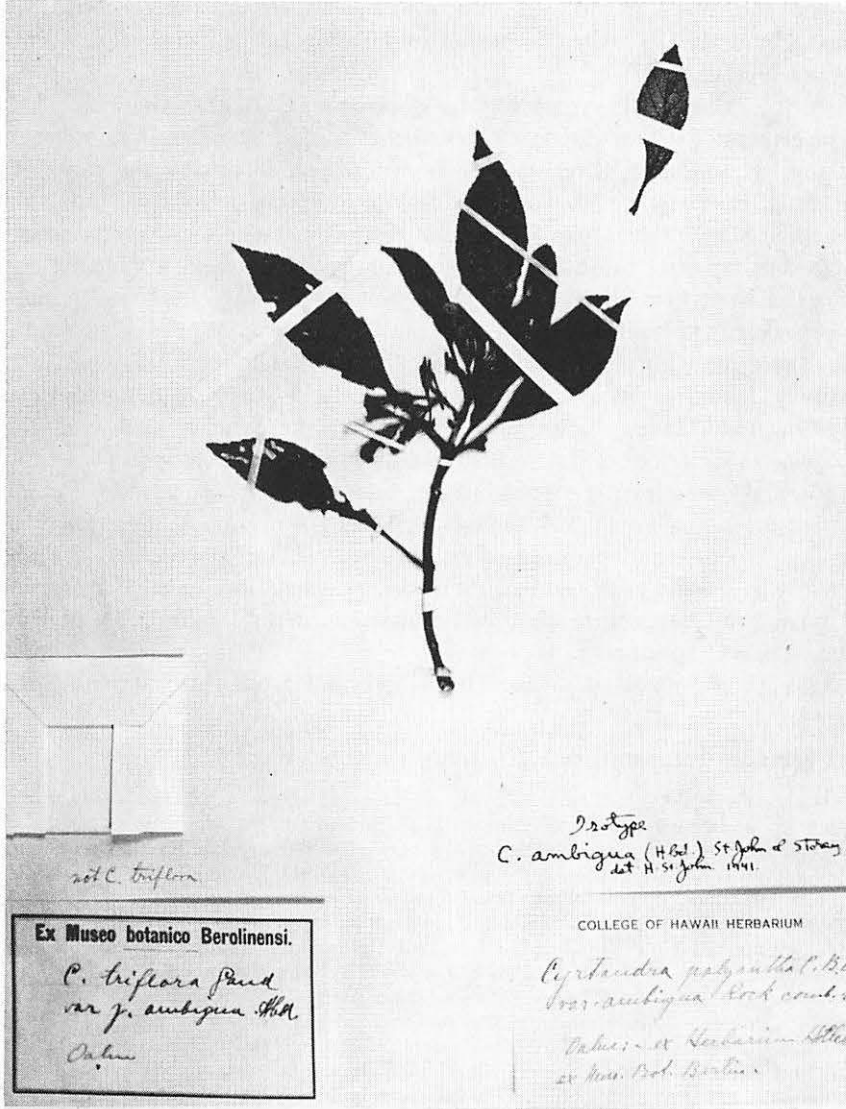


FIGURE 10.—*Cyrtandra triflora* var. *ambigua*, Oahu, Hillebrand, isotype (Bishop Mus.); also isotype of *C. ambigua* (Hillebrand) St. John and Storey.

piamoa Ridge, 1,500 ft. alt., moist thicket on ridge, Nov. 10, 1940, *St. John* 20,121.

Discussion: *C. ambigua* is a member of the section *Microcalyces*, but like its closest relative, *C. polyantha* C. B. Clarke, has the calyx obliquely and unevenly cleft $\frac{1}{2}$ to $\frac{2}{3}$ way to the base. In this character it is partly intermediate towards the section *Schizocalyces*.

This rare plant was known only from the Hillebrand type recorded only from Oahu, until 1940 when the writer found a few bushes on the steep central ridge of Niu Valley.

Rock was correct in separating this plant from *C. triflora* Gaudichaud, but his placement of it as a variety of *C. polyantha* C. B. Clarke was no more satisfactory. *C. ambigua*, here made a species, differs in having the calyx 9-12 mm. long, campanulate, the tube 4-7.5 mm. long, the lobes 3.5-7 mm. long, linear-lanceolate; the corolla 3-5 mm. in diameter; cyme 4-8-flowered; blades elliptic but tapering to an acute or subacuminate apex and a cuneate, short decurrent base, firm chartaceous, plane, below with only the veins minutely appressed brownish pilosulous. In contrast, *C. polyantha* has the calyx 4-6 mm. long, short funnellform, the tube 1-3 mm. long, the lobes 1.5-3.5 mm. long, narrowly deltoid to linear-lanceolate; the corolla 6-8 mm. in diameter; cyme 7-30-flowered; blades elliptic, tapering to an acute point at each end, thick subcoriaceous, the tips and margins revolute, the veins strongly impressed and the intervals prominently raised bullate, below densely appressed pilosulous, pale but drying pale or light brownish, appearing sericeous. With these differences in structure and shape of calyx, corolla, leaf, and pubescence, the plant is clearly of specific rank. To be sure, it occurs near a locality of *C. polyantha*, but no intermediates were observed, and the structural differences give it a strong claim to specific status.

The specific name was taken by Hillebrand from the Latin *ambiguus*, doubtful.

2. *Cyrtandra campaniformis* St. John, sp. nov. (Figs. 11, 186).

Diagnosis Holotypi: Frutex 2.5 m. altus, caule 3 cm. diametro supra ramosi, cortice griseo-brunneo sublaevi, ramulis 5-10 mm. diametro viridibus carnosus subquadrangularibus glabris, cicatricibus 3-4 mm. altis late cordatis vel depresso-obdeltoideo-scutelliformibus pallidis suberosis, fasciculis 5 vel 7, ramulis foliferis 3-5 mm. diametro viridibus carnosus subquadrangularibus in juvente pauca pilosis sed pilis mox caducis, novellis sparse brunneo-pilosulis, foliis oppositis rare subaequalibus plerumque uno $\frac{1}{2}$ minore, petiolis 2-6.2 cm. longis validis carnosus remote adpresso-pilosulis ad glabris, laminis 6-16 cm. longis 25-87 mm. latis firme chartaceis ellipticis vel late ellipticis saepe curvatis et asymmetricis apice acuto vel subacuminato basi breve cuneata saepe inaequali supra obscure lucido-viridibus glabris excepta in midnervo pilosuli infra albescenti-viridibus et in nervis puberulis intervallis glabris marginibus plerumque serrulatis nervis in uno latere 6-8 adscendentibus apicibus arcuatis et interconnectis, cymis axillaribus 3- vel 5-floriferis 18-40 mm. longis paene glabris, pedicellis 13-34 mm. longis remote pilosulis, bracteis 6-17 mm. longis lanceolatis vel oblanceolatis pallide viridibus foliaceis, alabastris anguste campanulatis lobis calycis divergentibus, calycibus viridibus in flore 20-22 mm. longis (15-17 mm. in sicco) ex-



FIGURE 11.—*Cyrtandra campaniformis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, bud, $\times 1$. Holotype, Laie, St. John 25,960 (Bishop Mus.).

accrescentibus anguste campanulatis extra remote albi-pilosulis vel ad basim subglabris minime bilabiatis inter labias 11-12 mm. partitis, labia supera 3-lobata lobis lanceolatis subacutis intra in apice glabris sed $\frac{2}{3}$ parte infera capitato-glanduloso-pilosula inter lobas 8-9 mm. partitis, labia infera bilobata lobis 11-13 mm. longis 4-5.5 mm. latis lanceolatis simulantibus, tubo calycis 6-8 mm. longo anguste campanulato intra in basi glabro sed ad orificem pilosulo, *corollis* in vivo 25-26 mm. longis albis tubo 17 mm. longo in basi 4.5 mm. diametro in medio 8 mm. in orifice 9 mm. in medio 20° deflexo extra in dimidia infera glabro sed in dimidia supera capitato-glanduloso-puberulo, lobis binis superis 4 mm. longis 7.5 mm. latis transverse ovalibus simili modo alteris lobis in basi impensis et item ad basem minute capitato-glanduloso-puberulis, labia infera trilobata, lobis lateralibus 5.5-6 mm. longis 8-9 mm. latis oblato-suborbicularibus, loba infera 6-7 mm. longa 9 mm. lata transverse ovalibus, staminibus inferis binis perfectis filamentis in tubo 5 mm. ex orifice affixis parte libera 3 mm. longa subtereti contorte adscendenti, antheris 2.9 mm. longis 2.5 mm. latis oblique ovatis connectivo ovato 2 mm. lato, staminodeis lateralibus in tubo 7 mm. ex orifice affixis parte libera 0.5 mm. longa subulata apice antheroidea 0.8 mm. longa lanceolata albescenti, *stylo* 2.5 mm. longo tereti glabro, lobis stigmatis 3 mm. longis late ellipticis $\frac{3}{4}$ connatis in dorso glabro, *ovario* 11 mm. longo anguste lanceoloideo glabro in basi cum disco cupulato 1.5 mm. alto cincto; *baccis* (parve immaturo) 18 mm. longis cum 1.5 mm. rostro 8 mm. diametro ellipsoideis glabris.

Shrub 2.5 m. tall; stem 3 cm. in diameter, simple below, bushy branched above; bark grayish brown, rather smooth; branchlets 5-10 mm. in diameter, green to brown, fleshy, subquadrangular, glabrate; leaf scars 3-4 mm. high, broad cordate to low obdeltoid shield-shaped, pale, corky; bundle scars 5 or 7; leafy branchlets 3-5 mm. in diameter, green, fleshy, subquadrangular, in youth with a little pilosity but almost immediately glabrate; young shoots sparsely brownish pilosulous; *leaves* opposite, less commonly subequal, more often one of a pair about $\frac{1}{2}$ the smaller; petioles 2-6.2 cm. long, stout, fleshy, sparsely appressed pilosulous to glabrate; *blades* 6-16 cm. long, 25-87 mm. wide, firm chartaceous, elliptic or broadly so, often curved and somewhat asymmetric, the apex acute or short subacuminate, base short cuneate, often unequally so, above dark shiny green, glabrous except for a little weak pilosity on the midvein, below whitish green and puberulous on primary, secondary, and tertiary veins, the intervals glabrous, the margins mostly serrulate, the lateral veins 6 to 8 on a side, ascending, then arcuate upcurved and interconnected; *cymes* axillary, 3- or 5-flowered, 18-40 mm. long, almost or quite glabrous; pedicels 13-34 mm. long, remotely pilosulous; bracts 6-17 mm. long, lanceolate or oblanceolate, pale green, foliaceous; buds narrowly campanulate, calyx lobes spreading; *calyx* greenish, firm, in anthesis when fresh 20-22 mm. long (when dried 15-17 mm. long), not accrescent, narrowly campanulate, without remotely white pilosulous or towards the base subglabrate, perceptibly bilabiate, cleft 11-12 mm. between the lips; upper lip 3-lobed, the lobes lanceolate, subacute, within glabrous at apex but the lower $\frac{2}{3}$ capitate glandular pilosulous, cleft between the lobes 8-9 mm.; lower lip bilobed, the lobes 11-13 mm. long, 4-5.5 mm. wide, lanceolate, similar; calyx tube 6-8 mm. long, narrowly campanulate, within at base glabrous, above that with pubescence increasing in size of hairs and near the orifice becoming pilosulous; *corolla* when fresh 25-26 mm. long, white, the tube 17 mm. long, 4.5 mm. in diameter at base, 8 mm. at the middle, 9 mm. at the throat, at the middle the tube deflexed at 20° from the axis of the lower part of the tube, tube glabrous without on lower half and up the proximal side to the throat which is capitate glandular puberulous, on the distal side the similar pubescence begins at the midsection and continues to the throat and overlaps on sides; limb 2-lipped, 5-lobed; upper lip 2-lobed, the lobes spreading at 70° from the axis of the throat, upper lobes 4 mm. long, 7.5 mm. wide, transversely oval, and like all the other lobes the bases overlapping and within the lobes glabrous except for being minutely capitate glandular puberulous at and near throat; lower lip 3-lobed; lateral lobes 5.5-6 mm. long, 8-9 mm. wide, oblate suborbicular; lower lobe 6-7 mm. long, 9 mm. wide, transversely oval; two lower stamens perfect, their filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 3 mm. long, subterete, spirally upcurved, the two perfect anthers 2.9 mm. long, 2.5 mm. wide, obliquely

ovate, the heavy connective 2 mm. wide, ovate; lateral staminodia adnate to the corolla tube 7 mm. from the throat, the free portion 0.5 mm. long, subulate, the antheroid tip 0.8 mm. long, lanceolate, whitish; upper staminodium adnate to within 8 mm., the free part 1.5 mm. long, slender subulate, the tip 0.6 mm. long, linear; *style* 2.5 mm. long, terete, glabrous; stigmatic lobes two, 3 mm. long, broadly elliptic, on proximal side connate $\frac{3}{4}$ way, the back glabrous; *ovary* 11 mm. long, narrowly lanceoloid, glabrous, surrounded at base by a cupulate disk 1.5 mm. high; *berry* (a little immature) 18 mm. long including the 1.5 mm. beak, 8 mm. in diameter, ellipsoid, glabrous.

Distribution: Known only from the type collection, Koolau Range, windward side, in the Ohia Zone at 1,250 ft. alt.

Holotypus: Oahu, Laie Trail, Kahawainui Gulch, in moist *Metrosideros* forest, 1,250 ft. alt., March 25, 1956, *H. St. John 25,960* (BISHOP MUS.).

Discussion: *C. campaniformis* is a member of section *Microcalyces*, though none of its species are very close relatives. The most similar appearing species is *C. olivacea*, a member of the *Cylindrocalyces* and it differs by having: the bundle scars 3; leafy branchlets densely olive brown appressed pilose; petioles 1-2 cm. long, their bases interconnected around the node; blades 13-36 mm. wide, narrowly elliptic, the base long cuneate and decurrent; pedicels 5-12 mm. long; bracts 1-3 mm. long; calyx 17 mm. long and its lobes at most 2.5 mm. wide; and the corolla tube with the exposed parts shaggy white hirsute. *C. campaniformis* differs by having: bundle scars 5 or 7; leafy branchlets in youth with a little pilosity but almost immediately glabrate; petioles 2-6.2 cm. long, their bases distinct; blades 25-87 mm. wide, elliptic or broadly so, the base short cuneate, often unequally so; pedicels 13-34 mm. long; bracts 6-17 mm. long; calyx 20-22 mm. long, the lobes 4-5.5 mm. wide; and the corolla tube capitate glandular puberulous outside around the throat and down to the middle on the distal side.

The specific epithet is coined from the Latin *campana*, a church bell, and *formis*, shaped, in allusion to the campanulate calyx.

3. *Cyrtandra cupuliformis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 84, 1950. (Figs. 12, 187.)

Description of Holotype: Shrub 2.4 m. tall; older branches glabrate, smooth pale grayish brown, somewhat fleshy, shrinking in drying and then longitudinally furrowed and ridged, 3-5 mm. in diameter, naked below; leaf scars 3-5 mm. high, stramineous, obcordate-shield-shaped; bundle scars 7; young shoots densely brown velvety pilose; leafy branchlets as much as 4 mm. in diameter, slightly quadrangular, somewhat fleshy and shrinking on drying, densely brown pilosulous; internodes 5-22 mm., commonly 10 mm. long; leaves opposite, unequal, one of a pair commonly $\frac{1}{2}$ smaller, ascending, borne at the 2-4 upper nodes, not crowded; petioles 17-38 mm. long, densely ferruginous pilosulous, each hair at first with an ellipsoid glandular head but these soon vanishing; *blades* 4.5-9 cm. long, 24-65 mm. wide, coriaceous, densely ferruginous pilose, the hairs at first gland-tipped, the blades asymmetrically obovate or ovate, apex subacute, base abruptly cuneate, the margins serrulate, secondary veins 6-8 on a side, ascending, arcuate, the tips inarching, the surfaces above dark rusty green, below light tawny; *cymes* 3-flowered, axillary, densely ferruginous glandular pilosulous; peduncles 8-21 mm. long, obliquely ascending; bracts 7-9 mm. long, ovate, deciduous; pedicels in fruit 15-22 mm. long; buds oblong-cupuliform, the calyx lobes ascending; *calyx*

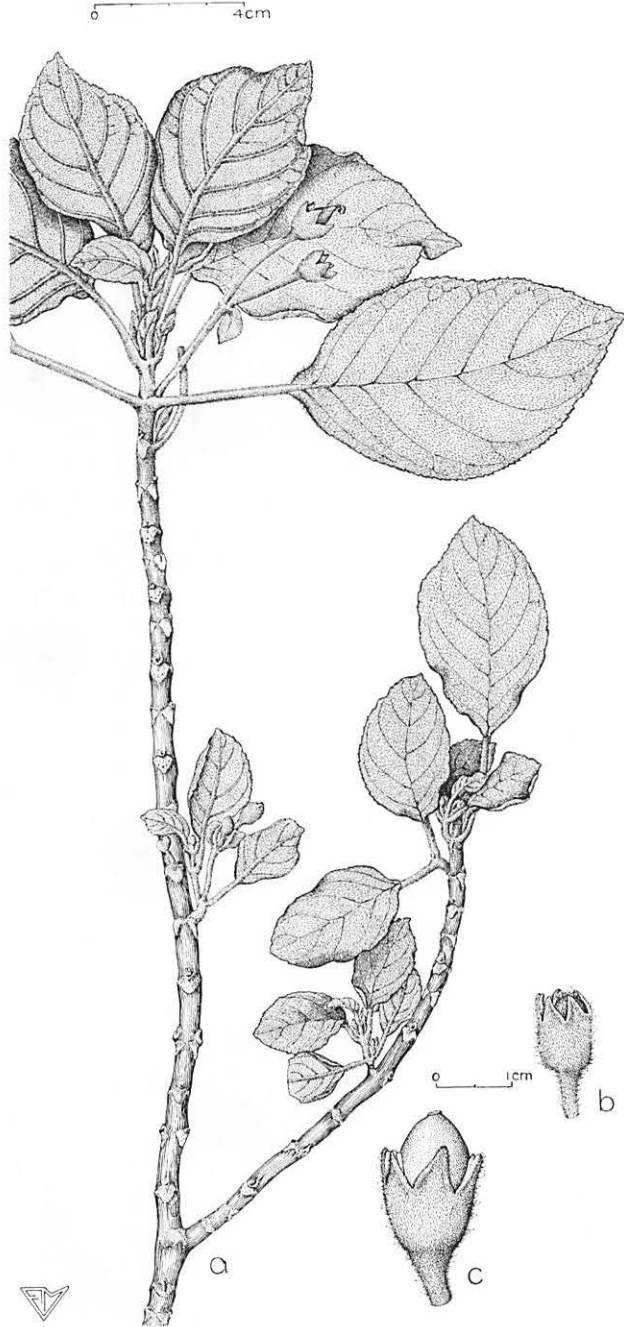


FIGURE 12.—*Cyrtandra cupuliformis*: a, habit, $\times \frac{1}{2}$; b, bud, $\times 1$; c, fruit, $\times 1$; DuPont Trail, Mita and Frederick 204, holotype (Bishop Mus.).

in fruit when fresh 8-11 mm. long, densely ferruginous, glandular pilosulous, in fruit campanulate, the tube 5-9 mm. long, 2-lipped, the sinus between the lips 5 mm. deep; upper lip 4 mm. long, the 2 lobes with a cleft 4 mm. deep, the lobes deltoid; lower lip with 3 lobes, with clefts 5 mm. deep, the lobes deltoid, 4-5 mm. wide: mature corolla unknown; *style* 3 mm. long, stout, terete, glabrous; stigmatic lobes 2, sessile 1.5 mm. long, elliptic, connate $\frac{2}{3}$ way up proximal side; *ovary* when well grown but not mature 15-16 mm. long, 7-8 mm. in diameter, ovoid, glabrous; seeds unknown.

Distribution: Waianae Mountains, northern or windward slopes of Mt. Kaala, at 3,300 ft. alt. in the Ohia Zone. Known only from the type collection.

Holotype: Oahu, Waianae Range, Du Pont Trail, 3,300 ft. alt., growing on ridge in moist *Metrosideros* forest, Aug. 3, 1947, *D. Mita & L. Frederick 204* (BISHOP MUS.).

Discussion: *C. cupuliformis* is a member of the section *Microcalyces*. It is closely related to *C. rivularis* St. John & Storey of the Koolau Range which has the blades 2.8-6.3 cm. long, firm chartaceous, lance-ovate to lance-obovate; secondary veins 4-6 on a side; calyx lobes narrowly deltoid. In contrast, *C. cupuliformis* has the blades 4.5-9 cm. long, coriaceous; secondary veins 6-8 on a side; calyx lobes broadly deltoid.

The specific name is coined from the Latin *cupula*, a little cup, and *forma*, a shape, in allusion to the shape of the young calyx.

4. *Cyrtandra Fosbergii* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 84, 1950. (Figs. 13, 188.)

Description of Holotype: Shrub; branches with gray, smooth, glabrous bark, the leaf scars 2.5-4 mm. high, low cordate, pale, annular, corky, and raised; bundle scars 9; internodes 0.8-9 cm., usually about 13 mm. long; leafy branches subquadrangular, densely dark ferruginous pilose; young shoots densely appressed brown pilose; *leaves* opposite subequal, ascending but not crowded; petioles 11-30 mm. long, densely appressed brown pilose, the bases perfoliate; *blades* 11-16 cm. long, 42-68 mm. wide, firm chartaceous, broadly elliptic, nearly symmetrical, the apex acute or subacuminate, the base cuneate and decurrent, plane, above remotely hirsute when young but soon glabrous, below whitish green, brown pilose on midrib and veins, the intervals sparsely brown pilose at first but soon subglabrate, the margin coarsely serrate; *cymes* from the leaf axils, 1-3-flowered, densely brown subappressed pilose; peduncles 5-11 mm. long; pedicels 2-8 mm. long; bracts 5-10 mm. long, lanceolate; buds campanulate, the calyx lobes erect; *calyx* 18-22 mm. long, campanulate, covered with a dense brown subappressed pilosity outside and villosity inside, slightly 2-lipped, the tube 6-8 mm. long; upper lip of 3 lobes, cleft $\frac{1}{3}$ way, the lobes linear-lanceolate, obtuse; lower lip of 2 lobes, cleft $\frac{2}{3}$ way, 14 mm. long, lanceolate, obtuse; *corolla* 23-30 mm. long, white, the tube 17-20 mm. long, cylindric and nearly straight for $\frac{3}{4}$ its length, 3 mm. in diameter, the upper part near the throat slightly expanded and narrowly funnelform, the throat 6-8 mm. in diameter, the inside glabrous, thickened and callous, the outside glabrous below the middle, above middle densely brown pilose; limb 2-lipped, 5-lobed; upper lip with two lobes, recurving at about 90° to the axis of the throat, 6 mm. long, 6 mm. wide, broadly oval reflexed at about 110° to the axis of the throat, the inside glabrous; lower lobes 3, except at the margins the three all thick, firm, and callous with the inner surface capitate glandular puberulous, the 2 lateral ones 7.5 mm. long 7 mm. wide, asymmetric ovate; lower lobe 11 mm. long, 8.5 mm. wide, ovate; the lobes all pilose outside on the median section near the base; two lower stamens perfect, the filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 3 mm. long,



FIGURE 13.—*Cyrtandra Fosbergii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Kahana Ditch 77, Kahana, Fosberg 10,390, holotype (Bishop Mus.).

stout, spirally upcurved; the two perfect anthers 2.5 mm. long, obliquely ovate, connate at apex; 2 minute straight staminodia 0.8 mm. long, and the upper staminodium 0.2 mm. long, all with minute, scarcely differentiated anther remnants; style 6 mm. long, stout, ascending pilose; 2 stigmatic lobes, 3.5 mm. long, broadly oblong-oval, connate $\frac{1}{3}$ way up proximal side; ovary 6 mm. long, lanceoloid, glabrous, base surrounded by a cupulate disk 1 mm. high; fruit unknown.

Distribution: Koolau Range, windward side, at 270 m. alt., in the wet forest of the Ohia Zone.

Holotype: Oahu: Koolau Mts., Kahana Valley, Ditch Trail, wet forest, alt. 270 m., with *C. kalichii* & *C. longifolia* var., Nov. 26, 1933, F. R. Fosberg 10,390 (BISHOP MUS.).

Discussion: *C. Fosbergii* is a member of the section *Microcalyces*. In that section it has a close relative found in Kaneohe, *C. kaneoheensis* St. John, which has its young shoots and petioles densely brownish hirsutulous; blades oblanceolate and above sparsely hirsute; cymes 3-7-flowered, densely hirsutulous; buds lance-fusiform; calyx 15-16 mm. long, hirsutulous without, lower lobes 9-11.5 mm. long, linear-oblanceolate; corolla tube with the upper half shaggy white villous without, its upper lobes 3.5 mm. long, the lower lobes 6-7 mm. long; and the style capitate glandular hirsute. *C. Fosbergii* has contrasting characters, young shoots densely dark ferruginous pilose; petioles densely appressed brown pilose; blades broadly elliptic, the upper surface when young remotely hirsute but soon glabrate; cymes 1-3-flowered, densely subappressed pilose; buds campanulate; calyx 18-22 mm. long, densely subappressed pilose; lower lobes 14 mm. long, lanceolate; corolla tube with upper half densely brown pilose without, the upper lobes 6 mm. long, the lower lobe 11 mm. long; and the style ascending pilose.

The specific epithet honors the collector of the holotype, Dr. F. Raymond Fosberg, who while a resident of Hawaii was an active collector and a productive student of its flora.

5. *Cyrtandra Garnotiana* Gaudichaud, Voy. Uranie, Bot. 447, 1826 [= 1829];

Atlas pl. 53, 1826-30 (as *C. garnotiana*). (Figs. 14-16, 189.)

C. Garnotiana Gaudichaud var. β *fulva* C. B. Clarke, in De Candolle, Monogr. Phanerog. 5 (1): 220, 1883.

There are orthographic variants due to errors or misspellings as follows:

C. Carnotiana Gaudichaud ex G. Don, Gen. Hist. Dichlam., Pl. 4: 661, 1838.

C. Garnottiana Gaudichaud ex Mann, Am. Acad. Arts Sci., Proc. 7: 190, 1867.

C. Garrottiana Gaudichaud ex Wawra, Flora 55: 563, 1872 (p. 17 of reprint).

Native Name: Hahala (Fafara of Gaudichaud).

Description of All Specimens Examined: Shrub 1-4 m. tall, usually with several branches, the branches terete or slightly quadrangular; bark gray, smooth; leaf scars 3-7 mm. high, cordate-shield-shaped, gray, inconspicuous, corky, flush or little raised;



FIGURE 14.—*Cyrtandra Garnotiana*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 4$; f, fruit, $\times 1$. Kaala, St. John 20,128.

bundle scars 7; internodes 1-4 cm., usually about 15 mm. long; leafy branchlets 2-4 mm. in diameter, canescent pilosulous, the hairs often drying brownish; young shoots densely white pilosulous, often drying brownish; *leaves* opposite, distinctly unequal, one of a pair about $\frac{1}{2}$ the larger, somewhat asymmetric and curved divergent, the few pairs distant; petioles 2-8 cm. long, viscid pilosulous; *blades* 7-23 cm. long, 4-12.5 cm. wide, chartaceous, lanceolate to elliptic or occasionally oval, the apex acute or subacuminate, the base cuneate and short decurrent, above green and sparsely subappressed puberulent, below pale green and moderately pilosulous, the margin closely or remotely serrate except at base; *cymes* from the leaf axils, 3-12 (-20, according to Rock) -flowered, viscid, pilosulous throughout; peduncles 25-82 mm. long; pedicels 10-32 mm. long;

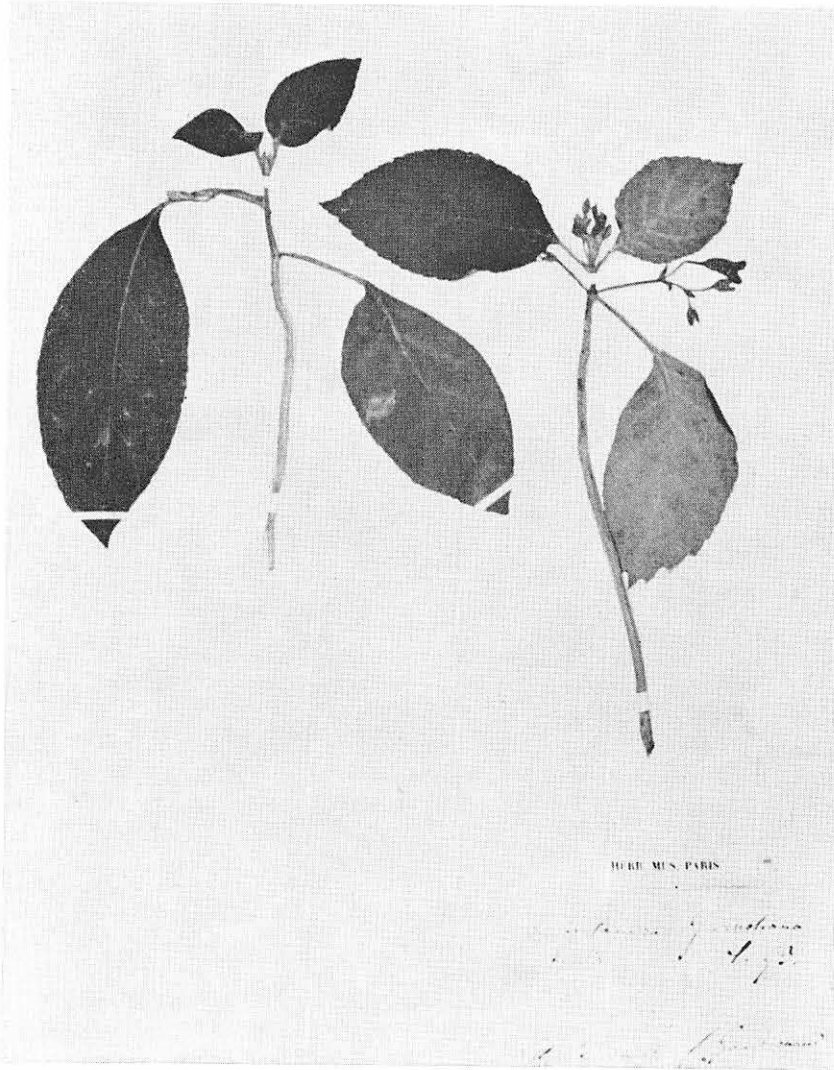


FIGURE 15.—*Cyrtandra Garnotiana*, holotype (Paris).

bracts 8-15 mm. long, lanceolate, foliaceous; buds ovoid, acute, the calyx lobes connivent; calyx 6-10 mm. long, green, campanulate, densely white viscid pilosulous canescent, within puberulent, distinctly 2-lipped, lobed about $\frac{1}{2}$ way to base, lobes narrowly deltoid or lance-ovate, 3-7 mm. long, subequal; corolla 10-17 mm. long, 3-7 mm. in diameter, white, the tube 7-13.5 mm. long, ellipsoid or obovoid but sharply deflexed at about 30° just above the level of exertion from the calyx, contracted to the throat, the outer surface white pilose beyond the calyx tube, the lobes 1-3.5 mm. long, semi-

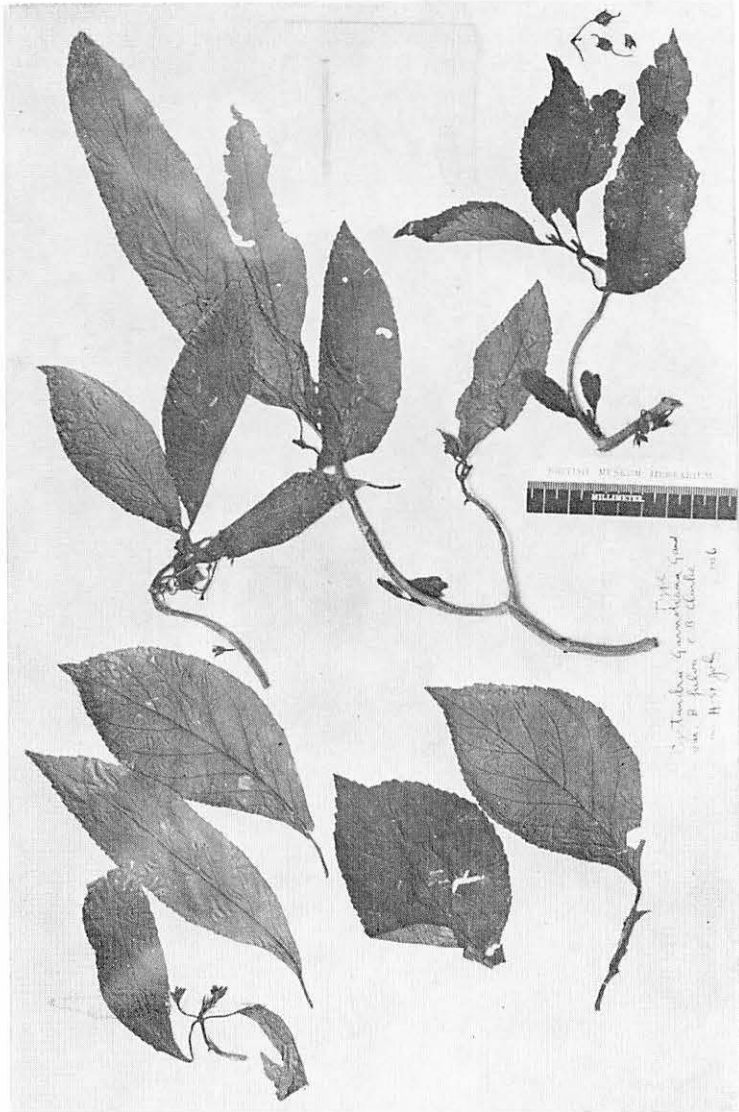


FIGURE 16.—*Cyrtandra Garnotiana* var. *beta fulva*, holotype (British Mus.); now classified as *C. Garnotiana* Gaudichaud.

orbicular, white pilose on the outside, glabrous within, unequal, the upper lobes 1-2 mm. long, 4 mm. wide, transversely elliptic; the lateral lobes 3.5 mm. long, 5 mm. wide, transversely oval; lower lobe 4 mm. long, 5 mm. wide, cordate, the lobes spreading at about 60° from the axis of the upper tube and throat; filaments fused to the tube to within 3 mm. of the throat, the free portion 2 mm. long, subulate, spirally incurved; anthers 2.5-3 mm. long, obliquely deltoid, thick, one cell much the smaller; style 0.5-1.5 mm. long, at first glabrous, but after anthesis it may become sparsely pilose; the two terminal stigmatic lobes 1 mm. long, opposite, distinct, suborbicular, thick; ovary glabrous, lanceoloid, becoming pubescent after anthesis, base surrounded by a cupulate disk 0.9-1.2 mm. high; berry 1.2-1.7 cm. long, white, ovoid, acute, puberulous; seeds 0.31-0.37 mm. long, shining, light brown, the ends dark brown, broadly ellipsoid, covered with a raised cellular reticulation, the areolae oblong polygonal, $\frac{1}{3}$ to $\frac{1}{4}$ the length of the seed.

Distribution: Koolau Range, windward side, at a single locality, below the Nuuanu Pali, at 1,025 ft. alt.; leeward side, from Wahiawa to Nuuanu, from 600 to 2,035 ft. alt., in the Koa Zone and the Ohia Zone.

Waianae Mountains, from Keekee Gulch in Kaena to Puu Kaua, mostly on the windward side, 1,500 to 2,800 ft. alt., in the Koa Zone and Ohia Zone.

Holotype: "In insulis Sandwicensibus," collected by Charles Gaudichaud in 1819 on the voyage of the "Uranie," certainly on Oahu, and probably on the mountains back of Honolulu. The holotype was examined in the herbarium at Paris (see Fig. 15). An isotype was also seen at Berlin, and it was similar to but much more meager than the specimen illustrated by Gaudichaud.

Specimens examined: Koolau Range.

Windward Side: Kaneohe, second ridge east of Nuuanu Pali Lookout, 1,025 ft. alt., on side of ravine, open brush, Oct. 2, 1955, *Pearsall 8*.

Leeward Side: Wahiawa, ex herb. *Hillebrand* (BISH, BM); Wahiawa, Aug. 5, 1908, *Forbes and Rock*; Kipapa Gulch, wet, steep slope, Jan. 16, 1930, *Degener 18,056* (NY); Waipio, Kipapa Gulch, Feb. 15, 1931, *Ho*; ditto, 1,500 ft. alt., Nov. 10, 1929, *Hosaka 24*; ditto, in woods, 1,000 ft. alt., Feb. 16, 1930, *Hosaka 147*; ditto, south ridge, 1,000 ft. elev., Feb. 16, 1930, *Hosaka 153*; ditto, north ridge, moist gully, 1,000 ft. elev., May 29, 1932, *Hosaka 576*; ditto, 2nd N. Fork, 1,500 ft. elev., Nov. 13, 1932, *Hosaka 847*; ditto, 1,500 ft. elev., Nov. 13, 1932, *Hosaka 847A*; ditto, on moderately moist slope, 900 ft. elev., Apr. 30, 1933, *Hosaka 978*; ditto, 1,400 ft. elev., in wet gully, Oct. 1, 1933, *Hosaka 1,225*; ditto, 425 m. elev., Feb. 15, 1933, *Hume 95* and *98* and *99*; ditto, in moist woods along dry stream bed, Feb. 15, 1931, *Koike*; ditto, woods along dry stream bed, 1,600 ft. elev., Feb. 15, 1931, *Storey 161*; ditto, North Fork, along stream bed, 1,250 ft. elev., Nov. 13, 1932, *Storey 213*; ditto, shady woods along dry stream bed, Feb. 15, 1931, *Koike (Storey 129)*; ditto, north fork, on slope above stream amongst *Gleichenia*, Nov. 13, 1932, *Storey 221*; ditto, small shady moist ravine, leading into main stream, 1,500 ft. elev., Nov. 13, 1932, *Storey and Hosaka 222*; Waiawa Valley, woods, Sept. 11, 1931, *Degener and Park 7,503* (NY); Waimano, Okt. 1935 (leg. *Degener*) *Meebold 20,765* (M); Waimano Valley, open forest, Nov. 3, 1935, *Degener et al. 10,523* (NY); ditto, Mar. 25, 1946, *Kerr*; ditto, east branch, east slope

above pass, May 29, 1933, *Russ*; Waimano, shaded bank of ditch, 700 ft. alt., Mar. 23, 1941, *St. John 20,218*; Waimalu valley, 400 m. elev., Dec. 31, 1925, *Brown 1,287*; Kalauao Ridge, on wooded slopes below the ridge trail, 1,700 ft. elev., April 30, 1933, *Storey 280*; Kalauao-Aiea, 650 m. elev., March 29, 1931, *Hume 137*; Aiea, gully shaded locality, Sept. 4, 1932, *Degener & Park 7,502* (NY); Moanalua Valley, E. ridge, $\frac{2}{3}$ way up, moist shaded gulch, 1,200 ft. alt., April 18, 1942, *St. John 20,285*; Kahauiki, gulch behind Ft. Shafter, May 5, 1919, *Forbes 2,571.O*; ditto, wet forest, 600 ft. elev., Dec. 25, 1933, *Yoshioka*; Kalihi Valley, upper part, Feb. 16, 1916, *Forbes & Labouchere 2,297.O*; Nuuanu, Waiolani Ridge, Dec. 10, 1908, *Forbes*; Nuuanu, Nov. 1910, *Forbes 1,611.O*; Pacific Hts., Dec. 20, 1903, *W. A. Bryan 533+*; ditto, March 1911, *Forbes 1,662.O*; Honolulu, Aug. 11, 1911, *Wilder 4* (NY); ditto, på bergen, 1852, *Andersson* (S); Tantalus, Castle Trail, wet woods, Feb. 20, 1928, *Degener & Shear 7,576* (NY); Konahuanui, April 1910, *Faurie 635* (BM); Niu, *Hillebrand* (BM); Niu Ridge, Sept. 7, 1924, *Topping 2,847* (NY).

Waianae Mountains: Below Hakaloa, head of Keekee Gulch, Kuaokala Forest Reserve, moist gulch bottom, 520 m. alt., Feb. 2, 1936, *Fosberg 12,868*; Makaha Valley, Kaala Range, Feb. 12-19, 1909, *Forbes*; ridges above Makaha Valley, Jan. 31, 1927, *MacDaniels 583*; Makaha, west side, 1,500 ft., May 16, 1933, *Russ*; ditto, in native forest above coffee and *Rubus* thickets, 1,500-2,000 ft. elev., Apr. 3, 1932, *Storey 183*; Makaleha Valley, *Rock 17,046*; ditto, Aug. 30, 1922, *Skottsberg 411* (BISH, S); ditto, wet gulch, 1,800 ft., July 30, 1950, *Degener, Greenwell & Hatheway 20,803*; ditto, dark, damp gulch, 1,600 ft., Oct. 9, 1950, *Degener & Hatheway 20,864*; West Branch of Kaawa [= Kaawa] Gulch (having ditch tunnel, north of Kaala), forest, May 19, 1940, *Degener 17,710* (NY); and *17,187* (NY); Kaawa Gulch, Kamanui, moist gulch under *Aleurites* and *Pipturus*, Sept. 18, 1952, *St. John 24,841*; Mt. Kaala, Feb. 11, 1928, *Bergman*; ditto, Haleauau Valley, under shrub in lower forest, 2,100 ft. alt., Nov. 13, 1934, *E. H. Bryan Jr. 854*; ditto, April 25, 1920, *E. Bryan (Degener 7,692)* (NY); Waianaueka, canyon above Kaala Trail, wet forest in steep canyon, 680 m. alt., Jan. 8, 1933, *Fosberg 9,125*; ditto, narrow shaded gulch in woods, the last gulch on the Firebreak Trail before reaching the stream, 2,000 ft. alt., May 25, 1952, *St. John 24,820*; Kaala, Sept. 25, 1938, *Selling 3,711*; ditto, *Hosmer (Rock 13,088)*; ditto, Waianaueka, on wooded slope, 2,800 ft. elev., Feb. 2, 1930, *Hosaka 129*; ditto, damp wooded ridge, 1,600-2,200 ft., Nov. 30, 1930, *Storey 45*; ditto, wooded slope, 2,600 ft. alt., Jan. 10, 1932, *Storey and Yamaguchi 159*; ditto, lower moist forest, 2,200 ft. alt., Jan. 12, 1941, *St. John 20,128*; ditto, lower forest, 2,800 ft. alt., Jan. 12, 1941, *St. John 20,129*; ditto, Waianaueka, Jan. 12, 1941, *Wong*; Puu Kumakalii, n. e. slope, forested slope, Apr. 1, 1936, *Degener et al. 10,515* (NY); ditto, steep wooded slope, 720 m. alt., *Fosberg 13,645*; Kolekole Pass, southeast of patch of forest, Sept. 22, 1940, *Degener & Dowson*

12,907 (NY); Puu Hapapa, small valley northeast of, dark wet woods, Aug. 7, 1932, *Degener & Park* 7,504; ditto, west side of ridge trail in woods, 2,000 ft. alt., Oct. 25, 1931, *Storey & Hashimoto* 120; Puu Kanehoa, northeast ridge of, forest near top, Mar. 31, 1940, *Degener et al.* 12,748 (NY); ditto, east side, moist woods, 2,400 ft. elev., Jan. 7, 1934, *St. John* 14,055; ditto, woods, 2,000 ft. alt., Jan. 24, 1932, *Storey*; Puu Kaua, moist woods, 2,500 ft. alt., Nov. 6, 1932, *Storey* 207; Waianae Range, 1897, *Guppy* (K); Waianae [Mts.], 2,000-2,500 ft. alt., Feb. 1930, *Meebold* 8,655 (M).

Oahu, without locality: 1929, *Nitta* (*Degener* 7,536) (NY); 1929, *Degener* 7,546 (NY); *Degener* 7,695 (NY); Galathea-Expeditionen, *Didrichsen* 3,529 (C); ditto, *Didrichsen* (C); *Hillebrand & Lydgate*; *Mann & Brigham* 77 (CU); 126 (GH); *Barclay* (BM); Wilkes Expedition (GH, US).

Sandwich (or Hawaiian) Islands, without locality: *Gaudichaud* (L); 1839 *Gaudichaud* 199 (G); Bonite Voyage, *Gaudichaud* (GH); *Hillebrand* 321 (GH); *Hillebrand* (BISH, E, GH, US, Z), *Mann and Brigham* 77 (BISHOP MUS., GH, US); 1863, *Seemann* 2,277 (G); 1837, *Barclay* (holotype of *C. Garnotiana* var. *β fulva* C. B. Clarke (BM)).

Discussion: *C. Garnotiana* is a member of the section *Microcalyces*. Its closest relative is *C. sandwicensis*, and the contrasting characters are given under that species. As indicated in the introduction, *C. Garnotiana* has the widest distribution of any of the species, occurring for two-thirds the length of the Koolau Range on the leeward side, and nearly the full length of the Waianae Mountains. It occurs over a considerable altitudinal range, from 600 to 2,800 feet, and is often very abundant. Because of its generalized floral and fruiting structures, it is postulated to represent the oldest ancestral stock of the region.

C. Garnotiana is often collected and is well represented in herbaria. All or nearly all students of the Hawaiian species have accepted this species; however, many of the specimens referred by Hillebrand and by Rock to *C. laxiflora* Mann are here redetermined as *C. Garnotiana*, and much of the material of *C. adpressipilosa*, having cymes on the upper stem or in the leafy axils, was included in *C. Garnotiana* by earlier investigators.

Gaudichaud published this personal specific epithet spelled with a small initial letter. This was an exception to his general practice, because in the table of plates in his atlas, he capitalizes other such names. He states in the text that the species was named for Prosper Garnot, who was surgeon and zoologist of the French Marine, and served as naturalist on the voyage of "La Coquille" under Capt. L. -I. Duperrey.

The gynoecium of *C. Garnotiana* is peculiar in that at anthesis the ovary is perfectly glabrous, but as the fruit forms, hairs grow upon it and the mature berry is obviously puberulous. This was not mentioned by Gaudichaud, but it was shown on his plate where the dissections show a glabrous ovary in the flower, and a pubescent fruit. One should not stress this detail in the drawing,

as A. Poirlet, Gaudichaud's artist, was grossly inaccurate in fine details, such as pubescence. (See, for instance, the present discussion under *C. cordifolia*.) The late development of the pubescence on the fruit has not been understood. Clarke wrote (1883: 220) "Ovarium minute pilosum;" Hillebrand (1888: 333) wrote "Ovary and style pubescent;" and Rock in his revision (1919: 205) repeated "ovary and style pubescent." Each of these three authors described the fruit without any mention of pubescence. Despite all these statements, a contrary condition must be stated. In nearly all of the specimens studied by the predecessors, and many other specimens as well which have been examined, every single specimen seen has in anthesis the ovary and style glabrous. Soon after the fall of the corolla, the pubescence begins to develop on the gynoeceum and by the time it is half grown, this persistent puberulence is conspicuous.

Several variant spellings of the specific epithet have been printed, but these are all author's or printer's orthographic errors.

C. Garnotiana Gaud. var. β *fulva* C. B. Clarke is in need of discussion. The original description from De Candolle (1883: 220) is as follows: "Var. β *fulva*; foliis subtùs magis fulvis; calyce altius diviso. Ins. Sandwich; Oahu (Barclay, in h. Mus. Brit.)."

Rock in his revision (1919: 206) repeats all of these words of the original description, but it can scarcely be said that he quotes them for he indicates it as an unnamed var. β , omits the separating semicolon, and runs the varietal name *fulva* in with the description, both in italics. It will be noted from Clarke's description quoted above, that the variety is both named and described and that the name and description are distinguished by both punctuation and font of type. Rock did not see the type in the British Museum. The writer has studied and compared the type in London and has a good photograph of it (Fig. 16). Clarke's characters were the more fulvous pubescence on the lower blade surface, and the less deeply lobed calyx. Clarke saw only five collections of *C. Garnotiana* and only one of his var. *fulva*. Study of a large series of specimens has convinced the writer that neither the lobing of the calyx nor the pale pilosulous pubescence of the lower surface of the blades is distinctive. The type sheet, Oahu, 1837, Barclay, contains four small leafy branches and four detached leaves. Three of the branches and three of the loose leaves are typical *C. Garnotiana* with narrowly lance-elliptic or oval blades. The remaining branch and one detached leaf are different in that the blades are longer and narrower. One leaf is 17 cm. long, 4 cm. wide, narrowly oblong, acute and cuneate. This is the mostly narrowly elongate blade the writer has seen. If this shape were constant the var. *fulva* would certainly deserve recognition. However, only one leaf is of this extreme shape, and other blades on the same stem are narrowly or broadly elliptic and inseparable from shapes common in the species. Hence, the var. *fulva* is here reduced to the synonymy of the species.

C. Garnotiana Gaudichaud f. *uniflora* Skottsberg was reduced to the synonymy of *C. sandwicensis* (Léveillé) St. John & Storey (1950: 85).

6. *Cyrtandra intonsa* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 84-85, 1950. (Figs. 17, 190.)

Description of All Specimens Examined: Shrub; branches terete, glabrous, bark smooth, shining, becoming pale brown; leaf scars 2-4 mm. high, cordate, pale, corky, raised; bundle scars 7; internodes 2-6 cm., usually about 3 cm. long; leafy branchlets 2-3.5 mm. in diameter, densely, later sparsely spreading pilose; young shoots densely pilose; *leaves* opposite, subequal or slightly unequal, slightly asymmetric and curved, the pairs rather remote and divergent; petioles 2.5-8 cm. long, spreading pilose; *blades* 7-16 cm. long, 3.5-8 cm. wide, firm chartaceous, elliptic to ovate-elliptic or oval, apex subacuminate, the base cuneate or short decurrent, above remotely appressed hirsute, below pilosulous, the margin irregularly serrate except towards the base; *cymes* from the leaf axils or in fruit persisting at the uppermost naked node, 2-4-flowered, but mostly 3-flowered, spreading white pilose; peduncles 22-45 mm. long; pedicels 15-25 mm. long; bracts 7-9 mm. long, oblanceolate, foliaceous, the pedicels on some producing a pair of similar but smaller bracteoles; buds lanceoloid, the calyx lobes connivent; *calyx* 6-8 mm. long, green, sparsely appressed puberulent, campanulate, lobed $\frac{1}{2}$ to $\frac{2}{3}$ way to base, 2-lipped, the lobes narrowly deltoid, subequal, within the lobes sparsely puberulent towards the tip, the base and the tube only minutely so; the tube 2-3 mm. long, campanulate; *corolla* 12-15 mm. long, the tube 9-11 mm. long, 2-4 mm. in diameter, tubular, slightly decurved from the middle, the exposed part densely white villous, but glabrous towards the base, glabrous within, the throat open, lobes unequal, the upper 1.5 mm. long, depressed suborbicular, outside glabrous, but villous along the edge of upper edge, within puberulent near the tip, the lateral lobes 3 mm. long, 4.5 mm. wide, broadly oval; lowest lobe 4 mm. long, 3.5 mm. wide, oval, villous without, glabrous within, the lobes apparently spreading at about 60° from the axis of the tube; filaments fused to the corolla tube to within 3.5 mm. of the throat, the free portion 1.5 mm. long, incurved, subulate; anthers 2-2.2 mm. long, ovate deltoid, flattened, asymmetric, one cell the smaller; *style* 2.5 mm. long, glabrous; stigma with two flattened, oblong-elliptic stigmatic lobes 1.5-2 mm. long, connate on one side for $\frac{2}{3}$ their length; *ovary* lanceoloid, glabrous, the base surrounded by a cupulate disk; half-grown *fruit* 8-15 mm. long, lance-ovoid, puberulent.

Distribution: Koolau Range, windward side, above 1,200 feet in Kahana Valley; leeward side, at 1,300 feet in the Koa Zone in Kipapa Gulch, also in Kalihi Valley.

Holotype: Oahu, Kipapa, elev. 425 m., Feb. 15, 1931, *E. P. Hume* 95 (BISHOP MUS.).

Specimens examined: Koolau Range.

Windward Side: Waikane-Schofield Trail, Kahana, 1st pass to main divide, 1,200-2,400 ft., Oct. 16, 1932, *Suehiro*.

Leeward Side: See type; Kipapa, elev. 425 m., Feb. 15, 1931, *Hume* 98; 99.

Discussion: *C. intonsa* is a member of the section *Microcalyces*. The closest relative is the very common and more widely distributed *C. Garnotiana* Gaudichaud, which is a larger, more vigorous plant, the blades often much larger, and commonly elliptic to lanceolate and below more densely soft pilosulous, above subappressed puberulent; and the calyx densely spreading pilosulous.



FIGURE 17.—*Cyrtandra intonsa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, pistil, $\times 2$; e, fruit, $\times 1$. Kipapa, Hume 95, holotype (Bishop Mus.).

In contrast, *C. intonsa* has the blades elliptic to oval, tapering to both ends and cuneate decurrent at base, below pilosulous, above remotely appressed hirsute, and the calyx sparsely subappressed puberulent.

7. *Cyrtandra kaluanuiensis* St. John, sp. nov. (Figs. 18, 186.)

Diagnosis Holotypi: Frutex, cicatricibus 6 mm. altis scutelliformibus aperite distinctis, novellis dense lutescentibus hirsutulis, fasciculis ignotis, ramulis foliosis ad 6 mm. diametro quadrangularibus carnosis hirsutulis, internodis 15-37 mm. plerumque 30

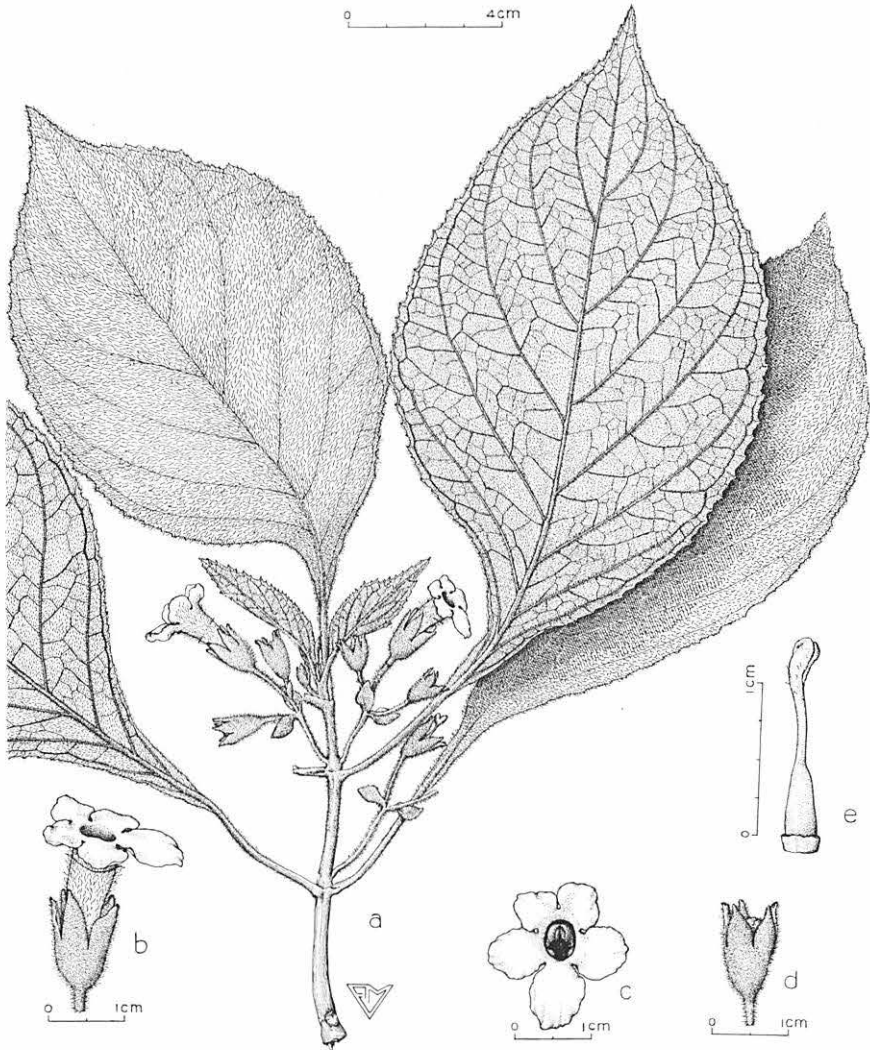


FIGURE 18.—*Cyrtandra kaluanuiensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Kaluanui, Storey 136A, holotype (Bishop Mus.).

mm. longis, *foliis* oppositis subaequalibus, petiolis 28-50 mm. longis hirsutulis, *laminis* 15-20 cm. longis 88-102 mm. latis subtiliter chartaceis late ellipticis apice breve acuminata basi modice vel longe decurrenti marginibus minute denticulatis sed ad apicem serrulatis supra obscure viridibus et catenulato-hirsutis et subscabris infra albescenti-viridibus et pilosulis nervis secundariis 7 in uno latere adscendentibus incurvatis interconnectisque et in apiculis dentorum salientibus, *cymis* 3-5-floriferis axillaribus dense hirsutulis, pedunculis 15-23 mm. longis, pedicellis 8-19 mm. longis, bracteis 7-9 mm. longis ovatis acutis foliaceis, alabastris campanulatis lobis calycorum divergentibus, *calycibus* in flore (bullitis) 12-13 mm. longis (10-12 mm. in sicco) campanulatis viridibus extra hirsutulis $\frac{1}{2}$ partitis bilabiatis apicibus lobarum subulatis crassis obtusis, labia supera trilobata, loba superiore 5.5 mm. longa 2 mm. lata lineari-lanceolata, lobis lateralibus 6.5 mm. longis 3.2 mm. latis lanceolatis intra ad apicem hirsutulis, labia infera bilobata, lobis 7 mm. longis 3 mm. latis lanceolatis, *corollis* quando bullitis 26 mm. longis albis extra pilosis tuba 20 mm. longa subcylindrica in medio 5 mm. diametro in orifice 6 mm. in 10° decurvata, limbo bilabiato 5-lobato intra labiis 6 mm. partito, lobis superis binis 5 mm. longis 7 mm. latis rhombico-suborbicularibus extra plerumque glabris intra glabris, labia infera trilobata, lobis lateralibus 6.5 mm. longis 7 mm. latis valde oblique ovato-orbicularibus ad basim auriculatis impensisque, loba infera 8 mm. longa 6 mm. lata late elliptica, staminibus binis inferis perfectis in corolla adnatis e 6 mm. orifice parte libera 2 mm. longa subulata incurvata, antheris 2.3 mm. longis oblique ovatis connectivo elliptico, staminodiis cum corolla adnatis 8 mm. orifice distantis parte libera 1 mm. longa subulata, antheroidiis 0.2 mm. longis albis sterilibus, *stilo* 5 mm. longo in apice sparse piloso, lobis stigmatorum binis 3 mm. longis ellipticis $\frac{1}{3}$ connatis extra sparse pilosis, *ovario* 6 mm. longo anguste lanceoloideo glabro in basi disco cupulato 0.7 mm. alto cincto, fructu ignoto.

Description of Holotype: Shrub; leaf scars 6 mm. high, shield-shaped, apparently separate; young shoots densely yellowish hirsutulous; bundle scars not seen; leafy branchlets as much as 6 mm. in diameter, quadrangular, fleshy, hirsutulous; internodes 15-37 mm., averaging 30 mm. long; *leaves* opposite, subequal; petioles 28-50 mm. long, hirsutulous; *blades* 15-20 cm. long, 88-102 mm. broad, thin chartaceous, broadly elliptic, the apex short acuminate, the base decurrent or long decurrent, and asymmetric, the margin minutely denticulate but towards the apex serrulate, above dark green and catenulate hirsute and subscabrous, below whitish green and pilosulous throughout, the secondary veins 7 on a side, ascending and the tips inarched interconnecting and salient as apiculations on the teeth; *cymes* 3-5-flowered, axillary, densely hirsutulous; peduncles 15-23 mm. long; pedicels 8-19 mm. long; bracts 7-9 mm. long, ovate, acute, foliaceous; buds campanulate, the calyx lobes curving outward; *calyx* in anthesis when boiled 12-13 mm. long (10-12 mm. when dry), campanulate, green, hirsutulous without, cleft to the middle, perceptibly 2-lipped; lobes all with apices thick, subulate, obtuse; upper lip 3-lobed, the two lateral lobes 6.5 mm. long, 3.2 mm. wide, lanceolate, within hirsutulous only just near the tip; the upper lobe 5.5 mm. long, 2 mm. wide, linear-lanceolate; lower lip with two lobes 7 mm. long, 3 mm. wide, lanceolate; *corolla* when boiled 26 mm. long, white, without pilose, the tube 20 mm. long, subcylindric, 5 mm. in diameter at the middle, 6 mm. at the throat, gently decurved at 10° from the axis of the lower tube; limb 2-lipped, 5-lobed, cleft down 6 mm. between the lips; upper lobes two, 5 mm. long, 7 mm. wide, rhombic-suborbicular, without largely glabrous, within glabrous; lower lip 3-lobed; lateral lobes 6.5 mm. long, 7 mm. wide, very obliquely ovate-orbicular, at base auriculate or overlapping like the others; lower lobe 8 mm. long, 6 mm. wide, broadly elliptic; two lower stamens perfect, with filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 2 mm. long, subulate spirally upcurved; the two perfect anthers 2.3 mm. long, obliquely ovate, the connective elliptic, the staminodia adnate to the corolla tube to within 8 mm. of the throat, the filaments 1 mm. long, subulate, the sterile anthers 0.2 mm. long, whitish; *style* 5 mm. long, sparsely pilose at very summit; stigmatic lobes two, 3 mm. long, elliptic, connate $\frac{1}{3}$ way up the proximal side, sparsely pilose on the backs; *ovary* 6 mm. long, narrowly

lanceoloid, glabrous, the base surrounded by a cupulate disk 0.7 mm. high; fruit unknown.

Distribution: Koolau Range, windward side, only in Kaluanui, at 2,000 ft., in the Ohia Zone.

Holotypus: Oahu, Kaluanui Valley, Koolau Mts. in dense woods above the second falls, 2,000 ft. elev., July 4, 1931, *W. B. Storey 136-A* (BISHOP MUS.).

Discussion: *C. kaluanuiensis* is a member of the section *Microcalyces*. The species most similar to it appears to be *C. scabrella* which has the blades 32-60 mm. wide, subcoriaceous, below appressed puberulent; cymes appressed puberulent; and the calyx 22 mm. long, sparsely appressed puberulent, the lobes 6 mm. wide, narrowly ovate, obtuse. *C. kaluanuiensis*, on the other hand, has the blades 88-102 mm. wide, thin chartaceous, below pilosulous; cymes hirsutulous; calyx 10-13 mm. long, hirsutulous, the lobes 2-3.2 mm. wide, lanceolate.

The new name is formed from the geographic name Kaluanui; and *-ensis*, the Latin adjectival place ending; thus "the species from the Kaluanui place."

8. *Cyrtandra opaeulae* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 85, 1950. (Figs. 19, 189.)

Description of Holotype: Shrub about 2 m. tall, erect with ascending branches; branchlets more or less villous, the leaf scars 3-3.5 mm. high, rounded shield-shaped, pale, corky; bundle scars 5, linear; internodes 9-32 mm., but usually about 18 mm. long; leafy branches quadrangular, densely brownish pilose throughout; shoots with 2-4 pairs of leaves; young shoots densely shaggy pilose; *leaves* opposite, bilaterally symmetrical, equal in length or one of a pair 1/10 the longer, but unequal in width, one of the pair being wider and with the greatest width at a point above the middle, ascending or in age drooping; petioles 3-6 cm. long, shaggy pilose; *blades* 8.3-17 cm. long, 29-78 mm. wide, lanceolate or elliptic, but most commonly oval, the apex acuminate, the base cuneate, texture thin chartaceous, above dark green, remotely crinkly pilose, below whitish green and appressed pilosulous, the veins salient pilose and more markedly so on the larger veins, the margin coarsely serrate, the veins forming callous apiculations at the apices of the teeth; principal lateral veins 6-8 on a side, subalternate, ascending and arcuate, tips inarched and connecting; *cymes* from leaf axils, 5-7-flowered, ascending, densely brownish pilose throughout; peduncles 2-4 cm. long; pedicels in anthesis 1-2 cm. long; bracts 12-35 mm. long, foliaceous, lanceolate, sessile or petioled; bud campanulate, open, the calyx lobes ascending; *calyx* 10-14 mm. long (9-12 when dried), without densely shaggy pilose, within glabrous below but the lobe margins and the apex pilose, subglobose-campanulate, lobed about $\frac{4}{5}$ way to the base; the tube 2-3.5 mm. long; upper lip of 3 lobes cleft $\frac{2}{3}$ way, the lobes lanceolate, narrowed to the tapering tip, without pilose, within capitate glandular puberulous, one of the lateral lobes usually unequal and $\frac{1}{2}$ longer than the others; lower lip of 2 lobes, cleft $\frac{2}{3}$ way, lobes 7-8 mm. long, broadly lanceolate, without pilose, within capitate glandular puberulous; *corolla* 20 mm. long (15 mm. when dried), white, the tube 17 mm. long, 4-5 mm. in diameter, cylindrical, straight, the outside shaggy white pilose, the inside glabrous; limb almost rotate, 2-lipped, 5-lobed; upper lip with 2 lobes, 2 mm. long, 4.5 mm. wide, broadly depressed sagittate, the apex obtuse and lobes very obtusely cordate; lower lip with 3 lobes, within minutely capitate glandular puberulous, without pilose, the 2 lateral lobes 3 mm. long, 5 mm. wide, depressed broad sagittate, the apex and lobes very obtuse; lowest lobe 3.5 mm. long, 5 mm. wide, of similar shape; 2 lower stamens perfect, the filaments adnate to corolla to within 5 mm. of the throat. the

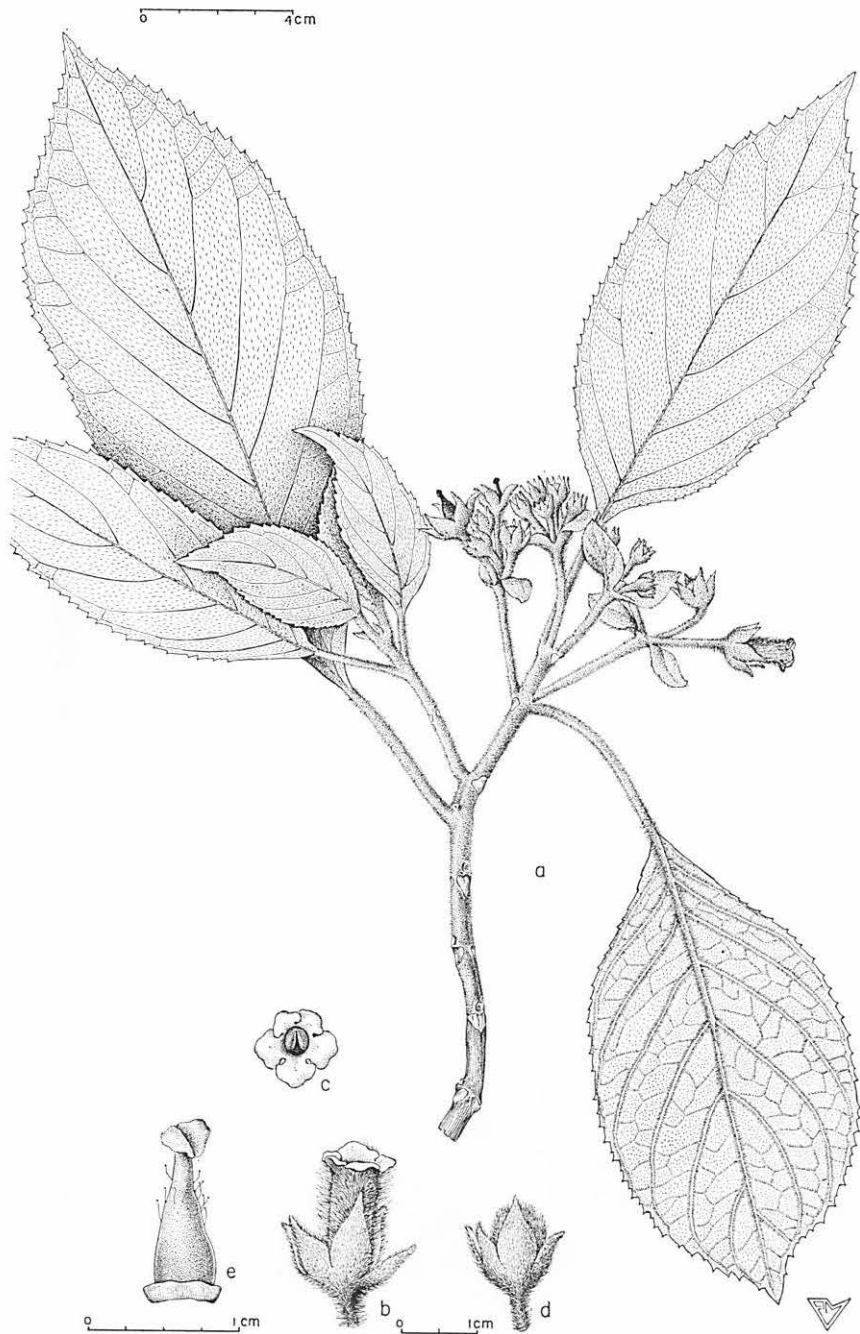


FIGURE 19.—*Cyrtandra opaculac*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Kawaioloa-Opauala, Paalaa, Storey 168, holotype (Bishop Mus.).

free portion 1.5 mm. long, subulate, spirally upcurved; the 2 perfect anthers 3 mm. long, very obliquely ovate, connate at apex; the 3 staminodia similar, with a 0.3 mm. recurved filament, and a longer flattened obdeltoid sterile tip; *style* 3 mm. long, stout, tapering, its base and summit of ovary remotely capitate glandular pilose; 2 stigmatic lobes 2.2 mm. long, semiorbicular, connate $\frac{2}{3}$ way up proximal side, the back glabrous; *ovary* 5-7 mm. long, glabrous, lance-conic, the base surrounded by a cupulate disk 1 mm. high; fruit unknown.

Distribution: Koolau Range, leeward side, Ohia Zone; known only from the type collection.

Holotype: Kawailoa-Opaepaue Divide, Paalaa, Koolau Mts., 1,800 ft. elev., in shade of woods along trail, Oct. 4, 1931, *W. B. Storey 168* (BISHOP MUS.).

Discussion: In appearance the closest species is *C. chartacea* St. John & Storey which has the branches glabrous; blades narrowly oblanceolate, long decurrent at base, the margin remotely serrulate; cymes 1-3-flowered; and the calyx 18-20 mm. long, subglabrous near the tip. On the other hand, *C. opaepaue* has the branches shaggy pilose; blades commonly oval, the base cuneate, the margin coarsely serrate; cymes 5-7-flowered; and the calyx 10-14 mm. long, densely shaggy pilose.

The specific name is taken from that of the type locality.

9. *Cyrtandra polyantha* C. B. Clarke, in De Candolle, Monogr. Phanerog. 5 (1): 220-221, 1883. (Figs. 20, 21, 191.)

C. triflora sensu parte Hillebrand, Fl. Hawaiian Is., 332, 1888, not of Gaudichaud (1826) = [1829].

C. gracilis sensu parte Drake del Castillo, Ill. Fl. Mar. Pacifici 7: 253, 1892, not of Hillebrand (1888).

Description of All Specimens Examined: Shrub 1-2 m. tall; stems brown finally terete, the leaf scars 4-6 mm. high, shield-shaped, paler, corky, prominent; bundle scars 7; the old branches nearly smooth, the bark close, with longitudinal fissures; leafy young branchlets glabrous or sparsely puberulent near nodes, soon glabrate, somewhat quadrangular; young shoots appressed, pale hirsutulous; internodes 5-20, averaging 9 mm. long; *leaves* opposite, numerous, unequal, one of a pair as much as $\frac{1}{2}$ the larger; petioles 1-4 cm. long, at first sparsely appressed hirsutulous, soon glabrous; *blades* 4-10.5 cm. long, 13-52 mm. wide, elliptic, tapering to an acute point at each end, slightly asymmetric and falcate, thick subcoriaceous, the tips and margins revolute, the veins strongly impressed but the intervals prominently raised bullate, so much so that blade will not press flat, above dark green, somewhat shiny, glabrous or with a few hirsute papillae mostly on the midrib, below densely appressed pilosulous, pale but drying, pale or light brownish, appearing sericeous, the margins callous serrate-denticulate; *cymes* from the leaf axils, 7-30-flowered, glabrous or remotely puberulent and early glabrate; peduncles 12-18 mm. long; pedicels 3-19 mm. long, slender; bracts 3-10 mm. long, lanceolate; buds ovoid with calyx lobes approximate, later campanulate; *calyx* 4-6 mm. long, glandular punctate, glabrous, slightly 2-lipped, lobed $\frac{1}{2}$ to $\frac{2}{3}$ way to the base into narrowly deltoid obtuse lobes, persistent, the tube 1-3 mm. long, short funnelliform; calyx limb distinctly 2-lipped, cleft 4 mm. between the lips; upper lip 3-lobed, the lobes 4 mm. long, 1.5 mm. wide, narrowly deltoid; lower lip 2-lobed, the lobes 5-6 mm. long, 2.5 mm. wide, narrowly deltoid; *corollas* 15-18 mm. long, white, the tube 12-13 mm. long, 6-8 mm. in diameter, obovate-ellipsoid to cylindric-ellipsoid,



FIGURE 20.—*Cyrtandra polyantha*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, $\times 1$; f, pistil, $\times 2$; g, fruit, $\times 1$. Niu, St. John 20,119.

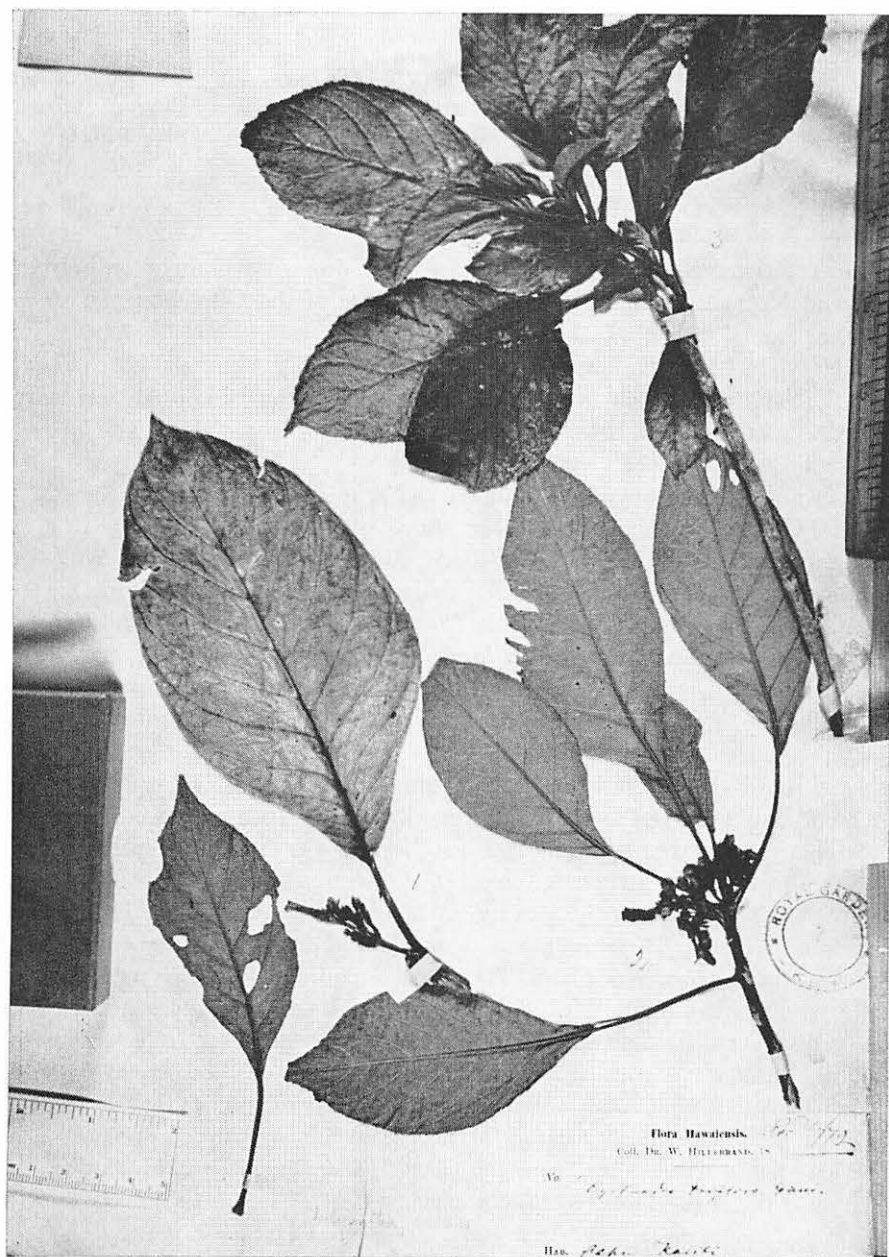


FIGURE 21.—*Cyrtandra polyantha*, holotype (Kew). Kalihi, Hillebrand.

densely white villous except at base, the throat open, the lobes 4-5 mm. long, subequal semiorbicular, rotate at or nearly at 90° to axis of the tube, the outer side sparsely pilosulous, margin pilosulous ciliate, the inner side glabrous except the lowest lobe is remotely pilose towards the base; filaments fused to the corolla tube to within 3 mm. of the throat, the free portion 1 mm. long, terete, incurved; anthers 2 mm. long, ovoid, asymmetric with one cell much the smaller; style 1-2 mm. long, stout, glabrous; stigma with 2 lobes, about 3 mm. long, unequal, ellipsoid, thick, somewhat flattened; ovary lanceoloid, glabrous; berry 17 mm. long, 8 mm. in diameter, ovoid, apiculate, white; seeds 0.45-0.51 mm. long, broadly ellipsoid, pale straw-colored except at the dark brown ends, the surface with raised cellular reticulations, the areolae broadly oblong-polygonal, $\frac{1}{4}$ to $\frac{1}{5}$ the length of the seed.

Distribution: Koolau Range, leeward side, known definitely only from Niu, and Maunaloa, where it grows at the edge of the Ohia Zone on steep ridges at from 1,600 to 2,000 feet altitude.

Holotype: "Ins. Sandwich; Oahu (Hillebrand in hh. [= hb.], Kew, Berol.)." The isotypes in the Gray Herbarium and the Bishop Museum are labeled "Oahu, Mts. of Ewa."

Specimens Examined: Koolau Range.

Leeward Side: See type; Niu Valley, 1,700 ft., Aug. 22, 1909, *Rock 4,815* (BISH, GH); Niu, Apr. 1930, *Russ*; Niu, Kulepiamoia Ridge, 1,600 ft. alt., thicket on moist ridge, Nov. 10, 1940, *St. John 20,119*; same data, *St. John 20,120*; Maunaloa, N. W. head of Hahaione Valley, Koolau Divide, 2,000 ft. alt., on ridge, upper limit of ohia forest, Feb. 16, 1941, *St. John 20,180*; without locality, Oahu (as *C. triflora*), *Hillebrand & Lydgate*, ex Herb. Lydgate.

Discussion: *C. polyantha* is in the section *Microcalyces*. It is a distinct and easily recognized species. Incidentally, it is one of the two Oahu species published as new by C. B. Clarke in his monograph (1883: 220-221).

Some flowers have the calyx lobed as deeply as $\frac{2}{3}$ way, especially on one side. This is an extreme for the section *Microcalyces*, and is an intermediate condition towards the structure typical of the section *Schizocalyces*.

Just what is meant by the locality "Mts. of Ewa" given on the Hillebrand collection in Bishop Museum, is not clear. Ewa is on the low, dry coral plain at the southwest corner of Oahu. The nearest mountains are the southern tip of the Waianae Mountains, which are barren and dry. *C. polyantha* has not been rediscovered in this area, if it ever grew there. All recent collections with definite localities are from Niu or Hahaione valleys, near the southeastern end of the Koolau Range, with a linear range on the mountains of 1½ miles. Hence, Hillebrand's locality data, "Mts. of Ewa," is considered dubious.

The specific name came from the Greek *polus*, many; *anthos*, flower, in allusion to the many-flowered inflorescence.

10. *Cyrtandra rivularis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 85, 1950. (Figs. 22, 187.)

Description of All Specimens: Shrub; branches with pale brown, smooth, glabrate bark, leaf scars 2-3 mm. high, cordate-suborbicular, pale, corky and slightly raised;

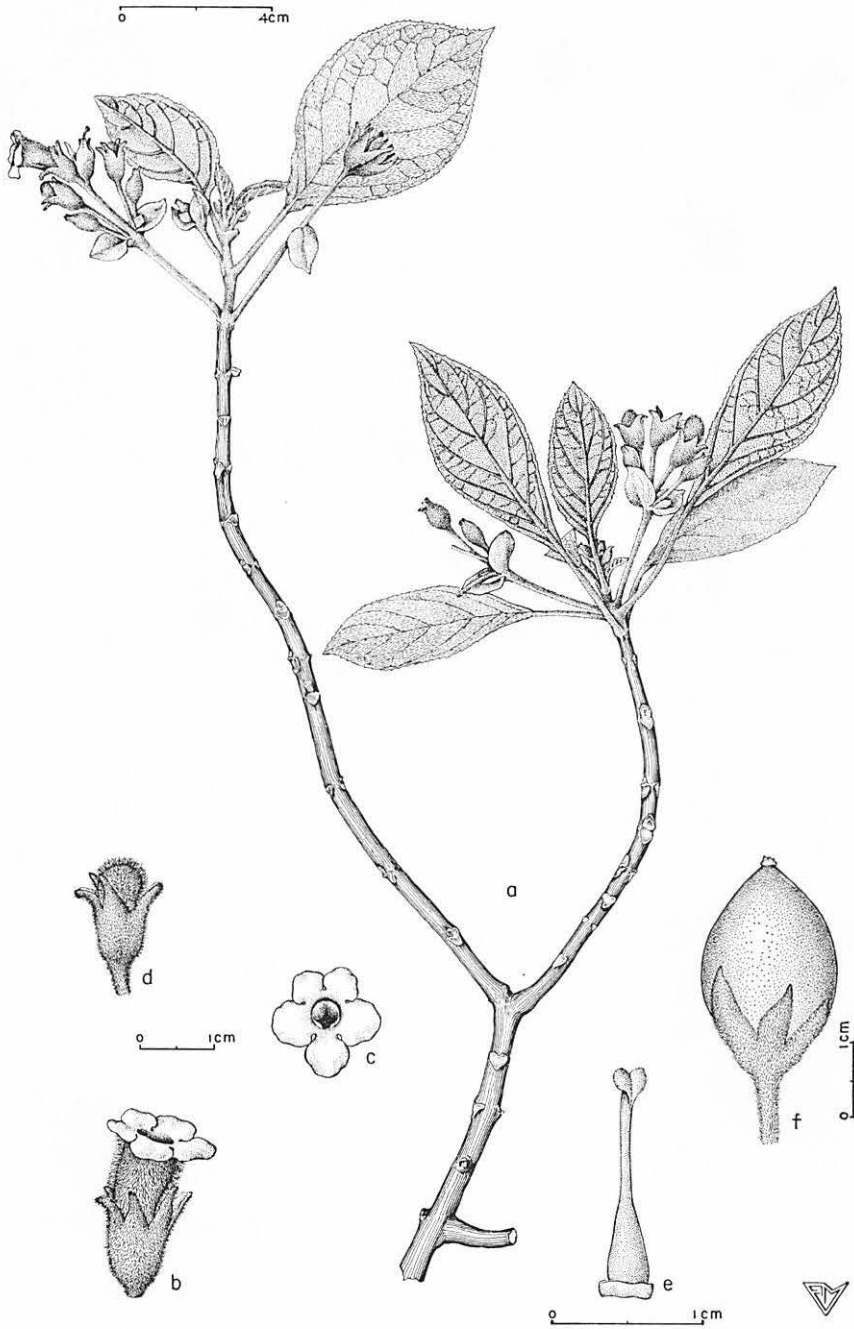


FIGURE 22.—*Cyrtandra rivularis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Fruit from Rock 684, Punaluu; rest from Storey 171, Kaluanui, holotype (Bishop Mus.).

bundle scars 5; internodes 6-25 mm., usually about 10 mm. long; leafy branches terete, densely soft puberulent, hairs drying brownish, shoots short with only 2-3 pairs of leaves; young shoots covered with a dense, soft puberulence; *leaves* opposite, unequal in size, one of a pair about $\frac{1}{5}$ the larger, ascending, later spreading, not crowded; petioles 10-35 mm. long, slender, densely soft puberulent, hairs gland-tipped; *blades* 2.8-6.3 cm. long, 15-41 mm. wide, lance-ovate to lance-obovate and usually arcuate and asymmetric, the apex acute, the base short cuneate, thick firm chartaceous, remotely low serrulate in the upper half or two-thirds, above crinkly multicellular pilose, the hairs gland-tipped at first, below densely soft spreading pilose; principal lateral veins 4-6 on a side, arcuate upcurved, the tips inarching and joining; *cymes* from the leaf axils, 3-5-flowered, brownish from the gland-tipped dense pilosity throughout, the hairs spreading; peduncles 20-32 mm. long, ascending at an angle of 45°; pedicels in anthesis 10-17 mm. long, in fruit 15-23 mm. long; bracts 8-14 mm. long, oval, foliaceous, the tip subacute; buds campanulate, the lobes directed outwards; *calyx* 10-12 mm. long (when dried) or 12-15 mm. (when fresh), the outer surface obscured by the gland-tipped dense pilosity that dries pale brownish, campanulate, definitely 2-lipped, lobed almost $\frac{1}{2}$ way to the base; the tube 7-9 mm. long; upper lip of 3 lobes cleft $\frac{1}{3}$ way, the lobes narrowly lance-deltoid, obtuse, thick, spreading and somewhat connivent, the central one less deeply cleft, only 3-4 mm. long; lower lip of 2 lobes, cleft almost $\frac{1}{2}$ way, the lobes 5-7.5 mm. long, thick, narrowly lanceolate, obtuse, ascending; calyx within to the eye apparently glabrous but actually minutely glandular atomiferous; *corolla* 20-21 mm. long, when fresh, white, the tube 16-17 mm. long, 5 mm. in diameter at base, 7 mm. at apex, subcylindric, gently decurved, slightly contracted to the throat, the outside glabrous towards the base, the exposed part, including all of the upper half, shaggy white spreading villous, the hairs at first with minute glandular tips, inside glabrous; limb 2-lipped, 5-lobed; upper lip with 2 lobes, rotate, 3.5 mm. long, 4.5 mm. wide, low depressed ovate-suborbicular, low obtuse, subcordate and overlapping at base, glandular villous without, glabrous within; lower lip with 3 lobes, rotate, villous without, glabrous within, the 2 lateral ones 5 mm. long, 6 mm. wide, transversely broadly oval; lowest lobe 5.5 mm. long and wide, suborbicular; 2 lower stamens perfect, the filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 2 mm. long, stout subulate, spirally upcurved; the 2 perfect anthers 2 mm. long, obliquely narrowly elliptic, connate at apex; 2 minute straight staminodia 1 mm. long, and upper staminodium 0.5 mm. long, all consisting of filament solely; style 7 mm. long, stout, glabrous; 2 stigmatic lobes 5 mm. long, broadly oval, connate $\frac{2}{3}$ way up proximal side; *ovary* 6 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1 mm. high; fruit wanting.

Fruit description from Rock 684, Punaluu; fruit 26 mm. long, 18 mm. in diameter, broadly ellipsoid, slightly narrowed towards the apex, white, soft fleshy; seeds 0.48-0.61 mm. long, 0.21-0.24 mm. in diameter, dark amber-colored, narrowly ellipsoid to obliquely spindle-shaped, the body covered with raised, narrowly oblong cellular reticulations $\frac{1}{4}$ as long as seed.

Distribution: Koolau Range, windward side, from Kaluanui to Kaaawa and Waiahole, from 1,700 to 1,900 ft. alt., in the Ohia Zone, typically on the rock walls of stream gorges. All of the records from Punaluu should apparently be credited to Kaluanui.

Holotype: Kaluanui Valley, Koolau Mts., overhanging stream from rocky walls above second waterfall, 1,960 ft. elev., July 4, 1931, *W. B. Storey 171* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Kaluanui Valley, on rocky walls overhanging stream above second waterfall, 1,900 ft. elev., May 8, 1932, *Storey 188*; Koolau, grow-

ing on rock wall along stream, Punaluu Mt. camp [= Kaluanui], Dec. 8, 1908, *Rock 155*, and *160* (serial sheet numbers and doubtless duplicates); ditto, on moist steep rock bank above stream, wet forest area, 1,800 ft. alt., May 23, 1948, *St. John 23,373*; Punaluu, Dec. 3-14, 1908, *Rock 330* and *333* (duplicates); ditto, Dec. 24-29, 1908, *Rock 372*; *373*; *374*; *382*; and *388*; all equaling *388* (permanent number); ditto, Dec. 24-29, 1908, *Rock 475*; ditto, Dec. 3-14, 1908, *Rock 684*; ditto, Dec. 3-14, 1908, *Rock 740* and *741*; ditto, Dec. 3-14, *Rock 760*, and *761*, equaling *763*; ditto, Nov. 14-21, 1908, *Rock 897*; ditto, Nov. 14-21, *Rock 920*; Kaaawa, W. ridge, 560 m. el., Apr. 12, 1931, *Hume 151* and *153*; Waiahole Valley, Dec. 1919, *Rock*, no number.

Discussion: *C. rivularis* is a member of the section *Microcalyces*. Its closest relative is *C. Vanioti* from Mt. Kaala which is characterized by the blades oval; the calyx 7-8 mm. long, the lobes ascending or inflexed; and the corolla 13.5 mm. long. *C. rivularis* has, in contrast, the blades lance-ovate to lance-ovate, cuneate at base; the calyx 12-15 mm. long, the lobes recurved and the whole campanulate in outline; and the corolla 20-21 mm. long.

The specific name is from the Latin *rivularis*, pertaining to a rivulet or stream.

11. *Cyrtandra sandwicensis* (Léveillé) St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 85, 1950. (Figs. 23-25, 189.)

Viola sandwicensis Léveillé, Fedde Repert. Sp. Nov. 11 : 63, 1912.

C. garnotiana Gaudichaud f. *uniflora* Skottsberg, Horti Gotoburg., Acta 10 : 174 (1935) = 1936, an invalid name.

Description of All Specimens Examined: Low shrub 0.5-2 m. tall, freely branched; branches terete, glabrous, the bark smooth, straw-colored; leaf scars 3-4 mm. high, shield-shaped, pale, corky, nearly flush; bundle scars 5; internodes 0.7-4 cm., usually about 1.5 cm. long; leafy branchlets 1.5-3 mm. in diameter, densely viscid, canescent pilosulous; young shoots densely white pilosulous; leaves opposite, unequal, asymmetric, divergent, one of a pair being $\frac{1}{4}$ - $\frac{1}{3}$ the larger; petioles 12-60 mm. long, viscid pilose; blades 3-15 cm. long, 1.6-5 cm. wide, chartaceous, oval or obliquely so, the apex abruptly acute or subacuminate, the base cuneate and short decurrent, above closely sub-appressed puberulent, the hairs longer and more abundant than in *C. Garnotiana*, below densely canescent pilosulous, the margin unevenly crenate-serrulate except at base; cymes from the leaf axils, 1-flowered (rarely 3-flowered), densely spreading, viscid pilose throughout; peduncles 5-12 mm. long, filiform; pedicels 7-25 mm. long, filiform; bracts 2-7 mm. long, linear-lanceolate; buds ovoid, acute, the calyx lobes connivent; calyx 7-12 mm. long, green, densely white spreading viscid pilose, campanulate, 2-lipped, lobed about $\frac{1}{2}$ way to base, cut 6-9 mm. between the lips; upper lip 3-lobed, the lobes 6-6.5 mm. long, 2.5 mm. wide, linear-deltoid, thick, within like the lower lobes sparsely puberulous, and lower down pilosulous; lower lip 2-lobed, the lobes 7-8.5 mm. long, 3 mm. wide, narrowly deltoid, obtuse, thick; corolla 13-19 mm. long, 3-7 mm. in diameter, white, the tube 8-12 mm. long, nearly straight, gradually widened upwards, the outer surface densely white villous beyond the calyx tube, glabrous below its rim, the lobes glabrous without near the margin, glabrous within, broadly deltoid-ovate, the upper ones 2-4 mm. long, the lower ones 3-5 mm. long, the lobes spreading at about 40° to 50° from the axis of the tube; filaments fused to within 5 mm. of the throat, the free portion 2.5 mm. long, subulate, spirally incurved; anthers 2.5 mm. long, obliquely deltoid-

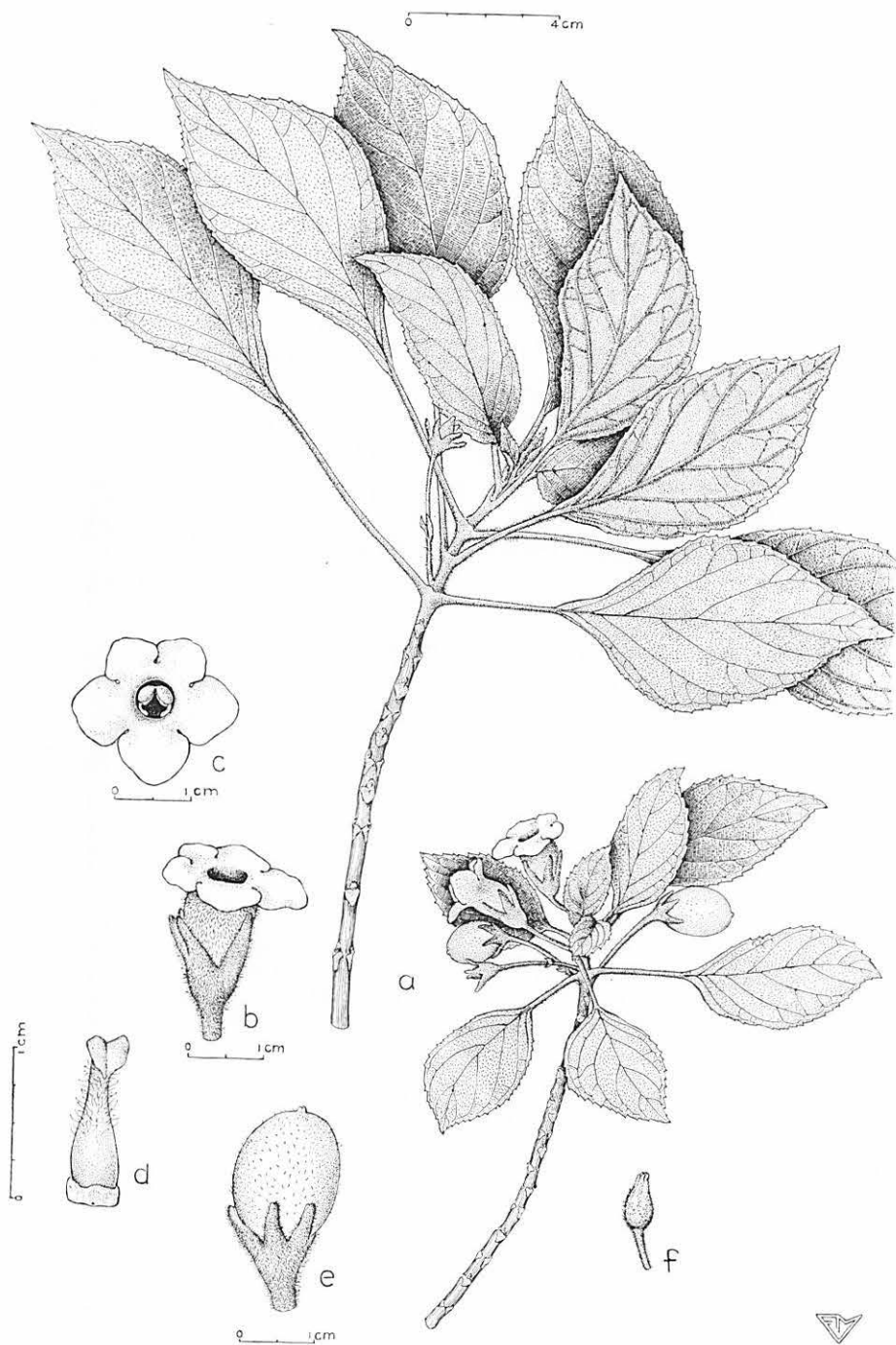


FIGURE 23.—*Cyrtandra sandwicensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, pistil, $\times 2$; e, fruit, $\times 1$. Mt. Tantalus, St. John and Storey 20,253.

ovate, flattened, one cell the smaller; *style* villous, becoming glabrate, 3 mm. long, stout, the two terminal stigmatic lobes 1 mm. long, opposite, distinct, suborbicular, thick; *ovary* glabrous, lanceoloid, becoming pubescent after anthesis, the base surrounded by a cupulate disk; *berry* 8-15 mm. long, 5-8 mm. wide, ovoid, short apiculate, white, puberulent; seeds 0.3-0.35 mm. long, fusiform-ellipsoid, the ends blackish, the body chestnut brown, shining, covered with a high raised cellular reticulation, the areolae oblong-polygonal, $\frac{1}{2}$ to $\frac{1}{3}$ the length of the seed.

Distribution: Koolau Range, leeward side, moist woods on ridges and gulches, from Nuuanu to Palolo, at 1,200 to 1,500 ft. alt., in the lower part of the Ohia Zone.

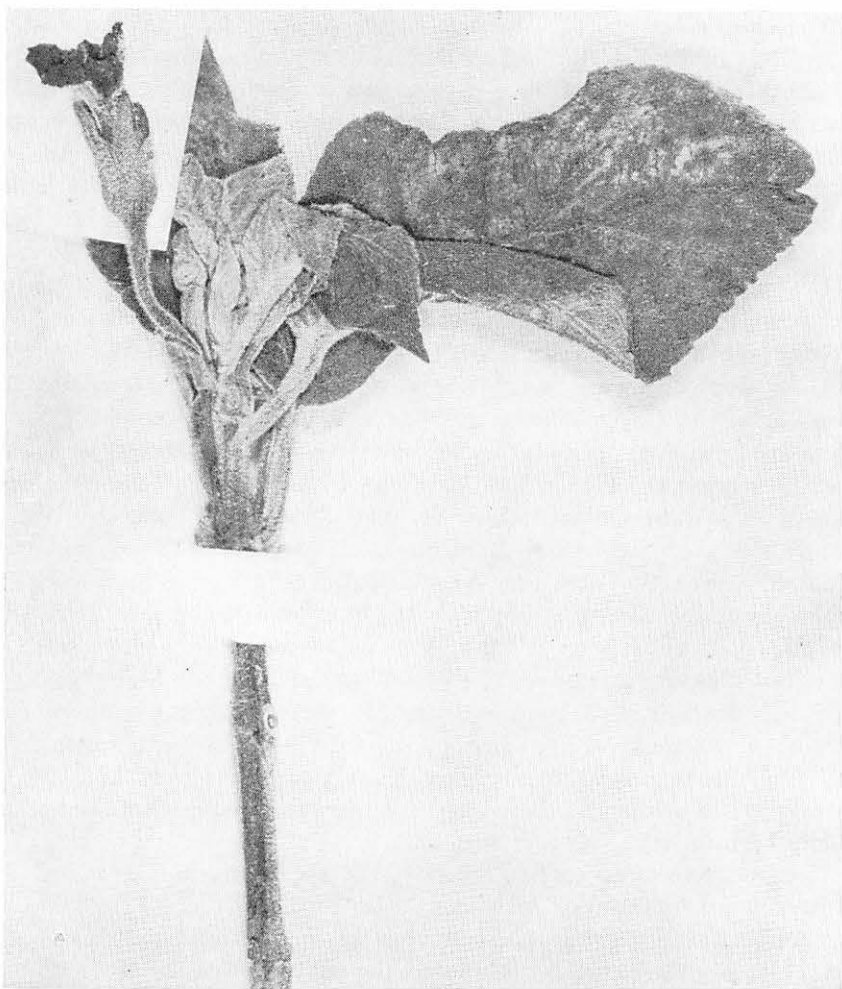


FIGURE 24.—*Viola sandwicensis*, isotype (Bishop Mus.), Sandwich Is., Faurie 1; also isotype of *Cyrtandra sandwicensis*.

Holotype: "Sandwich, 1910 (Faurie)." The isotype in the Bishop Museum is marked *Faurie* No. 1.

Specimens Examined: Koolau Range.

Leeward Side: Honolulu pali [= Nuuanu Pali], Nov. 1909, *Faurie* 637 (BM, BISHOP MUS.); Pauoa Valley, March 17, 1919, *Forbes* 2,547.O; ditto, in small dry watercourse draining from Tantalus, habitat moist and shaded, 1,200 ft. elev., March 20, 1932, *Storey* 181; ditto, along trail to Tantalus Flats, common in shade of trees, 1,500 ft. elev., Dec. 15, 1932, *Storey* 227; ditto, along trail to Tantalus Flats, in humid woods, 1,500 ft. elev., Oct. 13, 1932, *Storey* 204; [Manoa], Tantalus, Oct. 23, 1926, *Horner (Degener* 7,690) (NY); ditto, ridge back of, March 21, 1920, *Garber* 338; ditto, bei 3,000 ft. alt., in Regenwald, Feb. 1930, *Meebold* 8,403 (M); ditto, forest back of, Aug. 7, 1922, *Skottsberg* 81 (BISH, S); ditto, moist wooded gulch, 1,700 ft. alt., Sept. 20, 1941, *St. John & Storey* 20,253; Manoa Valley, Manoa Cliff Trail, wet forest, 430 m. alt., July 15, 1933, *Fosberg* 9,696; Manoa Valley, Aug. 18, 1922, *Skottsberg* 239; ditto, Manoa Cliff Trail, Dec. 1917, *Rock* 13,083; Palolo Valley, Feb. 9, 1918, *Rock* 13,084; ditto, 1911, *Shaw*; ditto, 1912, *Shaw* 1,456.

Oahu, without locality: Galathea-Expeditionen, 1845-47, *Didrichsen* 3,430 (C).

Hawaiian or Sandwich Islands, without locality: see holotype above; *Mann & Brigham* 77 (412; 378).

Discussion: *C. sandwicensis* is a member of the section *Microcalyces*. It is closely related to *C. Garnotiana*, and, like it, is peculiar in having a glabrous ovary which becomes pubescent as the fruit develops. *C. sandwicensis* is separated by having the blades 3-15 cm. long, oval or obliquely so, the apex short acute or subacuminate, above closely subappressed puberulent, below densely canescent pilosulous; the cymes 1- (rarely 3-) flowered; peduncles 5-12 mm. long; style villous. *C. Garnotiana* differs in having the blades 7-23 cm. long, usually lanceolate or elliptic, the base cuneate and short decurrent, above sparsely subappressed puberulent, below moderately pilosulous; the cymes 3-20-flowered; peduncles 25-82 mm. long; and the style at first glabrous.

C. sandwicensis is common in the middle forests in the mountains back of Honolulu. Though collected by most of the botanists who worked this area, from the time of Didrichsen, on the "Galathea" voyage (1845-47), to the present, its taxonomic status has not been well understood, and it has usually been included in other species.

Rock collected this species, but left the specimens undetermined, and made no place for it in his revision.

Skottsberg in 1936 gave the plant a new name, printing it as *C. garnotiana* Gaud. f. *uniflora*, with an English description and a discussion of its relationship to *C. garnotiana*. Though *uniflora* is an appropriate name indicating a diagnostic character of the plant, we cannot adopt it as it is invalid, being

published without a Latin diagnosis. There are other confusions in this publication of Skottsberg's. He cites two collections, "Manoa c. 400 m, fl.-fr. 18/8 1922 (n. 239); Tantalus, fl. 17/8 1922 (n. 218)." No type was indicated. The duplicates of these in Bishop Museum are both labeled, if we read the writing correctly, var. instead of forma. The Tantalus specimen is labeled "7/8 1922, (n. 81)," but it was printed in his publication as "17/8 1922, (n. 218)." It is fortunate, in view of these confusions, that this publication of

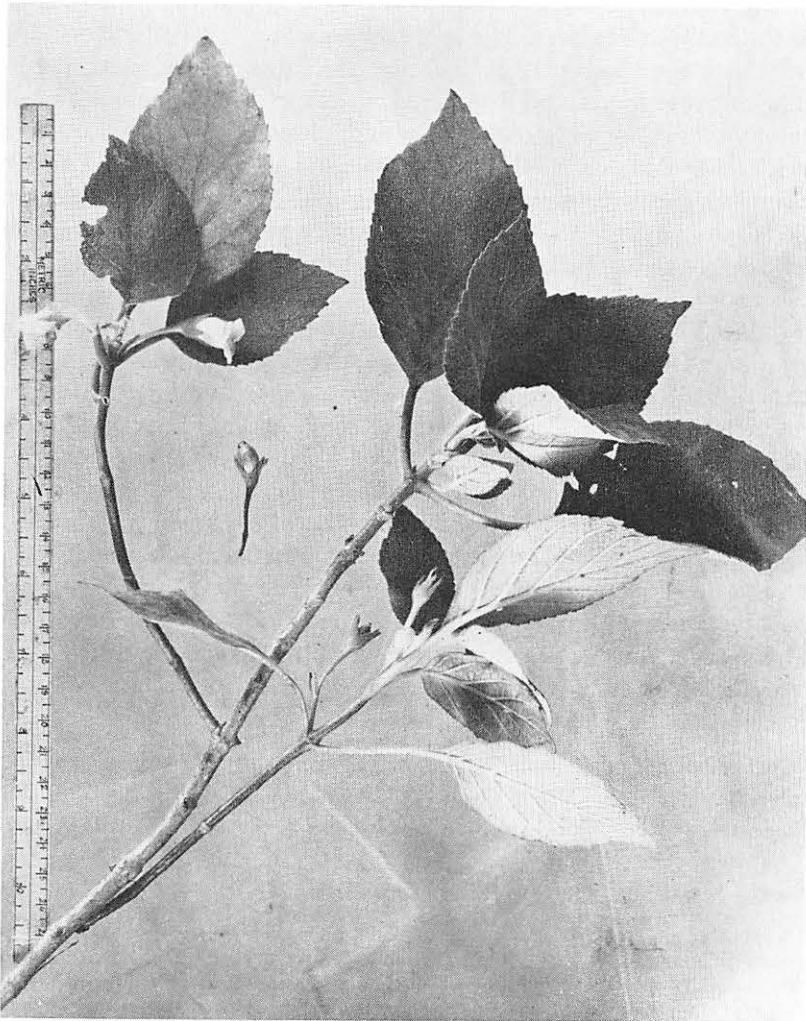


FIGURE 25.—*Cyrtandra sandwicensis*. Mt. Tantalus, Storey 181.

Skottsberg's can be disregarded. It lacks a Latin diagnosis and, hence, is invalid.

The selection of a specific name is a choice between evils. There is a name available, *Viola sandwicensis*, published by L veill , based upon a Hawaiian collection by Faurie. An isotype purchased by Prof. Rock for the College of Hawaii is now in the Bishop Museum. The description by L veill  is four lines long and more detailed and adequate than most of his. He also took more pains with this new species than was his wont, indicating the two species of Hawaiian *Viola* which he considered the closest relatives and giving diagnostic characters. Rock indicated (1914: 359) that the plant was not a *Viola* but really a *Cyrtandra*. The specimen was so meager that Rock did not identify it to the species. Rock had not distinguished and recognized this plant with ovate leaves and 1-flowered peduncles of the mountains behind Honolulu, though he had or saw other and adequate specimens collected by himself and by Mann and Brigham, Hillebrand, and Shaw. The Faurie isotype is meager, but it shows a stem, leaves, buds, and a flower. By comparison it is now possible to identify it positively as the species here treated. L veill  described many Hawaiian plants as new, most of which were promptly and correctly reduced to the synonymy of well-known Hawaiian plants or of introduced European weeds. His Hawaiian publications show inexcusable ignorance and carelessness. For a detailed critique of his work, see Rock (1913: 48-49; 1914: 352-361). Most of these species of L veill  are worthless, but in certain large and critical genera, some of his species have proven valid, due not to the discernment on his part, but to the laws of chance. No credit is due to him, since he failed to determine the correct genus, or even the family. Were there any technicality in the rules of nomenclature which could be invoked, we would do so and reject this name. However, it seems to be a valid and legitimate name, and being in the same category, we must adopt it for this species of *Cyrtandra*.

The specific name was coined from the place name, Sandwich Islands, and the Latin, *-ensis*, a place suffix, hence *sandwicensis*, from the Sandwich Islands place.

12. *Cyrtandra triflora* Gaudichaud, Voy. Uranie, Bot. 447 (1826) = [1829]: Atlas, pl. 52, 1826-30. (Figs. 26-28.)

C. triflora Gaudichaud var. *a Gaudichaudi* Gray, Am. Acad. Arts Sci., Proc. 5: 351, 1862.

Native Name: Hahala (Fafara of Gaudichaud).

Description of Holotype and Isotype: Shrub; stem yellowish, glabrate, shining; branchlets appressed brown pilosulous; *leaves* opposite, ascending, unequal, one of the pair about $\frac{1}{2}$ the larger; petioles 17-60 mm. long, appressed brown pilosulous; *blades* 6.8-12.2 cm. long, 25-50 mm. wide, firm chartaceous, markedly asymmetric-elliptic or -elliptic-oblongate, the apex subacuminate, the base cuneate but inaequilateral, margin low serrulate or crenate, above dark green and remotely appressed pilose, below pale

green and ascending-appressed pilosulous on the veins; *inflorescence* sparsely appressed brown pilose; peduncles 15-17 mm. long; bracts 7 mm. long, lance-ovate; upper axis 4 mm. long; buds oblong-fusiform, finely appressed pilosulous; *calyx* 14 mm. long (when dried), appressed pilosulous without, narrowly asymmetric campanulate, lobed $\frac{2}{5}$ way to base, 2-lipped, 5-lobed, the tube 9 mm. long, 6 mm. wide, tapering at base;

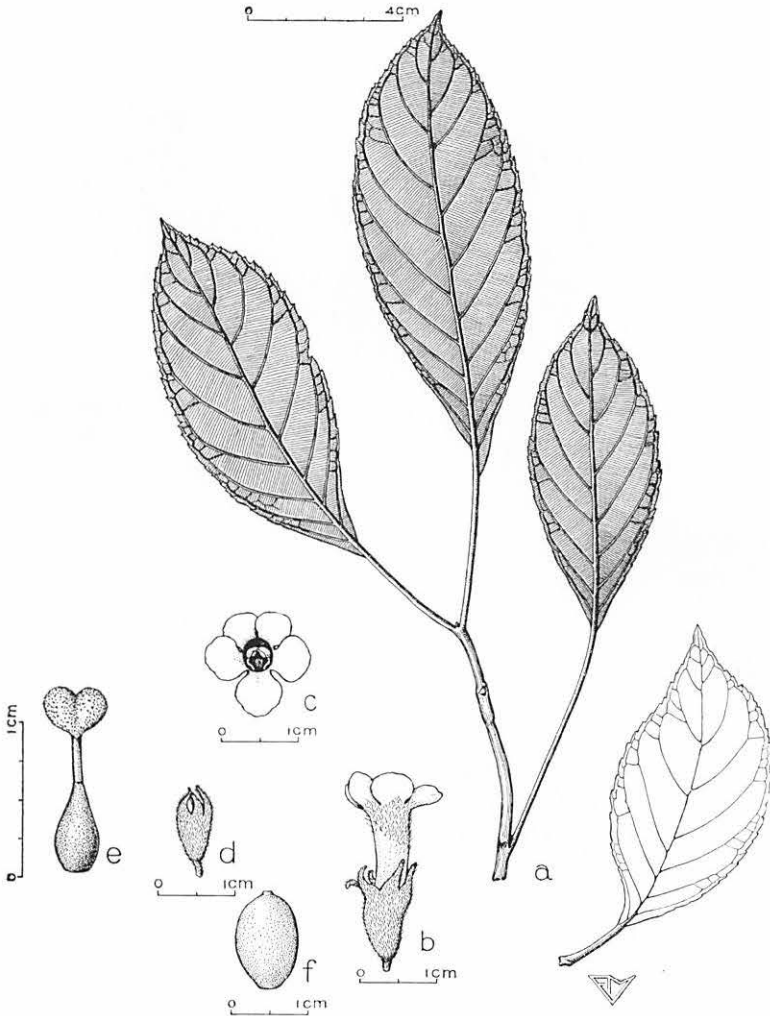


FIGURE 26.—*Cyrtandra triflora*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Iles Sandwich, Gaudichaud, isotype (Geneva).

upper lip with three lobes 4 mm. long, arcuate, the lower third lanceolate, tapering to the linear upper part; lower lip with two lobes 5 mm. long, linear-lanceolate; *corolla* 24 mm. long (when dried), the tube 19 mm. long, 4 mm. in diameter, cylindric, almost straight, outer surface glabrous elsewhere but upper third ascending pilosulous; corolla

lobes spreading at about 45° to the axis of the throat, glabrous within and without except near the base; upper lip of two lobes 5 mm. long, 5.5 mm. wide, suborbicular; lower lip 3-lobed, the lateral lobes 5 mm. long, 6.5 mm. wide, transversely broad elliptic; lower lobe 5.5 mm. long, 6 mm. wide, ovate-suborbicular; fertile stamens two, their filaments adnate to the corolla tube to within 6 mm. of the throat; filaments 3 mm. long, subulate, spirally upcurved; anthers 1 mm. long, lance-cordate; staminodia not seen; style 3 mm. long, stout, terete, glabrous; stigmatic lobes two, 3.5 mm. long,

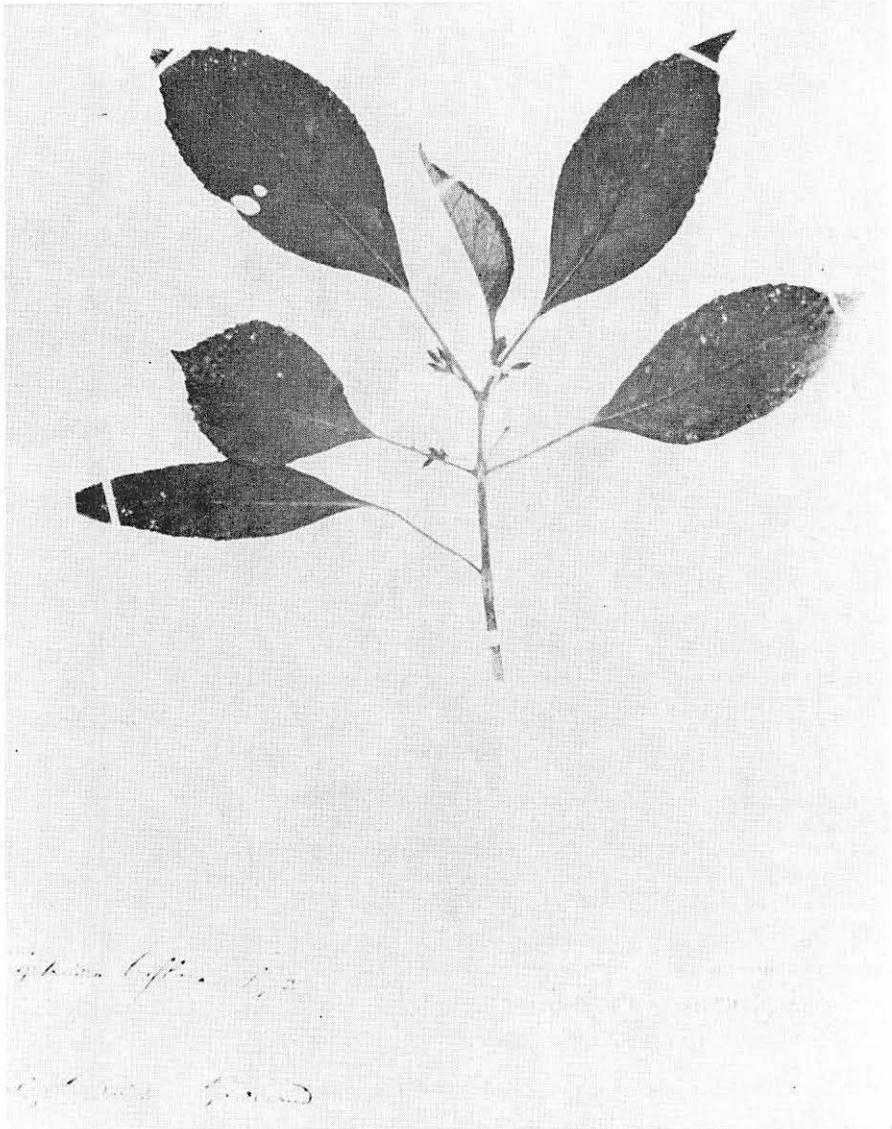


FIGURE 27.—*Cyrtandra triflora*, holotype, C. Gaudichaud (Paris).

semiobcordate, connate on proximal side $\frac{2}{7}$ way; ovary 6 mm. long, lanceoloid, glabrous; fruit (of which only the dried basal portion or perhaps half remains) 6 mm. long, 8 mm. in diameter, semiellipsoid; seeds not examined.

Distribution: Koolau Range, leeward side, near Honolulu.

Holotype: "In insulis Sandwicensibus (Alt. 100-300 hex.)." The holotype is labeled: Uranie, 1817-1820, Iles Sandwich, C. Gaudichaud (P). There is

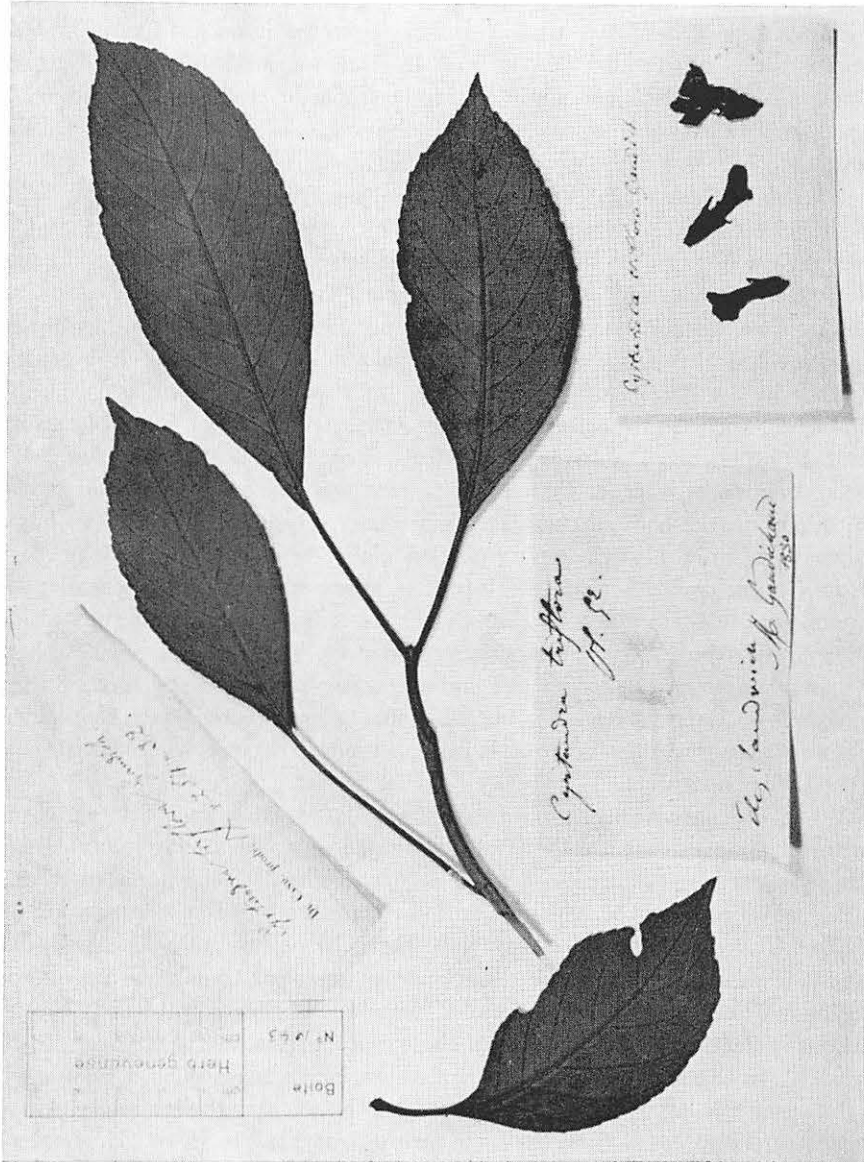


FIGURE 28.—*Cyrtandra triflora*, isotype (Geneva). Sandwich Is., Gaudichaud.

also an isotype: Iles Sandwich, pl. 52, 1830, *M. Gaudichaud* (G). Both have been examined.

Discussion: *C. triflora* was considered by Hillebrand and by Rock to be a member of the section *Microcalyces*. This species was described by Gaudichaud in 1829, when he published six species, the first ones of the genus from the Hawaiian Islands. He did not even mention the particular island where he found it. However, five of his six species are confined to Oahu, and all occur in the wooded valleys of the Koolau Range immediately behind Honolulu, and most of them are abundant in the lower or middle forests there. It is probable that the type was collected above Honolulu in Nuuanu, Kalihi, Manoa, or Moanalua Valley, but is now extinct.

C. triflora Gaudichaud has not been well understood. Gaudichaud's original description was of fourteen words of which nine were descriptive, and of these only a few of any diagnostic value. His figure (1826-1830: pl. 52) was attractively drawn and engraved, making an entire page in a magnificent folio volume. Modern taxonomists would not describe the leaves as oblong. He described the calyx as "glabriusculis" (= glabrate or subglabrate), whereas in the details of his figure two of them are shown as generally pubescent. Those in the habit sketch are shown as glabrous, probably an intentional omission. The original illustration of *C. triflora* shows the calyx and corolla slightly larger than in *C. Garnotiana*, the cymes 3-flowered, the fruit glabrous, the body of the blades more narrowly elliptic. *C. triflora* has a glabrous fruit, and also the young pistil is glabrous, characters that are diagnostic. Gaudichaud described the leaves as appressed pubescent beneath; De Candolle called them glabrous; but Clarke described them as glabrous above and appressed pubescent below along the nerves. The writer describes them as remotely appressed pilose above and ascending-appressed pilosulous on the veins below. Early systematic botanists often overlooked sparse or small pubescence, so our interpretation is probably not in serious conflict with that of the earlier botanists.

When compared with a photo of the holotype in Paris, taken by the author, it appears that Gaudichaud's plate of this species (like many others of his plates) is too generalized to be accurate. The drawing apparently was made from the holotypic specimen still in the museum in Paris, but two more pairs of leaves were supplied, as were three blooming inflorescences. The leaf blades appear much more equal and symmetrical than they are on the specimen. There are also seven detailed drawings of flower and fruit. Though without indication of scale, those of the calyx, corolla, and pistil seem to be life sized. In the split-open corolla three staminodia are shown. One stamen is shown much enlarged. The lobes of the calyx are shown more nearly symmetrical and equal than they are on the isotypic specimen (Herb. Geneva). It appears that the drawing of this new species published by Gaudi-

chaud was quite inaccurate in general appearance, in habit, and in numerous details of flower structure. Similarly Rock observed (1919:205) that the drawing, "is too schematic to permit identification," as he had not seen any of the type material.

The species, *C. triflora* Gaudichaud, has always been accepted, usually on the basis of the single type collection. No added collections were known to Hooker and Arnott in 1832, A. De Candolle in 1845, Wawra in 1872, C. B. Clarke in 1883, Rock in 1919, Skottsberg in 1936, or to the present writer. Hillebrand (1888) keyed and gave a description for the species, but a duplicate of his material was described by Clarke as the new and distinct species, *C. polyantha*. Hence, Hillebrand was treating another species, and he misinterpreted *C. triflora* Gaudichaud.

In addition to Gaudichaud's brief original description and inaccurate drawing, there is other authentic information. Alphonse De Candolle in his monograph (1845:284) accepted the species, cited an isotypic specimen received from the collector, and gave an expanded, independent description. Later, C. B. Clarke also accepted the species and gave a description of it (1883:218). He had seen the holotype in Paris and the isotype in the De Candolle Herbarium in Geneva, and he further expanded the description. His treatment seems in agreement with that by Gaudichaud and by De Candolle, except that he states that the calyx is 11 mm. long and the corolla 22-25 mm. long. No scale or statement of magnification was given by Gaudichaud. The holotypic sheet in Paris now bears no expanded flowers, only one naked peduncle and three cymes with three small buds each. De Candolle called the branches glabrous, while the writer calls the branchlets appressed brown pilosulous.

The author examined the holotype specimen in Paris in 1935, but did not then study it critically. However, he took the accompanying photograph of it, and noted its firm small asymmetric and diverse leaves and short, few-flowered cymes. No mature flowers or fruit remain on the holotype. In 1954 the author studied and made a drawing of the Gaudichaud specimen in the De Candolle Herbarium, Geneva. It consists of a stem with three attached leaves, one loose leaf, and in a pocket are a bud, four flowers, and the basal half of a ripe fruit. It has an original label written in Gaudichaud's hand: "*Cyrtandra triflora*, Pl. 52, îles Sandwich." This is the exact label form for the specimens from Gaudichaud's first voyage on the "Uranie," used with the first set of his specimens in the Museum National d'Histoire Naturelle, Paris. On this voyage he collected in the Sandwich (Hawaiian) Islands in 1819. At the bottom of the label on the Geneva specimen is added: "M. Gaudichaud, 1830," but in a different handwriting. The date would suggest that the specimen was collected on Gaudichaud's second voyage, on "La Bonite," but the label is not of the kind used for the specimens from the second

voyage. The writer suggests that the year stated, 1830, may well have been the year when the specimen was received in Geneva. The details of this specimen agree completely with those of the meager holotype in Paris, and with the characters included in Gaudichaud's original description. We conclude that the Geneva specimen is a true isotype. It has been used to complete the description of the morphology of *C. triflora* Gaudichaud and it is the basis of the drawing here included.

In any case, *C. triflora* is now apparently extinct, as none of the collectors who have botanized the mountain valleys behind Honolulu has rediscovered the species.

C. triflora Gaudichaud f. *typica* Wawra (Flora 30: 563, or 17 of the reprint, 1872) is, according to Rock (1919: 52), a synonym of *C. lysiosepala* (Gray) C. B. Clarke var. *Grayi* (C. B. Clarke) Rock.

C. triflora sensu Mann in part, not of Gaudichaud, equals *C. Skottsbergii* St. John & Storey.

C. Grayi C. B. Clarke (1883: 218-219) was based in part on *C. triflora* sensu Gray, not of Gaudichaud. Rock later (1919: 52) made this the name-bringing synonym of *C. lysiosepala* Gray var. *Grayi* (C. B. Clarke) Rock, and excluded it from the island of Oahu.

The specific name was coined from the Latin *tri*, triple; *flos*, *floris*, a flower, in allusion to the 3-flowered cymes.

13. *Cyrtandra villosa* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 85, 1950. (Figs. 29, 185.)

Description of Holotype: Shrub 2 m. tall; branches pale brown, smooth or somewhat roughened by longitudinal fissures, as much as 7 mm. in diameter; leaf scars 4-5 mm. high obcordate, pale; bundle scars 5; young shoots closely appressed brown puberulent; leafy branchlets as much as 4 mm. in diameter, subquadrangular, rusty brown puberulent; internodes 7-28 mm., averaging 15 mm. long; *leaves* opposite, ascending, borne at the 2-4 upper nodes, not crowded, unequal, one of the pair being $\frac{1}{4}$ larger; petioles 13-31 mm. long, stout, sparsely rusty brown puberulent; *blades* 9-16 cm. long, 4-8 cm. wide, firm chartaceous, broadly asymmetric-oblancheolate or oblanceolate, at the base, gradually decurrent, the apex short subacuminate, above dark green, remotely hirsutulous, below pale green, minutely pilosulous especially on the veins, secondary veins 8-11 on a side, ascending, arcuate, the tips inarching near the margin, the margins low callous serrulate; *cymes* axillary, closely brown appressed puberulent, 3-5-flowered; peduncles 8-23 mm. long, in anthesis ascending at 45°; pedicels 8-15 mm. long, divergent, frequently bibracteolate well above the base, the bracteoles oval, 4-7 mm. long; bracts at summit of peduncle 2-10 mm. long, foliaceous, oval, the larger ones petiolate; buds ovoid, later campanulate with calyx lobes spreading; *calyx* in anthesis 9-13 mm. long, green, the outside appressed puberulent, the inside glabrous, the tube 4-5 mm. long, campanulate, the lobes gently spreading, the limb 2-lipped, 5-lobed, cleft between the lips 6-7 mm.; upper lobes cleft 3.5 mm., deltoid-lanceolate; lateral lobes 5 mm. long, 2.5-3 mm. wide, lanceolate; lower lobe 5.5-6 mm. long, lanceolate; *corolla* 20 mm. long (when boiled), white, the tube subcylindric, widening above, almost straight, 3 mm. in diameter at the base, 4 mm. at the throat, without the tube glabrous at the very base, elsewhere closely white pilosulous, within glabrous; limb 2-lipped, 5-lobed, the lobes all glabrous within; upper lobes 2, spreading, 3 mm. long, 4.3 mm. wide, transversely oval, ciliate, auriculate and overlapping at

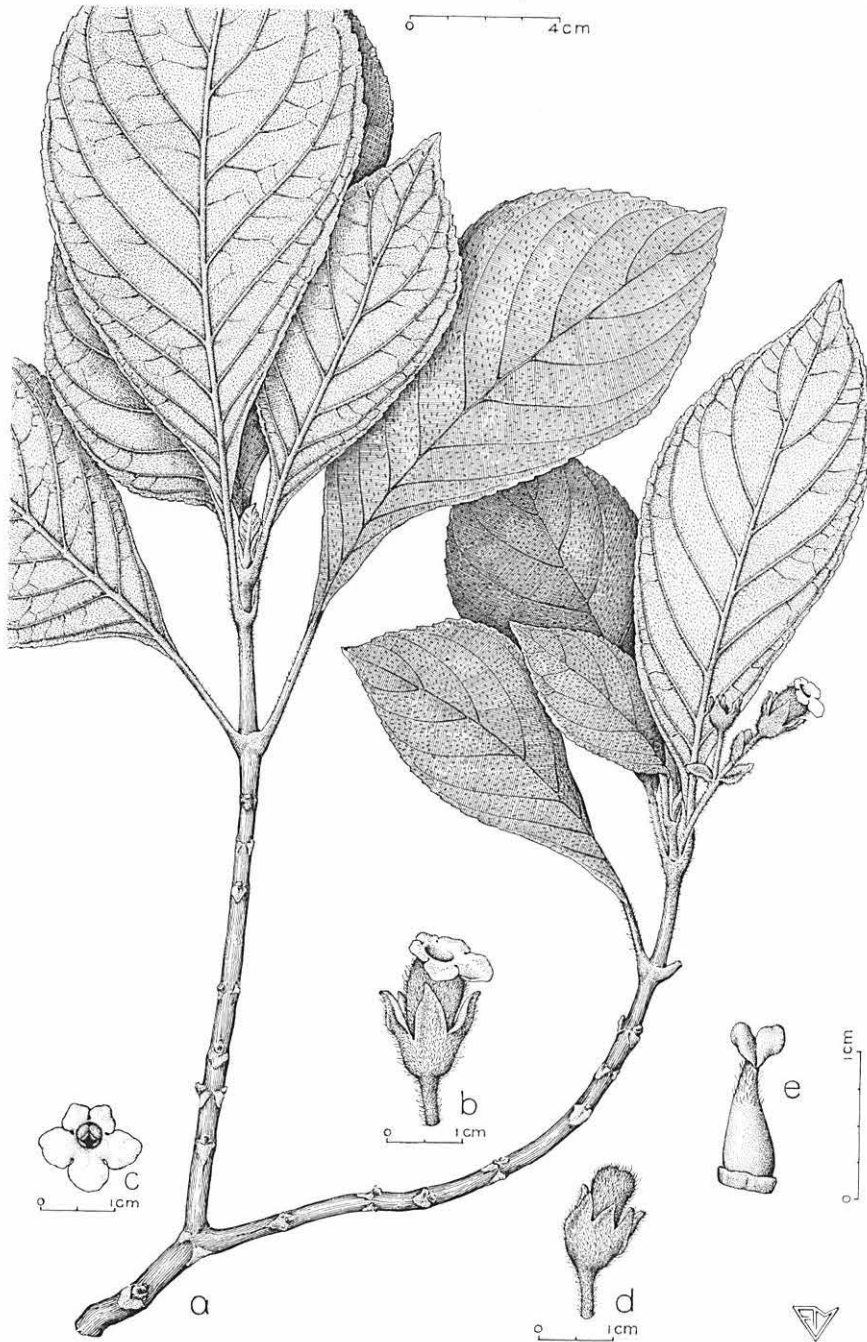


FIGURE 29.—*Cyrtandra villosa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Holotype, Waikane, Fosberg 8,786 (Bishop Mus.).

base; lower lip 3-lobed; lateral lobes 5 mm. long and wide, rhombic-suborbicular, obtuse; lower lobe 4 mm. long, 5 mm. wide, suborbicular; two lower stamens perfect, the filaments adnate to the corolla tube to within 5.5 mm. of the throat, the free portion 2 mm. long, stout subulate, spirally upcurved; anthers 2.2 mm. long, obliquely elliptic, the connective oval; staminodia attached to the corolla tube to within 7 mm. of the throat, the filaments 0.2 mm. long, subulate, the anther vestige 0.2 mm. long, yellowish; style 2.5 mm. long, sparsely pilosulous; 2 stigmatic lobes 2.5 mm. long, oval, connate $\frac{2}{3}$ way up proximal side; ovary 5 mm. long, lanceoloid, glabrous; fruit unknown.

Distribution: Koolau Range, windward side, in rain forest, at 800 ft. alt., in the Ohia Zone.

Holotype: Oahu, Waikane-Schofield Trail, Waikane, Koolau Mts., alt. 250 m., wet forest, shrub 2 m. tall, Oct. 16, 1932, *F. R. Fosberg 8,786* (BISHOP MUS.).

Discussion: *C. villosa* is a member of the section *Microcalyces*. Its closest relative is *C. rivularis* St. John & Storey which grows on the windward side of the Koolau Range from Kaluanui to Waiahole. It differs by having the blades 2.8-6.3 cm. long, glandular pilose; cymes glandular pilose; calyx tube 7-9 mm. long; exposed corolla tube shaggy villous; and the style glabrous. In contrast, *C. villosa* has the blades 9-16 cm. long, nonglandular hirsutulous above and pilosulous below; calyx tube 4-5 mm. long; exposed corolla tube pilosulous; and the style pilosulous.

The specific name is from the Latin *villosus*, rough hairy.

2. Section *Chaetocalyces*

14. *Cyrtandra axilliflora* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 77, 1950. (Figs. 30, 189.)

Description of All Specimens Examined: Shrub 1-2 m. tall, erect; stem 2 cm. in diameter, pale, smooth, quadrangular, the leaf scars 3-6 mm. high, shield-shaped, sinuately lobed below, connate, pale, raised; bundle scars seven; internodes 6-62 mm. but usually about 25 mm. long; leafy branches quadrangular, stout, closely ascending hirsutulous; leafy shoots with 3-7 pairs of well-spaced leaves; young shoots densely ascending hirsutulous; *leaves* opposite, clearly unequal, one of each pair being $\frac{1}{4}$ smaller, arcuate ascending or finally reflexed; petiole bases perfoliate, forming a fleshy raised flange about 2 mm. high, and leaving an annular scar connecting the leaf scars; petioles 2.3-5.7 cm. long, crinkly hirsutulous; *blades* 9-24 cm. long, 3.3-13.5 cm. wide, chartaceous, oval, the apex short acuminate, the base longer cuneate decurrent, the margin irregularly serrate or in part doubly so, above green and remotely crinkly hirsutulous, below pale green and hirsutulous on the veins, capitate glandular puberulent on the intervals; principal lateral veins 7-9 on a side, curved ascending, the tips in-arching and connecting within margin; *cymes* from the leaf axils, mostly 5-flowered, crinkly hirsutulous throughout; peduncles 3-13 mm. long, ascending; pedicels 6-15 mm. long, spreading, filiform; bracts 4-7 mm. long, linear, foliaceous, above glabrous; buds open campanulate; *calyx* 17-20 mm. long (14-17 mm. when dried), greenish and foliaceous, the outside ascending puberulent, deeply 2-lobed $\frac{3}{4}$ way to the base; the upper lip 3-parted, upcurving away from the corolla, the lobes parted for 13-15 mm., 2-2.5 mm. wide, linear-oblong, abruptly narrowed to the obtuse tip; lower lip 2-parted, similar to the upper lobes but almost straight, 16-18 mm. long, the middle sinus cut down 14-15 mm.; *corolla* 31-34 mm. long (24 mm. when dried), white, the outside white pilose on the exposed parts but the hairs smaller and fewer below and the base glabrous, the tube 5 mm. in diameter near the base, 9 mm. at the throat, nearly terete but gently decurved throughout and more markedly so at a point $\frac{3}{8}$ way from the base, the total curvature about 30° , within tube glabrous on lower two-thirds, but near the throat capitate glandular puberulent; limb almost rotate, 2-lipped, 5-lobed; upper lip with 2 lobes 9 mm. long, 8.5-9 mm. wide, suborbicular, broadly obtuse, within capitate glandular puberulent towards the throat, without stiffly puberulent from base to middle; lower lip with 3 lobes, within capitate glandular puberulent towards throat, without stiffly puberulent from base to middle, the 2 lateral lobes 8.5-9 mm. long, 10 mm. wide, oval-suborbicular, broadly obtuse; lower lobe 8-9 mm. long, 9-10 mm. wide obovate suborbicular, narrowed towards the base, broadly obtuse; 2 lower stamens perfect, filaments adnate to the corolla to within 8 mm. of throat, the free portion 2.5-3 mm. long, subulate, spirally upcurved; the 2 perfect anthers 1.5 mm. long, subglobose; 2 stout lateral staminodia 1 mm. long, straight, subulate, upper one 0.5 mm. long; *style* 4 mm. long, stout and capitate glandular puberulent; 2 stigmatic lobes 4 mm. long, oval connate $\frac{2}{3}$ way up proximal side; *ovary* 7 mm. long, linear-lanceoloid, glabrous, the base surrounded by a cupulate disk 1 mm. high.

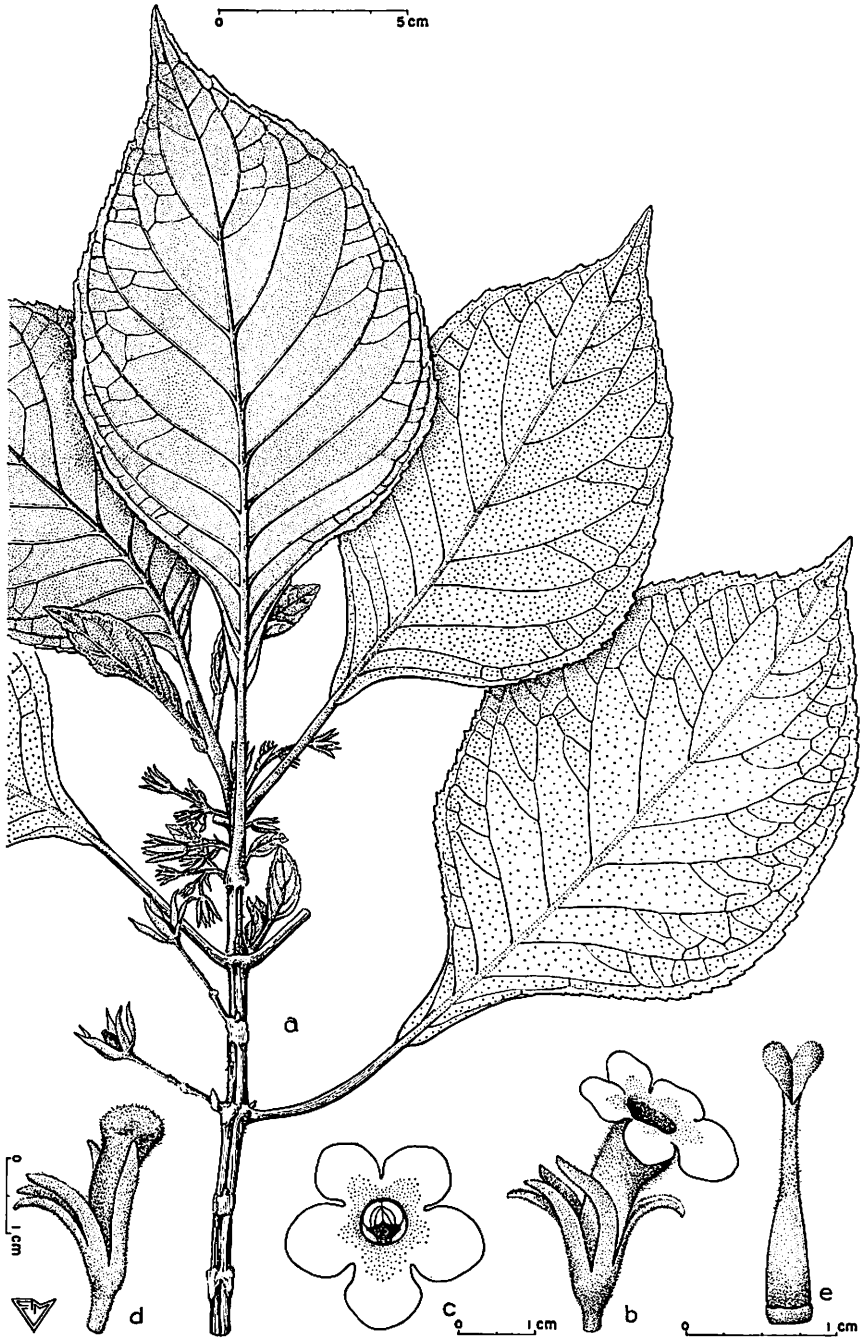


FIGURE 30.—*Cyrtandra axilliflora*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Holotype, Waikane-Schofield Trail, Kahana, St. John 20,240 (Bishop Mus.).

Distribution: Koolau Range, windward side, Ohia Zone, from Punaluu to Kahana.

Holotype: Oahu, Waikane-Schofield Trail, Kahana, rain forest on steep slope, 1,500 ft. alt., May 18, 1941, *H. St. John 20,240* (BISHOP MUS.).

Specimens Examined: Windward side, Punaluu, Sept. 27, 1938, Hawaiian Bog Survey. *Cranwell, Selling, Skottsberg 3,667*.

Discussion: *C. axilliflora* is one of the few species with the leaves joined by a raised fleshy united ring of the petiole bases. It is close to *C. collarifera* but besides the various differences used in the key, that species has much more shaggy hairy inflorescences and flowers, smaller flowers, more tapering lobes of the campanulate calyx, etc.

The specific name is coined from the Latin *axilla*, the node or axis; *flora*, flower, from the axillary inflorescences.

15. *Cyrtandra collarifera* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 78, 1950. (Figs. 31, 191.)

Description of All Specimens Examined: Shrub 2 m. tall; branches light brown, glabrate, as much as 7 mm. in diameter; fleshy, on drying shrinking and the bark wrinkled by longitudinal ridges and furrows, naked below; leaf scars 3-4 mm. high, broad shield-shaped, interconnected by a broad band, thus annular; bundle scars 5; young shoots densely brown shaggy hirsute; leafy branchlets as much as 2.5-4 mm. in diameter, subquadrangular, densely shaggy hirsute, hairs turning rusty brown on drying; internodes 3-20 mm., averaging 7 mm. long; *leaves* opposite, unequal, one of the pair being from subequal to $\frac{1}{5}$ larger, borne at the 3-5 upper nodes, not crowded, ascending; petioles 10-35 mm. long, stout, and shaggy ferruginous hirsute, bases broadly perfoliate and connate, forming a collar 1-2 mm. wide which after leaf fall makes the leaf scar annular; *blades* 8-30 cm. long, 36-142 mm. wide, thick chartaceous, fragile and easily broken, oval, apex subacuminate, base long decurrent, the margin irregularly serrulate, above dull green, and scabrous catenulate hirsute, below pale green and more softly catenulate hirsute; secondary veins 7 to 10 on a side, cross-linked both to the margin and next upper vein; *cymes* axillary, 1-7-flowered, shaggy brownish catenulate hirsute; peduncle 11 mm. long, spreading; pedicel 6 mm. long; bracts 6-8 mm. long, lanceolate, foliaceous (buds narrowly campanulate, shaggy hirsute); *calyx* in anthesis 14-17 mm. long, campanulate, densely shaggy brown hirsute, the tube 2 mm. long, broad campanulate, 2-lipped; upper lip 2-lobed, lower lip 3-lobed but the lobes all almost equal, 12-16 mm. long, 1-1.2 mm. wide, greenish, linear, attenuate, shaggy hirsute except within near the base; *corolla* 25 mm. long (when fresh), white; the tube 19 mm. long, 5 mm. in diameter, subcylindric, beginning at middle gently recurved at 30° to axis of the lower tube, without glabrous below the middle, the exerted upper portion shaggy hirsute, limb 2-lipped, 5-lobed; upper lobes 2.5 mm. long, 4 mm. wide, transversely oval, hirsute without and sparsely so within; lower lip 3-lobed; the lobes hirsute without and sparsely so within; lateral lobes 3 mm. long, 4 mm. wide, transversely oval; lower lobe 3 mm. long, 5 mm. wide, transversely oval; two lower stamens perfect, the filaments adnate to within 4 mm. of the throat, free portion 1.5 mm. long, subulate, spirally upcurved; anthers 2 mm. long, asymmetric oval, the connective oval; staminodia attached to within 5 mm. of the throat, 0.2 mm. long, subulate; *style* 2 mm. long, terete, sparsely pilose at base; stigmatic lobes 2, sessile, 2 mm. long, oval, connate, $\frac{2}{3}$ way up proximal side; *ovary* 5 mm. long, lanceoloid, sparsely pilose just at tip; fruit unknown.



FIGURE 31.—*Cyrtandra collarifera*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, pistil, $\times 2$; e, bud, $\times 1$. Palolo, St. John 20,303, holotype (Bishop Mus.).

Distribution: Koolau Range, leeward side; at about 800 ft. alt. only in Palolo and Manoa, in the Koa Zone.

Holotype: Oahu, Palolo, Waiomao Stream, Koolau Range, 800 ft. alt., moist lower forest, 2 m. shrubs, etc., July 12, 1942, *H. St. John 20,303* (BISHOP MUS.).

Specimens Examined: Koolau Range, leeward side, Manoa Valley, *Hillebrand* (ex Herb. Mann & Brigham); Right Fork, Palolo Valley, Aug. 1, 1920, *Garber 511*.

Discussion: *C. collarifera* is a member of the section *Chaetocalyces*. Its closest relative is *C. kalichii* Wawra which has its calyx cut only $\frac{2}{3}$ way down, the lobes 7-12 mm. long, lanceolate. In contrast, *C. collarifera* has the calyx cut $\frac{4}{5}$ way to the base, the lobes 12-16 mm. long, linear. It is also related to *C. waiolani* with which it is contrasted in the key.

The Hillebrand specimen from Manoa Valley bears an original pencil ticket in his hand calling it *Cyrtandra* sp. nov., but he does not seem to have ever published it. Someone (perhaps Asa Gray) marked it *C. latebrosa?* and C. N. Forbes determined it as *C. kalihii*. It well deserves the status of a new species. It has seldom been collected, and may be nearing extinction.

The specific name comes from the Latin *collare*, a collar; *fero*, to bear, in allusion to the conspicuous collarlike perfoliate petiole bases at the nodes.

16. *Cyrtandra dentata* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 78, 1950. (Figs. 32, 186.)

Description of Holotype: Shrub 2 m. tall; branches pilose, later glabrate, smooth, straw-colored to pale brownish, as much as 5 mm. in diameter; somewhat fleshy and on drying shrinking and forming longitudinal furrows and ridges; leaf scars 4-6 mm. high, rounded shield-shaped, pale, corky; bundle scars 5; young shoots densely shaggy yellowish pilose; leafy branchlets as much as 4 mm. in diameter, quadrangular, fleshy, white crinkly pilose; internodes 8-25 mm., averaging 12 mm. long; *leaves* opposite, borne at the upper 2-3 nodes, obliquely ascending, not crowded, the leaves of a pair unequal, one in blade and petiole being about $\frac{3}{4}$ size of its mate; petioles 3-7.5 cm. long, white crinkly pilose, the hairs multicellular catenulate (of elongate flat cells, the planes of which alternate at right angles); *blades* 9-18 cm. long, 5.8-10.2 cm. wide, chartaceous broadly asymmetric oval, the apex abruptly acute, the base unequally abruptly cuneate, the margins serrate, above dark green, remotely flattened crinkly catenulate hirsute, below pale greenish and softly similarly crinkly pilose, shaggily so on the veins, secondary veins 6-10 on a side, lower ones subsinuous, then gently arcuate, tips inarched; *cymes* axillary, 3-9-flowered, densely crinkly catenulate pilose, each hair tipped with an ellipsoid gland; peduncles 19-34 mm. long, in bud ascending, in fruit descending; pedicels 10-27 mm. long, diverging; bracts 12-15 mm. long, oval, foliaceous; buds campanulate, the calyx lobes at first erect, later spreading; *calyx* in anthesis 9-14 mm. long, not accrescent, similarly white, flattened, catenulate gland-tipped pilose within and without, the tissue green, perceptibly 2-lipped, but the subequal lobes very similar, subequal, lanceolate, 7-10 mm. long, 2.5-4.2 mm. wide, the 3 upper lobes slightly the longer; lower lobes 2 or 3; *corolla* when dried 22 mm. long, white, the tube nearly straight, slightly bulbous at base, then enlarging and perceptibly funnelform towards the throat which is 6 mm. in diameter, moderately white crinkly catenulate glandular pilose without, glabrous within; limb 2-lipped, 6-lobed, the lobes spreading at about 90° to the axis; upper lobes 2-2.8 mm. long, 3-4 mm. wide, trans-

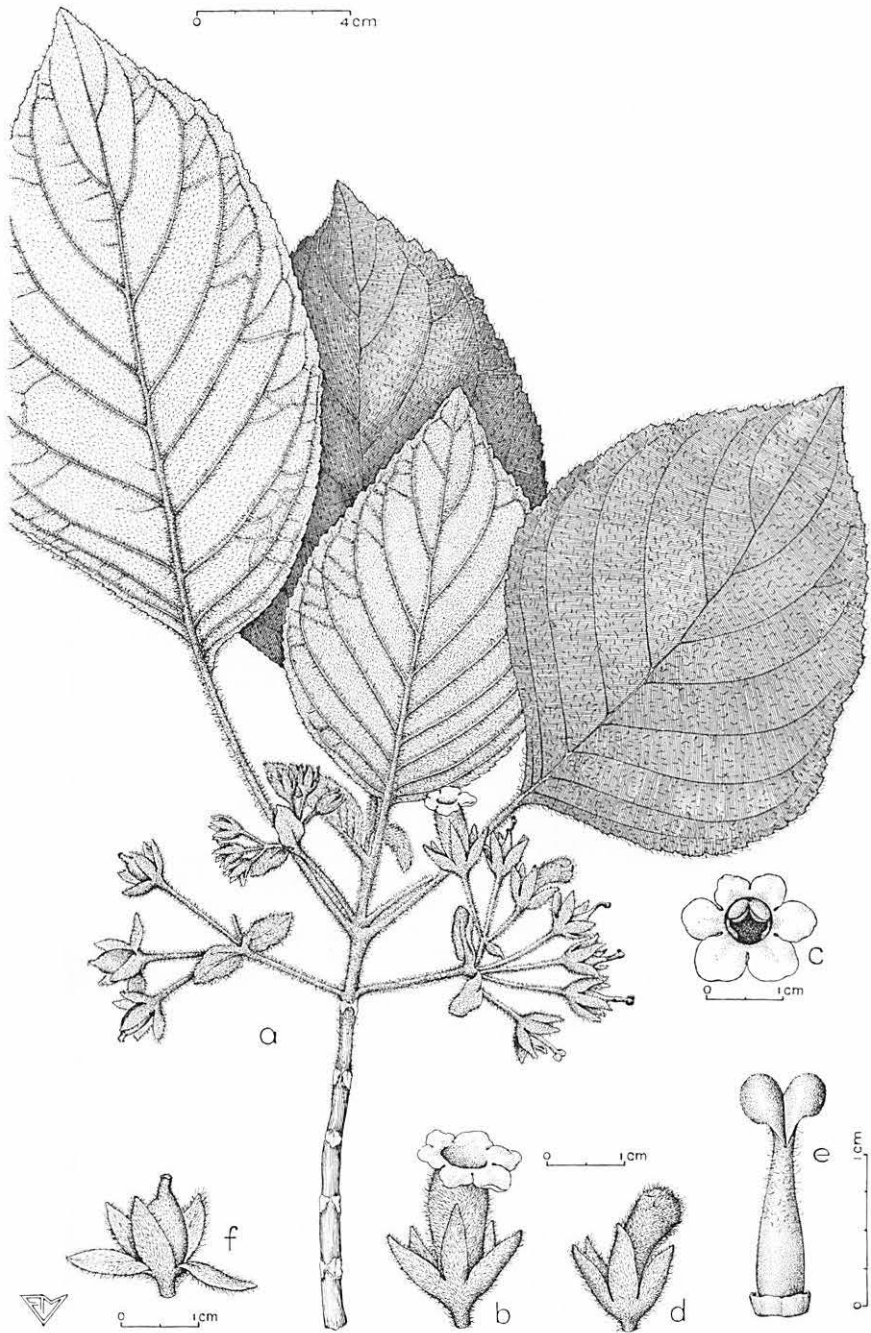


FIGURE 32.—*Cyrtandra dentata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Waiola Valley, Kawaioloa, St. John 21,364, holotype (Bishop Mus.).

versely oval; lower lobes 3.5-4 mm. long, 4 mm. wide, suborbicular; *style* stout, terete 3-3.5 mm. long, sparsely glandular pilose; stigmatic lobes 3 mm. long, oval, united $\frac{2}{3}$ way up the proximal side, pilose on the back; *ovary* 4-6 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1 mm. high; immature *fruit* 9-13 mm. long, ovoid, beaked, glandular-puberulous.

Distribution: Koolau Range, leeward side; moist forest at 1,250 ft. alt., lower edge of the Koa Zone. Known only from the type locality.

Holotype: Oahu, S. Fork of Waiola Valley, N. of Anahulu Trail, Kawai-*loa*, Koolau Range, 1,250 ft. alt., open woods under kukui in gulch, Oct. 14, 1945, *H. St. John* 21,364 (BISHOP MUS.).

Discussion: *C. dentata* is a member of the section *Chaetocalyces*. The closest relative is *C. poamohoensis* St. John & Storey which occurs on the Paalaa-Wahiawa ridge on the lee side of the Koolau Range, at 2,000 ft. alt. in the Ohia Zone. This related species differs in having: more leaves, the 3-5 terminal nodes bearing leaves, the blades elliptic-lanceolate to oval, 2.5-7.5 cm. broad; peduncles 30-45 mm. long; calyx 12-17 mm. long, subglobose, the lobes broadly lanceolate; style none. *C. dentata* differs in having: fewer leaves, only the 2-3 upper nodes leaf-bearing, the blades broadly asymmetric oval, 5.8-10.2 cm. wide; peduncles 19-34 mm. long; calyx 9-14 mm. long, campanulate, the lobes lanceolate; style terete 3-3.5 mm. long.

From the numerous inflorescences, only a single flower of *C. dentata* is well preserved. This lone flower is 6-parted, with 3 upper and 3 lower lobes. Otherwise the flower appears normal, with well-formed stamens and pistil. On close examination it is noted that several of the flowers have 6-parted calyces, though 5-parted is the commoner plan. Probably the corollas were also either 5- or 6-parted. All five branches constituting the type number were gathered from the same bush, so it appears that this type specimen has the flowers either 6- or 5-merous. It is the first report of 6-lobed corollas in the Hawaiian species.

The name of the species was taken from the Latin *dentatus*, toothed, referring to the toothed or dentate margin of the blades.

17. *Cyrtandra gracilis* Hillebrand in C. B. Clarke, A. and C. De Candolle Monogr. Phanerog. Prodr. 5 (1): 226, 1883; independently published by Hillebrand, Fl. Hawaiian Is. 333-334, 1888.—Rock, Am. Jour. Bot. 6: 65-66, pl. 7, 1919 (illustrations). (Figs. 33, 34, 187.)

Description of Holotype: Shrub; branches at first quadrangular as much as 3.6 mm. in diameter; leaf scars 2.4 mm. high, pale, oblong-shield-shaped; young shoots closely white pruinose; leafy branchlets as much as 3.2 mm. in diameter, pruinose, sharply quadrangular, but on drying the sides caving in forming 4 deep furrows; internodes 10-36 mm. long; *leaves* opposite, ascending, then diverging, not crowded, borne at the 4-6 upper nodes, unequal, one of a pair being about $\frac{1}{2}$ larger; petioles 25-69 mm. long, slender, in youth pruinose, in age subglabrate; *blades* 9-16.5 cm. long, 36-66 mm. wide, firm chartaceous, elliptic lanceolate, gradually long acuminate, the base cuneate and decurrent, above dark green and sparsely pruinose, later glabrate, below whitish green and sparsely capitate glandular puberulent on the veins, later sub-

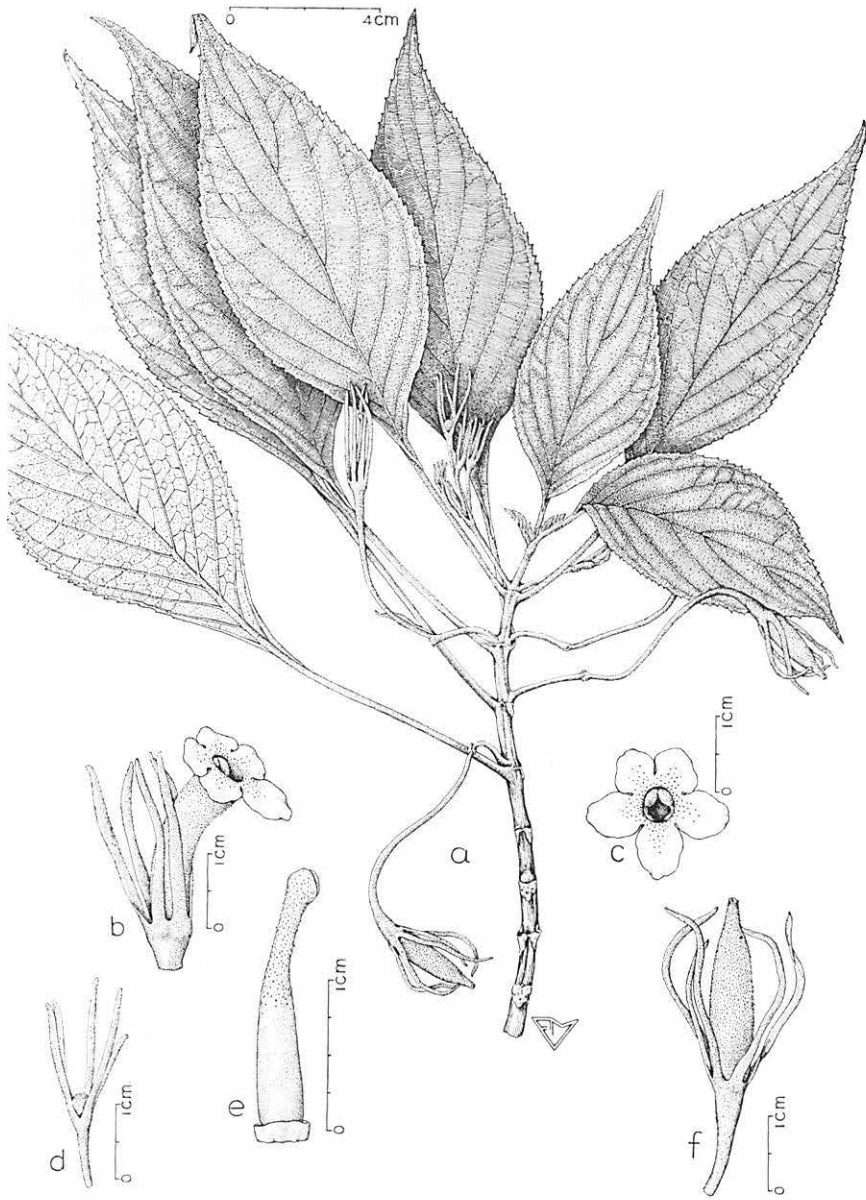


FIGURE 33.—*Cyrtandra gracilis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Palolo, isotype Hillebrand (Gray Herb.).

glabrate, the margins callous serrate, the secondary veins 6-7 on a side, ascending, arcuate, inarching, and excurrent in the teeth; *cymes* axillary, 1-4, commonly 3-flowered, pruinose, the lateral flowers developing soon after the central one; peduncles 12-22 mm. long; pedicels 23-75 mm. long, sigmoid, and at tip clavate; bracts 14-17 mm. long, 1.4-1.7 mm. wide, linear; buds slender campanulate, the calyx lobes elongate, distinct,

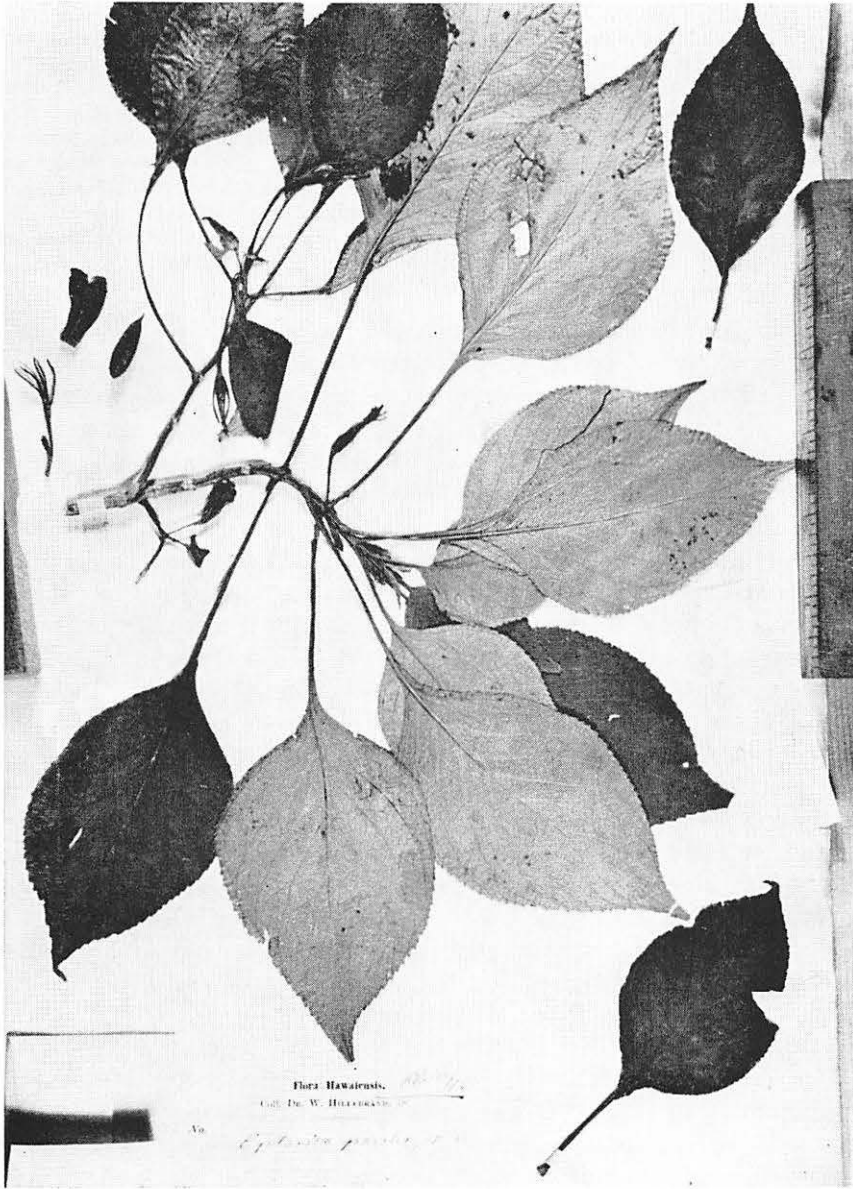


FIGURE 34.—*Cyrtandra gracilis*. Palolo, Hillebrand, holotype (Kew).

erect or diverging; *calyx* in anthesis 22-36 mm. long (when dried), green, sparsely pruinose, the tube 1 mm. long, kneepan-shaped; calyx lobes 21-35 mm. long, linear, equal or subequal, the grouping into lips dubious; *corolla* white, 29 mm. long when boiled, without pruinose, the tube 23 mm. long, 5 mm. in diameter, cylindric, gently decurved from the middle at 35° from the axis of the lower tube; limb 2-lipped, 5-lobed; upper lobes two, 5 mm. long, 6 mm. wide, broadly ovate to depressed suborbicular, within pruinose in the throat; lower lip 3-lobed, the lobes pruinose as on the upper ones, the lateral lobes 7 mm. long, 6.5 mm. wide, broadly oval; two lower stamens with filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 3 mm. long, subulate, spirally upcurved, the two perfect anthers 2.5 mm. long, 1-8 mm. wide, slightly asymmetric ovate, the connective darker, elliptic, 1.4 mm. wide; the two lateral staminodia with their filaments adnate to the corolla tube to within 9 mm. of the throat, the free part 0.6 mm. long, inflated, lanceoloid, the antheroid tip 0.4 mm. long, subulate; *style* 5 mm. long, granular pruinose; stigmatic lobes two, 2.5 mm. long, broadly obovate, pruinose on back, connate $\frac{2}{3}$ way up proximal side; *ovary* 11 mm. long narrowly linear lanceoloid, pruinose at apex, glabrous elsewhere, the base surrounded by a cupulate disk 1.3 mm. high; *berry* when dried 23-25 mm. long, 5-6 mm. in diameter, white, narrowly lance-subcylindric, pruinose; seeds unknown.

Distribution: Koolau Range, leeward side, only in Palolo.

Holotype: "Ins. Sandwich; Oahu, prope Palolo (Hillebrand, in hh. Kew; isotype in Berol.)." Holotype examined, and photograph here reproduced. Known only from the type locality.

Specimens Examined: There is an isotype, Oahu, Palolo, 18 —, *Plantae Hawaiensis*, Hillebrand (E); and *W. Hillebrand* (GH), and a probable isotype: Oahu, and (from the printed recent label heading) "Collected by Dr. William Hillebrand and J. M. Lydgate" (BISH). There seems no doubt but that this specimen sent by Hillebrand to Lydgate was an isotype, though Hillebrand did not write out the full locality data. It is a smaller and poorer specimen, but an exact match for the sheets in Kew and Berlin.

Discussion: *C. gracilis* is a member of the section *Chaetocalyces*. Its closest relative, *C. linearis* St. John, comes next to it in our key, and contrasting differences are stated there. Since Clarke published "*C. gracilis* (Hillebrand ms.)" and cited only the collection from Palolo, this one is clearly the type, and the specimen at Kew has the first claim. Though Hillebrand previously sent to Kew a large set of his collection but only partly named and without locality data, it is apparent that he made a later sending of *Cyrtandra* specimens to C. B. Clarke at Kew. It is not known whether Hillebrand supplied the description, or merely indicated on the label the name of his new *C. gracilis* sp. n. The description which Clarke published was in Latin, contained a three-line diagnosis, followed by an eight-line description, and a one-line citation of the type specimen.

It is certain that Hillebrand, even until his death in 1886, was unaware of the publication in 1883 of Clarke's monograph of *Cyrtandra*. He nowhere refers to it; he republishes "*C. gracilis*, sp. n."; and he republishes *C. Wawrae* Hillebrand, a renaming of *C. peltata* Wawra (1872), not Jack (1825), for which Clarke had already supplied the name *C. Wawrae* in his monograph of

1883. Hence, it is obvious that Hillebrand and the editors of his book, his son William F. Hillebrand and Professor E. Askenazy, were unaware of the publication of Clarke's monograph. Further evidence may be deduced from the differently worded description of *C. gracilis*, and his citation of the localities: (Hillebrand, 1888: 333-334), "Oahu! in the farthest recesses of Konahuanui, Manoa, Palolo." No Hillebrand collection from Manoa existed in Berlin or Kew in 1935-1936 or in any other herbarium known to the writer. Kew has only the type, the Hillebrand collection from Palolo. The Berlin Museum in 1935 contained both an isotype from Palolo and one from Konahuanui. On both the Palolo and the Konahuanui collections were original tickets marked Willie, that is, indicating that the specimens were collected by Hillebrand's son William F. Hillebrand who often accompanied him or assisted him in collecting. The collection from Konahuanui, Nuuanu, is here removed and made the type of the new species *C. linearis*. *C. gracilis* has not been collected since the time of Hillebrand.

The specific name was taken from the Latin *gracilis*, slender.

18. *Cyrtandra kahanaensis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 78, 1950. (Figs. 35, 185.)

Description of Holotype: Shrub; upper stem 4-6 mm. in diameter, quadrangular, fleshy and shrinking on drying, more or less brownish puberulent, the leaf scars 4-6 mm. high shield-shaped, deeply 3-lobed at base, pale, corky, raised, connected by a broad annular band; bundle scars 7; internodes 7-23 mm., but usually about 10-15 mm. long; leafy branches strongly quadrangular, 3-4 mm. in diameter at base, densely brownish puberulent, with 2-4 pairs of well-spaced leaves; young shoots velvety from dense brownish puberulence; leaves opposite, slightly unequal in size, divergent, later reflexed; petioles 2-6.5 cm. long slender, and closely puberulent; blades 12-18.5 cm. long, 5.5-7.6 cm. wide, slightly asymmetric, broadly oval, but acuminate to either end and the base a little decurrent, texture chartaceous, above dark green, uniformly but remotely subappressed puberulent, below greenish white and densely puberulent, more saliently so on the veins, the principal veins 6-7 on a side ascending at an acute angle, the tips arcuate and inarched interconnecting, the margins singly or doubly serrate; cymes from the leaf axils, 9-15-flowered, ascending, closely brownish puberulent throughout; peduncles 18-25 mm. long; pedicels 12-17 mm. long, almost filiform; bracts 8-10 mm. long, linear-lanceolate, green and foliaceous; bud campanulate; calyx 9-11 mm. long, without subappressed puberulent, within papillose, narrowly campanulate, lobed about $\frac{4}{5}$ way to the base; the tube 2-2.5 mm. long; upper lip 3-lobed, cleft $\frac{3}{4}$ way, the lobes lance-linear, obtuse; lower lip 2-lobed, cleft $\frac{1}{2}$ way, the lobes 7-8 mm. long, lance-linear, obtuse; corolla 20 mm. long (18 when dried) white, the tube 16-17 mm. long, 4 mm. in diameter at base, 5 mm. at throat, the lower half cylindrical, the upper half gradually widened to the throat, decurved at the middle at 25° to 30°, glabrous without below the middle, at the middle capitate glandular puberulent, but towards the tip the hairs lengthening to capitate glandular hirsute, within glabrous below the throat; limb becoming rotate, 2-lipped, 5-lobed; upper lip with 2 lobes 2-2.5 mm. long, 2.5-3 mm. wide, transversely oval, very obtuse, within capitate glandular puberulent, without capitate glandular hirsutulous; lower lip with 3 lobes, within capitate glandular puberulent, without capitate glandular hirsutulous, the 2 lateral lobes 4 mm. long, 3.7 mm. wide, suborbicular, slightly narrowed to a broad clawlike base; lowest lobe 4 mm. long, 5 mm. wide, deltoid-suborbicular, obtuse; 2 lower stamens per-

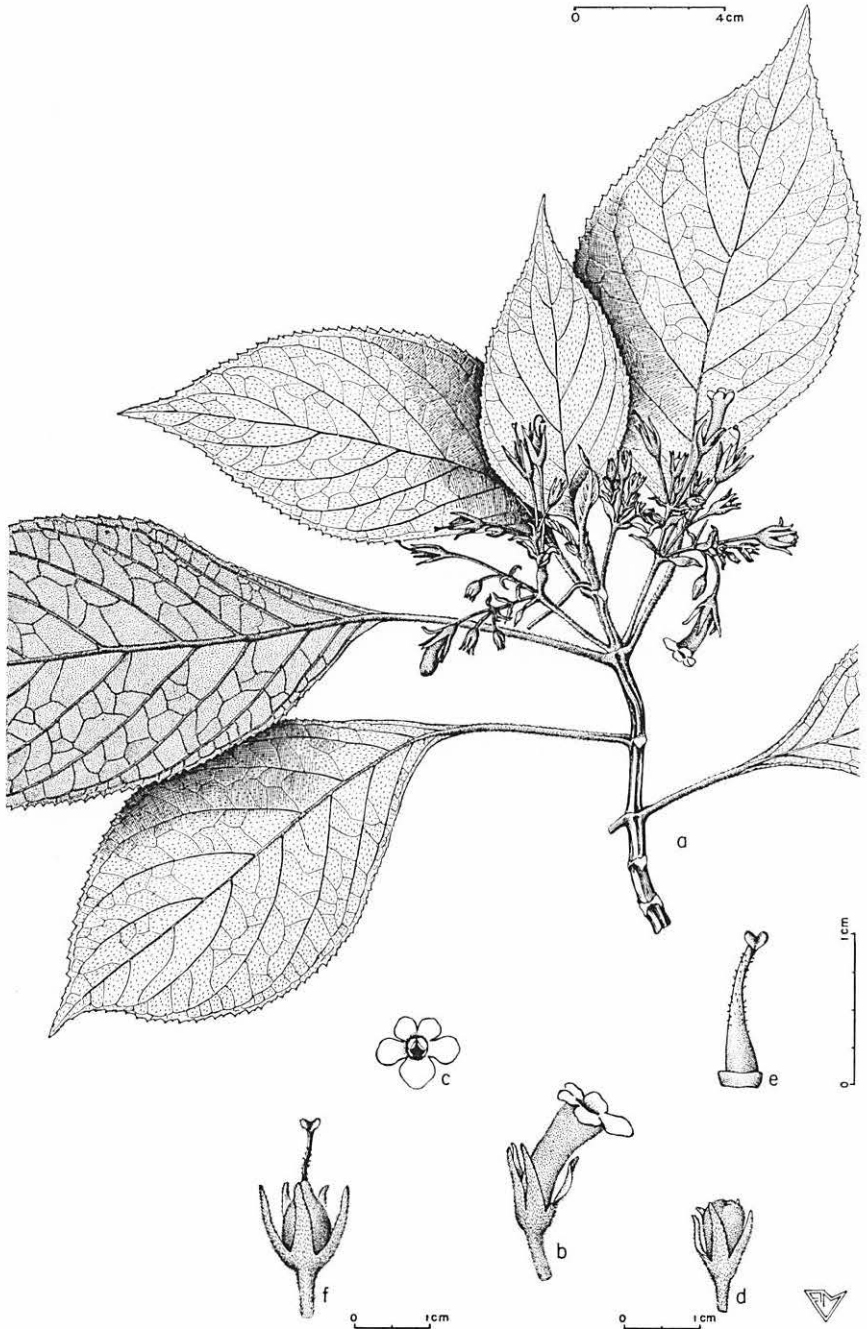


FIGURE 35.—*Cyrtandra kahanaensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Waikane-Schofield Trail, Kahana, Storey 197 (Bishop Mus.).

fect, the filaments adnate to the corolla to within 4 mm. of the throat, the free portion 3 mm. long, subulate, spirally upcurved; the 2 perfect anthers 2 mm. long, obliquely broadly oval, connate at apex; *style* 4 mm. long and slender, capitate glandular puberulent; 2 stigmatic lobes 1.5-2 mm. long, oval, connate $\frac{3}{4}$ way up proximal side; *ovary* 4.2 mm. long, linear-lanceoloid, glabrous, base surrounded by a cupulate disk 1 mm. high; young fruit ovoid.

Distribution: Koolau Range, windward side, upper Ohia Zone, known only from the type collection.

Holotype: Kahana Valley, along the Waikane-Schofield Trail, at about 2,000 ft., in fairly dense dwarfish upper forest, Oct. 16, 1932, *W. B. Storey 197* (BISHOP MUS.).

Discussion: One of the several species with markedly perfoliate petiole bases. It is most similar to *C. axilliflora* which has the blades markedly cuneate decurrent; the fresh calyx 17-20 mm. long, the fresh corolla 31-34 mm. long, etc. In contrast *C. kahanaensis* has the blades abruptly cuneate at base; the fresh calyx 9-11 mm. long; and the fresh corolla 20 mm. long.

The specific name is taken from the geographic locality, Kahana Valley.

19. *Cyrtandra koolauensis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 78, 1950. (Figs. 36, 189.)

Description of Holotype: Shrub; stem apparently simple, terete, corky, pale brown, glabrate; internodes 16-42 mm. averaging 3 cm. long; leaf scars 2.5-3.5 mm. high, low shield-shaped; bundle scars 5; leafy branches terete, densely appressed brown pilose, bearing about 8 pairs of unequal leaves, one of a pair being about $\frac{1}{2}$ the larger; young shoots covered by the dense brown pilosity; *leaves* opposite, ascending, diverging, and finally descending, not crowded; petioles 18-23 mm. long, brown appressed pilose, blending into the decurrent blade; *blades* 7-12.5 cm. long, 30-52 mm. wide, elliptic, the apex abruptly subacuminate, the base long and gradually decurrent, the margins remotely serrulate, chartaceous, above dark green, very remotely pilosulous mostly on the veins, below the intervals almost imperceptibly appressed puberulous, the veins brown pilose, the veinlets appressed brown pilosulous, the principal veins 7-9 on a side, subalternate, arched ascending and the tips inarched and connecting near margin; *cymes* from the leaf axils, 1-flowered; peduncles 11 mm. long, it and the 23 mm. pedicel ascending brown pilose; bracts 9 mm. long, linear, green; young bud narrowly campanulate, open; *calyx* 17 mm. long, cleft to the base into 5 subequal linear, attenuate lobes, these sparsely pilosulous without; flowers unknown; *fruit* when dried 14 mm. long, lanceoloid, glabrous, probably white.

Distribution: Koolau Range, windward side, Ohia Zone: known only from the type collection.

Holotype: Laie-Malaekahana Ridge Trail, Koolau Mts., 1,500 ft. elev., ridge in more or less open woods, Feb. 14, 1932, *W. B. Storey 145* (BISHOP MUS.).

Discussion: Though known from only a single collection, it is easily recognized by its linear calyx lobes cleft fully to the base.

The specific name is formed from Koolau, its mountain home, and *ensis*, the Latin place termination.



FIGURE 36.—*Cyrtandra koolauensis*: a, habit, $\times \frac{1}{2}$; b, fruit, $\times 1$. Laie-Malaekahana, Storey 145, holotype (Bishop Mus.).

20. *Cyrtandra laxiflora* Mann, Am. Acad. Arts Sci., Proc. 7: 190, 1867.
(Figs. 37, 38, 189.)

Description of Holotype: Shrub; branches terete, glabrous, the bark shining, pale brown, young shoots densely pilose; the leaf scars pale brown, corky, nearly flush; bundle scars 7; internodes 17-27 mm. long; leafy branchlets 1.5-4 mm. in diameter, at first densely spreading pilose, then later decreasingly so; *leaves* opposite, unequal, slightly curved, the few pairs diverging; petioles 3-6 cm. long, spreading pilose; *blades* 7-21 cm. long, 35-75 mm. wide, membranaceous, elliptic to oval, the apex short acuminate, the base short cuneate or rounded, above remotely appressed villous, below white pilose and densely so on the veins, the margin irregularly serrate or serrate-dentate from the apex almost to the base; *cymes* single or twinned in the leaf axils, persisting at the uppermost naked node in fruit or perhaps cauliflorous (if the detached cymes were thus borne), 5-10-flowered, hirsute throughout; peduncles 3-6 cm. long; pedicels 5-18 mm. long; bracts 2-6 mm. long, lanceolate; buds campanulate, the calyx lobes erect and separate; *calyx* 6-12 mm. long, apparently green, sparsely hirsute without, campanulate, strongly 2-lipped, lobed $\frac{3}{4}$ to $\frac{5}{6}$ way to base, the lobes at first lance-linear, early accrescent and becoming linear or narrowly oblong-linear, obtuse, within wholly glabrous or glabrous except on marginal area near tip; *corolla* 13-18 mm. long, 2-4 mm. in diameter, white, the tube 11-15 mm. long, slightly curved, tubular, densely shaggy villous beyond the calyx tube, glabrous below its rim, the lobes villous without to or near to the margin, glabrous within, suborbicular, the upper 1-1.5 mm. long, the lower 1.5-2.5 mm. long, the lobes apparently spreading at about 40° to 50° from axis of tube; filaments fused to within 5 mm. of the throat, the free portion 1.5 mm. long, subulate, spirally incurved; anthers 2 mm. long, obliquely deltoid-ovate, flattened, one cell the smaller; *style* with a few scattered hairs (pilose), 2-2.5 mm. long, stout, the 2 terminal stigmatic lobes 1 mm. long, opposite, distinct, spatulate, thick, not flattened; *ovary* lanceoloid, glabrous, becoming pubescent after anthesis, the base surrounded by a cupulate disk; *berry* 12-15 mm. long, ovoid or ovoid-subglobose, short apiculate, becoming puberulent throughout; seeds 0.34-0.42 mm. long, fusiform ellipsoid, mostly somewhat curved, the ends dark brown, the body shining, chestnut brown, covered with a raised cellular reticulation, the areolae narrowly oblong, $\frac{1}{3}$ to $\frac{1}{6}$ the length of the seed.

Distribution: known only from the type collection.

Holotype: "Waialua Mountains, Oahu.—Mann & Brigham 615." (GH).

Specimens Examined: Koolau Range, Leeward Side: see type; isotypes also examined in the Bishop Museum; and in Cornell University, Ithaca, New York, in part; and Kew.

Discussion: *C. laxiflora* is considered a member of the section *Chaetocalyces*. It is somewhat, though not very closely, related to *C. kahanaensis* and *C. waiolani*. Sufficient diagnostic differences from these are listed in our key.

C. laxiflora Mann was early collected and described. It has been maintained by all or nearly all students of the genus, but these later students have not agreed as to its delimitation or as to the identity of later collections with the type. Asa Gray obviously accepted the species, as the determination on the label of the type in the Gray Herbarium was written by Gray. Clarke accepted the species and enlarged the description from an isotype in the herbarium at Kew, but saw no other collections. Hillebrand maintained the species, assigned it to the section *Microcalyces*, and cited it from both mountain ranges. The writer later in Berlin redetermined the Hillebrand specimen

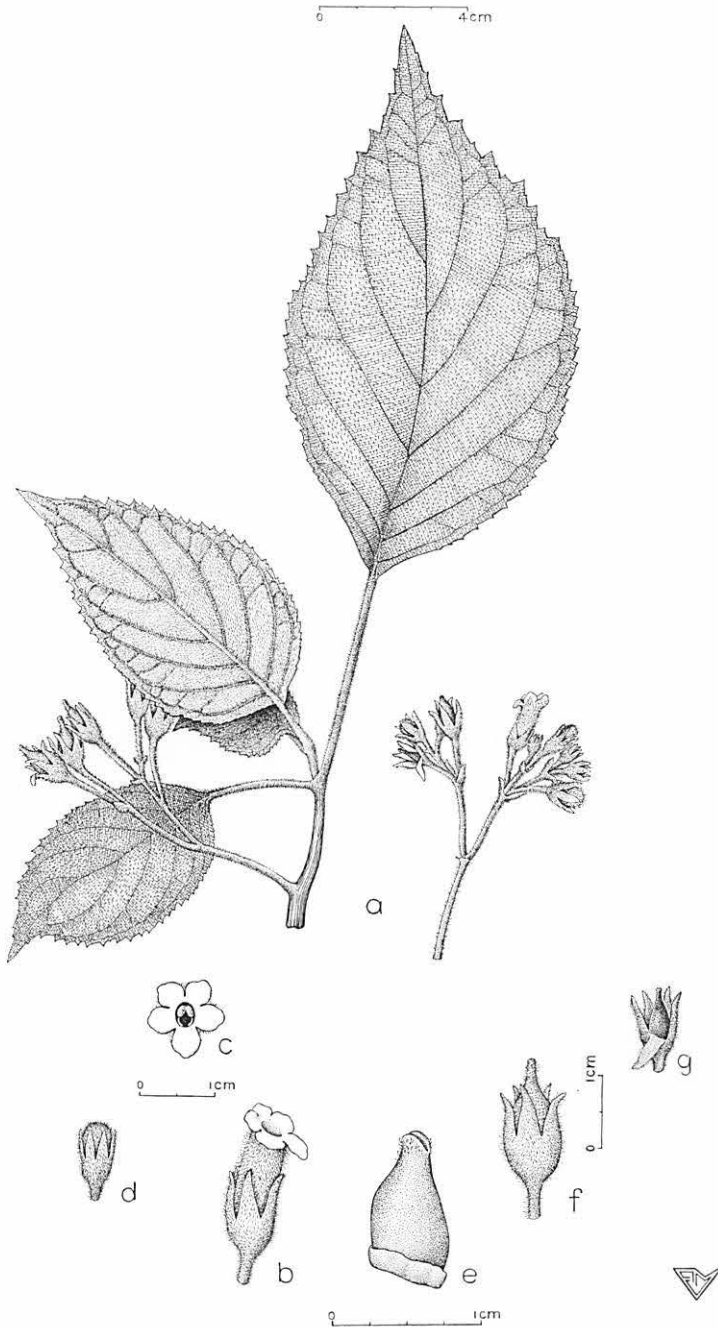


FIGURE 37.—*Cyrtandra laxiflora*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$; g, glabrous fruit, $\times 1$. Waialua Mountains, Mann and Brigham 615, isotype (Bishop Mus.).

from Kaala in the Waianae Mountains as *C. Garnotiana*. So, it is clear that Hillebrand included some divergent elements with *C. laxiflora*, though he had certainly seen the type at the Gray Herbarium. Rock's treatment was similar to that by Hillebrand, though he had seen the type or isotypes at Kew, Cornell, and the Gray Herbarium. Skottsberg maintained the species (1936: 175) but he identified with it his own collection no. 204 from the Kawaiiki ditch trail in the Koolau Range, and was the first to indicate a con-

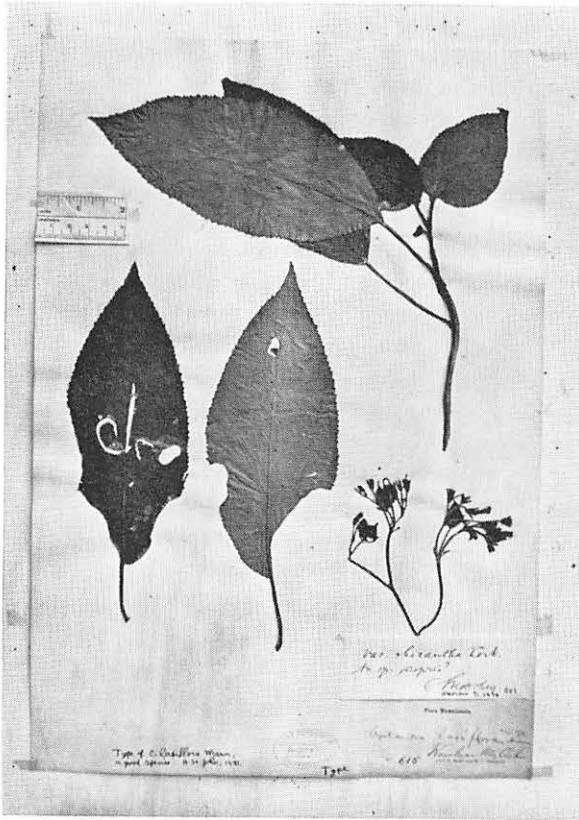


FIGURE 38.—*Cyrtandra laxiflora*, lectotype (Gray Herb.). Waialua Mountains, Mann and Brigham 615.

fusion in *Mann & Brigham 615*, the type number. He wrote "MANN & BRIGHAM distributed, under *laxiflora* and with the same number, a different plant (Gray Herb.), which is quoted by Rock under typical *laxiflora* but clearly belongs to var. *rhizantha*." Storey has studied the *Mann & Brigham 615* specimen at Cornell and St. John has studied it at Kew, Gray Herbarium, and Cornell. Now by loans, which were kindly granted, we have the Gray

Herbarium, and the Cornell specimens in Honolulu for comparison with that of the Bishop Museum and the specimen transferred there from Yale. Skottsberg was correct, as there are two kinds of plants in this type number, *Mann & Brigham 615*.

The first kind has the calyx 6-12 mm. long, sparsely hirsute without, glabrous within, the lobes accrescent, becoming oblong-linear, ascending; corolla 2-4 mm. in diameter; style with a few scattered hairs (pilose); ovary glabrous but the berry puberulent; inflorescence hirsute; lowest bracts 2-6 mm. long, reduced; petioles 3-6 cm. long; and the blades elliptic to oval.

The second kind has the calyx 11-15 mm. long, densely villous without, densely villous within almost to the base, the lobes not accrescent, but lanceolate or broadly so, sharply reflexed even in young fruit; corolla 4-8 mm. in diameter; style densely glandular villous; ovary and fruit densely glandular villous; inflorescence densely glandular villous; lowest bracts 1.5-2.5 cm. long, foliaceous; petioles 5-12 cm. long; and the blades oval to suborbicular.

Neither of the two kinds corresponds to any other described species. With such a lengthy list of differences, many of diagnostic value, it is obvious that the two are distinct species. Then we must consider which one to leave as *C. laxiflora*. It is perhaps impossible now to determine how many of each kind Mann had before the duplicates were distributed. The first kind is represented by the specimens in the Gray Herbarium, the one long in the Bishop Museum, and the two parts of the loose, disarticulated inflorescence in the pocket on the Cornell sheet; and apparently the one at Kew. The second kind is represented by the Cornell sheet and the two loose inflorescences with lanceolate calyx lobes in the pocket on the Cornell sheet, and by the Bishop Museum sheet ex Sheffield Scientific School, Yale University.

Mann's original description of *C. laxiflora* is rather full and detailed. The application of his specific name should, if possible, be determined by the description. It included characters from both kinds of plants, often given as the extremes of shape or size of an organ. These items do not help in making a choice. In Mann's description the following items are applicable to only one of the two kinds: To the first kind apply "pedunculis petiolum gracilem adaequantibus"—"pedicellis filiformibus hirsutis; calyce . . . lobis linearibus"—"corolla . . . fere semipollicari"—"fructu glabro ovato-globosa."—"Ovary almost glabrous. Immature fruit half an inch long, ovate, inclining to globose." These diagnostic points may be translated: peduncles equaling the slender petioles; pedicels filiform and hirsute; calyx lobes linear; corolla about $\frac{1}{2}$ inch long; fruit glabrous or nearly so, ovate to ovate-globose. These five or six characters are diagnostic and they apply only to the first kind, while none apply only to the second kind. This first kind, then, is the true *C. laxiflora* Mann. Rock considered that the types of Horace Mann, Jr., were in the herbarium of Cornell University, and he published a good photograph

of their sheet of *C. laxiflora*, showing clearly the reflexed, lanceolate calyx lobes (1919, pl. 29). After the premature death of Mann, his mother sold his private herbarium to Cornell University, so Rock had reasons for deciding that Mann's types were there. In this particular instance we have demonstrated that the specimen in the Gray Herbarium more closely tallies with the original description, and, hence, must be designated as the type. Also its label has the number and the locality in Mann's handwriting, but the binomial, the authority, and the n. sp. in Gray's handwriting. The other three sheets had the labels with number and locality, and *Cyrtandra* n. sp. in Mann's writing. The Yale and the Bishop Museum specimens were received in this state. The Bishop Museum specimen had added in pencil *laxiflora*, then over it in ink, *laxiflora* H. Mann, both in different hands. To Mann's own specimen, now at Cornell, Mann himself added at another time *laxiflora*, H. Mann. All this tends to confirm our designation of the Gray Herbarium specimen as the lectotype.

The second kind of plant of this discussion is described elsewhere in this paper as *C. reflexa*.

Skottsberg stated that the Gray Herbarium specimen of *C. laxiflora* Mann, "clearly belongs to var. *rhizantha*." The writer disagrees, observing that *rhizantha* differs in pronounced cauliflorous habit, in type and pubescence of inflorescence and calyx, in shape, toothing, and texture of leaves, in pubescence of petioles, etc. *C. laxiflora* var. *rhizantha* Rock we have raised to specific rank and called *C. stupantha*.

C. laxiflora has not been rediscovered since the type collection was made in 1864-1865 in "the Waialua Mts.," Oahu. It is not known where Mann got this name, the Waialua Mts. It may have been local usage at the time of his visit, but it has not persisted. There were no official maps at that time and those of the various voyagers were sketchy. The name does not appear in the exhaustive Gazetteer of the Territory of Hawaii by J. W. Coulter (1935). Waialua is a coastal town on the northwest side of Oahu and about equidistant from the two mountain ranges, though the Waianae Mountains are more prominent from there. Luckily we find that Mann explained that the western end of the northern range [Koolau Range] was "sometimes called the Waialua Mountains," (1867: 146). Thus, we infer that the type locality of *C. laxiflora* is in the Koolau Range on the ridges or the gulches tributary to the Waialua region. The locality has not been rediscovered. We do have, however, some indirect evidence. Mann confused and mixed *C. laxiflora* with our new *C. reflexa*. The two probably grew near to each other. *C. reflexa* has been collected recently on the slopes not far from Waialua. Skottsberg collected it on Aug. 15, 1922, on the Kawaiiki ditch trail where it is abundant. It was subsequently collected there in 1941, St. John 20,272 and 20,275; in 1947, St. John 22,863, and in 1951, St. John 24,702. Also Storey collected it Oct. 4, 1931, in a small, densely shaded ravine at 1,800 ft. elev. on the Ka-

wailoa-Opaewa divide. These two localities are adjacent and on the forks of Opaewa Gulch, a major valley draining the slopes of the Koolau Range and issuing directly at Wailua. From this indirect evidence we have an indication of the type locality of the species.

The name was coined from the Latin *laxus*, loose or lax; *flora*, flower, alluding to the loosely branched inflorescence.

21. *Cyrtandra linearis* St. John, sp. nov. (Figs. 39, 40, 192.)

Diagnosis Holotypi: Frutex, cicatricibus 3-4.4 mm. altis late scutelliformibus pallidis, fasciculis 5, internodis 12-40 mm. longis, novellis pruinosis, *foliis* oppositis divergentibus non aggregatis in 4 nodis superis affixis inaequalibus uno eis in nodo omne $\frac{1}{6}$ grandiori, petiolis 20-85 mm. longis gracilibus pruinosis, *laminis* 8.5-17.6 cm. longis 52-93 mm. latis graciliter chartaceis late ovalibus abrupte breve acuminatis in basi cuneatis et decurrentibus supra obscure viridibus et in initio pruinosis deinde glabratibus infra albo-viridibus et capitato-glanduloso-puberulentis marginibus serratis nervis secundariis 7-8 in uno latere ad margines arcuatis et interconnectentibus, *cymis* axillaribus 5-7-floriferis pruinosis floribus lateralibus tarde maturentibus, pedunculis 8-13 mm. longis, pedicellis 15-27 mm. longis ad apicem incrassatis, bracteis 5-7 mm. longis 1.8 mm. latis lanceo-linearibus, alabastris anguste campanulatis sed lobis calycis erectis, *calycibus* in flore 14-15 mm. longis viridibus pruinosis subaequaliter fere ad basim partitis tubo patelliformi 0.5 mm. longo, limbo subaequaliter 5-lobato lobis 13.5-14.5 mm. longis linearibus in basi 1.3-1.5 mm. latis sed plerumque in aliquis partibus 0.5-0.7 mm. latis obtusis, *corollis* (quando bullitis) 25 mm. longis albis extra glanduloso-puberulis tubo 22 mm. longo intra glabro cylindrico 3-4 mm. diametro media supero gradatim in 20°-30° recurvata, limbo bilabiato 5-lobato inter labiis 4 mm. partito, lobis superis binis 2.5-3 mm. longis 4 mm. latis transverse ovalibus lobis lateralibus 5 mm. longis et latis oblique late ovalibus, loba infera 5.5 mm. longa 4 mm. lata ovali, staminibus binis inferis in tubo 7 mm. ex orifice affixis partibus liberis 2.5 mm. longis subulatis tortuose ascendentibus, antheris 1.5 mm. longis asymmetrico-ovatis connectivo ovato, staminodeis in tubo 9 mm. ex orifice 0.5 mm. longis asynulatis, *stylo* 6 mm. longo valide subulatis capitato-glanduloso-puberulis, lobis binis stigmatis sessilibus 1.3 mm. longis ovalibus in latere proximale $\frac{2}{3}$ connatis, *ovario* 6 mm. longo lineari-ellipsoideo glabro in basi cum disco cupulato 1.5 mm. alto cincto, fructibus ignotis.

Description of Holotype: Shrub; leaf scars 3-4.4 mm. high, broad shield-shaped, pale; bundle scars 5; internodes 12-40 mm. long; young shoots pruinose, *leaves* opposite, divergent, not crowded, borne at the 4 upper nodes, unequal, one of the pair being about $\frac{1}{6}$ larger; petioles 20-85 mm. long, slender, pruinose; *blades* 8.5-17.6 cm. long, 52-93 mm. wide, thin chartaceous, broad oval, abruptly short acuminate, at base cuneate and decurrent, above dark green and at first pruinose, later glabrate, below whitish green and generally capitate glandular puberulent, the margins serrate, the secondary veins 7-8 on a side, near the margins upwards arcuate and inarching; *cymes* axillary, 5-7-flowered, pruinose, the lateral flowers maturing long after the central one; peduncles 8-13 mm. long; pedicels 15-27 mm. long, swollen at summit; bracts 5-7 mm. long, 1.8 mm. wide, lance linear; buds narrowly campanulate, the calyx lobes erect; *calyx* in anthesis 14-15 mm. long, green, pruinose, subequally parted almost to the base, the tube saucer-shaped, 0.5 mm. long; limb subequally 5-lobed, the lobes 13.5-14.5 mm. long, 1.3-1.5 mm. wide at base, but 0.5-0.7 mm. wide for most of the length, obtuse, linear; *corolla* 25 mm. long (when boiled), white, glandular puberulous without, the tube 22 mm. long, glabrous within, cylindric, 3-4 mm. in diameter, the upper half gently recurved at 20°-35° from the axis of the lower tube; limb sparsely glandular atomiferous in the throat, 2-lipped, 5-lobed, cleft down 4 mm. between the lips; the two upper lobes 2.5-3 mm. long, 4 mm. wide, transversely oval; lateral lobes 5 mm. long, 5 mm. wide, obliquely broad oval; lower lip 5.5 mm. long, 4 mm. wide, oval; two lower stamens with filaments adnate to the corolla tube to within 7 mm. of throat, the free portion 2.5 mm. long, subulate, spirally

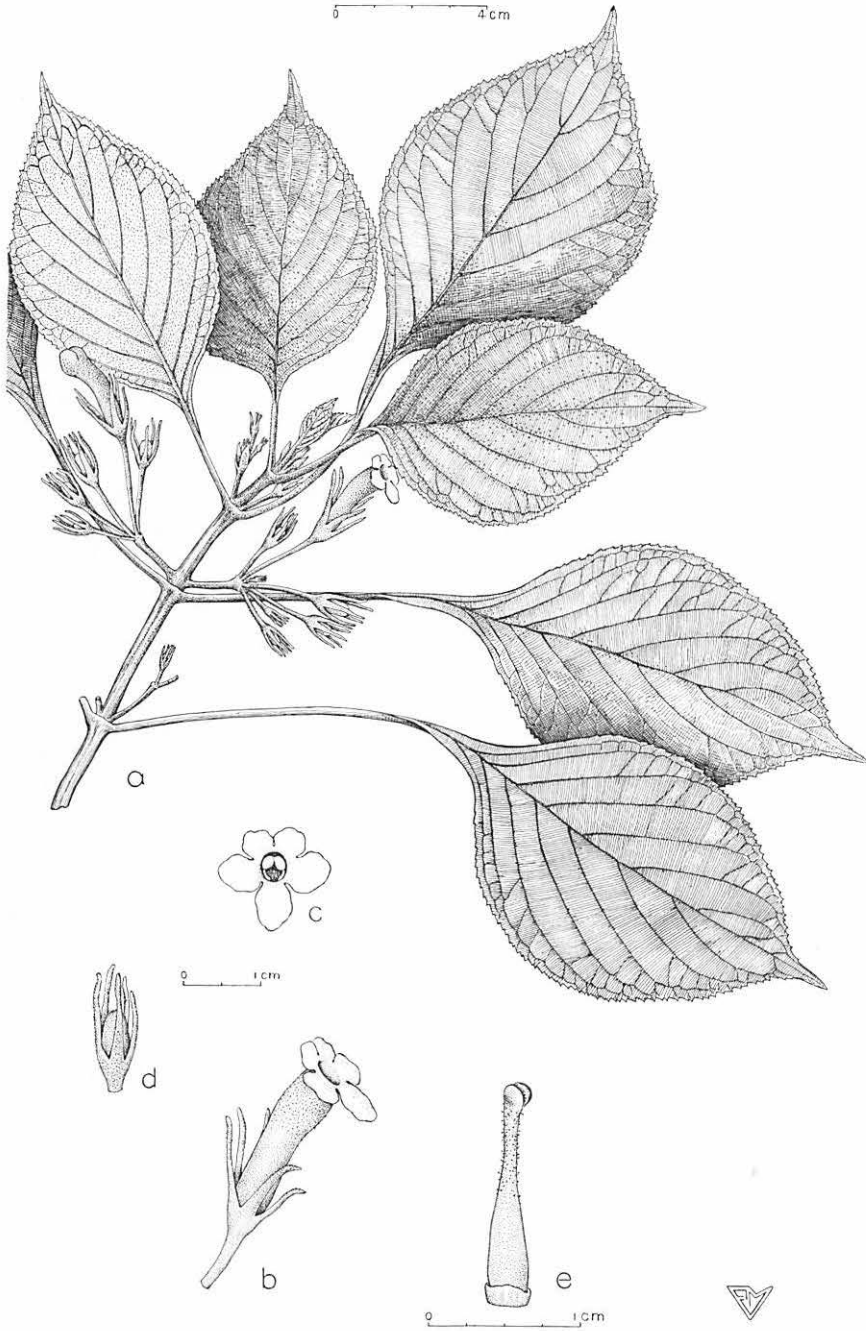


FIGURE 39.—*Cyrtandra linearis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Konahuanui, herbarium Hillebrand, holotype (Berlin).

upcurved, the 2 perfect anthers connate at tip 1.5 mm. long, asymmetric ovate, connective ovate; the staminodia adnate to the corolla tube to within 9 mm. of the throat, 0.5 mm. long, subulate; *style* 6 mm. long, stout subulate, capitate glandular puberulous throughout; stigmatic lobes 2, sessile 1.3 mm. long, oval, connate $\frac{2}{3}$ way up the proximal side; *ovary* 6 mm. long, linear-ellipsoid, glabrous; the base surrounded by a cupulate disk 1.5 mm. high; fruit unknown.

Distribution: Koolau Range, leeward side, Konahuanui gulch, Nuuanu, known only from the type.

Holotypus: Oahu, Konahuanui gulch, Nuuanu, *W. Hillebrand* (BISHOP MUS.). Isotype seen in Berlin. (Fig. 40.)

Discussion: *C. linearis* is a member of the section *Chaetocalyces*. Its closest relative is *C. gracilis* Hillebrand which was collected in Palolo, a valley also on the lee side of the Koolau Range and only 2.5 miles from Nuuanu Valley. Hillebrand's species can be recognized by having the blades 36-66 mm. wide, elliptic-lanceolate, beneath sparsely capitate glandular puberulent on the main veins, soon glabrate, the apex long acuminate; cymes 3-flowered, the lateral flowers developing soon after the central one; calyx 22-36 mm. long; peduncular bracts 14-17 mm. long, 1.4-1.7 mm. wide, linear; and the corolla pruinose. The diagnostic characters of *C. linearis* are: blades 52-93 mm. wide, broad oval, beneath generally capitate glandular puberulent, the apex short acuminate; cymes 5-7-flowered, the lateral flowers developing long after the central one; calyx 14-15 mm. long; peduncular bracts 5-7 mm. long, 1.8 mm. wide, lance-linear; and the corolla glandular puberulous. These two plants have sufficient differences to justify their separation as species. Earlier investigators did not so indicate or conclude. Unaware that Clarke had published *C. gracilis* Hillebrand in 1883, based upon the Palolo specimen, Hillebrand (1888: 333-334) again published *C. gracilis* Hillebrand, basing it upon specimens from "Oahu! in the farthest recesses of Konahuanui, Manoa, Palolo." The Manoa specimen cannot be located now, the Palolo one had five years earlier been made the type of *C. gracilis* Hillebrand ex C. B. Clarke. The present author makes the Konahuanui specimen the type of *C. linearis*, removing it from *C. gracilis* Hillebrand sensu Hillebrand (1888). This Konahuanui specimen was not seen or cited by Clarke.

Rock accepted *C. gracilis* (1919: 65-66) in the broader sense of Hillebrand's 1888 publication. He had seen and photographed the original collections by Hillebrand from Palolo and Konahuanui. To these he added collections from the mountains behind Punaluu, Rock nos. 325, 762, and 742 (misprinted in his revision as 7,421). These specimens, now in the Bishop Museum, we refer to *C. subumbellata* (Hillebrand) St. John & Storey.

The type specimen, collected by Hillebrand previous to 1870, is the only one known. The locality is in Honolulu, and the species is believed to have been exterminated by domestic grazing animals or by the urban expansion.

The name is from the Latin *linearis*, threadlike, in allusion to the long narrow calyx lobes.

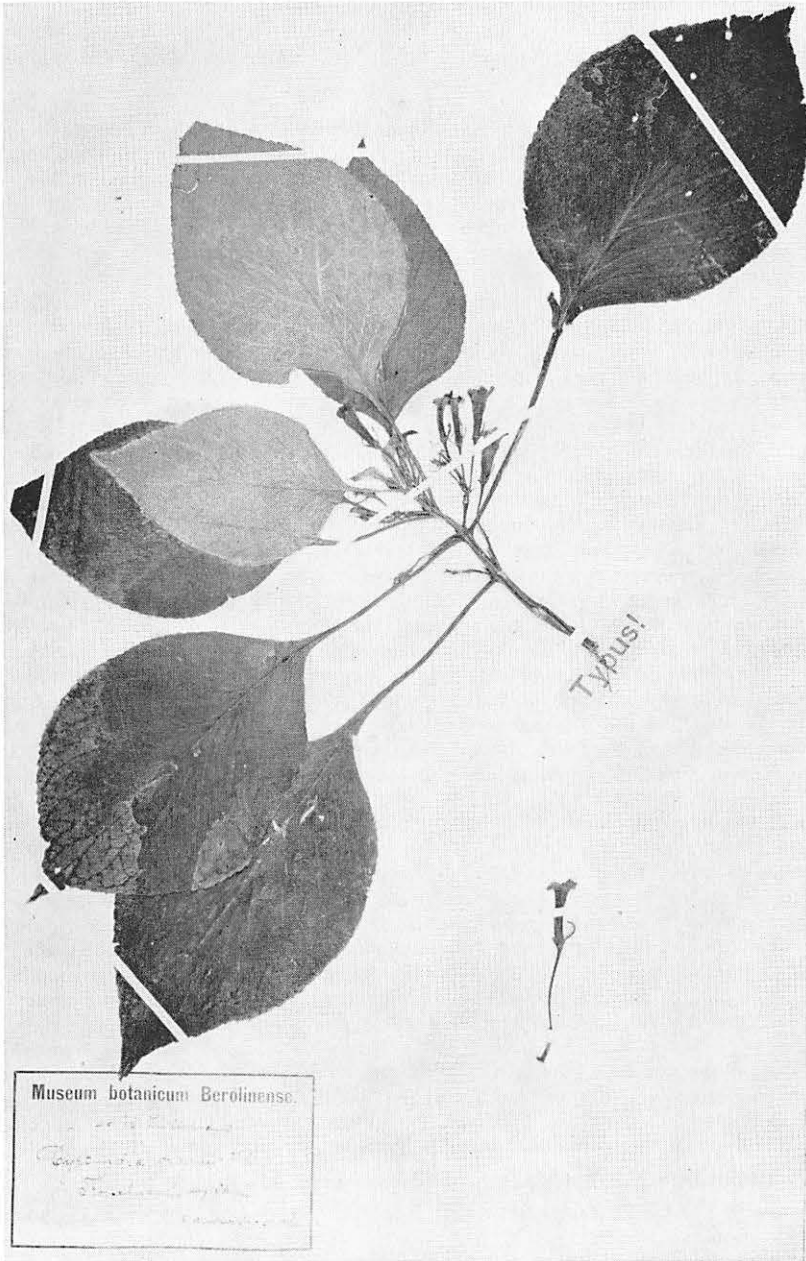


FIGURE 40.—*Cyrtandra linearis*, isotype (Berlin). Konahuanui Gulch, Hillebrand; this was *C. gracilis* Hillebrand in part.

22. *Cyrtandra Macraei* Gray, Am. Acad. Arts Sci., Proc. 5: 352, 1862.
(Figs. 41-44, 190.)

C. Macraei Gray var. *parvula* Rock, Am. Jour. Bot. 6: 67-68, pl. VIII, 1919.

Description of All Specimens Examined: Shrub to 4 m. tall, 3 cm. in diameter; bark brown, at first pruinose, later glabrate; leaf scars 3-8 mm. high, pale, corky, broad shield-shaped and at first distinct, soon confluent and annular on the tardy dehiscence of the connecting perfoliate rim, the large older scars palmately 3-lobed below; bundle scars 5, tall V-shaped; young shoots densely pruinose; branchlets as much as 8 mm. in diameter, quadrangular, pruinose; internodes 6-70 mm. averaging 22 mm. long; *leaves* opposite soon diverging, not crowded, borne at the 3-6 upper nodes, those of a pair unequal, one being $\frac{1}{4}$ to $\frac{1}{5}$ larger; petioles 3-13 cm. long, rather slender, pruinose; *blades* 8.5-24 cm. long, 57-155 mm. wide, thick chartaceous, broad asymmetric oval, apex acuminate, the base abruptly cuneate and short peltate or auriculate on proximal apex of petiole, upper surface darkish green, impressed nerved, sparsely pruinose, below very pale or whitish green, raised rugose-nerved, closely white pruinose or stalked pruinose, the midrib, secondary and tertiary veins densely pilosulous, the smaller veinlets more sparsely and minutely so, the margins crenate, denticulate, or serrate, the secondary veins 7-10 on a side ascending, gently curving, the tips inarched and connecting; *cymes* pruinose, compact, axillary, with 10-25 flowers, only 6-10 of which are fertile, cyme including the 3-7 branches 5-15 mm. long; peduncle 3-7 mm. long; bracts 0.5-3 mm. long ovate to lanceolate; pedicels 6-12 mm. long, slender; buds ovoid, then cylindrical-campanulate, the calyx lobes erect; *calyx* in anthesis when fresh 4-4.5 mm. long (when dried 3-4.5 mm.) green, the surface pruinose, the tube 1.5-2 mm. long (when dried 1-1.5 mm.) almost symmetrically funnel form, then 5 lobes subequal but on close examination the 3 lower lobes are perceptibly longer than the others, 2.5-3 mm. long (when dried 1.5-3 mm.), very narrowly deltoid, obtuse, at base 1-1.5 mm. wide (when dried 0.7-1.2 mm. wide); *corolla* white, 14-15 mm. long (when dried 8-14 mm.), at the beginning of anthesis tubular, later enlarging at the middle and somewhat barrel-shaped, at base 3 mm. in diameter, at the middle 4-6 mm., at the throat 5 mm., the tube subcylindric but deflexed at the middle at 20° to 40° from the axis of the lower tube, without closely pruinose, within glabrous; limb 2-lipped, 5-lobed; the lobes all pruinose without, glabrous within, upper lobes 2, spreading at about 60° to the axis of the throat, 1.5-2 mm. long, 3-4 mm. wide, transversely oval, lateral lobes spreading at about 70°, 3 mm. long, 4 mm. wide, broadly oval; lower lobes 3-5 mm. long, 4-5 mm. wide, broad oval; two lower stamens with filaments adnate to the corolla tube to within 4 mm. of the throat, the free portion 2 mm. long, subulate from a broad base, spirally upcurved, the 2 perfect anthers 2 mm. long, obliquely broad ovate, connate at apex, the connective ovate; the staminodia adnate to the corolla tube to within 5 mm. of the throat, 1 mm. long, subulate; *style* 2 mm. long, columnar, pruinose; stigmas 2, oval, 1.8 mm. long, connate $\frac{2}{3}$ way up proximal side, pruinose on the back; *ovary* 5-6 mm. long, lanceoloid, at first pruinose on upper part, later to the base which is surrounded by a cupulate disk 0.7 mm. high; *berry* white, 9-12 mm. long, 4-7 mm. wide, lanceoloid, short beaked, pruinose; seeds 0.29-0.37 mm. long, 0.13-0.16 mm. wide, oval-fusiform to lunate-fusiform, resin-brown-colored, the body covered with raised cellular, narrow oblong reticulations $\frac{1}{2}$ as long as the seed.

Distribution: Koolau Range, windward side, Hauula to Kailua, at 800 to 1,800 ft., in the Ohia Zone; leeward side, Palolo and Wailupe, 1,000 to 1,700 ft., in the Koa and Ohia Zones; Waianae Mountains: both sides, in Makaleha Valley and Makaha Valley, altitude and zone not recorded.

Type: "Oahu, gathered by Macrae (1825), Gaudichaud (in the voyage of the Bonite), and by Brackenridge."

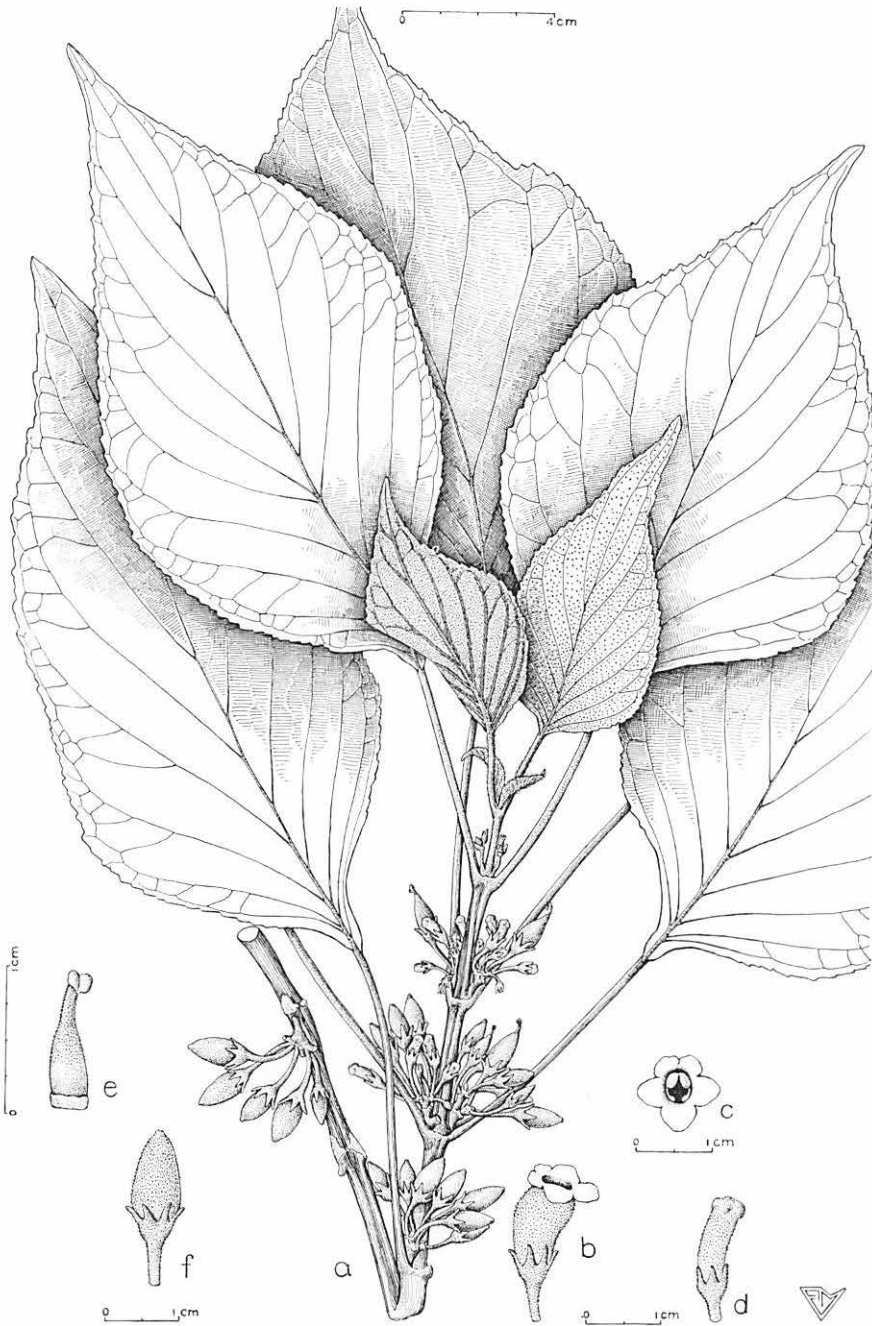


FIGURE 41.—*Cyrtandra Macraei*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Makawao Stream, Kailua, St. John 21,546.

Lectotype: Ins. Sandwich, Woahoo, Maio, 1825, *Macrae* (GH), two sheets, lectotype examined, isotype seen (BM, collector's name written *McRae*).

Specimens Examined: Koolau Range.

Windward Side: Hauula, Waipilopilo, dark woods, June 11, 1940, *Degener 17,198* (NY); ditto, forest, June 11, 1940, *17,716* (NY); Punaluu-Kaluanui divide, 1,800 ft. elev., wet slope, Dec. 21, 1931, *Hume 438*; Maunawili, near base of pali directly back of Kaimi Farm, 1,500 ft. elev., in moist woods, Jan. 22, 1935, *Storey 252*; Kailua, East Fork of Makawao Stream, below Puu Lanipo, 1,500 ft. alt., under *Aleurites* trees near head of gulch,

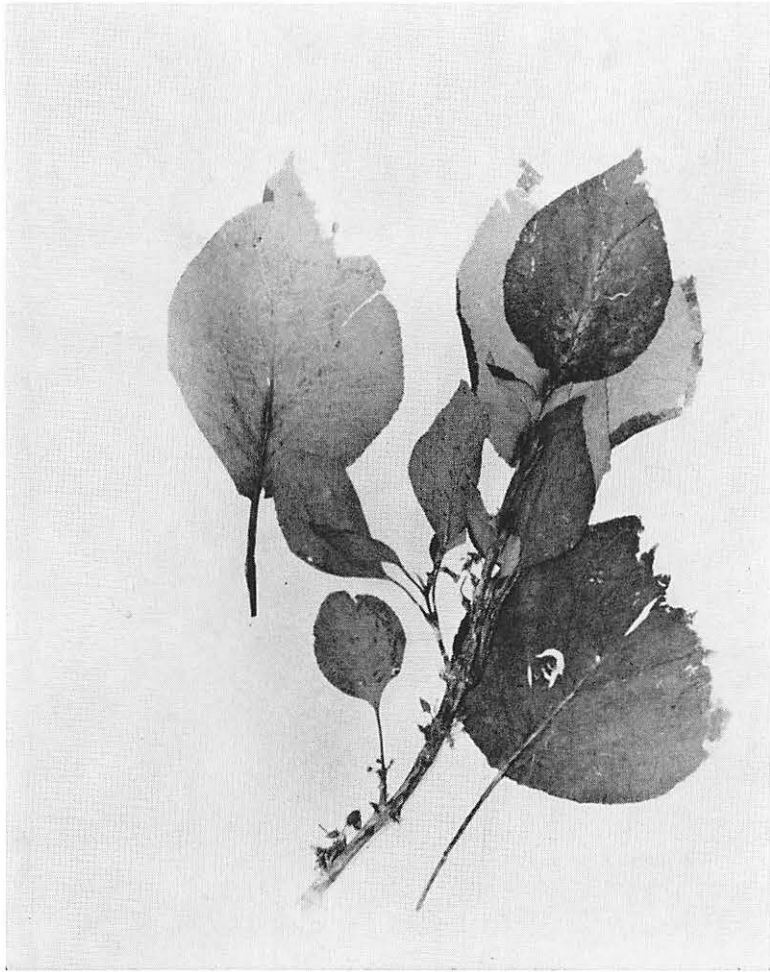


FIGURE 42.—*Cyrtandra Macraei*, lectotype (Gray Herb.). Sandwich Is., Oahu, *Macrae*.

March 20, 1946, *St. John 21,546*; Kailua, North Fork of Kahanaiki Stream, brushy gulch, 800 ft. alt., July 27, 1955, *Pearsall*.

Leeward Side: Palolo Valley, right hand side to falls and up a lateral ravine, Oct. 22, 1914, *Forbes 1,964.O*; ditto, gulch below Puu Lanipo, Aug. 1, 1920, *Garber 514*; Palolo Valley, Feb. 9, 1918, *Rock 13,077* (BISH, GH); ditto, Feb. 9, 1918, *Rock 13,079* (BISH, GH), type of *C. Macraei* var. *par-*

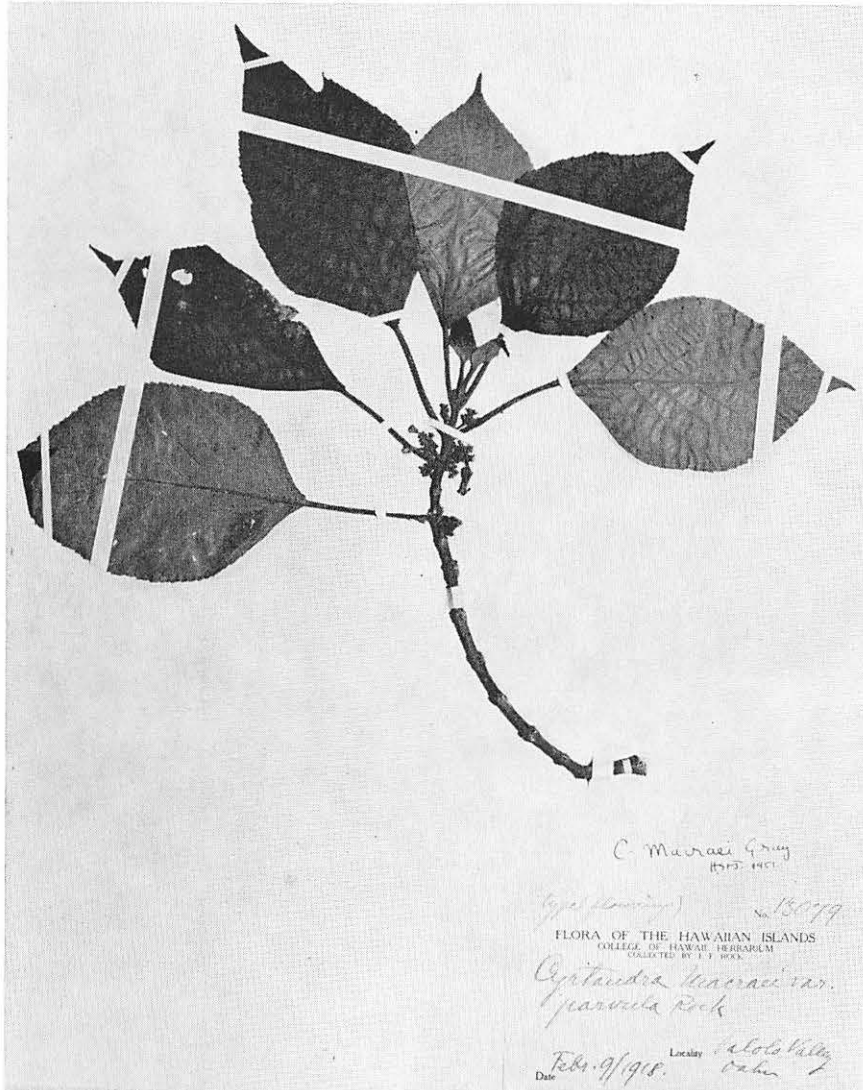


FIGURE 43.—*Cyrtandra Macraei* var. *parvula*, holotype (Bishop Mus.). Palolo Valley, Rock 13,079.

vula Rock; ditto, Kaau Cascade, 1,400 ft. alt., moist thicket by waterfall, May 17, 1942, *St. John* 20,296; Wailupe Valley, *Hillebrand*; ditto, along wooded watercourses near head of valley, 1,000 ft. elev., June 25, 1933, *Storey* 246; West Wailupe, moist shaded stream bank, 1,700 ft. alt., *Kondo*.

Waianae Mountains: Windward side: Makaleha Valley, Aug. 30, 1922, *Skottsberg* 410; ditto, wet ravine, Feb. 11, 1939, *Degener* 17,361 (NY).

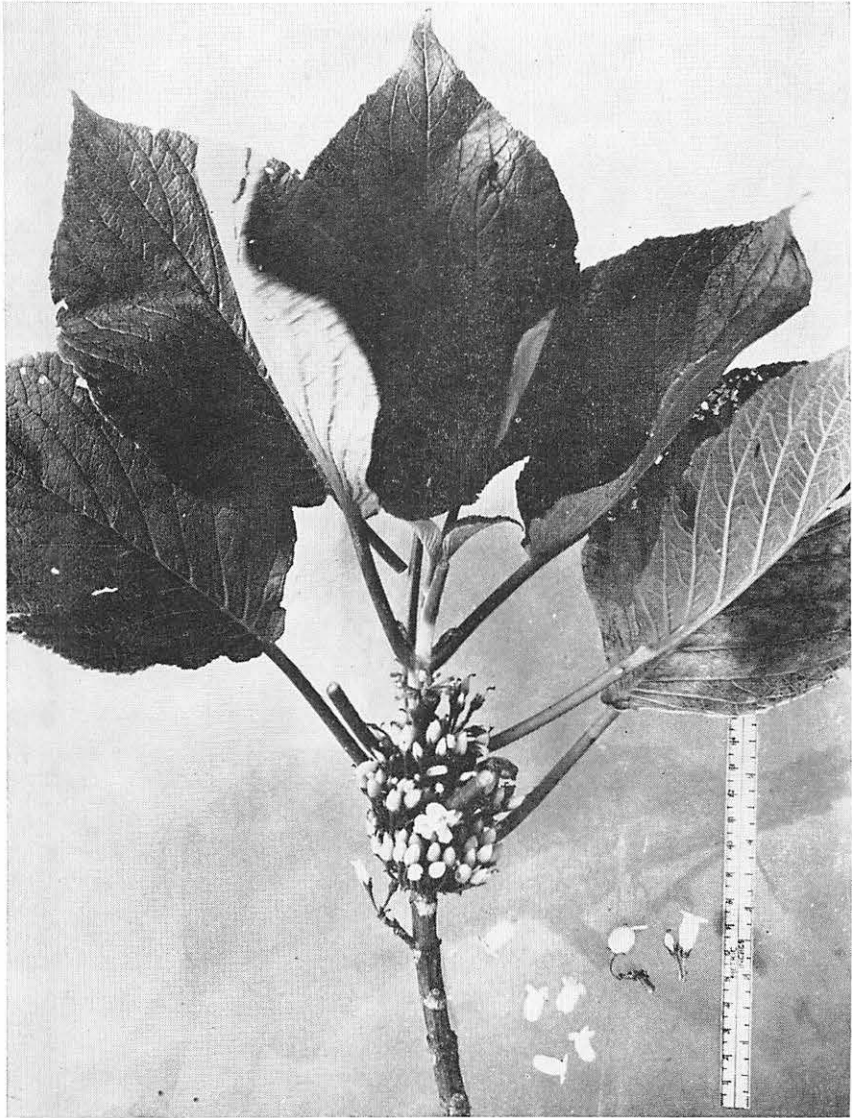


FIGURE 44.—*Cyrtandra Macraei*. Wailupe Valley, Storey 246.

Leeward Side: Makaha Valley, wet forest near head of valley but not at high elevation, Aug. 2, 1931, *Degener 7,520* (NY); ditto, Kaala Range, Feb. 12-19, 1909, *Forbes*.

Oahu (without other locality data): Galathea-Expeditionen, 1845-47, *Didrichsen 3,479* (C); ditto, two sheets *Didrichsen* (S); Oahu, *Hillebrand & Lydgate*, two sheets; one sheet mixed with two sterile branches of a different species of *Cyrtandra*; ditto, *Mann & Brigham* (BISH, CU).

Sandwich (or Hawaiian) Islands (without other locality data): *Hillebrand* (BM, US); U.S. South Pacific Exploring Exped., 1838-42, under Capt. Wilkes (GH, US).

Discussion: *C. Macraei* is one of the small group (7 species) that have the corolla and usually the inflorescence pruinose. They are concentrated at the southeast end of the Koolau Range. *C. Macraei*, first collected in 1825, has often been found since. It is still common in several of the moist mountain valleys back of Honolulu. It has a disrupted range, as it occurs also at Punaluu, and on the slopes of Mt. Kaala in the Waianae Mountains.

The writer has tried repeatedly to find a basis for the segregation of the populations of this species in these remote areas, but without success. The plants from all three areas seem homogeneous morphologically.

The var. *parvula* Rock was described from Palolo Valley, *Rock 13,079*. This was a large collection, and four sheets of it are still preserved in the Bishop Museum. It was said to differ "mainly in the smaller leaves and dense agglomerate inflorescence which is confined to the upper leaf axils; the flowers are much smaller, as are the fruits." With our present much larger collections we find a complete and continuous transition in the leaf sizes. The inflorescences are small and compact, and hence most, but not all, of them are in the upper and leafy axils. Many of the small buds would probably have aborted, as is a common occurrence. The corollas were "8 mm.," and the only flower preserved here, shrivelled and dried with little pressure, is 8 mm. long, but that is within the range of the flowers of the species. The berry was said to be "6-8 mm. long," but only very immature ones are preserved. This size, however, is scarcely, if at all, smaller than for the proper species. Considerable study of *C. Macraei* has been made in the field, particularly in the region from Palolo to Wailupe, and there appears to be no justification for the retention of Rock's var. *parvula*. It is to be noted that Skottsberg came to the same conclusion after studying an isotype at the Gray Herbarium. He discussed in detail the characters, the supposed differences, and concluded, "I can see no reason for separating N. 13079 from the type" (1936: 176).

Gray based his species on three early collections, but did not designate a type. Doubtless, because Gray had named the species for Macrae, Rock (1919: 67) chose the Macrae specimen in the Gray Herbarium as the type

(we would now call it the lectotype). This was a sound choice and will be final.

The species was named by Asa Gray in honor of James Macrae, Scottish gardener and explorer for the Royal Horticultural Society of London, who made the voyage on the "Blonde" under Lord Byron. He made large collections in the Sandwich Islands in 1825 on "Woahoo, Mowee, and Owhyhee" Islands, or Oahu, Maui, and Hawaii. His specimens are in the British Museum of Natural History, Cambridge University, and the Gray Herbarium. For the previous year, 1823, he was stationed at the Botanical Garden at the Island of St. Vincent. From 1827 to 1830 he was superintendent of the Ceylon Botanical Garden, and he died in 1830.

23. *Cyrtandra oahuensis* Lévillé, Fedde Repert. Sp. Nov. 10:124, 1912. (Figs. 45, 46, 185.)

Description of All Specimens Examined: Shrub; branches yellowish, later brown, soon glabrate, fleshy and shrinking on drying to show longitudinal ridges and furrows; leaf scars 2-2.5 mm. high, pale, depressed shield-shaped, interconnected by an annular band; bundle scar 1, large; young shoots densely hirsute; leafy branchlets as much as 2.5 mm. in diameter, shaggy brown hirsute; internodes 2-12 mm. averaging 4 mm. long; leaves opposite, divergent, not crowded, borne at the 2-4 upper nodes, quite unequal, one of a pair mostly $\frac{1}{3}$ larger; petioles 5-20 mm. long, obscured by the shaggy hirsute pubescence, at base narrowly connected and perfoliate; blades 2-10.7 cm. long, 9-39 mm. wide, firm chartaceous, elliptic or oblance-elliptic, the apex acute or subacuminate, the base cuneate and decurrent, above dark green and stiffly hirsute, below brown hirsute, shaggily so on the veins, sparsely so on the intervals, the margins serrulate, the secondary veins 6-8 on a side, arched ascending, excurrent in the teeth; cymes 1-flowered, densely shaggy hirsute; peduncle 3-8 mm. long; pedicels 3-8 mm. long; peduncular bracts 5-8 mm. long, linear-lanceolate, foliaceous; calyx in anthesis 15 mm. long (when boiled) (11-16 mm. when dry) green but so densely shaggy brown hirsute as to almost conceal the tissue, cleft almost to the base, 2-lipped, 5-lobed, campanulate, the sinus between the lips cut quite to the base; upper lip 3-lobed, cleft to within 1.5 mm. of the base between the lobes, the lobes linear, 1.3-1.5 mm. wide, within glabrous on the lower quarter, elsewhere densely brown shaggy hirsute; lower lip 2-lobed, the sinus between the lobes reaching to within 0.5 mm. of the base; corolla 21 mm. long (when boiled), (when dry 17-20 mm.) white, glabrous within; the tube 17 mm. long, almost straight, 4 mm. in diameter at the throat and elsewhere; limb 2-lipped, 5-lobed; upper lobes 2, recurving at about 50° to axis of the throat, 3.5 mm. long, 4 mm. wide depressed rhombic-orbicular, auriculate and overlapping at base, densely hirsute without except near the margin; lower lip 3-lobed; lateral lobes 4 mm. long, 5 mm. wide, ovate-suborbicular, hirsute without right to the margin; lower lip 5 mm. long, 4.5 mm. wide, suborbicular, without hirsute except near the margins; the two lower stamens fertile, their filaments adnate to the corolla to within 5 mm. of the throat, the free portion 2 mm. long, spirally curved, but apparently lying flush on the distal side of the tube; two perfect anthers 2.8 mm. long, asymmetric oval, the connectives oval; the staminodia adnate to the corolla tube to within 6 mm. of the throat, subulate 0.2-0.3 mm. long; style 2 mm. long, terete, glabrous, sharply distinct from the ovary; stigmatic lobes 2, sessile, 2.5 mm. long, broadly oval, opposite, equally cleft on both sides; ovary 7.5 mm. long, lance-ovoid, glabrous, the base surrounded by a cupulate disk 1.2 mm. high; fruit unknown.

Distribution: Koolau Range, windward side, at Punaluu and Kaipapau.
Type: "Oahu: Punaluu, maio 1910 (U. Faurie, 638)." Isotypes examined

(BM, BISH.). When printed, the locality was misspelled; but on the labels it is correctly written Punaluu.

Specimens Examined: Koolau Range, windward side, Punaluu Mt., Aug. 1908, Board of Agriculture and Forestry [= *Rock*]: Koolauloa [= Koolau] Mts. between Punaluu and Kaipapau [= Kaipapau], Nov. 14-21, 1908,

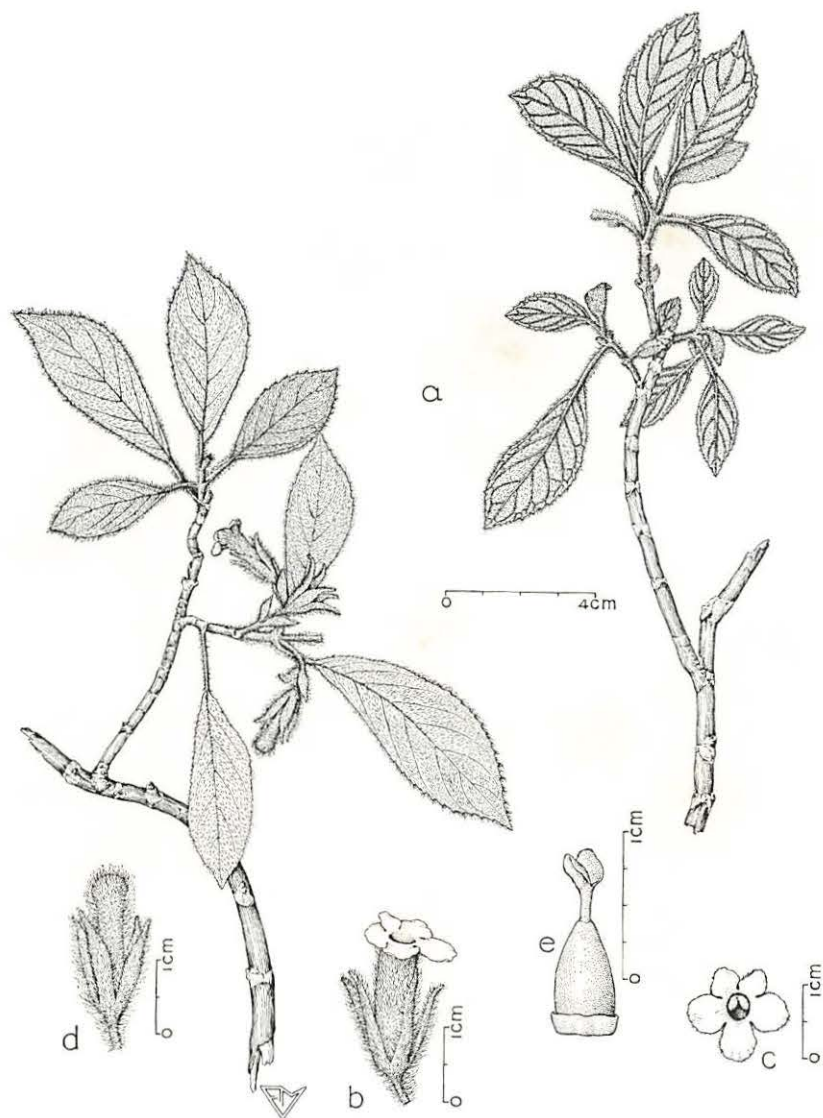


FIGURE 45.—*Cyrtandra oahuensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Punaluu Mountains, Rock 884 (Bishop Mus.).

Forbes; ditto, May 3-8, 1909, *Forbes & Cooke*; Punaluu Mts., Nov. 14-21, 1908, *Rock* 884; ditto 898. The last two look like duplicates and probably are so, as Rock customarily gave his duplicates consecutive numbers in series. The Forbes' collection in Nov. 14-21, 1908, may also be a duplicate, as it is known that for that week Forbes and Rock made a joint expedition up the new Castle Trail that started from lowland Punaluu, crossed the ridge to Kaluanui, then into Kaipapau where it reached the summit of the Koolau

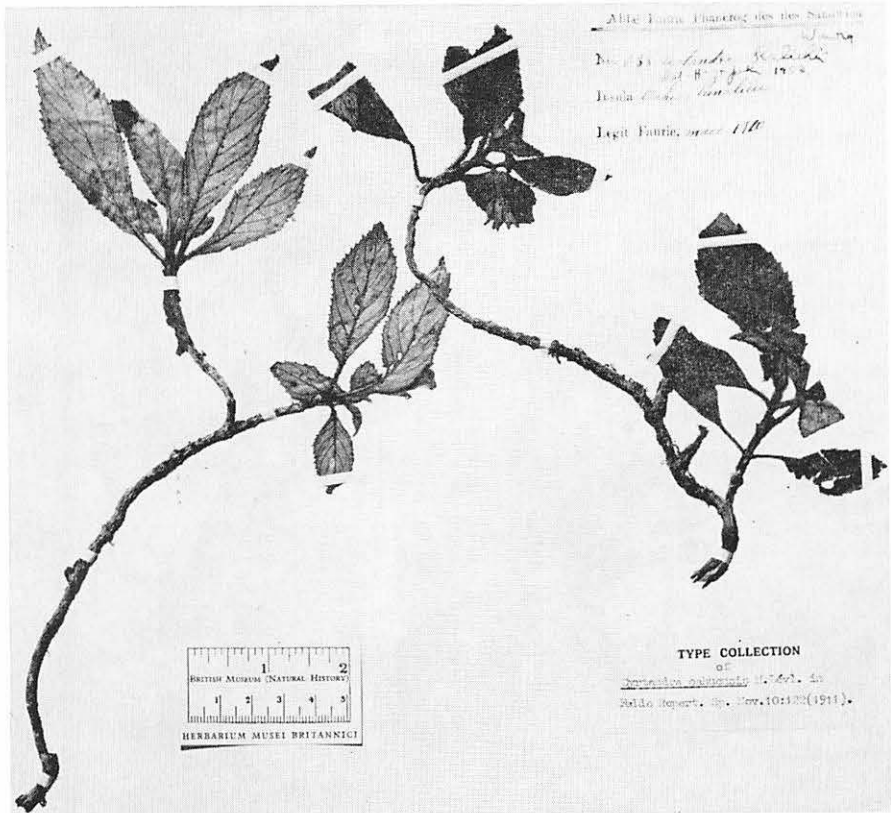


FIGURE 46.—*Cyrtandra oahuensis*, isotype (Bishop Mus.). Punaluu, Faurie 638.

Range. The two botanists stayed together at the pig hunters' camp by the stream in Kaluanui, but collected separate sets of plants.

Discussion: *C. oahuensis* is a member of the section *Chaetocalyces*. Its close relative is *C. zwiolani* Wawra of Nuuanu and Kalihi in the southern Koolau Range. The two are contrasted in the treatment of that species.

This species has not been collected since 1909, but may well still exist in the jumbled, rugged mountains reached by the Castle Trail from Punaluu.

It was described as new by L veill  in 1912 but reduced to the synonymy of *C. waiolani* Wawra by Rock (1914: 359; and 1919: 65).

Rock admitted that "The specimens from Punaluu mountains are a little less hairy and occasionally the calycine lobes are a little wider, which fact perhaps persuaded L veill  to describe it as a new species." Apparently Rock did not dissect the flowers of *C. oahuensis* and perceive the characters of the pistil. Then, too, Rock's concept of *C. waiolani* Wawra included, besides *C. oahuensis*, *C. linearis* St. John & Storey, and Hillebrand collections from Kaala in the Waianae Range. This Kaala specimen has not been located, but it probably represented *C. Wilderi* St. John & Storey.

The specific name was formed from the island name Oahu, to which was added the Latin adjectival suffix, *ensis*, signifying place of origin.

24. *Cyrtandra subumbellata* (Hillebrand) St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 78, 1950.

Description: Shrub 2-3 m. tall; *leaves* opposite, below pruinose and veins glabrous or puberulent; *calyx* 20-23 mm. long, pruinose; *corolla* 26-32 mm. long, white; *ovary* glabrous.

This is composed of the two following varieties:

25. *Cyrtandra subumbellata* (Hillebrand) St. John & Storey var. *subumbellata*, B. P. Bishop Mus., Occ. Papers 20 (6): 78, 1950. (Figs. 47, 48, 186.)

Cyrtandra gracilis Hillebrand β var. *subumbellata* Hillebrand, Fl. Hawaiian Is., 334, 1888.

Description of All Specimens Examined: Shrub, 2-3 m. tall; branches reddish, turning yellowish, glabrous, at first strongly quadrangular, as much as 1 cm. in diameter; leaf scars 4-7 mm. high, shield-shaped and all palmately 5-lobed below, pale, those of a pair connected and hence annular; bundle scars 7; young shoots white and pruinose; leafy branchlets as much as 4-6 mm. in diameter, quadrangular, white pruinose; internodes 12-70 mm., averaging 20 mm. long; *leaves* opposite, ascending, not crowded, borne at the 3-6 upper nodes, those of a pair unequal, one being $\frac{1}{6}$ - $\frac{1}{2}$ larger; petioles 2-7 cm. long, pruinose, when fresh 3-5 mm. in diameter; *blades* 10-33.5 cm. long, 31-190 mm. wide, commonly asymmetrically but varying to obliquely sub-orbicular and to asymmetric lanceolate, the base cuneate and decurrent, the apex acuminate, thick soft chartaceous, above green and impressed rugose reticulate veiny, glabrous, below whitish green, pruinose, strongly raised reticulate veiny, the margin coarsely crenate or doubly crenate, the secondary veins 7-11 on a side, arcuate, ascending, excurrent in the teeth; *cymes* 5-15-flowered, pruinose, axillary, numerous, dense, crowded and almost concealing the stem; peduncles 2-8 mm. long, these and the upper branches heavy, having a total length of 4-12 mm., pedicels 7-20 mm. long, filiform, thickened at apex; bracts 5-17 mm. long, foliaceous, lanceolate; buds campanulate, the calyx lobes diverging early; *calyx* in anthesis 22-23 mm. long (when fresh), green, pruinose (10-20 mm. when dried), the tube 1 mm. long; upper lip 3-lobed; lower lip 2-lobed, all the lobes linear, 21-22 mm. long, 1 mm. wide except at very base where about 2 mm. wide; *corolla* 26-32 mm. long (when fresh) (21-28 mm. when dried), white, pruinose without, the tube subcylindric, minutely capitate glandular puberulent at the throat, at base 4 mm. in diameter, at the middle 9 mm., at the throat 7 mm., near the middle deflexed at 25° from the axis of the lower tube; limb 2-lipped, 5-lobed, cleft

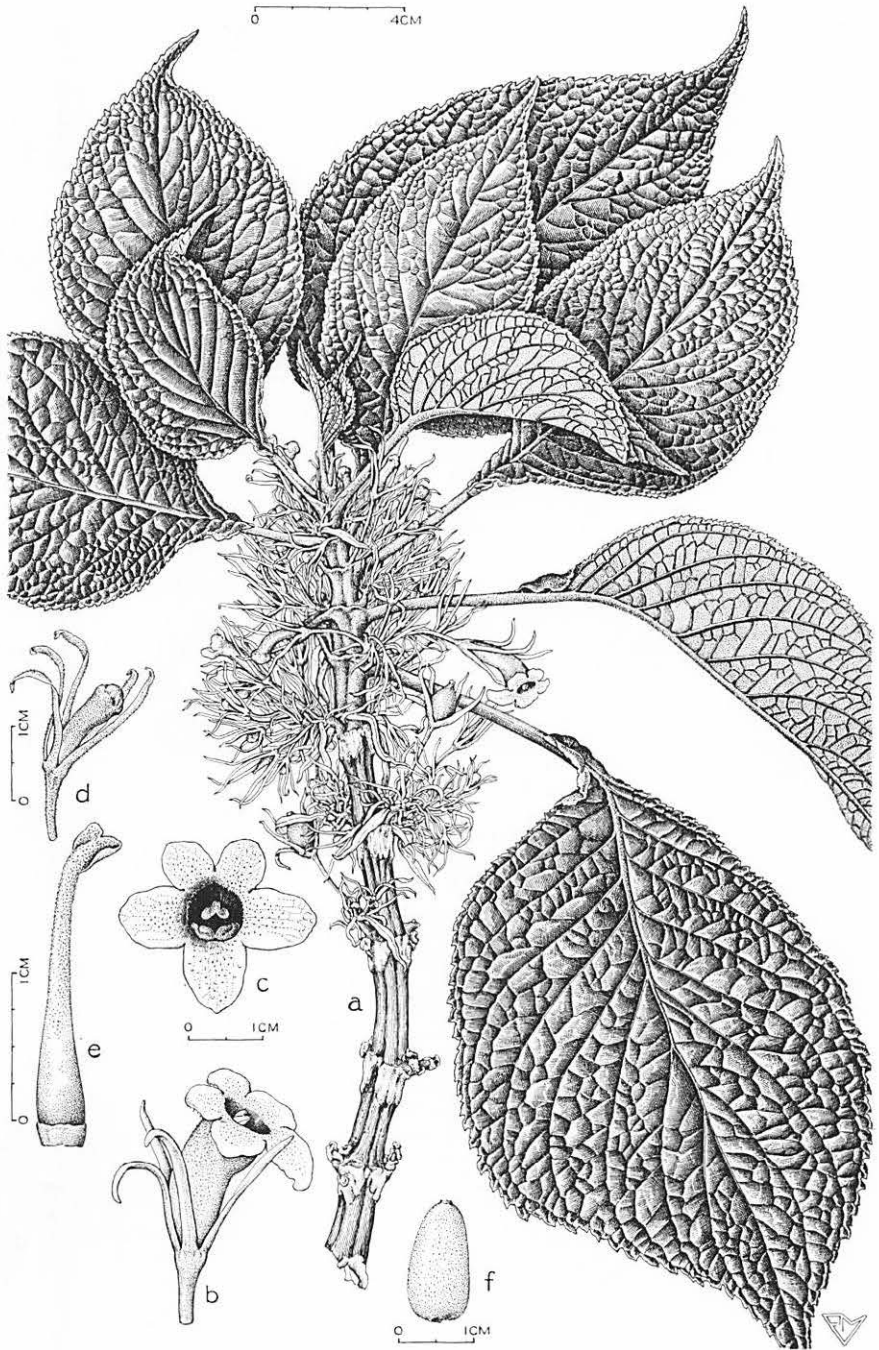


FIGURE 47.—*Cyrtandra subumbellata* var. *subumbellata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 2$; e, pistil, $\times 2$; f, fruit, $\times 1$. Kahana, St. John 20,243, neotype (Bishop Mus.).

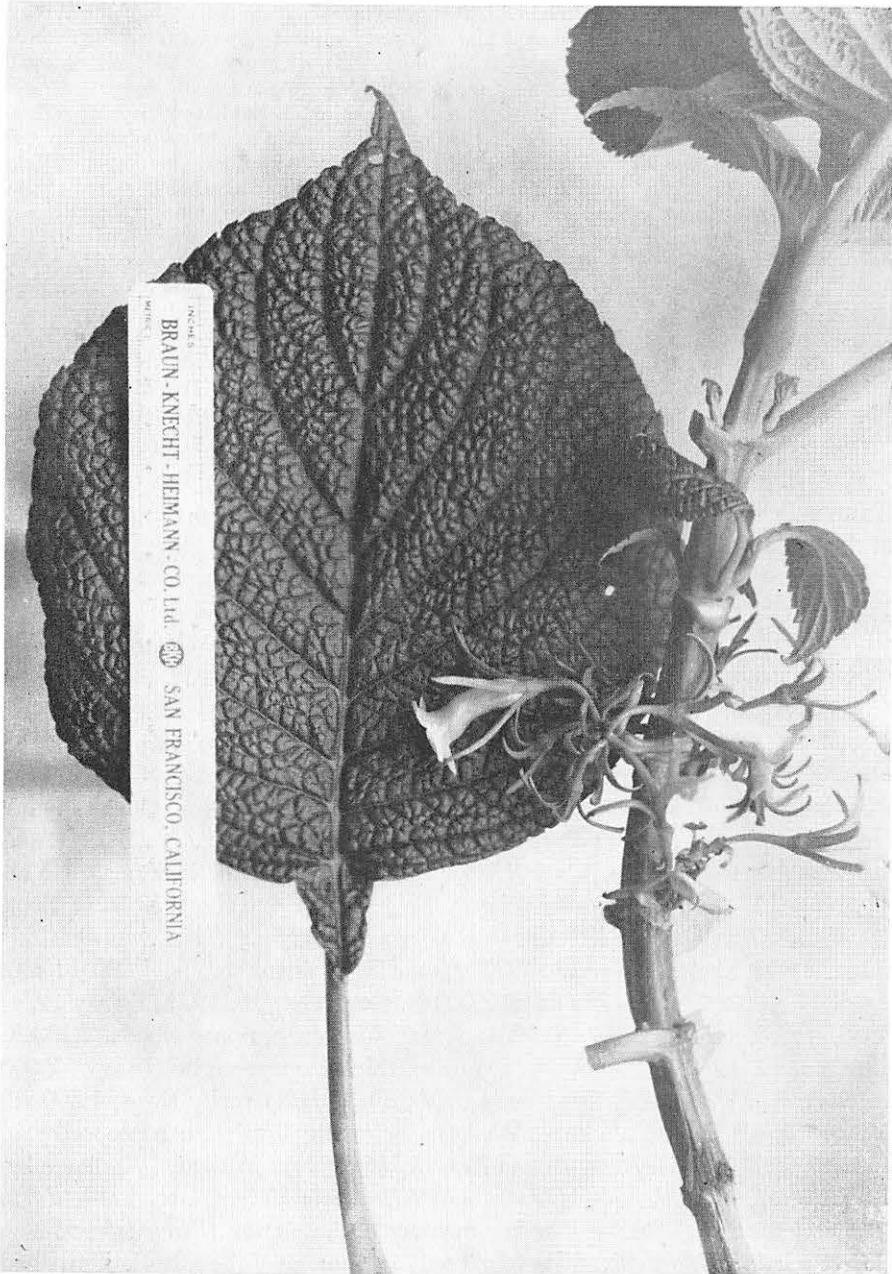


FIGURE 48.—*Cyrtandra subumbellata* var. *subumbellata*: Waikane-Schofield Trail, Storey 268.

4-7 mm. between the lips; upper lobes 2, recurving at 45° from the axis of the throat, 5-6 mm. long, 4-5.5 mm. wide, suborbicular, minutely capitate glandular within; lower lip 3-lobed; lateral lobes 6-9 mm. long, 5.5-7.5 mm. wide, diverging at 90°, oblong oval, minutely capitate glandular puberulent from the middle to the throat; lower lobe 6-9 mm. long, 5.5-7.5 mm. wide, oval, strongly reflexing, minutely capitate glandular puberulent throughout within; two lower stamens perfect, with filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 3 mm. long, terete, spiralling but unique in lying close to the distal side where attached and not being raised to the proximal side as in all other species examined; anthers connate at tip, 3.5 mm. long, obliquely oval, the connective oval, the staminodia with filament wholly adnate to the corolla tube to within 9-10 mm. of the throat, the anther remnants visibly 2-lobed, 0.3-0.4 mm. long, colorless; *style* 11 mm. long, stout, terete, closely glandular atomiferous; stigmatic lobes 2, sessile, broadly oval, connate ½ way up proximal side; *ovary* 7 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; *berry* 10-15 mm. long, 5-8 mm. in diameter, oblong-ovoid, short beaked, white, pruinose; seeds 0.27-0.37 mm. long, 0.11-0.13 mm. wide, yellowish brown, straight or curved ellipsoid, the surface covered with raised cellular narrow polygonal reticulations ⅓ as long as seed.

Distribution: Koolau Range, windward side, from Kaliuwaa (which is in Kaluanui) south to Waiahole, from 1,500 to 2,000 ft. alt. in the rain forests of the Ohia Zone.

Neotype: Oahu, Waikane-Schofield Trail, Kahana, moist wooded slope, 1,500 ft. alt., common, erect branching shrub 2-3 m. tall, 1-4 cm. diam., May 18, 1941, *H. St. John & W. B. Storey 20,243* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Punaluu, Pig God Trail, rain forest, May 31, 1931, *Degener et al. 7,509* (NY); Punaluu, rather wet, Nov. 3, 1929 *Nitta (Degener 7,565)* (NY); Punaluu Mts., Dec. 3, 1908, *Rock 325* (BISH, GH); Punaluu, Kaliuwaa Valley, above second waterfall, growing along stream, Dec. 24, 1908, *Rock 416*; Punaluu, Dec. 3-14, 1908, *Rock 742*; *762*; Punaluu Mts., Oct. 31, 1914, *Rock 13,078*; along Castle trail in Punaluu Valley, Nov. 30, 1929, *Yamaguchi (Storey 154)*; high ridge above Kahana, Sept. 17, 1926, *Skottsberg 1839*; Kahana, Waikane-Schofield Trail, wooded side ridge, 1,800 ft. alt., April 17, 1932, *Hume 351*; ditto, woods, 1,800 ft. alt., April 17, 1932, *Storey 174*; ditto, 2,000 ft. elev., Oct. 16, 1932, *Storey 197a*; ditto, woods, 1,800 ft., May 6, 1934, *Storey 268*; ditto, upper woods, 2,100 ft. alt., Jan. 19, 1930, *St. John 10,166*; ditto, thicket on precipitous slope, 2,000 ft. elev., April 28, 1935, *St. John 17,627*; ditto, damp rocky slope, 1,500 ft., May 18, 1941, *Wong*; Waikane, Waikane-Schofield Trail, dense exposed rain forest, April 4, 1931, *Degener and Park 7,516* (NY); Waikane, Koolaupoko, 1,500 ft. alt., Aug. 9, 1930, *Hosaka 292*; Waiahole Valley, Dec. 1919, *Rock*.

Discussion: *C. subumbellata* is a member of the section *Chaetocalyces*. The closest relative, *C. gracilis* Hbd., found only in Nuuanu Valley, is distinguished by having the leaf scars oblong-shield-shaped; the blades lanceolate, long acuminate, capitate glandular puberulent on the veins below, the margins callous serrate; cymes 3-flowered; peduncles 12-22 mm. long; and the pedi-

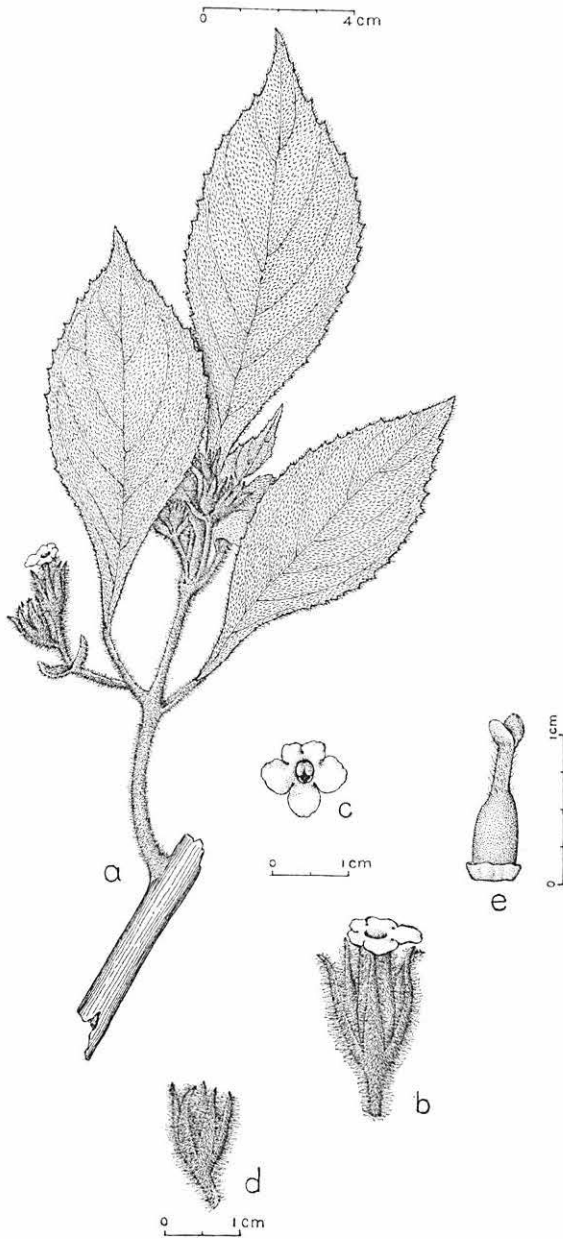


FIGURE 49.—*Cyrtandra waiolani* var. *waiolani*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Waiolani, Hillebrand (Bishop Mus. ex Berlin).



cels 23-75 mm. long. *C. subumbellata* has the contrasting characters, leaf scars shield-shaped, palmately lobed below; the blades suborbicular or the reduced ones lanceolate, acuminate, below pruinose, the margins coarsely crenate or doubly crenate; cymes 5-15-flowered; peduncles 2-8 mm. long; and the pedicels 7-20 mm. long.

This plant was first described as *C. gracilis* var. *subumbellata* by Hillebrand (1888: 334). His characterization was brief, but clearly applicable to this plant, and Rock, in 1919, accepted it on Hillebrand's description and applied it to several of his own collections from Punaluu. Both of these botanists discussed the existence of specimens intermediate between this variety and *C. gracilis* and *C. Macraei*. Now with these same Rock specimens and much more abundant ones of recent collection, the plant stands out as a very distinct species, easily separated from the others. Of all the species studied, only *C. subumbellata* has the lower edge of the leaf scars palmately lobed, and the fertile stamens remaining on the distal side of the corolla tube near their attachment to it. Details of the floral structure have been easily studied in fresh flowers bottled in formalin when collected in the forests. When a botanist studies these only from dried specimens, he is much handicapped by the poorly preserved flowers which shrink and rot during the first day after gathering.

No type specimen was found by Rock or by the writer, both of whom searched the great herbaria of Europe and the United States. The first set of the Hillebrand collections was in Berlin, and there are duplicates in Kew, Paris, Gray Herbarium, Smithsonian Institution, Edinburgh, British Museum of Natural History, and Zurich, but no type of this var. *subumbellata* Hillebrand exists in any of these museums. Hence, it is apparent that the type has been destroyed. In its place is selected as neotype, a recent collection with many duplicates and bottled flowers and fruits. From this specimen has been made the drawing and the neotype description.

The name of the species was coined from the Latin *sub-*, somewhat, more or less; *umbellatus*, like a parasol, or botanically, with an umbellate inflorescence.

26. *Cyrtandra subumbellata* (Hillebrand) St. John & Storey var. *intonsa* St. John, var. nov. (Fig. 192).

Diagnosis Holotypi: A specie differt in laminis infra in venis puberulentis.

Description: Differing from *C. subumbellata* only in having veins of the under side of the blades spreading puberulent.

Holotypus: Oahu, Koolau Mts., Kahana Valley, Waikane-Schofield Trail, in woods, 1,800 ft., May 6, 1934, *W. B. Storey 268a* (BISHOP MUS.).

Discussion: This is a hairy variant which is unique and local, and is deemed worthy of description.

The varietal name is from the Latin *in-*, not, or *un-*; *tonsus*, shaven, in allusion to the hairy veins of the blades.

27. *Cyrtandra waiolani* Wawra, Flora 55: 566, 1872.

Description: Shrub; *leaves* opposite; *blades* elliptic, scabrous hirsute; *cymes* 1-7-flowered; *calyx* 12-18 mm. long; *corolla* 16-22 mm. long, white.

This species is composed of the two following varieties.

28. *Cyrtandra waiolani* Wawra var. *waiolani* (Figs. 49, 50, 193).

Cyrtandra waiolani Wawra, Flora 55: 566, 1872 (in reprint p. 20), (as *Waiolani*).

Cyrtandra Hillebrandii Vatke, Linnaea 40: 222, 1876 (reprint p. 20), not *C. Hillebrandii* C. B. Clarke, in De Candolle, Monogr. Phanerog. 5 (1): 228, 1883, which is now *C. Clarkei* Vatke ex Skottsberg, Horti Gotoburg, Acta 10: 168-170, 1936; or *C. Hillebrandii* Oliver in Hillebrand, Fl. Hawaiian Is., 331, 1888, which is now *C. scabrella* C. B. Clarke, in De Candolle, Monogr. Phanerog. 5 (1): 277, 1883.

Description of All Specimens Examined: Shrub; branches pale, yellowish tardily glabrate, fleshy and on drying shrinking, forming numerous longitudinal ridges and furrows; leaf scars 1-3 mm. high, pale, obcordate, united and annular; bundle scars 5; leafy branchlets as much as 4 mm. in diameter, terete, shaggy brownish hirsute; internodes 4-70 mm., averaging 20 mm. in length; *leaves* opposite, ascending, not crowded, borne at the 3-6 upper nodes, those of a pair unequal, one being about $\frac{1}{2}$ larger; petioles 16-51 mm. long, hirsute perfoliate at the base; *blades* 2-13 cm. long, 12-56 mm. wide, thin chartaceous, elliptic; the apex acuminate, the base cuneate and decurrent, above dark green and remotely catenulate hirsute and thus scabrous, below catenulate hirsute especially on the veins, whitish green, the margins irregularly dentate-serrate, the secondary veins 5-8 on a side, arcuate ascending, excurrent in the teeth; *cymes* axillary, 1-2-flowered, densely shaggy brown hirsute, the indument obscuring the surface; peduncles 7-35 mm. long; pedicels 5-22 mm. long; peduncular bracts 5-11 mm. long, lanceolate, foliaceous; buds campanulate; *calyx* in anthesis 18 mm. long (when boiled), campanulate, green but the surface concealed by the dense shaggy hirsute indument, the hairs at first minutely capitulate glandular (the gland scarcely to be seen with a hand lens), 2-lipped, 5-lobed, the sinus between lips to within 0.5 mm. of the base, the sinus between lobes cut to within 1 mm. of the base, all the lobes densely hirsute throughout except within on the lowest 3-4 mm., 3-nerved, subequal, narrowly linear, gently attenuate, at base 1.5 mm. long; upper lip 3-lobed; lower lip 2-lobed; *corolla* 22 mm. long (when boiled), white, the tube 18 mm. long, straight, cylindric, 3.5 mm. in diameter, without glabrous for the basal 4 mm., but above densely shaggy hirsute, within glabrous; limb 2-lipped, 5-lobed, the lobes all glabrous within; upper lip, 2-lobed, the lobes 2.5 mm. long, 4 mm. wide, transversely oval, without hirsute only at the very base; lower lip 3-lobed, the lateral lobes 3.5 mm. long, 5 mm. wide, ovate-suborbicular and like the others auriculate and overlapping at base, without shaggy hirsute almost to the margin; lower lobe 4 mm. long, 4.5 mm. wide, broadly ovate, without hirsute only at the very base; two lower stamens with filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 3 mm. long, spirally up-curved, the 2 perfect anthers connate at tip, 2.3 mm. long, asymmetric oval, the connectives oval; the staminodia with their filaments adnate to within 9 mm. of the throat, the free portion 0.3-0.5 mm. long, subulate; *style* 3 mm. long, stout, terete, and capitulate glandular pilose; stigmatic lobes 2, sessile, 2.5 mm. long, oval, connate $\frac{1}{2}$ way up proximal side; *ovary* 5 mm. long, ovoid glabrous, surrounded at base by a cupulate



FIGURE 50.—*Cyrtandra waiolani* var. *waiolani*, holotype (Vienna). Oahu, Wawra 1,792.

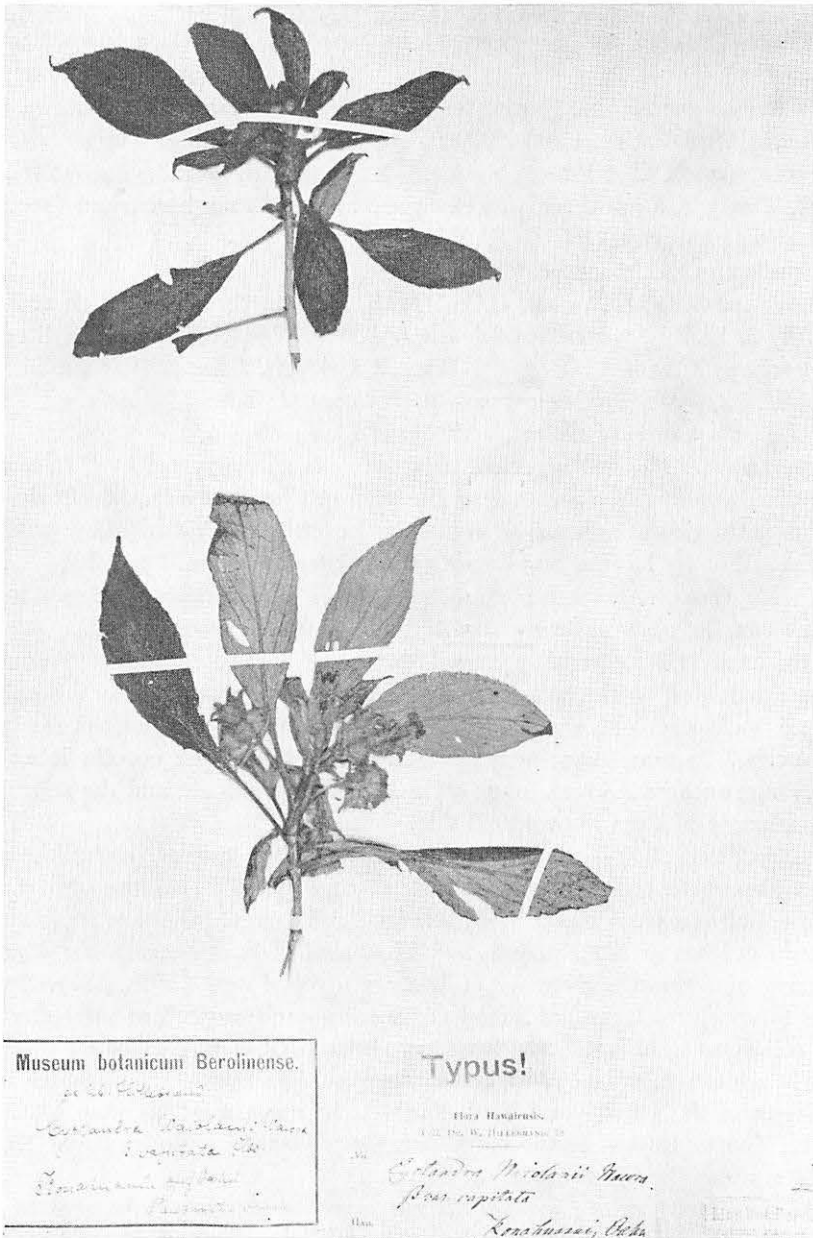


FIGURE 51.—*Cyrtandra waiolani* var. *capitata*, holotype (Berlin). Konahuanui, Hillebrand.

disk 1 mm. high; *berry* 12-18 mm. long, white, ellipsoid, apiculate, becoming glandular pilosulous above the middle; seeds 0.35-0.43 mm. long, 0.18-0.21 mm. wide, symmetrically ovoid, amber colored, the body covered with raised, narrow oblong reticulations $\frac{3}{4}$ as long as the seed.

Distribution: Koolau Range, leeward side, Kawailoa, North Halawa Valley, and Kalihi Valley, 1,700-2,000 ft. alt. in the Ohia Zone.

Holotype: "Oahu, Waldschluchten des Waiolani. 1792." That is: *Wawra* 1,792. The type, a full sheet, was examined at the Vienna herbarium (see Fig. 50); also a clastotype (BISHOP MUS.).

Specimens Examined: Koolau Range.

Leeward Side: Kawailoa, C.C.C. Trail, rich, partly sunny gulch at 2,000 ft., July 3, 1938, *Degener & Ordonez* 12,058 (NY); North Halawa Stream, wet gorge by stream, 1,700 ft. alt., Dec. 12, 1943, *St. John* 20,405; Kalihi Valley, Oct. 22, 1908, *Forbes*; Waiolani, *Hillebrand*; Kalihi, *Hillebrand* (BM, GH, L); *Plantae Hawaienses*, *Hillebrand* (US).

Discussion: The last specimen cited above is an isotype of *C. Hillebrandii* Vatke. *C. waiolani* is a member of the section *Chaetocalyces* and also in this section is the closest relative, *C. oahuensis* Lévillé of Kalihi Valley which is distinguished by having bundle scar 1; petioles 5-20 mm. long; blades 9-39 mm. wide, firm chartaceous; peduncles 3-8 mm. long; pedicels 3-8 mm. long; all the corolla lobes differing slightly, as the upper lobes being 3.5 mm. in length; anthers 2.8 mm. long; style 2 mm. long, glabrous; and the stigmatic lobes equal, cleft to the base. On the other hand *C. waiolani* has the bundle scars 5; petioles 16-51 mm. long; blades 12-56 mm. wide, thin chartaceous; peduncles 7-35 mm. long; pedicels 5-22 mm. long; upper corolla lobes 2.5 mm. long; anthers 2.3 mm. long; style 3 mm. long, pilose; and the stigmatic lobes connate $\frac{1}{5}$ way up proximal side.

Rock (1919:65) had a wider concept of this species, including also material representative of what is here recognized as *C. oahuensis* Lév. He listed collections from Kaala by Hillebrand, and asserted that the species also grew in gulches of Konahuanui, and Moanalua. This appears to be a paraphrasing of the range given by Hillebrand in his *Flora* (1888:334). Specimens to vouch for these localities have not been encountered in these studies. The collection from Kaala may well have been what is here called *C. Wilderi*.

The geographic name Waiolani is obsolete, but Hillebrand includes it in his *Flora* of the Hawaiian Islands (1888). It appears on his map of Oahu on the Koolau Range, as the culminating peak between Nuuanu and Kalihi Valleys, now officially named Puu Lanihuli.

As now restricted, *C. waiolani* is narrowed to a concept like that of the original author, Wawra. His description was long (two-thirds of a page), detailed, and accurate, even down to the hairs on the style. The only discrepancy is that once he calls the plant a tree, then later a little shrub. Doubtless the latter is correct, though he states it as 4-5 fathoms tall which is

gigantic for a Hawaiian *Cyrtandra*. The two early collections may have been made together, as Hillebrand guided Wawra in the Koolau forests on one or more excursions. The Wawra and the Hillebrand collections are so similar that they may well have been made together.

The specific name chosen by Wawra was the unmodified Hawaiian geographic name of the mountain upon which the species grew, *Waiolani*, meaning the waters of heaven, alluding to the frequent, heavy rains that fall on this 2,700 ft. peak.

29. *Cyrtandra waiolani* Wawra, var. *capitata* Hillebrand, Fl. Hawaiian Is. 334, 1888 (as β var. *capitata*). (Figs. 51, 188.)

The original description was as follows: "Leaves thick chartaceous, with prominent veins. Flowers 5-7, with very short pedicels, almost clustered at the end of the peduncle. Calyx 6", corolla 8". Konahuanui gulch."

In 1935 the writer found this type sheet and photographed it (Fig. 51), though he did not critically study it at that time. The specimen is believed to have been destroyed in 1944 in the bombing of Berlin. The photograph shows the specimens with a habit somewhat different from that of *C. waiolani* and the floral morphology might be quite different. No recent collections from Oahu match this var. *capitata*. Until it becomes possible to study the original or more recent material, it is deemed best to list this, following the judgment of that excellent botanist, Hillebrand, as *C. waiolani* var. *capitata*. Konahuanui, 3,150 ft. alt., is the highest peak of the Koolau Range. The gulch referred to is Lulumahu, a spectacular gulch and waterfall, draining Puu Konahuanui into upper Nuuanu Valley on the leeward side.

3. Section *Schizocalyces*

30. *Cyrtandra adpressipilosa* St. John, sp. nov. (Figs. 52, 194).

Diagnosis Holotypi: Frutex 1-5 m. altus, ramis 8-15 mm. diametro teretibus, cortice vetustiore in sicco sulcati, cicatricibus 3.5-5 mm. altis pallidis semiorbiculari-scutelliformibus, fasciculis 7, ramis nudis glabrescentibus, novellis dense subadpressi-puberulentis, ramulis foliferis sparse adpressi-puberulentis quadrangularibus 2-3 mm. diametro, internodis 6-30 plerumque 10 mm. longis, *foliis* oppositis ab initio adscendentibus, tunc divergentibus in nodis 3-5 superis affixis, foliis jugum inaequalibus uno $\frac{1}{4}$ majori, petiolis 20-60 mm. longis in maturitate sparse adpressi-puberulentis, *laminis* 8-14.5 cm. longis 36-77 mm. latis chartaceis ellipticis vel late ellipticis plure asymmetricis cuneatis subacuminatis supra remote adpressi-pustulato-hirsutulis atri-viridibus infra pallide viridibus, nervis modice adpressi-puberulentis, intervallis subremote adpressi-puberulentis, marginibus grosse serratis, nervis secundariis 7-11 in uno latere minime arcuatis in dentibus excurrentibus, *cymis* caulifloribus in ramis nudis 5-13-floriferis in axile 1-2 totis albis et adpressi-puberulentis (rare in ramulis secundariis parvis in axillis foliferis et tunc calycibus viridibus), pedunculis 8-30 mm. longis gracilibus, pedicellis 5-16 mm. longis gracilibus, bracteis 3-12 mm. longis lanceolatis vel anguste lanceolatis viridescensibus, alabastris lanceolatis lobis erectis et conniventibus, *calycibus* in flore et vivo 8-9.5 mm. longis (in sicco 5-8 mm.) albis deinde in fructu viridescensibus adpressi-puberulentibus pilis separatis 0.2 mm. longis, tubo 2.5-3 mm. longo campanulato, limbo crasso carnosio bilabiato 5-lobato inter labias 5.5-7 mm. partito, labia supera trilobata lobis intra glabra anguste lanceolata obtusa similia sed loba media 5 mm. longa, labia infera bilobata inter lobas 6 mm. partita lobis lanceolatis obtusis, *corollis* in vivo 16-19 mm. longis (in sicco 13-16 mm.) albis extra in partibus expositis albi-hirsutulis intra glabris, tubo 11-14 mm. longo 3-5.5 mm. diametro cylindrico subrecto, limbo bilabiato 5-lobato, lobis superis binis 3 mm. longis 5.5 mm. latis oblato-suborbicularibus in marginibus capitato-glanduloso-hirsuto-ciliatis, labia infera trilobata, lobis lateralibus 4 mm. longis 5.5 mm. latis rhomboideo-suborbicularibus auriculatis, loba infera 3.5 mm. longa 4 mm. lata suborbiculare auriculata, staminibus binis inferis perfectis, filamentis 4 mm. ex jugulo affixis, antheris 1.8 mm. longis 1.3 mm. latis oblique ovatis, *stilo* 1-2 mm. longo tereto glabro, stigmatibus 2.5 mm. longis, *ovario* 5-6 mm. longo lanceoloideo glabro, *fructu* albo 12-14 mm. longo 5-8 mm. diametro lanceoloideo vel ovoideo apiculato sparse puberulo infra apicem, seminibus 0.24-0.27 mm. longis 0.12-0.13 mm. diametro asymmetricice ellipsoideis reticulatis.

Shrub 1-5 m. tall; stems 8-15 mm. in diameter, terete; older dark brown, drying with many longitudinal fissures; leaf scars 3.5-5 mm. high, pale, semiorbicular-shield-shaped; bundle scars 7; bare branchlets soon glabrate; young shoots densely subadpressed puberulent; leafy branchlets sparsely adpressed puberulent, quadrangular, 2-3 mm. in diameter; internodes 6-80 mm., averaging 10 mm. long; *leaves* opposite, ascending, then spreading, borne at the 3-5 upper nodes, those of a pair unequal, one being $\frac{1}{4}$ the larger; petioles 20-60 mm. long, at maturity sparsely adpressed puberulent; *blades* 3-25 cm. long, 13-100 mm. wide, chartaceous, elliptic or broadly so, to elliptic-obovate, often asymmetric, cuneate at base, the apex subacuminate or acuminate above,

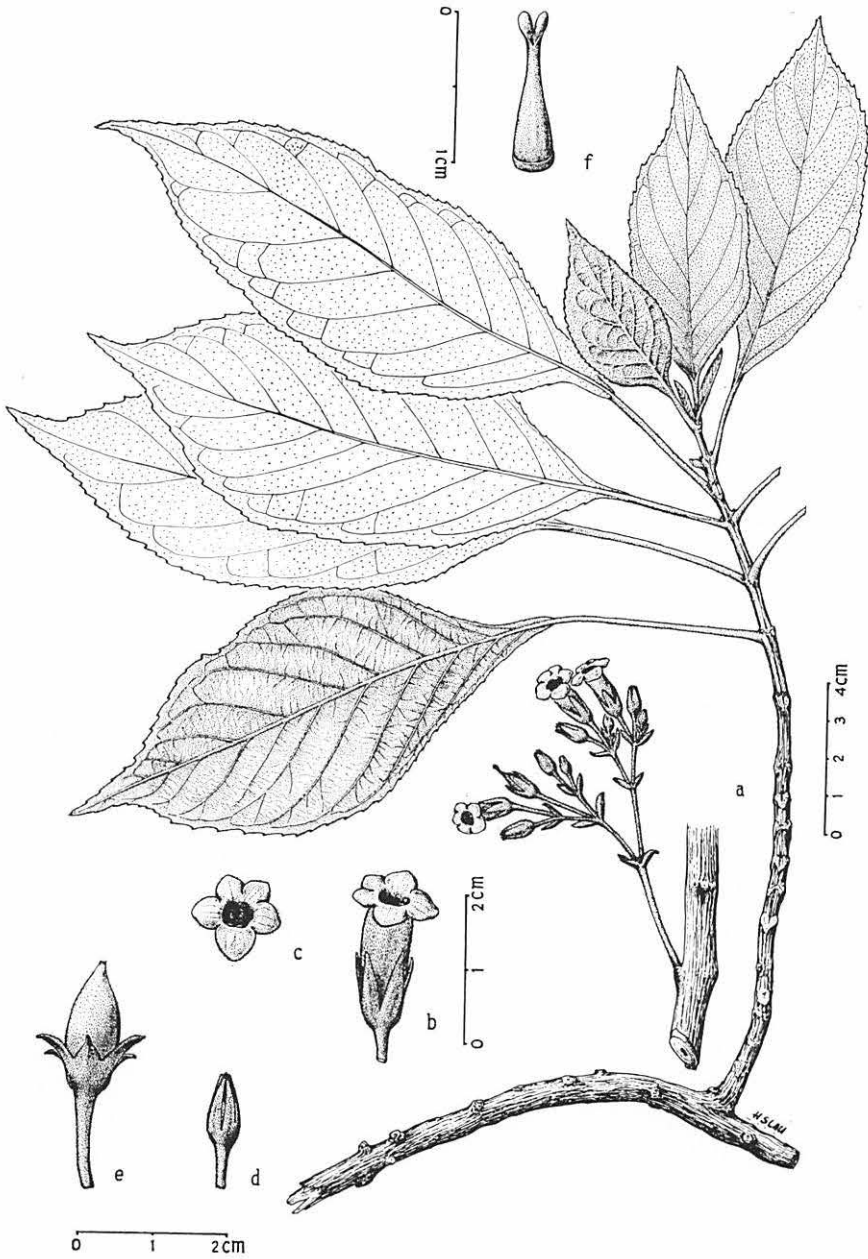


FIGURE 52.—*Cyrtandra adpressipilosa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, $\times 1$; f, pistil, $\times 2$. Waiahole, St. John 22,579, holotype (Bishop Mus.).

remotely appressed pustulate hirsutulous, dark green, below whitish green, the veins moderately appressed puberulent, the intervals subremotely appressed puberulous, margin coarsely serrate, the secondary veins 7-11 on a side, gently upward arching, excurrent in the teeth; *cymes* 3-10 cm. long, cauliflorous on the lower, naked branches, 5-13-flowered, single or more commonly paired at an axil, white throughout, appressed puberulent, or a few cymes in leafy axils on weak secondary branches, and on these the calyx is green; peduncles 8-30 mm. long, slender; pedicels 5-16 mm. long, slender; bracts 3-12 mm. long, lanceolate or narrowly so, foliaceous, becoming green; bud lanceoloid, the calyx lobes erect and connivent; *calyx* in anthesis when fresh 8-9.5 mm. long (when dried 5-8 mm. long), white, but later in fruit becoming greenish, appressed puberulent, the hairs 0.2 mm. long, spaced, the tube 2.5-3 mm. long, campanulate; the limb thick, fleshy, 5-lobed, 2-lipped, cleft down 5.5-7 mm. between the lobes; upper lip 3-lobed, the lobes glabrous within, narrowly lanceolate, blunt, similar, but the central one 5 mm. long; lower lip with two lobes, cleft 6 mm. between the lobes, the lobes lanceolate, blunt; *corolla* when fresh 16-19 mm. long (when dried 13-18 mm. long) white, without white hirsutulous where exposed, within glabrous, tube 11-14 mm. long, 3-5.5 mm. in diameter, cylindrical, almost straight; limb 2-lipped, 5-lobed; upper lobes two, 3 mm. long, 5.5 mm. wide, depressed suborbicular, margin capitate glandular hirsute ciliate; lower lip 3-lobed, the lateral lobes 3.5-4 mm. long, 4.5-5.5 mm. wide, rhombic-suborbicular, auriculate; lower lobe 3.5-4 mm. long, 4-5 mm. wide, suborbicular, auriculate; two lower stamens perfect, with the filaments adnate to the corolla tube to within 4 mm. of the throat, the free portion 1.5 mm. long, stout, twisted, but directed forward instead of ascending, the 2 perfect anthers 1.8 mm. long, 1.3 mm. wide, obliquely ovate, the connective ovate; lateral staminodia adnate to the corolla tube to within 4.5 mm. of the throat, the free portion 0.7-1 mm. long, terete, stout, with an apical thin ovate antheroid tip; the upper staminodium 0.4 mm. long, subulate; *style* 1-2 mm. long, terete, glabrous; stigmas 2.5 mm. long, obovate, connate $\frac{1}{2}$ way up proximal side; *ovary*, 5-6 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1 mm. high; *berry* white, 12-14 mm. long, 5-8 mm. in diameter, lanceoloid or ovoid, apiculate, sparsely puberulous except at the apex; seeds 0.24-0.27 mm. long, 0.12-0.13 mm. in diameter, asymmetric ellipsoid, honey-brown, but the ends dark brown, the body covered with raised cellular oblong reticulations $\frac{1}{4}$ to $\frac{1}{3}$ as long as the seed. This being a description of all specimens examined.

Distribution: Koolau Range: windward side, moist shady gulches or slopes from 400 to 2,000 ft. alt., from the Koa Zone to the Ohia Zone, from Kahana to Kaneohe; leeward side, at 1,400 ft. alt. in Kipapa Gulch.

Holotypus: Oahu, Waiahole, Waiahole Ditch Trail, N. Fork Uwau Stream, moist gulch, common, 700 ft. alt., Mar. 23, 1947, *H. St. John 22,579* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Kahana Valley, Waikane-Schofield Trail, steep rocky slope, 550 m. alt., Nov. 10, 1935, *Fosberg 12,321*; ditto, upper woods, 2,000 ft. alt., *St. John 10,525*; ditto, woods, 1,200-1,500 ft., Apr. 17, 1932, *Storey 173*; Waikane, Waiahole Ditch Trail, 800 ft. elev., Mar. 23, 1947, *Donaghho*; ditto, *Eugenia* woods, 750 ft. alt., Oct. 16, 1932, *St. John 12,111*; ditto, woods, 500 ft., Oct. 16, 1932, *Storey 202*; ditto, woods, 800 ft., Aug. 21, 1932, *Storey 206*; [Waiahole], Waianu, small gulch in lower forest, Aug. 10, 1937, *Degener, Salucop, McGuire & Topping 12,178* (NY); Waiahole Valley, Dec. 1919, *Rock*; Waiahole, Waiahole Ditch Trail, forest of *Aleurites moluccana* and *Acacia Koa*, 800 ft. alt., Mar. 23, 1947, *St. John 22,575*; ditto, see holotype;

Waikane-Waiahole Trail, Dec. 14, 1924, *Topping 2,955* (NY); Kaalaea, moist bank under *Eugenia malaccensis*, 400 ft. alt., Nov. 2, 1941, *St. John 20,271*; Waihee Valley, south ridge, wooded ridge and gulch, 500 to 1,000 ft. alt., May 11, 1941, *St. John & Storey 20,236*; ditto *St. John & Storey 20,236 A*; ditto, head of n. w. gulch, wet shady mossy cliff, 400 ft. alt., June 1, 1941, *St. John 20,250*; Kahaluu, n. ridge, steep fairly moist slope, 1,000 ft. elev., July 4, 1935, *Hosaka 1,284*; ditto, small gulches on n. slope, moist open forest, 300 m. alt., July 4, 1935, *Fosberg 12,200*; Heeia, Haiku Valley, moist shaded woods, 450-900 ft. elev., Dec. 11, 1932, *Storey 231*; ditto, *Storey 231 A*; Kaneohe, Luluku Stream, moist stream bank above intake, 500 ft., alt., Apr. 27, 1941, *St. John 20,227*; ditto, N. Fork Luluku Stream, foot of waterfall, 700 ft., alt., *St. John 20,228*.

Leeward Side: Kipapa Gulch, S. Ridge Trail, hillsides, 1,400 ft. elev., Nov. 13, 1932, *Storey 221 A*.

Discussion: *C. adpressipilosa* is a member of the section *Schizocalyces* and there is found its closest relative, *C. stupantha*, which is also conspicuous in having the inflorescences on old, naked stems. The two are contrasted in the key and other detailed differences are to be found in the descriptions. The ranges of the two almost, but not quite, touch, *C. stupantha* occurring on the windward slope of the Koolau Range south to Punaluu and Kaaawa; whereas *C. adpressipilosa* begins to appear at the head of Kahana Valley, less than three miles distant and then extends continuously to Kaneohe. There is a single collection that is intermediate in characters, having the style glabrous but the calyx spreading hirsutulous and the inflorescences both cauliflorous and axilliflorous. This specimen, *Fosberg 13,713*, was collected on the west side of Kahana Valley, six miles upstream, at an altitude of 100 meters. Since it occurs in the neutral zone between the two species and as it recombines their essential characters, it is here treated as the putative hybrid, *C. adpressipilosa* × *stupantha*.

Besides the diagnostic characters given in the key the following are also observed. *C. stupantha* has the blades above appressed pilose or hirsutulous, below the veins loosely pilosulous and the intervals sparsely appressed puberulous; the inflorescence almost wholly cauliflorous; the corolla when dried 12-14 mm. long; ovary puberulent; and the berry closely puberulent. *C. adpressipilosa* has the blades above remotely appressed pustulate hirsutulous, below moderately appressed puberulent on veins and intervals; the inflorescence wholly cauliflorous or axilliflorous on weak laterals or branches exposed to much sunlight; the corolla when dried 13-18 mm. long; ovary sparsely puberulous; and the berry minutely puberulous. Even though the aspect of the two is similar, they seem to be good species.

The specific epithet is coined from the Latin *adpressus*, pressed onto, and *pilosa*, with hairs, or in its modern meaning, with long soft hairs.

31. *Cyrtandra arcuata* St. John, sp. nov. (Figs. 53, 188).

Diagnosis Holotypi: Frutex 1 m. alta multiramosa, ramulis ad 8 mm. diametro laevibus brunneis carnosis in sicco contractis et multistriatis, cicatricibus 3-4 mm. altis pallidis corticosis depresso-scutelliformibus, fasciculis 5 et V-formibus, novellis dense brunneo-hirsutulis, ramis foliferis 2-5 mm. diametro quadrangularibus dense hirsutulis, internodis 9-50 mm. plerumque 20 mm. longis, foliis oppositis divergentibus non aggregatis in 3-5 nodis superis affixis inaequalibus uno $\frac{1}{4}$ - $\frac{1}{2}$ minore petiolis 12-58 mm. longis validibus dense brunneo-hirsutulis, lamina 5-13 cm. longis 18-58 mm. latis crasse firmo-chartaceis late oblanceolatis vel etiam lanceolatis vel ellipticis apice acuto basi cuneato marginibus denticulatis sed ad apicem serratis supra obscure viridibus et remote hirsutis deinde glabris infra albo-viridibus et dense hirsutulis nervis secundariis 6-9 in uno latere adscendentibus proxime marginibus arcuatis in dentibus apiculato-salientibus, cymis axillaribus 3-5-floriferis dense fulvo-hirsutis, pedunculis 8-13 mm. longis, pedicellis 7-14 mm. longis, bracteis 6-9 mm. longis lineari-lanceolatis foliaceis, alabastris campanulatis, calycibus in flore 19-20 mm. longis (in sicco 12-16 mm.) asymmetrico-campanulatis viridibus extra pilosis intra glabris evidenter bilabiatis sed subaequaliter fere ad basim partitis tubo 2-3 mm. longo, labia supera trilobata lobis 17-18 mm. longis 6 mm. latis subsymmetrico-lanceolatis prominente trinervatis, labia infera bilobata lobis 18 mm. longis 5.5 mm. latis falcato-lanceolatis, corollis albis 24-27 mm. longis quando bullitis (in sicco 20-22 mm.) extra crebre albo-villosis excepta in basi et in partibus lobarum in alabastro obtectis, tubo 17-20 mm. longo recto cylindrico 6 mm. diametro intra glabro, limba bilabiata 5-lobata, lobis superis binis 5 mm. longis 7 mm. latis reniformibus valde auriculatis et impensis in basi, lobis omnibus intra glabris excepta in orifice capitato-glanduloso-puberulis, labia infera trilobata, lobis lateralibus 7 mm. longis et latis ovato-suborbicularibus auriculatis, loba infera 6.5-7 mm. longa 7-8 mm. lata late ovato-suborbiculari auriculata, staminibus binis inferis in tubo 6 mm. ex orifice adnatis parte libera 1.5 mm. longa subulata contorte adscendente, antheris 2.5 mm. longis 1.8 mm. latis asymmetrico-ovalibus connectivo ovali, staminodeis lateralibus in tubo 8 mm. ex orifice affixis parte libera 1 mm. longa lanceo-ligulata, stylo 1 mm. longo cum apice ovari sparse crebre hispido, lobis stigmatibus binis 4.5 mm. longis 2.5 mm. latis ovalibus aequaliter partitis in dorso hispidis, ovario 7 mm. longo lanceoloideo glabro excepta in apice in basi disco cupulato 1 mm. alto cincto, fructibus incognitis.

Shrub 1 m. tall, bushy branched; branchlets as much as 8 mm. in diameter, smooth, brown, fleshy and on drying shrinking to form many longitudinal ridges and furrows; leaf scars 3-4 mm. high, pale, corky, low shield-shaped; bundle scars 5, V-shaped; young shoots densely brownish hirsutulous; leafy branchlets 2-5 mm. in diameter, quadrangular, densely hirsutulous; internodes 9-50 mm., averaging 20 mm. long; leaves opposite, diverging, not crowded, borne at the 3-5 upper axils, those of a pair unequal, one being $\frac{1}{4}$ - $\frac{1}{2}$ smaller; petioles 12-58 mm. long, densely brown hirsutulous, stout; blades 5-13 cm. long, 18-58 mm. wide, thick firm chartaceous, broadly oblanceolate or even lanceolate or elliptic, the apex acute, the base cuneate, the margin denticulate but towards the apex serrate, above dark green and remotely hirsute, later glabrate, below whitish green and closely hirsutulous, the secondary veins 6-9 on a side, ascending, then arcuate to margin and apiculate salient in the teeth; cymes axillary, 3-5-flowered, densely tawny hirsute; peduncles 8-13 mm. long; pedicels 7-14 mm. long; bracts 6-9 mm. long, linear-lanceolate, foliaceous; buds campanulate; calyx in anthesis 19-20 mm. long when boiled (12-16 mm. when dried), asymmetric campanulate, green, without pilose, within glabrous, subequally cleft almost to the base, perceptibly 2-lipped; calyx tube 2-3 mm. long; upper lip 3-lobed, the lobes cleft to within 2 mm. of the base, 17-18 mm. long, 6 mm. wide, subsymmetric lanceolate, strongly 3-nerved; lower lip with 2 lobes cleft to within 3 mm. of the base, 18 mm. long, 5.5 mm. wide falcate-lanceolate; corolla white, 24-27 mm. long when boiled (20-22 mm. when dried), without shaggy white villous except at the very base and on the portions of the lobes covered in vernation, the tube 17-20 mm. long, straight, cylindric, 6 mm. in diameter, within glabrous; limb 2-lipped, 5-lobed; upper lobes two, 5 mm. long, 7 mm. wide, kidney-shaped, strongly

auriculate and overlapping, like the other lobes glabrous within except for being capitate glandular puberulous at the throat; lower lip 3-lobed; lateral lobes, 7 mm. long and wide, ovate-suborbicular, auricled; lower lobe 6.5-7 mm. long, 7-8 mm. wide, broadly ovate-suborbicular, auricled; two lower stamens with filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 1.5 mm. long, stout subulate, spirally upcurved; the two perfect anthers 2.5 mm. long, 1.8 mm. wide, asymmetric oval, as is the large connective; the two lateral staminodia with their filaments adnate

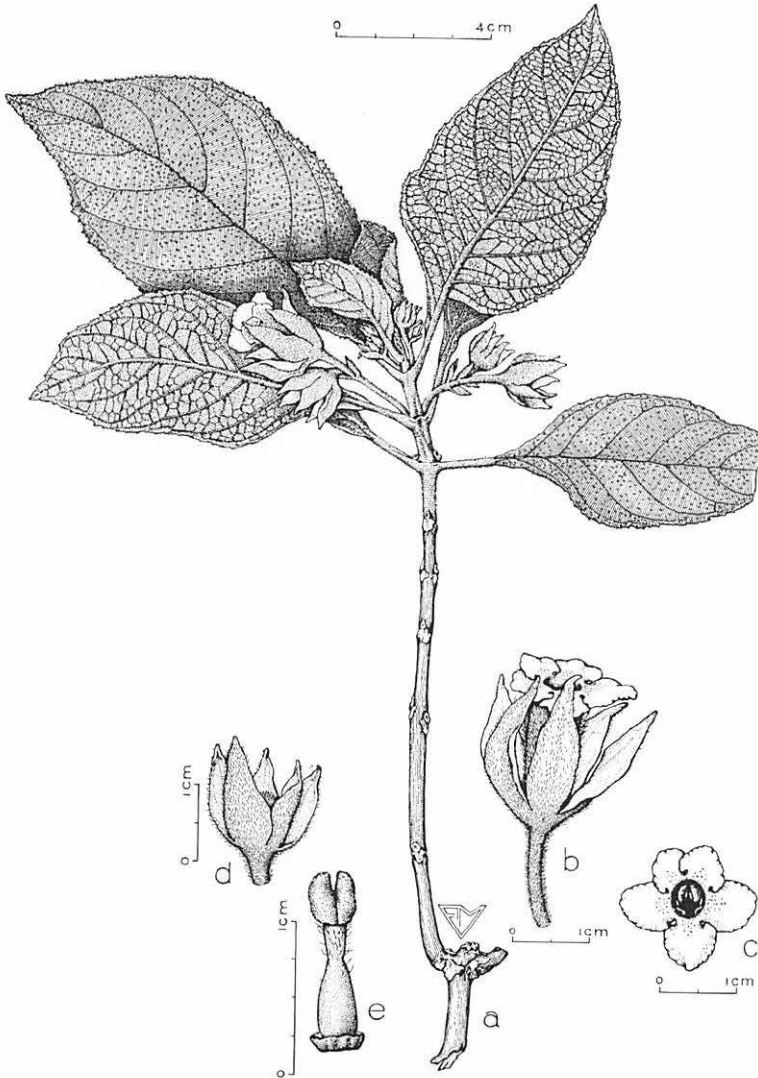


FIGURE 53.—*Cyrtandra arcuata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Kahana Valley, St. John 13,421, holotype (Bishop Mus.).

to the corolla tube to within 8 mm. of the throat, the free part 1 mm. long, lance-ligulate, sterile; the upper staminodium attached to within 9 mm. of the throat, minute; *style* 1 mm. long, it and the apex of the ovary sparsely coarse hispid; stigmatic lobes two, 4.5 mm. long, 2.5 mm. wide, oval, separate to the base, hispid on the back; *ovary* 7 mm. long, lanceoloid, glabrous except at apex, the base surrounded by a cupulate disk 1 mm. high; fruit unknown.

Distribution: Koolau Range, windward side, at the head of Kahana Valley, alt. 1,000 ft. in the Ohia Zone; known only from the type collection.

Holotypus: Oahu, Kahana Valley, Waiahole Ditch Trail, Hauula Forest Reserve, open woods, 1,000 ft. alt., Dec. 10, 1933, *H. St. John 13,421* (BISHOP MUS.).

Discussion: *C. arcuata* is a member of the section *Schizocalyces*. It is most closely related to *C. opaaulae* but that species has the young shoots densely shaggy pilose; petioles 3-6 cm. long, shaggy pilose; blades usually oval, 29-78 mm. wide, thin chartaceous, above crinkly pilose, below appressed pilosulous, the margin coarsely serrate; cymes brownish pilose; peduncles 2-4 cm. long; bracts 12-35 mm. long; calyx 9-14 mm. long, pilose within; dried corolla 15 mm. long, pilose without. On the other hand *C. arcuata* has the young shoots densely hirsutulous; petioles 12-58 mm. long, hirsutulous; blades broadly oblanceolate, 18-58 mm. wide, thick firm chartaceous, the margin denticulate but serrate towards the apex; cymes tawny hirsute; peduncles 8-13 mm. long; bracts 6-9 mm. long; calyx 12-20 mm. long, glabrous within; dried corolla 20-22 mm. long, shaggy villous without.

The specific name is from the Latin *arcuatus*, bent or curved, in allusion to the strongly curved lower calyx lobes.

32. *Cyrtandra basipartita* St. John, sp. nov. (Figs. 54, 189).

Diagnosis Holotypi: Frutex, novellis dense subluteis hirsutis, ramulis foliosis ad 6-7 mm. diametro subteretibus carnosus et in sicco rugosis, internodis 12-45 mm. longis plerumque 30 mm. longis, *foliis* oppositis adscendentibus-divergentibus non approximatis in nodis 4-6 superis affixis subaequalibus, petiolis 35-63 mm. longis sparse hirsutis, *laminis* 15-17 cm. longis 10-10.7 cm. latis chartaceis late ovalibus apice subacuminato basi abrupte breve cuneata marginibus bisdenticulatis supra obscure viridibus scabris catenulato-hirsutis infra albi-viridibus et molliter catenulato-hirsutulis, nervis secundariis 6-8 in uno latere adscendentibus apicibus arcuatis interconnectis et in dentibus salientibus, *cymis* 7-9-floriferis hirsutis, pedunculis 20-26 mm. longis tenuibus, pedicellis 7-17 mm. longis tenuibus, bracteis 5-12 mm. longis lineari-lanceolatis foliaceis hirsutis, alabastris campanulatis, *calycibus* in flore 18 mm. longis quando bullitis (in sicco 13-15 mm.) anguste campanulatis extra hirsutis viridibus bilabiatis inter labias 15 mm. partitis, tubo 3-3.5 mm. longo campanulato intra glabro, labia supera trilobata lobis 14 mm. longis 3 mm. latis (in sicco 2.5-2.8 mm. latis) latissimis in tertia infera anguste lineari-lanceolatis trinervatis ad apicem acuminatis sed obtusis glabris intra hirsutis, labia infera bilobata lobis 15 mm. longis 3 mm. latis, *corollis* 34 mm. longis quando bullitis (in sicco 25-30 mm.) albis et extra albi-pilosis, tubo 25 mm. longo intra glabro in basi medioque 3 mm. diametro in orifice 6-7 mm. diametro et sparse minute capitato-glanduloso-puberulo, limbo bilabiato 5-lobato lobis extra pilosis, lobis superis binis 6.5-7 mm. latis suborbicularibus in basi rotundatis impensisque, labia infera trilobata lobis lateralibus 7.5 mm. longis 7 mm. latis suborbicularibus, loba infera 7.5 mm. longa 9 mm. lata suborbiculari in basi impensi, staminibus inferis binis perfectis cum corolla

adnatis 6 mm. ex orifice parte libera 3 mm. longa incurvata, antheris 2.1 mm. longis oblique late ovatis connectivo late ovato, staminodiis 0.5 mm. longis in tubo 9 mm. ex orifice affixis, *style* 4 mm. longo glanduloso-hirsuto, lobis stigmatibus binis 3 mm. longis ellipticis $\frac{1}{3}$ connatis, *ovario* 8 mm. longo lanceoloideo glabro in basi cum disco cupulato 1.1 mm. alto cincto, fructu ignoto.

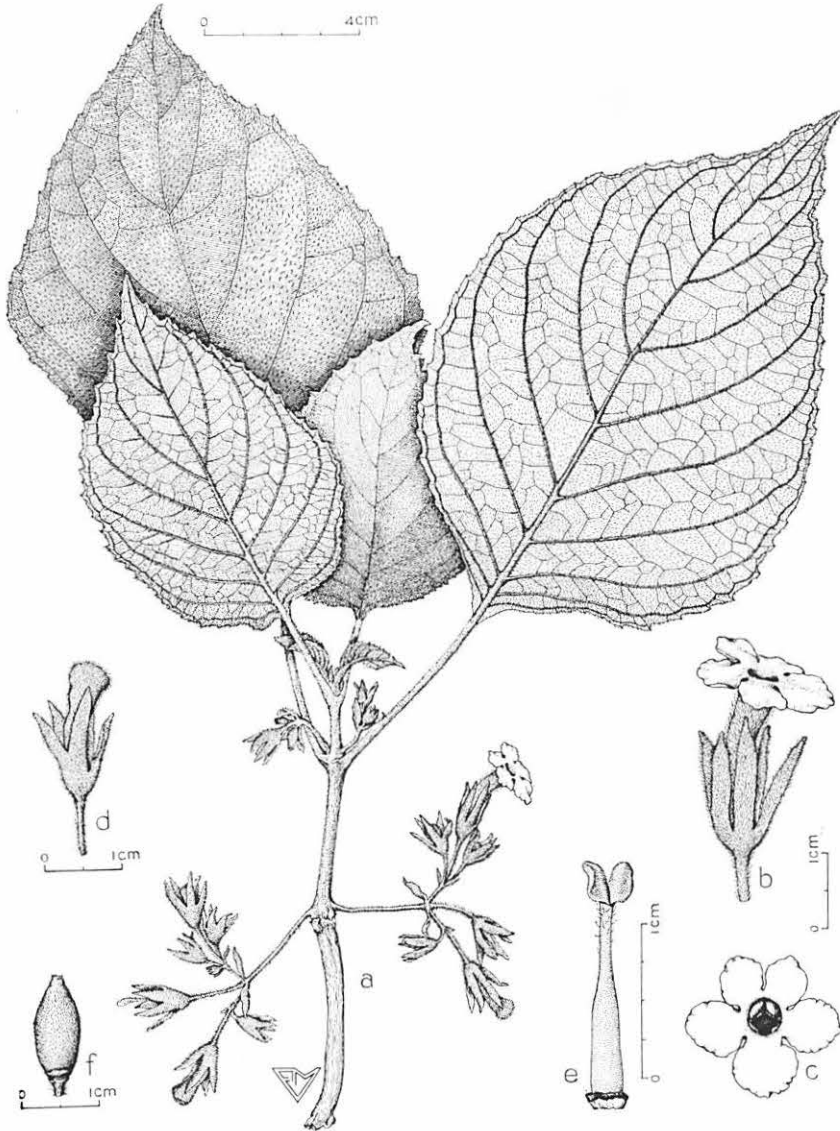


FIGURE 54.—*Cyrtandra basipartita*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Anahulu Trail, Storey 266A, holotype (Bishop Mus.).

Description of All Specimens: Shrub, branchlets as much as 8 mm. in diameter, at first hirsute; leaf scars 3-4 mm. high, low shield-shaped; bundle scars 5; young shoots densely yellowish hirsute; leafy branchlets as much as 6-7 mm. in diameter, subterete, fleshy, and shriveling on drying; internodes 12-45 mm., averaging 30 mm. long; *leaves* opposite, ascending diverging, not crowded, borne at the 4-6 upper nodes, subequal; petioles 35-82 mm. long, sparsely crinkly hirsute; *blades* 15-17 cm. long, 10-10.7 cm. wide, chartaceous, broadly oval (to oblique elliptic), the apex subacuminate, the base abruptly short cuneate, the margin doubly denticulate, above dark green and scabrous catenulate hirsute, below whitish green and more softly catenulate hirsutulous, the secondary veins 6-8 on a side, ascending, tips arcuate, inarched interconnecting and salient in the teeth; *cymes* 5-9-flowered, hirsute throughout; peduncles 20-26 mm. long, slender; pedicels 7-17 mm. long, slender; bracts 5-12 mm. long, linear-lanceolate, foliaceous, hirsute; buds campanulate; *calyx* in anthesis 18 mm. long when boiled (when dried 13-15 mm.), narrowly campanulate, hirsute without, green, perceptibly 2-lipped and cleft 15 mm. between the lips; tube 3-3.5 mm. long, campanulate, glabrous within; calyx lobes 5, two of which are asymmetric on the narrowed tip from an excurrent nerve with a terminal rounded nubbin; upper lip 3-lobed, the lobes 14 mm. long, 3 mm. wide (when dried 2.5-2.8 wide), widest $\frac{1}{3}$ way from the base, cleft to within 3.5 mm. of the base, narrowly linear lanceolate, 3-nerved, narrowing to a blunt, glabrous point at the apex, within hirsute; lower lip 2-lobed, the lobes 15 mm. long, 3 mm. wide, similar to and only slightly larger than the upper ones; *corolla* in anthesis when boiled 34 mm. long (when dried 25-30 mm.), white, white pilose without, the tube 25 mm. long, glabrous within, 3 mm. in diameter at base and middle, then slightly enlarging and at the throat 6-7 mm. in diameter and sparsely minutely capitate glandular puberulous; limb 2-lipped, 5-lobed, the lobes pilose without; upper lobes two, 6.5 mm. long, 7 mm. wide, suborbicular, the bases rounded and overlapping; lower lip 3-lobed, the lateral lobes 7.5 mm. long, 7 mm. wide, suborbicular; lower lobe 7.5 mm. long, 9 mm. wide, suborbicular, overlapping at base; two lower stamens perfect, with filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 3 mm. long, spirally upcurved, subulate; the two perfect anthers 2.1 mm. long, oblique broad ovate, the connective broadly ovate; staminodia 0.5 mm. long, connate to corolla tube to within 9 mm. of the throat; *style* 4 mm. long, glandular hirsute; stigmatic lobes two, 3 mm. long, elliptic, connate $\frac{1}{3}$ way up proximal side; *ovary* 8 mm. long, lanceoloid, glabrous, surrounded at base by a cupulate disk 1.1 mm. high; fruit unknown.

Distribution: Koolau Range, on both sides, in Kawailoa and Hauula, at about 1,600 feet, in moist woods in the Ohia Zone. The two regions are nearly on opposite sides of the mountain range.

Holotypus: Oahu, Koolau Mts., Anahulu Trail, 1,600 ft. alt., on wooded slopes along trail, moist shady habitat, Mar. 10, 1935, *W. B. Storey 266A* (BISHOP MUS.).

Specimens Examined: Koolau Range, windward side: Hauula, Waipilopilo, June 11, 1940, *Degener 17,717* (NY).

Discussion: *C. basipartita* is a member of the section *Schizocalyces*. In the key it comes next to and is contrasted with *C. opaaulae*. However, in appearance it is much more similar to *C. propinqua* Forbes which can be recognized by being shaggy villous; blades broadly oval to suborbicular, the veins below conspicuously shaggy villous, the base mostly cordate; bracts lance-ovate; calyx in anthesis 20-25 mm. long; corolla 22-25 mm. long; style none. In contrast, *C. basipartita* is hirsute and at length the parts only sparsely so; blades broadly oval to oblique elliptic, the lower surface rather uniformly

softly hirsutulous, the base abruptly short cuneate; calyx in anthesis 18 mm. long; corolla 25-34 mm. long; and the slender style hirsute.

The specific name is from the Latin *basis*, base; *partitus*, parted, in allusion to the deeply parted calyx.

33. *Cyrtandra Bryanii* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 85-86, 1950. (Figs. 55, 185.)

Description of All Specimens Examined: Shrub, 2-4 m. tall, branching, the branches with the bark smooth and glabrous, gray, with longitudinal ridges, the leaf scars 3-3.5 mm. high, rounded shield-shaped, corky, pale, raised; bundle scars 7; internodes 6-25 mm., usually about 12 mm. long; leafy branchlets subterete, subappressed ferruginous villous, tardily subglabrate; young shoots densely subappressed ferruginous villous; *leaves* opposite, equal or unequal, then one of the pair as much as $\frac{1}{4}$ the larger, spreading, in 2-9 pairs on a branch; petioles 7-22 mm. long, densely subappressed ferruginous villous; *blades* 3-12.5 cm. long, 11-46 mm. wide, subcoriaceous, elliptic or oblance-elliptic, apex acute or short subacuminate, the base cuneate, nearly straight and symmetric, plane, above green, impressed nerved, sparsely subappressed ferruginous scabrous hirsute from pustulate bases, below pale green, the much raised and prominent midrib and primary veins subappressed ferruginous villous, smaller veinlets and intervals finely viscid pilose, margin remotely serrulate; *cymes* from the leaf axils, 1-4-flowered, subappressed ferruginous villous; peduncles 4-13 mm. long, in anthesis ascending; pedicels 5-13 mm. long; bracts 6-9 mm. long, lanceolate, foliaceous, persistent; buds subglobose to cupulate, the calyx lobes approximate but distinct; *calyx* in anthesis 8-13 mm. long, not accrescent, loose, cupulate, densely subappressed villous, lobed $\frac{5}{6}$ way, nearly regular and the 5 lobes subequal, lobes 7-11 mm. long, ovate, or lance-ovate, not overlapping at base, within sparsely hirsutulous; *corolla* 14-18 mm. long, white, nearly straight; the tube 10-14 mm. long, 4-7 mm. in diameter, nearly straight tubular, densely villous outside, the inside glabrous, the throat 6-7 mm. in diameter, very thick, fleshy and firm; the limb 2-lipped, 5-lobed, the lobes apparently spreading at about 50° from the axis of tube, overlapping at base, all thick, fleshy and firm from the throat almost to the tip, glabrous within, densely villous without; the 2 upper lobes 4-5.5 mm. long, suborbicular; lower lip 3-lobed, the 2 lateral lobes 5-5.5 mm. long, orbicular, the lower lobe 4.5-5 mm. long, orbicular; two lower stamens perfect, filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 2 mm. long, spirally upcurved; the 2 perfect anthers 3 mm. long, flattened, obliquely ovate, attached off center, connate at apex; staminodia two, 1 mm. long, subulate, attached to the tube to within 5.5 mm. of the throat; *style* wanting or nearly so; stigmas 2.5-2.8 mm. long, opposite, equal, elliptic-ovate; *ovary* lanceoloid, sparsely villous towards the tip, the base surrounded by a cupulate disk 1.5 mm. high; fruit "ovoid, creamy white."

Distribution: Koolau Range, leeward side, near the north end in Kawai-
loa at 1,600-2,000 ft. alt., in the Ohia Zone.

Holotype: Oahu, Kawai-
loa, 1,600 ft. alt., undershrub in moist rain forest, Oct. 2, 1934, E. H. Bryan, Jr. 813 (BISHOP MUS.).

Specimens Examined: Koolau Range.

Leeward Side: Kawai-
loa, 1,700 ft. alt., undergrowth in lower rain forest, shrub or small tree, Nov. 20, 1934, Bryan 859; ditto, C.C.C. Trail, rich, partly sunny gulch, 2,000 ft. alt., July 3, 1938, Degener & Ordóñez 12,057 (NY); ditto, rain forest, July 3, 1938, Degener 17,125 (NY); Anahulu Trail, forest, March 23, 1939, Degener (NY).

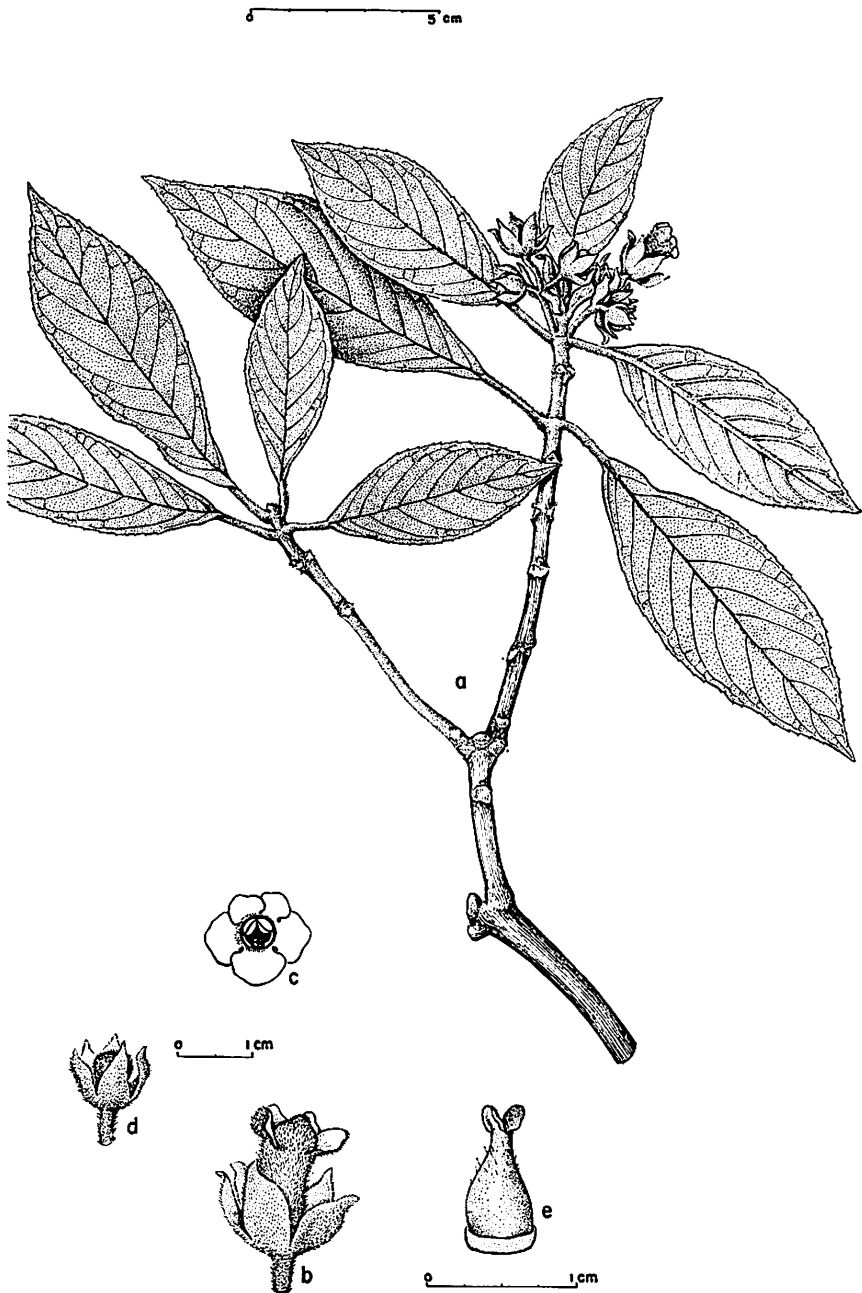


FIGURE 55.—*Cyrtandra Bryonii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Kawaioloa, Bryan 813, holotype (Bishop Mus.).

Discussion: *C. Bryanii* is a member of the section *Schizocalyces*. It resembles *C. Lessoniana* Gaud. var. *Lessoniana* in having a loose, cupulate calyx, but the calyx is green and without revolute margins.

The new species is named for its collector, Edwin H. Bryan, Jr., Curator of Collections at B. P. Bishop Museum.

34. *Cyrtandra charadraia* St. John, sp. nov. (Figs. 56, 192).

Diagnosis Holotypi: Frutex, ramulis 8-10 mm. diametro hirsutis deinde glabratibus quadrangularibus in sicco rugescentibus, cicatricibus 4-6 mm. altis late scutelliformibus sed annulosis et connatis, ramulis foliosis ad 8 mm. diametro quadrangularibus dense brunneo-hirsutis, internodis 2-4.3 cm. longis plerumque 3 cm. longis, novellis dense brunneo-hirsutis, foliis oppositis adscendentibus non congregatis in 3-4 nodis superis affixis aequalibus, petiolis alatis vel nullis ad nodis late perfoliatis carnosus et supra glabris, lamina 26-35 cm. longis 16.5-22.5 cm. latis tenuiter chartaceis late ovalibus apice subacuta basi longe cuneati et decurrenti $\frac{1}{4}$ - $\frac{1}{8}$ parte foliarum infra in nervis hirsutis et in intervallis sparse hirsutis marginibus irregulariter depresso-serrulatis, nervis secundariis 7-8 in uno latere apicibus arcuatis interconnectis et in dentibus salientibus, cymis axillaribus dense hirsutis 13-17-floriferis, pedunculis 5-7 mm. longis, pedicellis 9-15 mm. longis gracilibus, bracteis 8-13 mm. longis semifoliaceis linearilanceolatis ad basem glabris, alabastris campanulatis lobis calycorum distinctis adscendentibus, calycibus in flore viridibus 18-19 mm. longis quando bullitis (in sicco 13-17 mm. longis) extra hirsutis, tubo 6-7 mm. longo anguste campanulato intra glabro, limbo 11-13 mm. longo bilabiato 5-lobato intra hirsuto sinibus inter lobis 5 mm. e basi, labia supra trilobata lobis 12-16 mm. longis 2 mm. latis linearibus trinervatis subacutis adscendentibus, lobis binis inferis 15-16 mm. longis 2.5 mm. latis linearibus attenuatis, corollis albis quando bullitis 25-29 mm. longis (in sicco 22-24 mm.) tubo 20-24 mm. longo valde infundibuliformibus subrectis, in basi 3-3.5 mm. diametro in medio 4 mm. in orifice 7-9 mm. extra hirsuto excepta in basi intra glabro, limbo bilabiato 5-lobato, lobis extra sparse hirsutis intra capitato-glanduloso-puberulis ad orificem, lobis superis binis 4 mm. longis 6.5 mm. latis semiorbicularibus e 25° divergentibus, labia infera trilobata, lobis lateralibus 6 mm. longis 6-8 mm. latis semiorbicularibus, loba infera 6-7 mm. longa 5.5-6 mm. lata late ovalibus, staminibus binis inferis fertilibus cum corolla adnatis 6-7 mm. ex orifice, parte libera 2 mm. longa subulata incurvata, antheris 2 mm. longis oblique late asymmetriciter ovatis, connectivo 1.7 mm. longo oblique ovalibus, staminodiis lateralibus 0.9 mm. longis subulatis in apice subcapitatis cum corolla adnatis 8 mm. ex orifice, staminodia supra 0.8 mm. longa subulata, stylo 2 mm. longo hirsuto, lobis stigmatis binis 3.5 mm. longis ovalibus in dorso hirsutis $\frac{1}{2}$ connatis, ovario 4 mm. longo lanceoloideo glabro in basi cum disco cupulato 1.3 mm. alto cincto, fructu ignoto.

Description of All Specimens: Shrub 1 m. tall; branchlets sparsely hirsute to glabrate, 8-10 mm. in diameter, fleshy, much shrunken on drying, quadrangular; leaf scars 4-6 mm. high, broad shield-shaped, annular from broad connecting ring; bundle scars not observed; leafy branchlets as much as 8 mm. in diameter, quadrangular, densely brownish hirsute; internodes 1.4-4.3 cm., averaging 3 cm. long; young shoots densely brownish hirsute; leaves opposite, ascending, not crowded, borne at 3-4 upper nodes, those of a pair equal in size; petioles winged almost to the base or none, the leaves perfoliate by a broad fleshy flange, glabrous above; blades 12.8-37 cm. long, 8-22.5 cm. wide, thin chartaceous, broad oval, the apex abruptly subacute, the base cuneate tapering and decurrent for $\frac{1}{4}$ - $\frac{1}{8}$ the length of the leaf, above dark green and well-spaced catenulate hirsute, below hirsute on the veins and sparsely so on the intervals, the margins minutely low and irregularly serrulate, secondary veins 7-8 on a side, ascending, the tips arcuate and inarched interconnecting and salient in the teeth; cymes axillary densely shaggy hirsute, 13-17-flowered; peduncles 5-7 mm. long; pedicels 9-15 mm. long, slender; bracts 8-13 mm. long, semifoliaceous, linear-lanceolate, glabrous

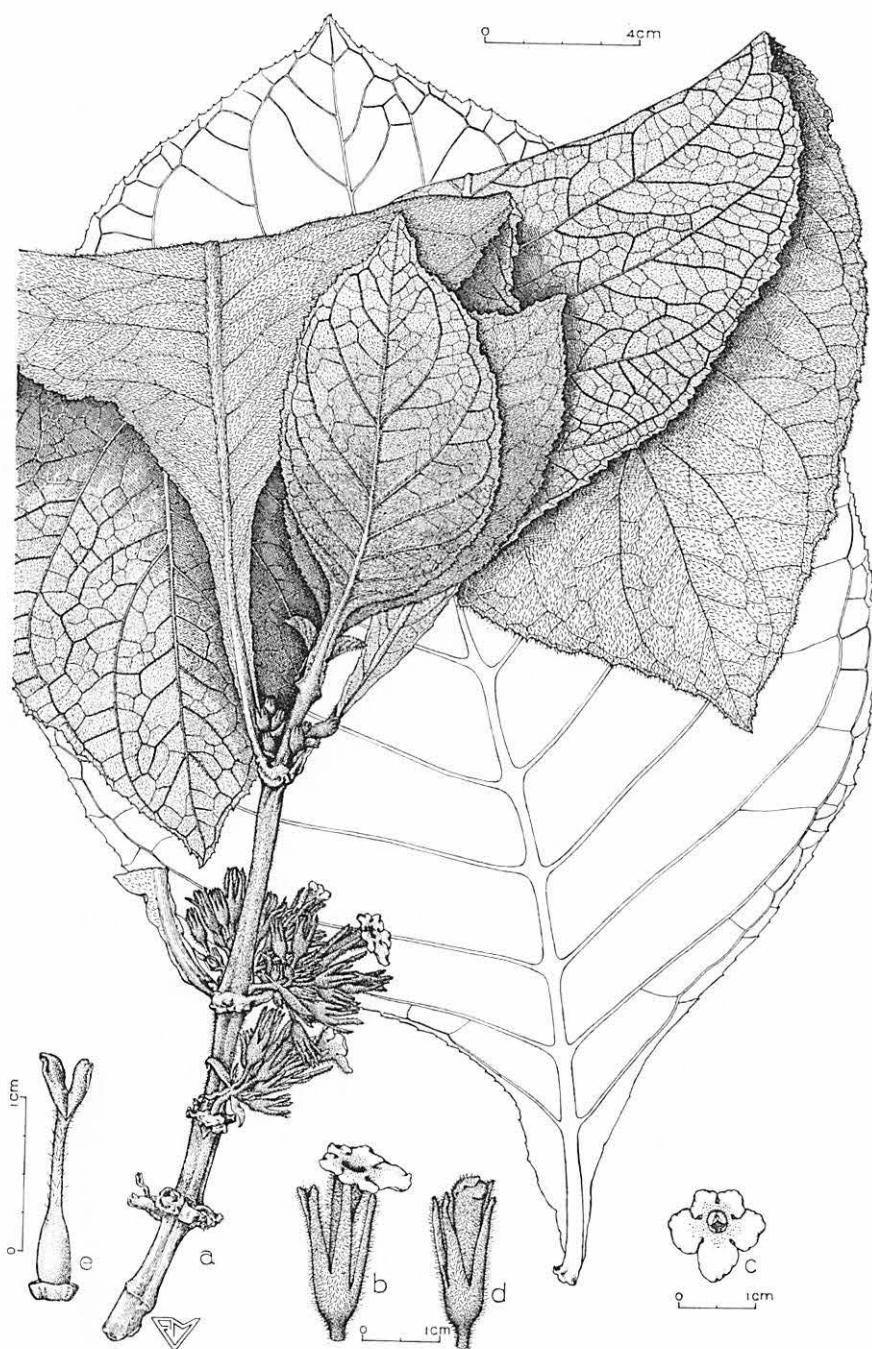


FIGURE 56.—*Cyrtandra charadraia*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Puu Kaala, holotype, Storey 142 (Bishop Mus.).

towards base; buds campanulate, the calyx lobes distinct, ascending; *calyx* in anthesis green, 18-19 mm. long when boiled (13-17 mm. when dried), hirsute without, the tube 6-7 mm. long, narrowly campanulate, within glabrous; limb 11-13 mm. long, 2-lipped, 5-lobed, hirsute within, cleft between the lips to within 5 mm. of the base; upper lip 3-lobed, cleft between the lobes to within 6 mm. of the base, the lobes 12-16 mm. long, 2 mm. wide, linear, subacute, three-nerved, ascending; lower lip 2-lobed, lobes 15-16 mm. long, 2.5 mm. wide, linear, tapering; *corolla* white, when boiled 25-29 mm. long (when dried 22-24 mm.), the tube 20-24 mm. long, strongly funnellform, almost straight, at base 3-3.5 mm. in diameter, at middle 4 mm., at the throat 7-9 mm., without hirsute almost to the base, within glabrous; limb 2-lipped, 5-lobed, the lobes sparsely hirsute without, and within capitate glandular puberulous towards the throat; upper lobes two, spreading at about 25° to the axis of the throat, 4 mm. long, 6.5 mm. wide, semiorbicular; lower lip 3-lobed; lateral lobes 6 mm. long, 6-8 mm. wide, semiorbicular; lower lobe 6-7 mm. long, 5.5-6 mm. wide, broadly oval; two lower stamens fertile, with filaments adnate to the corolla to within 6-7 mm. of the throat, the free portion 2 mm. long, spirally upcurved, subulate, the two perfect anthers 2 mm. long, obliquely broad asymmetric ovate, the connective 1.7 mm. long, obliquely oval; two lateral staminodia 0.9 mm. long, subulate, minutely capitate at apex, the filament adnate to the corolla tube to within 8 mm. of the throat; upper staminodium 0.8 mm. long, subulate; *style* 2 mm. long, hirsute; two stigmatic lobes 3.5 mm. long, oval, hirsute on the back, connate ½ way up proximal side; *ovary* 4 mm. long, lanceoloid, glabrous, surrounded by a cupulate disk 1.3 mm. high; fruit unknown.

Distribution: Waianae Mountains, Mt. Kaala, windward side at 1,800 ft. alt., in the Ohia Zone. Known positively in only one small gulch off the Fire-break Trail.

Holotypus: Puu Kaala, Waianae Mts., in narrow ravine which trail crosses about ¼ mile before running stream, densely shaded and humid, 1,800 ft. elev., Jan. 8, 1932, *W. B. Storey 142* (BISHOP MUS.).

Specimens Examined: Waianae Mountains.

Windward Side: Mt. Kaala [*Hillebrand*]; Kaala, lower slopes, shrub in small valley, Jan. 10, 1932, *Hume 452*; canyon above Kaala Trail, above Schofield, bottom of wet canyon, 650 m. alt., Jan. 8, 1933, *Fosberg 9,127*; Puu Kaala, small damp, densely shaded ravine, 1,800 ft. elev., May 1, 1932, *Storey*.

Oahu: 1929, *Nitta (Degener 7,562)*, (NY).

Discussion: *C. charadraia* is a member of the section *Schizocalyces*. The early collections of it were identified first as *C. kalichii*, then as *C. kalichii* var. *tristis*. The latter, here classed as *C. tristis*, is a species of the southern Koolau Range and is certainly the closest relative, but it differs by having the leaves of the pair at a node unequal, fleshy; blades 8-45 cm. long, 8-18 cm. wide; cymes 8-11-flowered, hirsutulous; peduncles 6-10 mm. long; pedicels 4-12 mm. long; bracts 5-10 mm. long; calyx in anthesis when fresh 10-16 mm. long, hirsutulous, the tube 2-3 mm. long, the lobes 8-13 mm. long, narrowly linear-lanceolate; corolla when fresh 18 mm. long, the tube densely glandular pilose without; style and tip of ovary capitate glandular puberulent. On the other hand *C. charadraia* has the leaves equal, chartaceous; blades 12.5-37 cm. long, 8-22.5 cm. wide; cymes 13-17-flowered, shaggy hirsute; peduncles 5-7 mm. long; pedicels 9-15 mm. long; bracts 8-13 mm. long; calyx in anthesis



FIGURE 57.—*Cyrtandra chartacea*: a, habit, $\times \frac{1}{2}$; b, bud, $\times 1$. Kipapa, Hosaka 605, holotype (Bishop Mus.).

when fresh 18-19 mm. long, hirsute without, the tube 6-7 mm. long, the lobes 12-16 mm. long, linear, subacute; corolla when fresh 25-29 mm. long, the tube hirsute without; style hirsute; ovary glabrous. Thus, it is seen that from *C. tristis*, the new *C. charadraia* has numerous and significant differences, and it occurs in a separate area on a different mountain range.

The new specific name is Greek, *charadraia*, of a mountain torrent, or ravine.

35. *Cyrtandra chartacea* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 86, 1950. (Figs. 57, 188.)

Description of Holotype: Shrub, branches buff-colored, smooth and glabrous, the leaf scars pale, corky, and raised; internodes 2-3.5 cm., usually 2.5 cm. long; leafy branchlets subquadrangular, 2-4 mm. in diameter, ascending ferruginous hirsutulous, finally glabrate; young shoots densely ascending, ferruginous hirsutulous; *leaves* opposite, subequal, the several pairs not remote; petioles 2-5 cm. long, slender, ascending ferruginous hirsutulous; *blades* 4-21 cm. long, chartaceous, narrowly oblanceolate, long decurrent at base, the apex short acuminate, blade nearly straight and symmetric, plane, above a darkish green, remotely hirsutulous, below pale green, and ferruginous hirsutulous especially on the veins, the intervals soon glabrate, the margin irregularly and remotely callous serrulate except towards the entire base; *cymes* from the leaf axils, 1-3-flowered, densely ascending, ferruginous hirsutulous; peduncles 12-15 mm. long, ascending; pedicels 3-10 mm. long, slender; bracts 8-10 mm. long, narrowly linear-lanceolate, glabrate; buds campanulate, the calyx lobes distinct; *calyx* 18-20 mm. long, broad funnellform, ferruginous hirsutulous, densely so at base, decreasingly so upwards and sparsely so at tip, slightly oblique and 2-lipped, the upper lobes the longer, lobed $\frac{1}{2}$ way to base, the lobes 9-12 mm. long, subequal, lanceolate, sparsely hirsutulous within; *corolla* in half-grown bud densely villous (6 mm. long), glabrous within; anthers 2 mm. long, deltoid-ovate, asymmetric; *style* pilose; *ovary* glabrous; fruit unknown.

Distribution: Koolau Range, leeward side, known only from Kipapa Gulch where it grows at 1,500 ft. alt. in the Ohia Zone.

Holotype: Oahu, Kipapa Gulch, south ridge, Waipio, in moderately moist side gully, 1,500 ft. alt., July 4, 1932, E. Y. Hosaka 605 (BISHOP MUS.).

Discussion: *C. chartacea* is a member of the section *Schizocalyces*. As indicated in the key it is close to *C. Fosbergii* St. John & Storey, but in appearance it would seem to be closer to *C. Wilderi* St. John & Storey var. *minor* St. John & Storey. That is characterized by having the calyx lobes linear-lanceolate, hirsute; blades 2.5-6.5 cm. long, subcoriaceous, abruptly cuneate at the base, and glabrous above. On the other hand, *C. chartacea* has calyx lobes lanceolate, hirsutulous; blades 4-21 cm. long, chartaceous, long decurrent at base, and sparsely hirsutulous above. This species is rare, and is known only from the type collection.

The specific name is taken from the Latin *chartaceus*, papery, in allusion to the thin texture of the blades.

36. *Cyrtandra Christophersenii* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 86, 1950. (Figs. 58, 195.)



FIGURE 58.—*Cyrtandra Christophersenii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Puu Hapapa, Storey and Hashimoto 126, holotype (Bishop Mus.).

Description of Holotype: Shrub; branches slender, longitudinally ridged, the bark buff-colored, smooth, glabrate; leaf scars pale, corky, slightly raised, connected and annular; bundle scars 5; internodes 5-20 mm., usually about 8 mm. long; leafy branchlets 1.5-3 mm. in diameter, subquadrangular, closely appressed, pale brownish pilosulous, tardily glabrate; young shoots densely appressed, brownish pilosulous; *leaves* opposite, distinctly unequal, ascending, the several pairs approximate; petioles 12-35 mm. long, appressed, pale brownish pilosulous; *blades* 5-13.5 cm. long, 23-56 mm. wide, chartaceous, elliptic, the apex acute, the base cuneate or short decurrent, slightly asymmetric and curved, plane, above green, and appressed pilosulous, below pale greenish and closely appressed pilosulous, the margin minutely and remotely serrulate; *cymes* from the leaf axils, but in fruit some borne from the 1-2 uppermost naked nodes, 3-flowered, densely appressed, pale brownish pilosulous throughout; peduncles 23-26 mm. long, slender, divergent; ascending in anthesis; pedicels 12-23 mm. long, slender, dilated at apex; bracts 5-10 mm. long, lanceolate, foliaceous; buds lance-ovoid, the calyx lobes distinct; *calyx* 11-14 mm. long, narrowly campanulate, closely appressed brownish pilosulous outside, slightly 2-lipped, cleft between the lobes to within 3-4 mm. of base; upper lip 2-lobed, the lobes 8-9 mm. long, linear-lanceolate; lower lip 2-lobed, the lobes 9-11 mm. long, similar; the tube 3-5 mm. long, campanulate; *corolla* 14-18 mm. long, white, the tube 12-15 mm. long, 3-5 mm. in diameter, cylindric and nearly straight, the exposed part densely white villous outside, glabrous within, the lobes 2-3 mm. long, subequal, suborbicular, villous without, glabrous within, apparently spreading at about 60° from the axis of the tube; upper lobes two, 3 mm. long, 5 mm. wide, transversely rhombic-elliptic, overlapping; lower lip 3-lobed; lateral lobes 3.5 mm. long, 6 mm. wide; lower lobe 4 mm. long, 6.5 mm. wide, transversely elliptic; filaments fused to the corolla tube to within 4 mm. of the throat, the free portion 1 mm. long, subulate, spirally incurved; anthers 1.5 mm. long, ovate, flattened, slightly oblique; *style* 1 mm. long, stout, glabrous; stigma with 2 flattened, opposite, narrowly elliptic, distinct lobes 2-2.5 mm. long; *ovary* lanceoloid, glabrous; *berry* when nearly mature 9-10 mm. long, ovoid, beaked, puberulent; seeds 0.43-0.5 mm. long, oblong-ellipsoid, shining, pale brown except for the dark brown ends, the surface raised cellular reticulate, the areolae broadly oblong, $\frac{1}{4}$ to $\frac{1}{2}$ length of the seed.

Distribution: Waianae Mountains, windward side, known only from Puu Hapapa, at 2,000 ft. alt., in the Ohia Zone.

Holotype: Oahu, Waianae Mts., Puu Hapapa, north side of wooded spur leading up to elev. 2,000 ft., Oct. 25, 1931, *W. B. Storey & Edward Y. Hashimoto 126* (BISHOP MUS.).

Discussion: *C. Christophersenii* is a member of the section *Schizocalyces*. Its closest relative is *C. hirsutula* St. John & Storey which has striking differences in leaf shape, texture, size, and pubescence of the parts. These are contrasted in the key.

The species was named in honor of Dr. Erling Christophersen of the Norwegian diplomatic service, Oslo, Norway.

37. *Cyrtandra elliptisepala* St. John, sp. nov. (Figs. 59, 191).

Diagnosis Holotypi: Frutex 6 dm. altus, ramulis ad 4 mm. diametro glabratibus pallide brunneis subquadrangularibus carnosius et in sicco contractis sulcatisque, cica-tricibus 2-3.5 mm. altis scutelliformibus approximatis pallidis suberosis margine sinuiter lobato, fasciculis 5; ramulis foliferis ad 3 mm. diametro subquadrangularibus crebre brunneo-adscendenti-hirsutis, internodis 4-50 mm. plerumque 12 mm. longis, novellis crebre brunneo-hirsutis, *foliis* oppositis divergentibus econgrogatis in 2-3 nodis superis affixis subaequalibus, petiolis 7-11 mm. longis dense adscendente brunneo-

hirsutis, *laminis* 3.5-6.1 cm. longis 13-22 mm. latis tenuiter chartaceis lanceo-ellipticis basi cuneata apice subacuminati marginibus serrulatis supra viridibus et catenulato-hirsutis nervis principalibus crebre adscendenti-pilosulis marginibus sime serrulatis nervis secundariis 7-9 in uno latere adscendentibus sed proxime margine arcuatis et interconnectis, *cymis* axillaribus adscendente pilosulis 1-floriferis, pedunculis 7-12 mm. longis, pedicellis 7-11 mm. longis hirsutulis, bracteis 5-6 mm. longis anguste ellipticis foliaceis adpresse pilosulis, alabastris late campanulatis lobis calycis arcuatis, *calycibus* in flore albescentibus 11 mm. longis quando bullitis (in sicco 8-10 mm. longis)

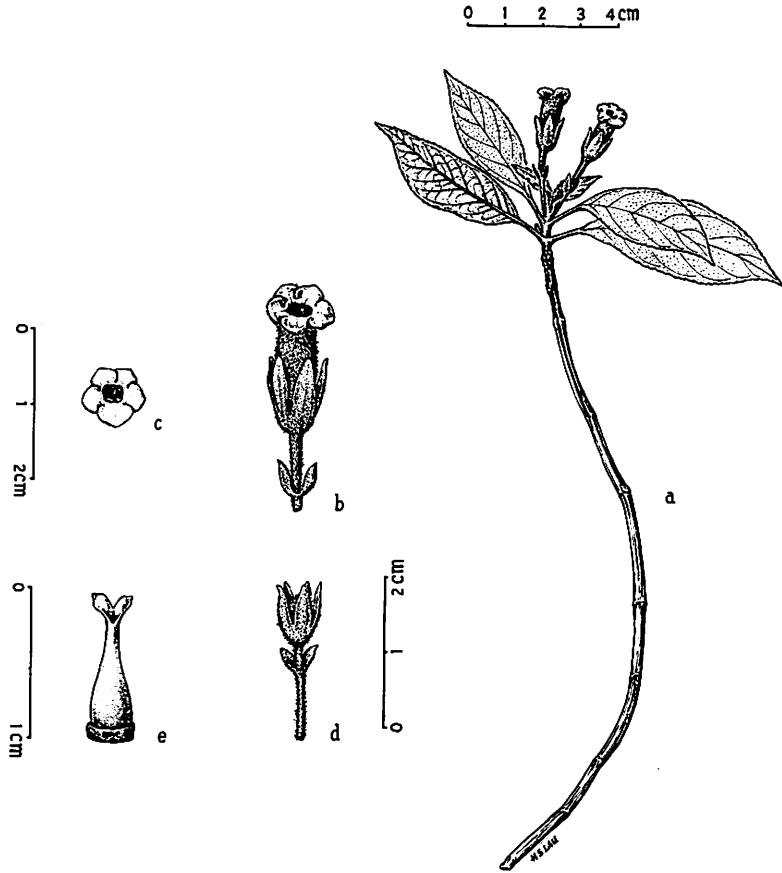


FIGURE 59.—*Cyrtandra elliptisepala*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Hauula, St. John 13,354, holotype (Bishop Mus.).

campanulatis, tubo 1.5-2 mm. longo adscendente hirsutulo, limbo minime bilabiato inter labias 9 mm. partitis, labia supra trilobata inter lobas 8 mm. partita, lobis 2.3-3.8 mm. latis ellipticis obtusis dimidia infera adscendente hirsutula dimidia supra puberula marginibus subrevolutis intra glabra, labia infera bilobata inter lobas 9 mm. partita, lobis 2.5-3 mm. latis oblique lanceo-ellipticis obtusis tertia infera adscendente hirsuta parte reliqua puberula marginibus ad basim subrevolutis intra glabris, *corollis* 17 mm. longis quando bullitis (in sicco 15 mm.) albis, tubo 15 mm. longo subrectis in basi 2.5

mm. diametro in orifice 4 mm. diametro extra in basi glabro quarta parte infera puberula parte reliqua dense albo-villosa intra glabra, limbo bilabiato inter lobas 3 mm. partito, lobis superis binis 2.2-2.5 mm. longis 4 mm. latis oblato-reniformibus valde impensis intra glabris extra in partibus expositis dense villosis, labia infera trilobata, lobis lateralibus 3 mm. longis 4 mm. latis suboblique reniformibus impensis, loba infera 2.8 mm. longa 4.5 mm. lata transverse late elliptica impensa, staminibus binis inferis fertilibus filamentis in tubo adnatis in 5.5 mm. ex orifice affixis parte libera 1.5 mm. longa tereti contorte adscendenti, antheris 1.8 mm. longis 1.6 mm. latis suborbiculari-ovatis connectivo 0.8 mm. lato ovato acuto, staminodeis lateralibus in tubo 7 mm. ex orifice affixis parte libera 0.2 mm. longa filiforme apice antheroidea 0.2 mm. longa lanceo-subulata pallida, *stylo* 2 mm. longo glabro validi, lobis stigmaticis binis 2 mm. longis oblongo-ellipticis angulatis $\frac{1}{2}$ connatis, *ovario* 5 mm. longo lanceoloideo glabro in basi cum disco obscuro cupulato 1 mm. alto cincto, fructibus ignotis.

Description of Holotype: Shrub 6 dm. tall; branchlets as much as 4 mm. in diameter, glabrate, pale brownish, subquadrangular, fleshy, on drying much shrunken and with numerous longitudinal ridges and furrows; leaf scars 2-3.5 mm. high, shield-shaped, approximate, pale, corky, the lower margin sinuous lobed; bundle scars 5; leafy branchlets as much as 3 mm. in diameter, subquadrangular, densely brownish ascending hirsute; internodes 4-50 mm., averaging 12 mm. long; young shoots densely brownish hirsute; *leaves* opposite, diverging, not crowded, borne at 2-3 upper nodes, those of a pair subequal in size; petioles 7-11 mm. long, densely brownish ascending hirsute; *blades* 3.5-6.1 cm. long, 13-22 mm. wide, thin chartaceous, lance-elliptic, the base cuneate, the apex subacuminate, the margin serrulate, above green and catenulate hirsute, the hairs well spaced, below softly white pilosulous, the principal veins densely ascending pilosulous, the margins low serrulate, the secondary veins 7-9 on a side, ascending, then near the margin arcuate, interconnected to adjacent veins and to the teeth; *cymes* axillary, ascending pilosulous, 1-flowered; peduncles 7-12 mm. long; pedicels 7-11 mm. long, hirsutulous; bracts 5-6 mm. long, narrowly elliptic, foliaceous, appressed pilosulous; buds broadly campanulate, the calyx lobes arching; *calyx* in anthesis whitish, 11 mm. long when boiled (when dried 8-10 mm. long) campanulate, the tube 1.5-2 mm. long, ascending hirsutulous, the limb perceptibly 2-lipped, cleft down 9 mm. between the lips; upper lip 3-lobed, cleft down 8 mm. between the lobes, the lobes 2.3-3.8 mm. wide, elliptic, obtuse, the lower half ascending hirsutulous, the upper puberulous, the lateral margins somewhat revolute, within glabrous; lower lip 2-lobed, cleft 9 mm. between the lobes, the lobes 2.5-3 mm. wide, obliquely lance-elliptic, obtuse, the lower third ascending hirsutulous, the remainder puberulous, the lateral margins slightly revolute near the base, within glabrous; *corolla* 17 mm. long when boiled (15 mm. when dried), white, the tube 15 mm. long, almost straight, at base 2.5 mm. in diameter, gradually enlarging to the throat which is 4 mm. in diameter, without glabrous at the very base, then the lower $\frac{1}{4}$ puberulous, the upper $\frac{3}{4}$ densely shaggy white villous, within glabrous; limb 2-lipped, parted 3 mm. between the lips, upper lobes two, 2.2-2.5 mm. long, 4 mm. wide oblate reniform, much overlapping at base, within glabrous, without where exposed shaggy villous, where covered in aestivation from glabrous to sparsely puberulent; lower lip 3-lobed, similar in pubescence; lateral lobes 3 mm. long, 4 mm. wide, slightly oblique reniform, overlapping at base; lower lobe 2.8 mm. long, 4.5 mm. wide, transversely broad elliptic, overlapping at base; two lower stamens fertile, with filaments adnate to the corolla tube to within 5.5 mm. of the throat, the free portion 1.5 mm. long, terete, stout, spirally upcurved; anthers 1.8 mm. long, 1.6 mm. wide, connivent and coherent, suborbicular-ovate, the dark connective 0.8 mm. wide, ovate, acute; the two lateral staminodia with filaments adnate to the corolla tube to within 7 mm. of the throat, the filament tip 0.2 mm. long, filiform, the antheroid tip 0.2 mm. long, lance-subulate, pale; *style* 2 mm. long, glabrous, stout; two stigmatic lobes 2 mm. long, oblong-elliptic, angled, connate $\frac{1}{2}$ way up proximal side; *ovary* 5 mm. long, lanceoloid, glabrous, surrounded at base by a dark, cupulate disk 1 mm. high; fruit unknown.

Distribution: Koolau Range, windward side, at 1,600 ft. alt., in the Ohia Zone.

Holotypus: Oahu, Maakua-Papali ridge, Kaipapau For. Res., Hauula, moist wooded gulch, 1,600 ft. elev., Oct. 15, 1933, *H. St. John 13,354* (BISHOP MUS.).

Discussion: *C. elliptisepala* is a member of the section *Schizocalyces*. Its closest relative is *C. Lessoniana* Gaud. var. *koolauloensis* St. John which, like it, has a white calyx with lobes revolute along the lateral margins. The variety is marked by having the young shoots appressed brown pilose; the petioles 10-40 mm. long; the blades 3-22 cm. long, 12-52 mm. broad, subcoriaceous, oblanceolate, abruptly acute; peduncles 14-17 mm. long, accrescent and in fruit becoming 20-28 mm. long; bracts 8-18 mm. long, lanceolate, white; calyx 13-22 mm. long, the lobes 5-6 mm. wide, narrowly elliptic-lanceolate, the tips arcuate; corolla 25-27 mm. long, the upper lobes 4-4.5 mm. long, oblate-orbicular, the lower lobe 4-5.5 mm. long, suborbicular; style none; and the ovary 7 mm. long, narrowly ovoid. *C. elliptisepala* is distinguishable by having the young shoots densely brownish hirsute; petioles 7-11 mm. long; blades 3.5-6.1 cm. long, 13-22 mm. wide, thin chartaceous, lance-elliptic, subacuminate; peduncles 7-12 mm. long; bracts 5-6 mm. long, narrowly elliptic, green; calyx 11 mm. long, the lobes 2.3-3.8 mm. wide, elliptic, ascending; corolla 17 mm. long, the upper lobes 2.2-2.5 mm. long, oblate-reniform, the lower lobe 2.8 mm. long, transversely broad elliptic; style 2 mm. long; and the ovary 5 mm. long, lanceoloid.

The new specific epithet is coined from the Latin *ellipticus*, elliptic; and the new Latin noun, *sepalum*, sepal.

38. *Cyrtandra ferrocolorata* St. John, sp. nov. (Figs. 60, 190).

Diagnosis Holotypi: Frutex 1.5 m. alta, ramis fuscis ad 7 mm. diametro ab initio adpresse ferruginoso-pilosis et subquadrangularibus deinde glabris et teretibus carnosus in sicco contractis et prominente sulcatis, cicatricibus 3-4 mm. altis pallidis scutelliformibus, fasciculis 5, novellis dense adpresse olivaceo-brunneo-pilosis, ramulis foliferis ad 5 mm. diametro subquadrangularibus dense adscendente brunneo-pilosis, internodis 1-6 cm. plerumque 2 cm. longis, foliis oppositis divergentibus exaggreatis in 3-4 nodis superis affixis inaequalibus uno $\frac{1}{2}$ majore, petiolis 10-26 mm. longis adpresse brunneo-pilosis validis, laminis 11-18 cm. longis 44-79 mm. latis chartaceis late oblanceolatis in basi cuneatis et longe decurrentibus apice acuto vel subacuminato supra glabris et obscure viridibus infra pallide viridibus in nervis adpresse brunneo-pilosis et in intervallis sparse adpresse brunneo-pilosis marginibus grosse serratis nervis secundariis 8-11 in uno latere subarcuatis et in serris salientibus, cymis axillaribus trifloriferis dense brunneo-pilosis obscuratis, pedunculis 3-6 mm. longis, pedicellis 5-10 mm. longis, bracteis 5-6 mm. longis lineari-lanceolatis, alabastris anguste campanulatis lobis calycorum erectis, calycibus in flore 22-25 mm. longis in sicco viridibus sed extra et intra dense adpresse brunneo-villosis excepta ad basim anguste campanulatis tubo 5-7 mm. longo campanulato, limbo bilabiato inter labias 14-15 mm. partito 5-lobato, labia supra trilobata ferre recta inter lobas 10-14 mm. partita, lobis 1.9-2 mm. latis lineari-lanceolatis, labia infera bilobata inter lobis lineari-lanceolatis 14-17 mm. partitis, corollis 34 mm. longis quando bullitis (in sicco 28-30 mm. longis)



FIGURE 60.—*Cyrtandra ferrocolorata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Kaluanui, Fosberg 13,752, holotype (Bishop Mus.).

albis tubo infundibuliforme media infera 4 mm. diametro cylindrico glabro in media abrupte expanso et in 35° deflexo parte supera extra villosa orifice 8 mm. diametro, limbo bilabiato extra glabro, lobis superis 9 mm. longis 9.5 mm. latis suborbicularibus ad orificem capitato-glanduloso-puberulis, lobis lateralibus 11 mm. longis latisque late ovatis intra ad orificem capitato-glanduloso-puberulis, loba infera 13 mm. longa 12 mm. lata late elliptica intra e media ad basim capitato-glanduloso-puberulis, staminibus binis inferis perfectis filamentis in tubo in 9 mm. ex orifice adnatis partibus liberis 2 mm. longis contorte ascendentibus, antheris 3.3 mm. longis 2.3 mm. latis oblique ovatis connectivo 2.8 mm. longo ovato, staminodiis lateralibus in tubo in 10 mm. ex orifice affixis partibus liberis 1 mm. longis apicibus sterilibus pallidis lanceolatis 0.5 mm. longis, *stylis* 6-7 mm. longis pilosis, lobis stigmatibus binis 4 mm. longis sessilibus ovalibus in latere proximi $\frac{3}{4}$ connatis, *ovario* 6-8 mm. longo anguste lanceoloideo glabro in basi disco cupulato 1 mm. alto cincto; "*bacca glabra*" late ovoideo-ellipsoidea in sicco 15 mm. longa 10 mm. diametro in calyce inclusa, seminibus 0.30-0.43 mm. longis 0.13-0.18 mm. latis fusiformibus vel ellipsoideis mellicoloratis rectis vel curvatis apicibus obscure brunneis cute reticulati cellularibus polygonis subaequalibus $\frac{1}{2}$ - $\frac{1}{3}$ longis quam semine.

Diagnosis of Holotype: Shrub 1.5 m. tall; branches tawny, as much as 7 mm. in diameter, at first appressed rusty pilose and subquadrangular, later glabrate and terete, fleshy, on drying shrinking and with prominent longitudinal furrows and ridges; leaf scars 3-4 mm. high, pale, shield-shaped; bundle scars 5; leafy branchlets as much as 5 mm. in diameter subquadrangular, densely ascending brown pilose; young shoots densely appressed olive brown pilose; internodes 1-6 cm., averaging 2 cm. in length; *leaves* opposite, divergent, not crowded, borne at 3-4 upper nodes, unequal, one of each pair about $\frac{1}{2}$ the larger; petioles 10-26 mm. long, appressed brown pilose, stout; *blades* 11-18 cm. long, 44-79 mm. wide, chartaceous obliquely broad oblanceolate, cuneate and long decurrent at base, the apex acute or subacuminate, above glabrous and dark green, below pale green, and appressed brown pilose on the veins and sparsely so on the intervals, the margins coarsely serrate, the secondary veins 8-11 on a side, gently arcuate, the tips salient on marginal teeth; *cymes* axillary, 3-flowered, completely covered with dense brown villosity; peduncles 3-6 mm. long; pedicels 5-10 mm. long; bracts 5-6 mm. long, linear lanceolate; buds narrowly campanulate, the calyx lobes erect; *calyx* in anthesis (when dried) 22-25 mm. long, green but densely appressed brown villous without and within except at base, narrowly campanulate; the tube 5-7 mm. long, campanulate; the limb 2-lipped, cleft down 14-15 mm. between the lips, 5-lobed; upper lip 3-lobed, nearly straight, cleft down 10-14 mm. between lobes which are 1.9-2 mm. wide, linear-lanceolate; lower lip with 2 lobes, cleft 14-17 mm. between the lobes, linear-lanceolate; *corolla* 34 mm. long (when dried 28-30 mm. long), white; the tube funnelliform, the lower half cylindrical, 4 mm. in diameter, glabrous, at the middle abruptly expanded and deflexed at 35° from the axis of the lower tube, the upper part villous without, the throat 8 mm. in diameter; limb 2-lipped, glabrous without, upper lobes 9 mm. long, 9.5 mm. wide, suborbicular, capitate glandular puberulous towards the throat; lateral lobes 11 mm. long and wide, broadly ovate, within capitate glandular puberulous towards the throat; lower lip 13 mm. long, 12 mm. wide, broadly elliptic, within capitate glandular puberulous from middle to the throat; two lower stamens perfect, the filaments adnate to corolla tube to within 9 mm. of the throat, the free portion subulate, spirally upcurved, 2 mm. long; the perfect anthers 3.3 mm. long, 2.3 mm. wide, obliquely ovate, the ovate connective 2.8 mm. long; two lateral staminodia with filaments adnate to the corolla tube to within 10 mm. of the throat, the free portion 1 mm. long, the pale sterile tip 0.5 mm. long, lanceolate; *style* 6-7 mm. long, pilose; stigmatic lobes 2, sessile, 4 mm. long, oval, connate $\frac{3}{4}$ way up the proximal side; *ovary* 6-8 mm. long, narrowly lanceoloid, glabrous, surrounded at base by a cupulate disk 1 mm. high; *berry* white, "broadly ovoid-ellipsoid," when dried 15 mm. long, 10 mm. in diameter, surrounded by the persistent calyx; seeds 0.30-0.43 mm. long, 0.13-0.18 mm. wide, fusiform to ellipsoid, honey-colored, with dark-brown ends, straight or curved, the surface with raised heavy, nearly isodiametric, polygonal cellular reticulations $\frac{1}{2}$ to $\frac{1}{3}$ as long as seed.

Distribution: Koolau Range, windward side, Kaluanui, at 650 m. alt., in the Ohia Zone.

Holotypus: Koolau Mts., Kaluanui Valley, wet forest, 650 m. alt., Apr. 25, 1937, *F. R. & V. O. Fosberg 13,752* (BISHOP MUS.).

Discussion: *C. ferrocylorata* is a member of the section *Schizocalyces*. Its close relative is *C. Fosbergii*; the diagnostic differences between the two are indicated in the key.

Though not listed, this specimen, *Fosberg 13,752*, formed a part of the concept of *C. Rockii* St. John & Storey when published. The confusion has been solved by removing Fosberg's collection, making it the type of the new *C. ferrocylorata*, and retaining the name *C. Rockii* for the species based on *St. John 13,357*, its originally designated type.

The name of the new species is from the Latin *ferrum*, iron; *coloratus*, colored, in allusion to the rusty color of the abundant villosity of the plant.

39. *Cyrtandra Forbesii* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 86, 1950. (Figs. 61, 189.)

Description of Holotype: Shrub; branches slender, stramineous, smooth, tardily glabrate, with longitudinal ridges on drying; the leaf scars 2.2-3 mm. high, cordate, connected and annular, pale, corky, raised; bundle scars 5; internodes 9-30 mm., usually about 15 mm. long; leafy branchlets 1-2.5 mm. in diameter, somewhat quadrangular, spreading white, viscid pilose; young shoots densely white, spreading, viscid pilose; leaves opposite, markedly unequal, one of a pair being $\frac{1}{4}$ - $\frac{1}{5}$ the larger, ascending and approximate; petioles 35-62 mm. long, slender, with a dense, white, spreading, viscid pilosity; blades 52-67 mm. long, 28-40 mm. wide, firm chartaceous, straight or slightly curved and asymmetric, oval, acute, the base short cuneate, plane, above dark green, dull and shaggy white, viscid pilose, below densely shaggy, white, viscid pilose, the margin irregularly apiculate denticulate; cymes 1-flowered, from the leaf axils, densely spreading, white, viscid pilose; peduncles 15-23 mm. long, slender; pedicels 3-10 mm. long; bracts 7-11 mm. long, linear-oblongate, foliaceous; buds campanulate, the calyx lobes ascending; calyx 12-14 mm. long, funnelform, lobed almost to the base, densely white, spreading, viscid pilose without, distinctly oblique and 2-lipped, the lobes 8-11 mm. long, 2.5-3 mm. wide, subequal, foliaceous, narrowly elliptic-oblongate, broadest at or above the middle, within sparsely pilose at tip, glabrous below, the tube 2-3 mm. long; corolla 18-22 mm. long, 4 mm. in diameter, narrowly funnelform and gradually widening to the 8 mm. throat, the tube 15-16 mm. long, almost straight, sparsely villous near the throat, the lobes apparently spreading at from 25° to 50° to axis of the tube, the upper lobes 2.5-3 mm. long, semiobovate; lateral lobes 4 mm. long, 7 mm. wide, transversely oval; lower lobe 6 mm. long, 5 mm. wide, oval; the corolla glabrous within; filaments fused to within 6 mm. of the throat, the free portion 3-4 mm. long, subulate from a ligulate base, incurved; anthers 2.5 mm. long, ovate deltoid, flattened, asymmetric; style 4 mm. long, sparsely pilosulous; stigma with two oval lobes 1.8 mm. long, connate along the proximal edge for $\frac{1}{4}$ their length; ovary ovoid, remotely pilosulous above the middle, surrounded at base by a cupulate disk 0.7 mm. high; fruit unknown.

Distribution: Known only from the type collection, in the Koolau Range, windward side, in the mountains between Punaluu and Kaipapau.

Holotype: Oahu, Koolauloa [= Koolau] Mts., between Punaluu and Kaipapau [= Kaipapau], May 3-8, 1909, *C. N. Forbes & C. M. Cooke* (BISHOP MUS.).

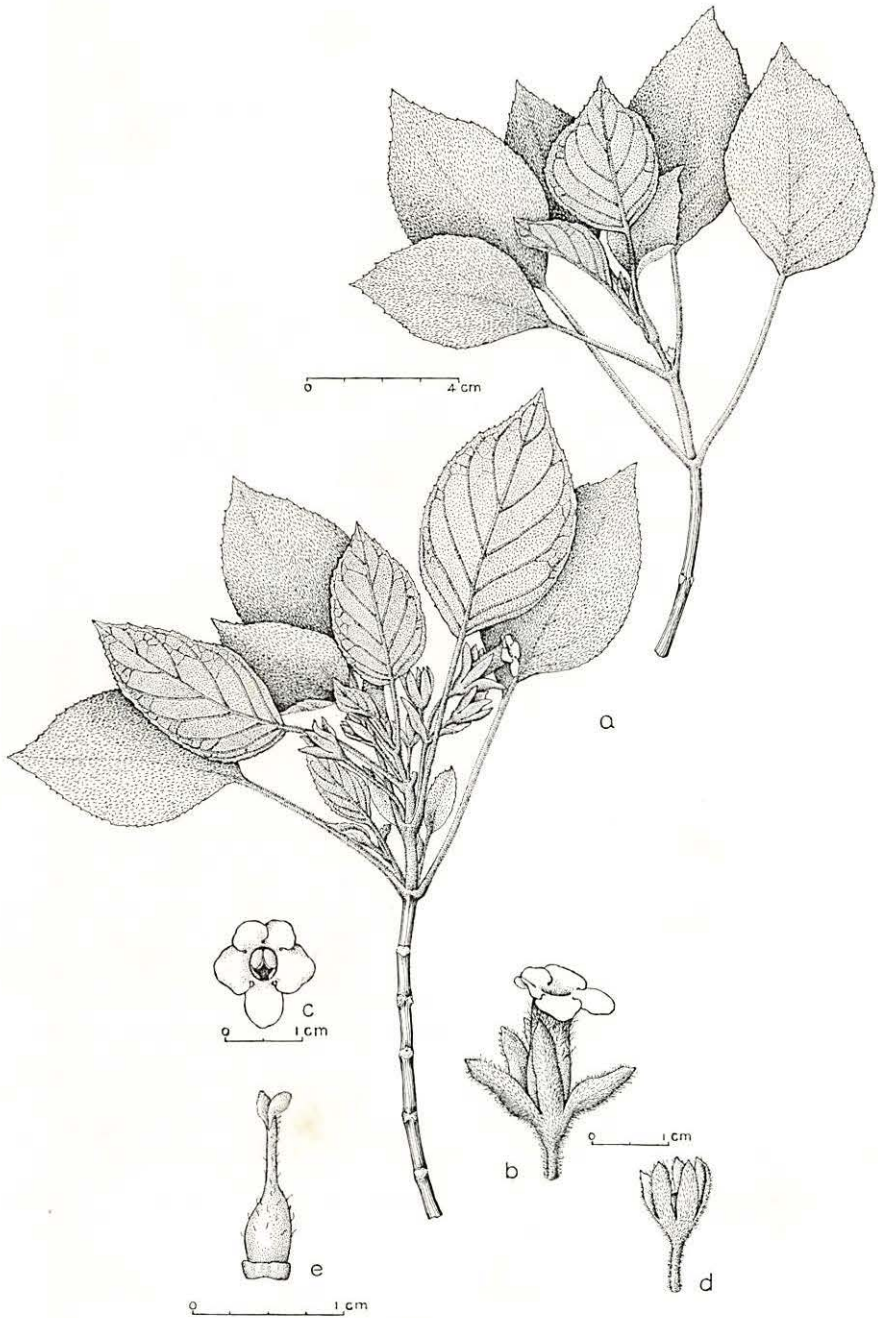


FIGURE 61.—*Cyrtandra Forbesii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Punaluu-Kaipapau, Forbes and Cooke 5/3-8/09, holotype (Bishop Mus.).

Discussion: *C. Forbesii* is a member of the section *Schizocalyces*. It does not seem closely related to any particular species. The diagnostic differences are brought out in the key.

The specific name is given in commemoration of the late Charles N. Forbes, Curator of Botany at the B. P. Bishop Museum, Honolulu.

40. *Cyrtandra Frederickii* St. John and Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 86, 1950. (Figs. 62, 186.)

Description of All Specimens Examined: Shrub 2-5 m. tall, sparsely branching; branches at length smooth, corky, gray, as much as 5 cm. in diameter, subquadrangular, slightly furrowed on drying; leaf scars 4-6 mm. high, obcordate, straw-colored; bundle scars 5-7, young shoots densely villous; leafy branchlets as much as 4 mm. in diameter, saliently quadrangular, densely shaggy tawny villous, the twigs somewhat fleshy, on drying the sides shrinking and broadly channeled; internodes 0.7-5.5 cm., averaging 3 cm. long; *leaves* opposite, subequal, though one of each pair may be distinctly broader; petioles 2.5-11 cm. long, tawny villous; *blades* 6-23.5 cm. long, 5.5-19 cm. wide, thick chartaceous, broadly asymmetric oval, rounded at the base (or abruptly cuneate on small leaves of weak laterals), apex acute (or short acuminate), margins sharply dentate, above dark green and villous, below whitish green and pilose or villous, shaggily so on the veins, secondary veins 6-8 on a side, from the base nearly straight, then near the margin arcuate and inarching, more or less plinerved at base, the tips apiculate salient in the teeth; *cymes* axillary but fruiting after the leaf fall, 5-7-flowered, tawny villous throughout in anthesis ascending at about 50°; peduncles 1.8-5.1 cm. long; pedicels 7-34 mm. long, slender; bracts 12-30 mm. long, foliaceous, lanceolate, petiolate buds campanulate; *calyx* in anthesis when fresh 9-16 mm. long (when dried 8-10 mm.), foliaceous and green, and tawny shaggy villous throughout, slightly 2-lipped, the cleft between lips to within 2 mm. of the base, but the lobes subequal and cleft fully $\frac{4}{5}$ way to the base, upper lip 3-lobed, the lobes 8-12 mm. long, 3-5 mm. wide, ovate-lanceolate, cleft between the lips to within 1 mm. of the base; lower lip 2-lobed, cleft to within 2 mm. of the base, ovate-lanceolate, 4-11 mm. long, 3.5-6 mm. wide, soon after anthesis the calyx completely reflexed; *corolla* when fresh 18-20 mm. long, white, the tube 12 mm. long, exceeded by the calyx, pilose without, glabrous within, almost straight, at base 3.5-5 mm. in diameter, the throat 4-5 mm. in diameter; corolla limb 2-lipped, 5-lobed, the lobes glabrous within, pilose without almost to the margins; upper lip 2-lobed, the lobes 3 mm. long, 4-5 mm. wide, spreading at about 90°, transversely oval; lower lip 3-lobed, the lateral lobes 4-6 mm. long, 4.5-5 mm. broad, suborbicular, the lower lobes 4-5.5 mm. long, 6-7 mm. wide, oblate-suborbicular reflexing at about 110°; two lower stamens perfect, connate at tip, filaments adnate to the corolla tube to within 4 mm. of the throat, free portion 2-2.5 mm. long, stout subulate, spirally upcurved; the 2 perfect anthers 3 mm. long, 2.7 mm. wide, broadly asymmetric ovate, flattened, the connective ovate, the 3 staminodia scalelike, 0.5 mm. long, attached to within 6 mm. of the throat; *style* short (or up to 3 mm.) in length, densely capitate glandular pilose; stigmatic lobes 2, sessile, 2 mm. long, broadly oval, the margin sinuate, connate $\frac{3}{4}$ way up proximal side; *ovary* 6-7 mm. long, lanceoloid, glandular pilose, the base surrounded by a cupulate disk 1 mm. high; *berry* 26 mm. long, 10 mm. wide, ovate-ellipsoid, white, tipped by a stout beak, the surface glandular pilose; seeds 0.50-0.54 mm. long, 0.21-0.23 mm. in diameter, ellipsoid, olive brown, the hilum end broad umbonate, the surface iridescent shining, covered with a high raised cellular reticulation, the areolae oblong, about $\frac{1}{6}$ length of the seed.

Distribution: Waianae Mts., on the northern slopes, vicinity of Moku-leia, at 1,600 to 2,350 ft. alt. in the Koa Zone, and the Ohia Zone; leeward side, Makaha Valley, 1,800 ft. alt., in the Ohia Zone.

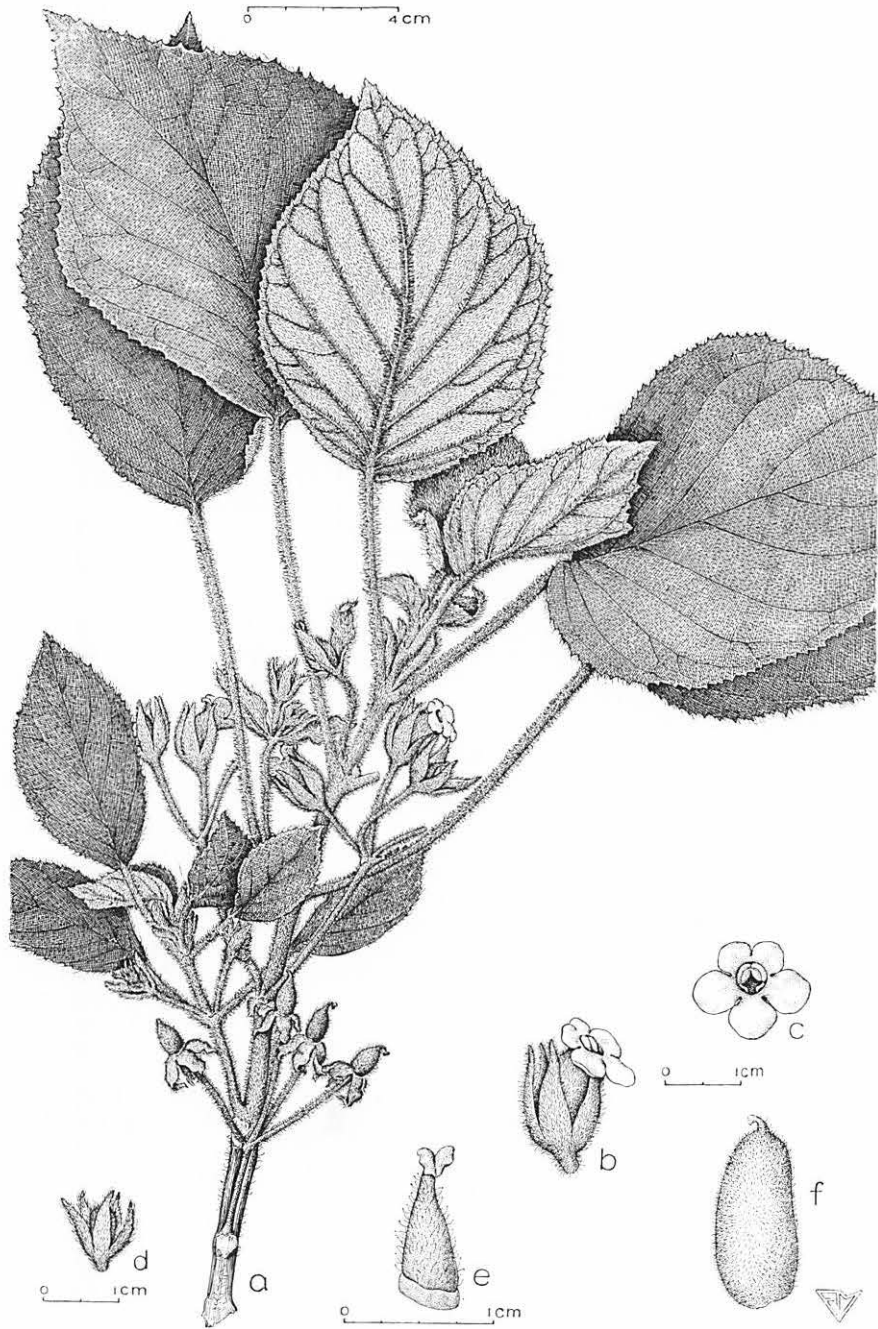


FIGURE 62.—*Cyrtandra Frederickii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Mokuleia, Mita and Frederick, holotype (Bishop Mus.).

Holotype: Oahu, Mokuleia, Keawapilau gulch, Mokuleia Trail, rather common sparsely branching shrub to 2 m. in height, moderate shade, on slopes and in ravines, moist *Aleurites* forest, 1,800-2,000 ft. alt., July 13, 1947, *D. Mita & L. Frederick* (BISHOP MUS.).

Specimens Examined: Waianae Mountains.

Windward Side: Mokuleia Trail, in moist kukui forest at 1,900 ft. alt., sparsely branching shrub 5 ft. tall, July 27, 1947, *Frederick 202*; Makaleha Trail, Mokuleia, Jan. 12, 1947, *Mita*; Kukuiula Valley, in deep moist valley, under native rainforest, 1,900 ft. alt., Oct. 9, 1934, *E. H. Bryan 819*; Mokuleia, C.C.C. trail across head of Kapuna Valley, Waianae Mts., moist gulch, 600 m. alt., Apr. 11, 1936, *Fosberg 13,044*; Mokuleia, Piko Trail, moderately wet, sloping forest, 2,350 ft. alt., Nov. 25, 1932, *Yamauchi*; Mokuleia Trail, W. ridge of Makaleha Valley, Mokuleia, 1,600 ft. alt., moist shaded stream bank in deep gulch, Jan. 11, 1948, *St. John 23,231*.

Leeward Side: Makaha Valley, moist forest, 1,800 ft. alt., Dec. 1, 1952, *St. John 24,858*.

Discussion: *C. Frederickii* is a member of the section *Schizocalyces*. Its closest relative is *C. reflexa* which is found in the Koolau Range from Kawai-*loa* to Paalaa. This species is separable by having the blades with the margins coarsely and irregularly serrate or serrate-dentate; cymes 5-32-flowered; the calyx lobes linear-lanceolate, reflexed in anthesis and fruit, persistent in the fruit; corolla villous without. For contrasting characters, *C. Frederickii* has: the blades with the margins sharply dentate; cymes 5-7-flowered; the calyx lobes ovate-lanceolate, ascending in anthesis, deciduous in fruit.

The species is named for Lafayette Frederick, interested student of and active collector of Hawaiian plants.

41. *Cyrtandra hirsutula* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 86-87, 1950. (Figs. 63, 195.)

Description of Holotype: Shrub; stem brown or stramineous, glabrate, the younger parts hirsutulous, the leaf scars 2-3 mm. high, low cordate rounded below, truncate above, pale, sunken; bundle scars 5; internodes 7-45 mm., usually about 15 mm. long; leafy branches slightly 4-sided, ascending brownish hirsutulous, freely branching, with 4-6 pairs of uncrowded leaves; young shoots closely hirsutulous, except on upper leaf surfaces; leaves opposite, markedly unequal in size, one of a pair being $\frac{1}{4}$ - $\frac{1}{2}$ the larger, ascending, later spreading; petioles 6-20 mm. long, ascending hirsutulous; blades 2.5-6 cm. long, 9-16 mm. wide, narrowly oblanceolate, the apex acute, the base cuneate, firm and apparently subcoriaceous, above dark green and glabrous, below whitish and sparsely hirsutulous on the intervals, appressed hirsutulous on veins, the margin entire except for the minutely apiculate vein tips 6-8 on a side; secondary veins subalternate, arched ascending, the tips inarched and joining the adjacent veins near the margin; cymes from the leaf axils 1-flowered, moderately appressed hirsutulous, the hairs tawny when dry; peduncles 8-14 mm. long, ascending at 45°; pedicels 6-12 mm. long, slender; bracts 5-9 mm. long, lanceolate, foliaceous, glabrous above; buds narrowly campanulate; calyx 12-13 mm. long (-15 mm. when fresh), campanulate, to a moderate degree ascending hirsutulous, slightly 2-lipped, the tube 2-4 mm. long; upper lip of 3 lobes, these 8-13 mm. long, 1.5-2.9 mm. wide, narrowly linear-lanceolate, plane; lower lip of



FIGURE 63.—*Cyrtandra hirsutula*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, fruit, $\times 1$; f, pistil, $\times 2$. Kaala, north side, Bergman, holotype (Bishop Mus.).

2 lobes, cleft a little more deeply, similar to the upper ones; *corolla* 23 mm. long (18 mm. when dried), white, the tube 17-18 mm. long, cylindrical, straight, 3.7 mm. in diameter, the throat 2.7 mm. wide, 3 mm. high, the tube glabrous within, the outside glabrous for 3 mm. at and near the base, the remainder densely white shaggy villous; limb 2-lipped, 5-lobed; upper lip of 2 lobes, apparently almost rotate, the lobes 2.5 mm. long, 4 mm. wide, transversely rhombic-oval, obtuse, much overlapping at base, within glabrous, without shaggy villous on back, diminishing to pilose at the margin; lower lip of 3 lobes, apparently rotate, similarly glabrous within and hairy without, the 2 lateral lobes 3 mm. long, 4.7 mm. wide, transversely oval, overlapping at base; lower lobe 3.5 mm. long, 4.7 mm. wide, suborbicular; the two lower stamens perfect, the filaments adnate to the corolla to within 7.5 mm. of the throat, the free portion 2 mm. long, subulate, spirally upcurved; the 2 perfect anthers 1.7 mm. long, obliquely elliptic, connate at apex, staminodia 0.4-0.6 mm. long, curved, with or without traces of the anther; *style* 1.5 mm. long, stout, glabrous; stigmatic lobes two, 3 mm. long, narrowly oval, equally cleft on both sides; *ovary* 6 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1 mm. high; immature *fruit* 7-12 mm. long, ovoid, short beaked, glabrous.

Distribution: Waianae Mts., windward side, in the Ohia Zone, near the summit of the highest peak. Known only from the type collection.

Holotype: [Waianae Mts.], N. side of Kaala, elev. 4,000 ft., in moist woods, Feb. 11, 1928, *H. F. Bergman* (BISHOP MUS.).

Discussion: *C. hirsutula* is a member of the section *Schizocalyces*. Its closest relative is *C. longiloba*. In the treatment of that species is given a comparative statement of the specific differences.

The specific epithet is the Latin *hirsutus*, rough, hairy; and the diminutive *ula*, thus meaning short or sparsely hairy, in reference to the leaf pubescence.

42. *Cyrtandra intrapilosa* St. John, stat. et nom. nov. (Figs. 64, 191).

C. Lessoniana Gaudichaud var. *borealis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 87, 1950.

Description of Holotype: Shrub; branchlets 5-7 mm. in diameter, quadrangular, persistent brown pilose, somewhat fleshy, on drying shrinking and furrowed; leaf scars 3-4 mm. high, pale, obcordate-shield-shaped; bundle scars 7; young shoots densely appressed brown pilose, leafy branchlets as much as 4.5 mm. in diameter, quadrangular, densely brown appressed pilose; internodes 13-25 mm., averaging 20 mm. long; *leaves* opposite, divergent, approximate, borne at the 8 upper nodes, those of a pair unequal and one being about $\frac{1}{2}$ larger or rarely subequal; petioles 15-28 mm. long, stout, and densely appressed brown pilose; *blades* 9.5-13 cm. long, 44-59 mm. wide, subcoriaceous, oval, the apex abruptly acute, the base long cuneate, above dark green and sparsely appressed, catenulate hirsute, and closely so on the midrib, below pale green and closely appressed pilose, the margins low callous serrulate, the secondary veins 10-11 on a side, ascending, gently arcuate, the tips closely following margin, then interconnected and salient in the teeth; *cymes* axillary 1- or 3-flowered, densely appressed brown pilose; peduncles 18-34 mm. long; pedicels 25-33 mm. long; bracts 7-10 mm. long, lanceolate, foliaceous; buds broadly campanulate, the calyx lobes ascending; *calyx* in anthesis 16-17 mm. long (when boiled), green, thick foliaceous, campanulate (13-14 mm. long when dried), without pilose and brownish when dried, within pilose, tube 1-2 mm. long, obconic; the limb 2-lipped, cleft down 15 mm. between the lips, 5-lobed; upper lip 3-lobed, cleft 12-14 mm. between the lobes, the lobes 6-7 mm. wide, lance-ovate, acute; lower lip with 2 lobes, cleft 15 mm. between the lobes, the lobes 7 mm. wide, lance-

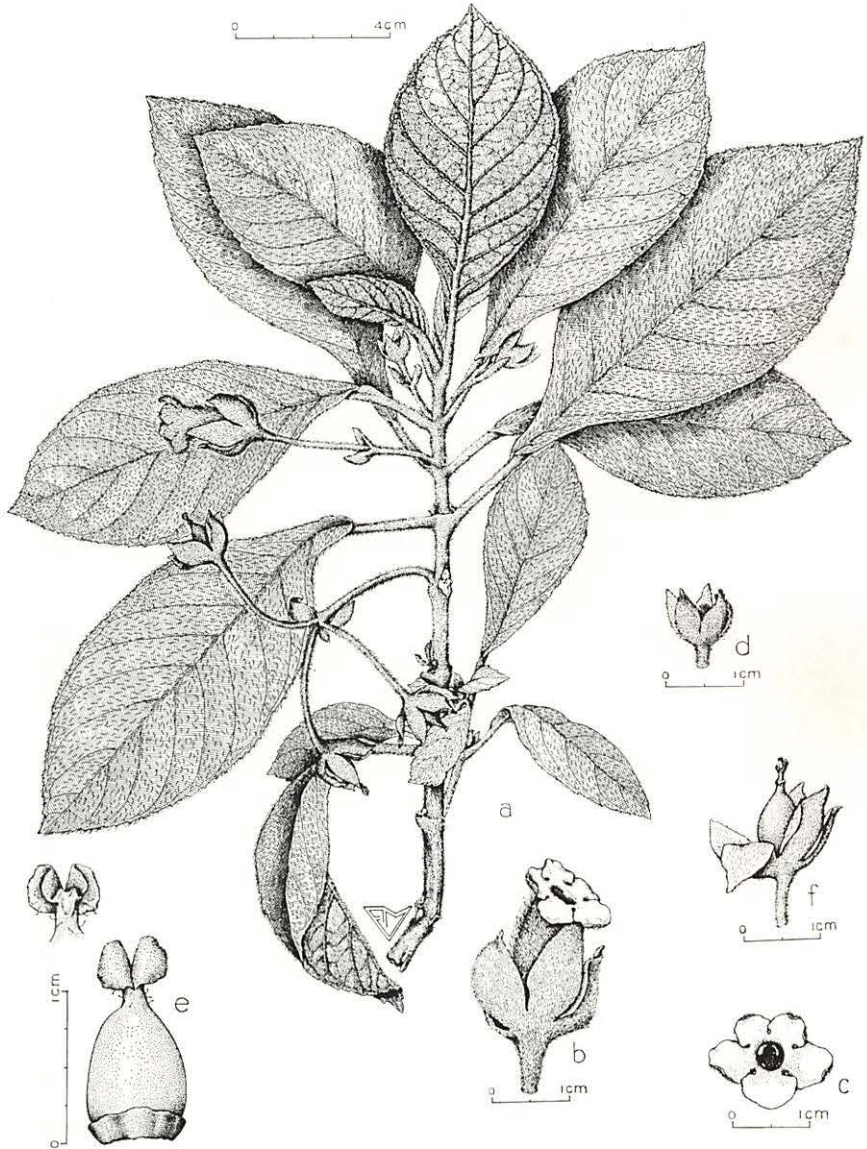


FIGURE 64.—*Cyrtandra intrapilosa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, calyx and berry, $\times 1$. Pupukey Military Trail, MacDaniels 559, holotype (Bishop Mus.).

ovate, acute, ascending; *corolla* 26 mm. long (when boiled), white, without shaggy white villous (22 mm. long when dried), densely shaggy white villous without, glabrous within, subcylindric, 15 mm. long, 6 mm. in diameter, gently downcurved at 10° to 15° from the axis of the base; limb 2-lipped, 5-lobed; upper lip spreading at 30° to the axis of the throat, the two lobes 3 mm. long, 4.5 mm. wide, semiorbicular, at base cordate auriculate and overlapping, these and other lobes villous without, within puberulous near the throat; lower lip 3-lobed; the two lateral lobes 5 mm. long, 7 mm. wide, oblique transverse oval; lower lobe 4.5 mm. long, 6 mm. wide, transverse broad oval; the two lower stamens perfect, the filaments adnate to the corolla to within 6 mm. of the throat, the free portion 3 mm. long, subulate, spirally upcurved; the two perfect anthers connivent, 2.8 mm. long, asymmetric broad oval, the connective obovate; two lateral staminodia 1 mm. long, stout subulate, the filament adnate to the corolla tube to within 7 mm. of the throat; *style* none; stigmatic lobes two, 3.2 mm. long, broadly ovate, connate $\frac{1}{3}$ way up proximal side, sparsely glandular pilosulous without; *ovary* 9 mm. long, ovoid, acute, glabrous, the base surrounded by a cupulate disk 1.8-2 mm. high; fruit unknown.

Distribution: Known only from the type locality, Koolau Range, leeward side.

Holotypus: Oahu, Pupukea Military Trail, Jan. 29, 1927, L. H. MacDaniels 559 (BISHOP MUS.).

Discussion: *C. intrapilosa* is a member of the section *Schizocalyces*. The most similar species is *C. niuensis* which has the bundle scars 5; young shoots densely appressed brownish villous; petioles 6-18 mm. long; blades 2-6.8 cm. long, 8-29 mm. wide, the secondary veins 5-8 on a side; peduncles 6-10 mm. long; pedicels 6-18 mm. long; calyx in anthesis 10-10.5 mm. long, almost equally lobed, the lobes 5 mm. wide; corolla 19-20 mm. long; and the style glabrous. In contrast, *C. intrapilosa* has the bundle scars 7; the young shoots densely appressed brown pilose; petioles 15-28 mm. long; blades 9.5-13 cm. long, 44-59 mm. wide, the secondary veins 10-11 on a side; peduncles 18-34 mm. long; pedicels 25-33 mm. long; calyx in anthesis 16-17 mm. long, irregular, the lobes 6-7 mm. wide; corolla 26 mm. long; and the style none.

Though at first described as a variety of *C. Lessoniana*, this plant now is known to have sufficient distinctive characters to be accepted as a species.

The new epithet is coined from the Latin *intra*, within; and *pilosa*, soft hairy, in allusion to the pubescence on the inner side of the calyx lobes.

43. *Cyrtandra kaalae* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 87, 1950. (Figs. 65, 66, 185.)

Description of All Specimens Examined: Shrub; branches with pale yellowish-brown smooth bark; leaf scars 3-5 mm. high, low shield-shaped, confluent, darker brown; bundle scars 5; internodes 12-70 mm., usually about 25 mm. long; leafy branches terete, closely ascending brownish hirsute, the shoots with 5-6 pairs of leaves; young shoots densely brown soft pilose; *leaves* opposite, unequal, one of a pair being $\frac{1}{2}$ - $\frac{2}{3}$ the larger, ascending, not crowded; petiole bases perfoliate, forming a fleshy raised flange, and leaving an annular scar connecting the leaf scars; petioles 15-56 mm. long, slender, at first densely brown crinkly multicellular hirsute, finally almost glabrate; *blades* 7-15.5 cm. long, 30-78 mm. wide, chartaceous, oval, the apex abruptly acute, base cuneate and short decurrent, the margin irregularly denticulate, above dark green, and sparsely crinkly hirsute, below pale and generally pilose; principal lateral veins 6-9 on

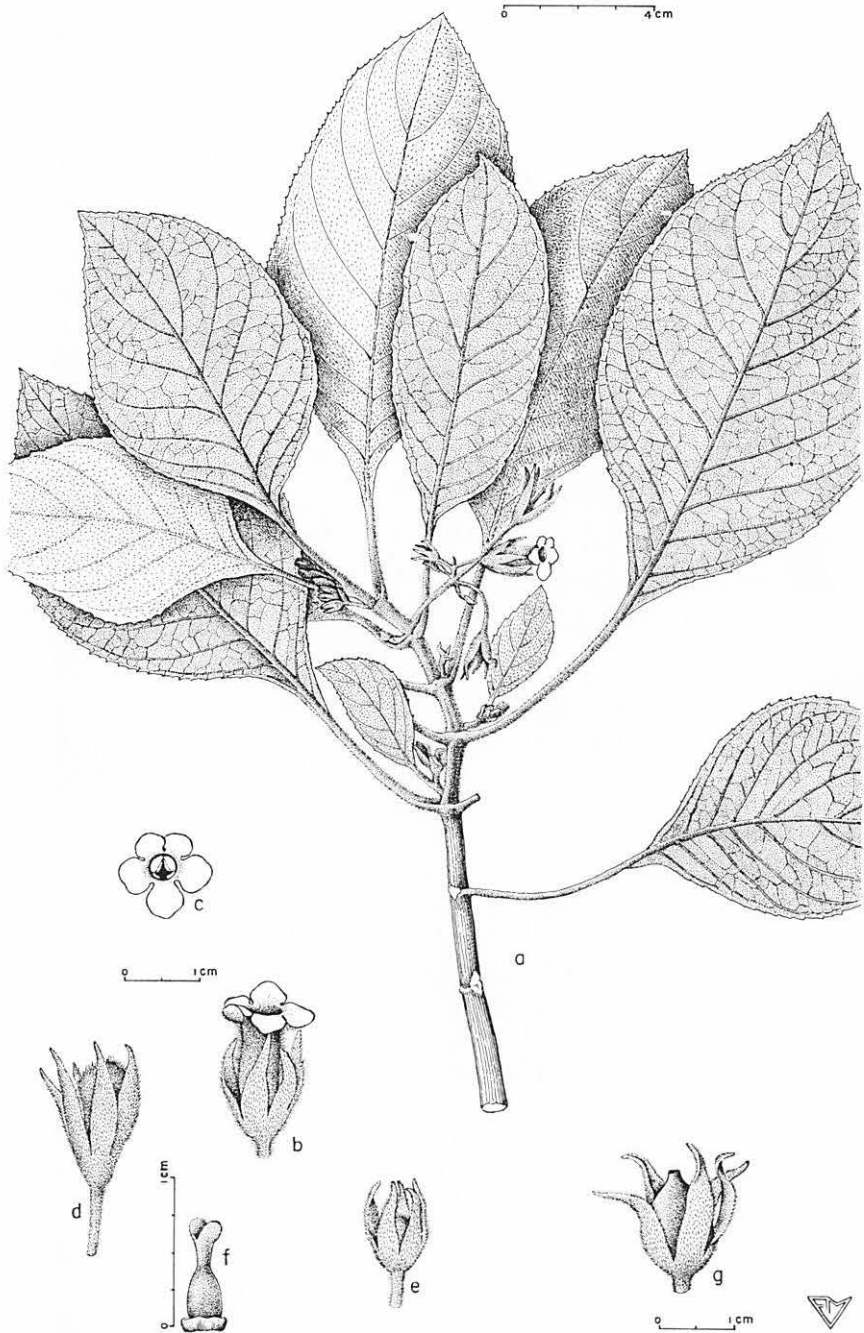


FIGURE 65.—*Cyrtandra kaalae*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, bud, $\times 1$; f, pistil, $\times 2$; g, fruit, $\times 1$. Puu Kaala, Storey 189, holotype (Bishop Mus.).

a side, ascending, mostly straight except for the inarching tips; *cymes* from the leaf axils, 3-5-flowered, hirsute throughout; peduncles 12-18 mm. long, divergent; pedicels 8-23 mm. long, slender, divergent; bracts 8-10 mm. long, lanceolate, foliaceous; buds campanulate, the tips of the calyx lobes ascending; *calyx* 14-19 mm. long, green and foliaceous, in flower narrowly funnellform, in fruit campanulate, the outer surface sub-

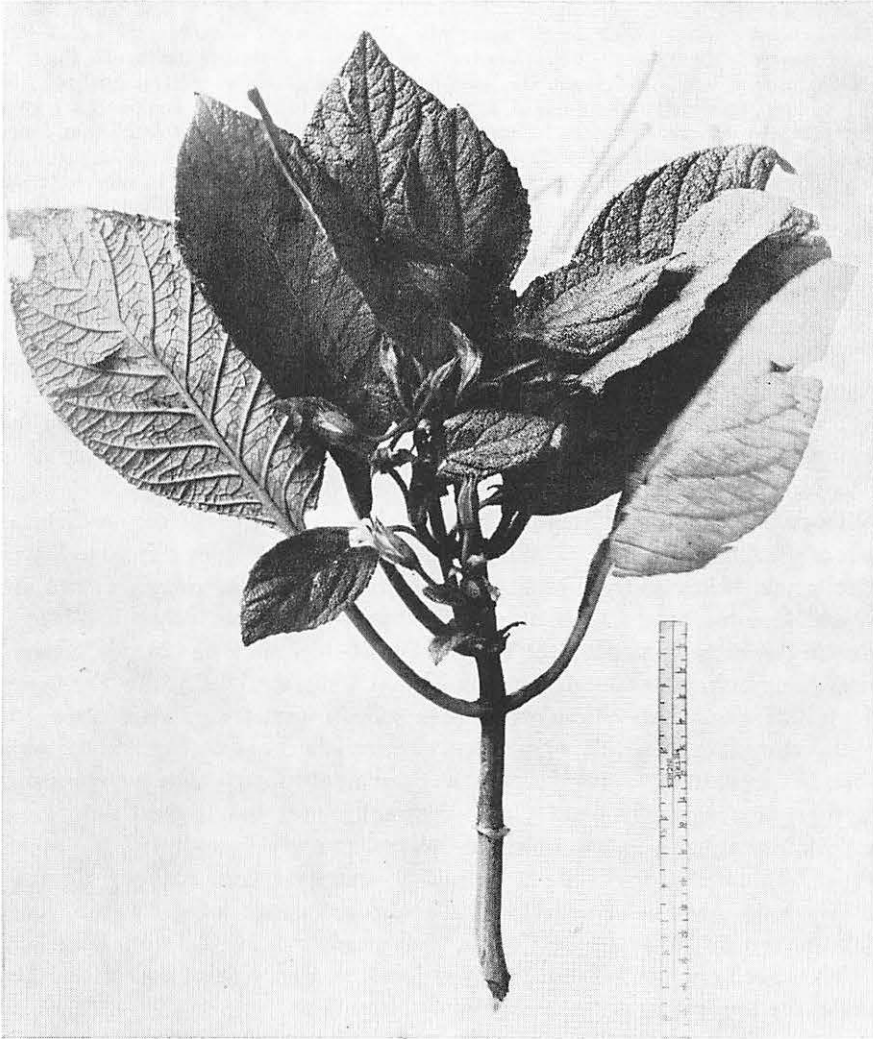


FIGURE 66.—*Cyrtandra kaalae*, topotype. Puu Kaala, Storey 270.

appressed hirsute, slightly 2-lipped, rather from the posture of the lobes than by their shape or union, lobed $\frac{5}{8}$ way to base; the tube 2-2.5 mm. long; upper lip of 3 lobes, cleft $\frac{5}{8}$ way, the lobes 12-15 mm. long, 2.3-3.5 mm. wide, narrowly linear-lanceolate, long tapering to the tip, ascending; lower lip of 2 lobes cleft $\frac{5}{8}$ way, the lobes similar to the upper ones; calyx within glabrous except for the hirsute inner surface of the

thick tips of the lobes; *corolla* 20 mm. long when fresh, white, the tube 15 mm. long, 5 mm. in diameter near base, 4 mm. at the neck below the throat, subcylindric, gently decurved near the throat, the outside spreading villous throughout and the exerted parts densely and shaggily so, the inside glabrous; limb 2-lipped, 5-lobed; upper lip with the lobes 2, widespreading, 2.7 mm. long, 4 mm. wide, transversely oval, overlapping at the sides, villous without, glabrous within; lower lip with 3 lobes, rotate, villous without, glabrous within, the 2 lateral lobes 8 mm. long, 10 mm. wide, transversely rhombic-oval; lowest lobe 9 mm. long, 10 mm. wide, oval, obtuse; two lower stamens perfect, the filaments adnate to the tube to within 7 mm. of the throat, the free portion 1.5 mm. long, stout, subulate, spirally upcurved; the two perfect anthers 2.3-2.5 mm. long, narrowly oblong-ovate, asymmetric, connate at apex; staminodia 1 mm. long, subulate, delicate, attached 1.5 mm. lower down on the throat; *style* 2.5 mm. long, stout, glabrous; stigmatic lobes 2, oval, 2.5 mm. long; *ovary* 7 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; *fruit* 16 mm. long, 10 mm. in diameter, ovoid, tapering to the tip, doubtless white; seeds 0.38-0.45 mm. long, 0.14-0.26 mm. in diameter, dark honey-colored, with brown ends, obliquely ellipsoid, the body covered with raised broad polygonal cellular reticulations $\frac{1}{5}$ to $\frac{1}{6}$ as long as the seed.

Distribution: Waianae Mts., windward side, just above the cap rock precipice, in rain forest, 3,500 ft. alt., in the Ohia Zone.

Holotype: Oahu, Puu Kaala, 3,500 ft., in swampy soil on ledge above the spring, Waianae Mts., Apr. 24, 1932, *W. B. Storey 189* (BISHOP MUS.).

Specimens Examined: Waianae Mts., Puu Kaala, in shade of trees on the swampy ledge just above the Kaala spring, 3,500 ft., Jan. 8, 1932, *Storey 270*; ditto, May 25, 1952, *St. John 24,821*.

Discussion: *C. kaalae* St. John & Storey is a member of the section *Schizocalyces*. Its closest relative, *C. partita* St. John, has the blades elliptic to lanceolate, acute, below softly hirsute, the margin unevenly serrulate; cymes appressed hirsute; bracts 12-16 mm. long, linear-lanceolate; calyx 19-21 mm. long, in flower campanulate, the upper lobes 16-18 mm. long; corolla 25 mm. long, shaggy hirsute without, the tube 20 mm. long, straight, within the upper $\frac{1}{3}$ capitate-glandular-puberulous; upper lobes 6 mm. long, within towards the throat capitate-glandular-puberulent; lowest lobes 8 mm. wide; and the style none. In contrast, *C. kaalae* has the blades oval, abruptly acute, below pilose, the margin irregularly denticulate; cymes hirsute; bracts 8-10 mm. long, lanceolate; calyx 14-19 mm. long, in flower narrowly funnelform, the upper lobes 12-15 mm. long; corolla 20 mm. long, shaggy villous without, the tube 15 mm. long, gently decurved, within glabrous; upper lobes 2.7 mm. long, glabrous within; lowest lobe 10 mm. wide; and the style 2.5 mm. long.

The specific name is from the type locality, Puu Kaala, now called Mt. Kaala, the highest peak of the Waianae Mountains.

44. *Cyrtandra kailuaensis* St. John, sp. nov. (Figs. 67, 193).

Diagnosis Holotypi: Frutex 1.5-2 m. alta, ramis griseis laevibus mox glabratibus in sicco longitudinaliter multi-sulcatis, cicatricibus 3-6 mm. altis pallidis scutelliformibus, fasciculis 9, novellis dense semiadpressi-puberulentis obscuratis, ramulis foliosis subquadrangularibus sparse puberulis 1.5-3 mm. diametro, internodis 8-68 mm. (plerumque 30 mm.) longis, foliis oppositis sparsis divergentibus in 3-4 nodis superis affixis uno jugi $\frac{1}{10}$ -3-plo majoribus, petiolis 13-72 mm. longis in vetuste sparse puberu-

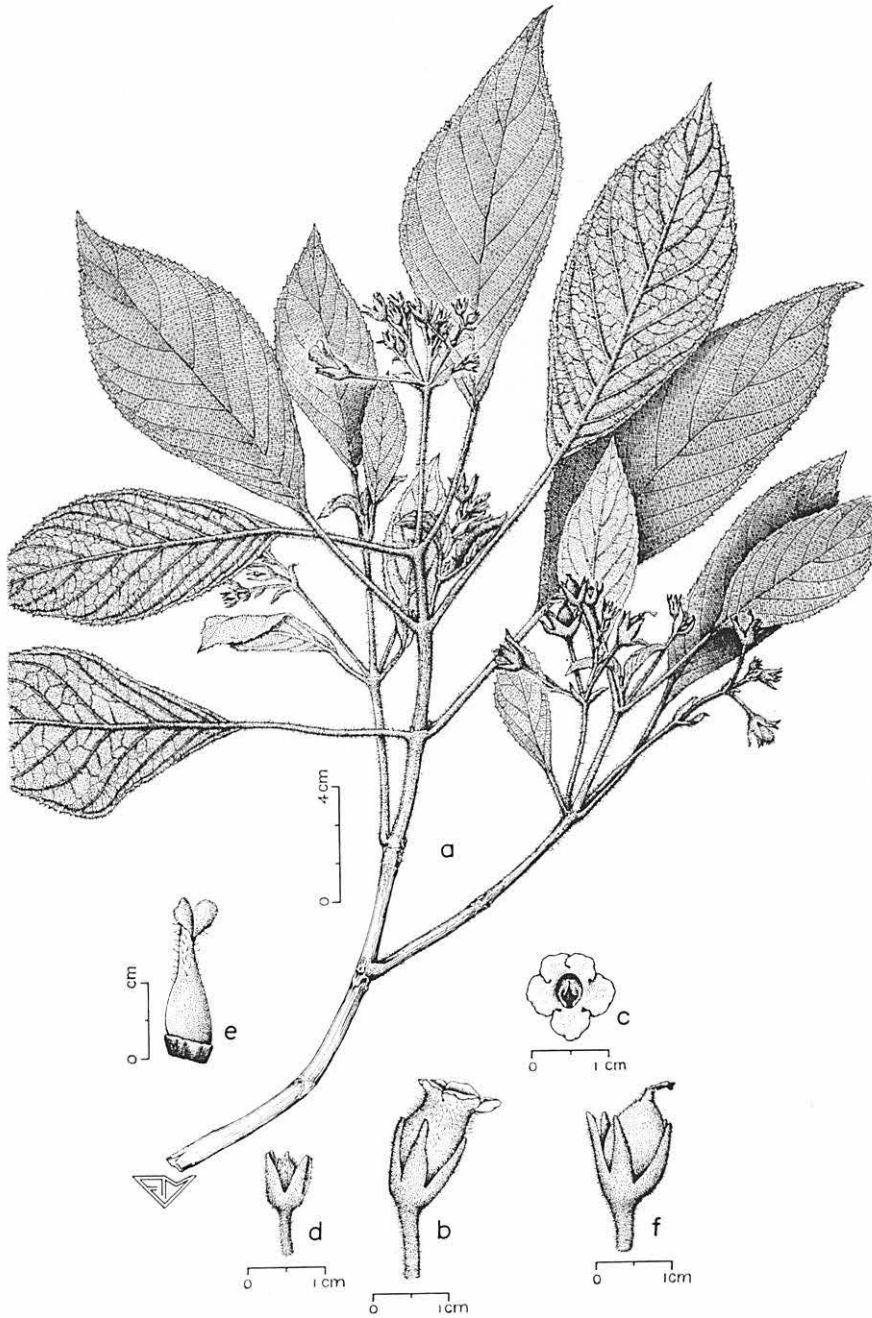


FIGURE 67.—*Cyrtandra kailuaensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 1$; f, fruit, $\times 1$. Kailua, Pearsall 2, holotype (Bishop Mus.).

lentic, *laminis* 3.5-12.5 cm. longis 13-52 mm. latis, subtiliter chartaceis elliptico-oblan-
 ceolatis plerumque symmetricalibus in basi abrupte cuneatis apici acuti vel subacuminati
 supra adpressi-pustulato-puberulentis obscure viridibus infra hinnuleo-coloratis nervis
 hirsuto-puberulentis intervallis dense puberuli-canescens marginibus duplo-serru-
 latis nervis secundariis 7-9 in uno latere arcuato-adscedentibus apicibus in dentibus
 excurrentibus, *cymis* axillaribus in 45° adscedentibus semiviridibus 3-9 cm. longis 7-16-
 floriferis crebre brunneis semiadpressi-puberulentis, pedunculis 17-43 mm. longis pedi-
 cellis 6-18 mm. longis, bracteis 3-10 mm. longis lanceolatis foliaceis, alabastris camp-
 anulatis apicibus lobae separatis, *calycibus* in flore et in vivo 10-12 mm. longis (in sicco
 7-9 mm.) viridibus extrinsecus semiadpresso-puberulentis intra glabris excepta lobis ad
 margines puberulentis tubo 2-2.5 mm. longo anguste campanulato, limbo 14.5-15 mm.
 longo crasso 2-labiato, labia supra 3-lobata lobis simulantibus sed loba centralia 8.5
 mm. longa, labia infera 2-lobata lobis 9 mm. partitis linearilanceolatis, *corollis* in vivo
 16-17 mm. longis (in sicco 10-12 mm.) albis extrinsecus crebre hirsutis excepta ad
 basim intra glabris tubo 13-14 mm. longo turgento-subcylindrico in medio paene de-
 clinato et 6 mm. diametro in orifice 5 mm. diametro, limbo bilabiato, labia supra
 2-lobata lobis in 90°-110° divergentibus 2.5 mm. longis 4.5 mm. latis transverse late
 ellipticis in basi auriculatis impensisque, labia infera 3-lobata lobis in 50° divergenti-
 bus, lobis lateralibus 3-3.5 mm. longis 5 mm. latis transverse late ovalibus in basi
 auriculatis impensisque, loba infera 3.5 mm. longa 4.5 mm. lata ovata-suborbiculari in
 basi auriculata, staminibus binis perfectis filamentis in tubo 3 mm. ex orifice affixis
 parte libera 1 mm. longa, antheris 2.2 mm. longis 1.5 mm. latis asymmetrico-ellipticis,
 connectivo elliptico, staminodiis tribus in tubo 4 mm. ex orifice affixis 0.3 mm. longis
 late subulatis, *stylo* 2 mm. longo sparse hirsuto, lobis stigmatibus 2.1 mm. longis late
 ovatis $\frac{1}{2}$ connatis in dorso hirsutulis, *ovario* 6 mm. longo lanceoloideo subglabro sed
 in medio remote hirsuto in basi disco cupulato 1 mm. alto cincto, *baccis* 9-10 mm. longis,
 5 mm. latis lanceo-ovoideis apiculatis tarde puberulis, seminibus 0.26-0.27 mm. longis
 0.10-0.16 mm. diametro asymmetrico-ellipsoideis mellicoloratis in epidermi reticulis
 $\frac{1}{4}$ - $\frac{1}{2}$ longa quam semines.

Description of All Specimens Examined: Shrub 1.5-2 m. tall; branches gray,
 smooth, early glabrate, on drying forming numerous longitudinal ridges; leaf scars
 3-6 mm. high, shield-shaped, pale; bundle scars 9; young shoots obscured by the dense
 semiappressed puberulence; leafy branchlets subquadrangular, sparsely spreading puberul-
 ent, 1.5-3 mm. in diameter; internodes 8-68 mm., averaging 30 mm. long; *leaves* op-
 posite, spreading, sparse, borne at the 3-4 upper nodes, those of a pair unequal, one being
 $\frac{1}{10}$ -3-times the larger; petioles 13-72 mm. long, at maturity sparsely spreading puberul-
 ent; *blades* 3.5-17.5 cm. long, 13-90 mm. wide, thin chartaceous, elliptic-oblan-
 ceolate, mostly symmetric, abruptly cuneate at base, the apex acute or subacuminate, above
 appressed pustulate puberulent, dark green, below fawn-colored, the veins shaggy pu-
 berulent, the intervals densely puberulous canescent, the margin doubly serrulate, the
 secondary veins 7-9 on a side, curved ascending, the tips excurrent in several teeth;
cymes axilliflorous, these ascending at 45°, greenish, 3-10 cm. long, 7-16-flowered,
 densely semiappressed brownish puberulent; peduncles 17-43 mm. long; pedicels 6-18
 mm. long; bracts 3-10 mm. long, lanceolate, foliaceous; bud campanulate, the tips of
 the calyx lobes well separated; *calyx* in anthesis when fresh 10-12 mm. long (when
 dried 7-9 mm. long), green, without semiappressed puberulent, within the lobes puberul-
 ent near the margins and on the outer half, elsewhere glabrous, tube 2-2.5 mm. long,
 narrowly campanulate; the limb 14.5-15 mm. long, thick, 2-lipped, cleft down 14.5-15
 mm. between the lips; upper lip 3-lobed, the lobes linear-lanceolate, similar, but the
 central one 8.5 mm. long; lower lip with two lobes cleft 9 mm. between the lobes,
 linear-lanceolate; *corolla* when fresh 16-17 mm. long (when dried 9-12 mm. long),
 white, without abundantly spreading hirsute except near the base, within glabrous, the
 tube 13-14 mm. long, tumid subcylindric, slightly declined at the middle, 3 mm. in
 diameter at the base, 6 mm. at the middle, 5 mm. at the throat; limb 2-lipped; upper
 lobes 2, spreading at 90° to 110°, and 2.5 mm. long, 4.5 mm. wide, transversely broad

elliptic, at base auriculate and overlapping; lower lip 3-lobed, the lobes spreading at about 50°; the lateral lobes 3-3.5 mm. long, 5 mm. wide, transversely broad oval, auriculate and overlapping at base; lower lobe 3.5 mm. long, 4.5 mm. wide, ovate-suborbicular, at base auriculate; two lower stamens perfect, with the filament adnate to the corolla tube to within 3 mm. of the throat, the free portion 1 mm. long, twisted in a straight close spiral and slightly ascending; the anthers 2.2 mm. long, 1.5 mm. wide, asymmetric elliptic, as is the broad connective; the three staminodia adnate to the tube to within 4 mm. of the throat, 0.3 mm. long, broad subulate; *style* 2 mm. long, stout, sparsely hirsute; stigmatic lobes two, 2.1 mm. long, broadly ovate, connate $\frac{1}{2}$ way up proximal side, hirsutulous on the distal side; *ovary* 6 mm. long, lanceoloid, subglabrous, but above the middle hirsute with a very few, remote hairs, the base surrounded by a cupulate disk 1 mm. high; *berry* 9-11 mm. long, 5-7 mm. in diameter, lance-ovoid, apiculate, becoming generally puberulous; seeds 0.26-0.27 mm. long, 0.10-0.16 mm. in diameter, asymmetric ellipsoid, honey-colored, with brown ends, the body covered with cellular, oblong reticulations $\frac{1}{4}$ - $\frac{1}{2}$ as long as the seed. Rarely cauliflorous from old, naked nodes; these cymes twinned, 3-flowered, 4-6.8 cm. long; calyx when dried 5-6 mm. long; berries 7-8 mm. long, 5-6 mm. in diameter.

Distribution: Koolau Range, windward side, moist thickets from 775 to 1,000 ft. alt. in Kailua on the side of Puu Konahuanui.

Holotypus: Oahu, Kailua, Fourth South Fork of the South Fork of Kahanai Stream, open scrub of guava, *Perrotettia*, kukui, *Rubus*, 800 ft. alt. Sept. 18, 1955, *G. Pearsall 2* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Kailua, Third Branch South of South Fork of Kahanai Stream, on east side of wet ravine, open brush of kukui, *Dioscorea*, guava, *Musa*, *Touchardia*, and *Pipturus*, 775 ft. elev., Mar. 16, 1956, *Pearsall 90*; Kailua, First Fork North of Main South Fork of Kahanai Stream, thicket of *Psidium Guajava*, *Aleurites*, *Rubus*, in steep gulch, 1,000 ft. alt., Nov. 25, 1955, *St. John 25,585*; Kailua, South Branch South of South Fork of Kahanai Stream, on east bank in brush of *Dioscorea*, staghorn fern, pamakani, guava, kukui, and *Clermontia*, 875 ft. alt., Dec. 4, 1955, *Pearsall 21*; Kailua, Fourth South Fork of South Fork of Kahanai Stream, 800 ft. alt., Sept. 2, 1955, *Pearsall 1*; ditto, but Fifth South Branch, open brush of guava, ti, *Clermontia*, kukui, *Dioscorea*, *Musa*, *Wikstroemia*, 800 ft. alt., Nov. 7, 1955, *Pearsall 10*; Kailua, Maunawili, woods near foot of pali directly back of Kaimi Farm, 1,000 ft. elev., Jan. 25, 1935, *Storey 253*; Kailua, East Fork of Makawao Stream, at foot of cliff, on steep slope, under kukui, ieie, and ti, 1,300 ft. alt., Feb. 22, 1946, *Hemphill*.

Discussion: *C. kailuaensis* is a member of the section *Schizocalyces*, as is its closest relative, *C. adpressipilosa*. Diagnostic differences are given in the key. Though similar, their flowering tendency is different. The former is normally axilliflorous and only very rarely in part cauliflorous. The latter is usually cauliflorous but occasionally on the same bushes is axilliflorous on weak lateral branches, especially if much exposed and sunlit.

The specific epithet is the place name Kailua; plus the Latin place suffix, *-ensis*, indicating the locality.

45. *Cyrtandra kalichii* Wawra, Flora 55: 564, 1872 (as *Kalichii*) (in reprint, p. 18). (Figs. 68, 69, 187.)

C. Kalihii Wawra, emend. Hillebrand, Fl. Hawaiian Is., 334, 1888.

Description of All Specimens: Shrub 1-5 m. tall; branches, greenish to straw-colored, smooth, glabrate, on drying much shrunken and closely longitudinally ridged and furrowed; leaf scars 3.5-5 mm. high cordate-shield-shaped, pale, corky, connected and annular by a broad band 1.5-2 mm. wide; bundle scars 9; young shoots densely brown hirsute; leafy branchlets as much as 5 mm. in diameter subquadrangular, closely hirsute; internodes 5-85 mm., averaging 20 mm. long; *leaves* opposite, divergent, not crowded, borne at the 3-5 upper nodes, those of a pair equal, subequal, or one as much as $\frac{1}{2}$ larger; petioles 13-90 mm. long, fleshy, stout, brown, stiff hirsute, later subglabrate, the petiole bases fleshy perfoliate and interconnected, on the larger leaves as much as 6 mm. wide, 3 mm. thick and revolute; *blades* 4-25 cm. long, 27-160 mm. wide, ovate to broadly oval, the apex acute or subacuminate, the base broadly rounded and abruptly short acuminate, thick chartaceous, above dark green, and brown hirsute scabrous, the well-spaced hairs multicellular, the very short cells with heavy, prominent end walls, the bases of the hairs indurate, below pale green and sparsely slender hirsute, the margins doubly dentate or serrate-dentate, the secondary veins 6-9 on a side, the tips arcuate, both inarched connecting and excurrent in the teeth; *cymes* axillary, densely hirsute, 1-, 3-, or 5-flowered; peduncles 6-20 mm. long, pedicels 1-18 mm. long; peduncular bracts 5-9 mm. long, lanceolate; buds ovoid; *calyx* in anthesis green, 11-12 mm. long when fresh (when dried 7-12.5 mm.), densely brownish rough hirsute without, the tube 2-4 mm. long, asymmetrically ovoid, glabrous within; the limb 8-9 mm. long, 2-lipped, cleft down 10 mm. between the lips, 5-lobed; upper lip 3-lobed, the lobes ascending, cleft down 9 mm. between the lobes which are lance-oblong, 3- or 5-nerved, within sparsely hirsute; lower lip with 2 lobes, cleft down 9 mm. between the lobes, the lobes 4 mm. wide, 5-nerved, sparsely hirsute within, lance-elliptic; *corolla* 20-24 mm. long when fresh (15-23 when dry), white, the tube 12-17 mm. long, cylindrical but slightly distended at base, 5 mm. at the throat, 3 mm. elsewhere, deflexed by a broad curve at the middle to 50° or 55° from the axis of lower tube, without from the middle upwards long crinkly hirsute, shaggily so at the throat, within glabrous below, minutely capitate glandular puberulous towards the throat; limb 2-lipped, 5-lobed, the lobes hirsute and minutely capitate glandular puberulous without except near the margin, glabrous within or at base capitate glandular puberulous, upper lobes 2, recurving at about 80° to the axis of the throat, 3.5-5 mm. long, 5-6.5 mm. wide, transversely oval; lower lip 3-lobed; lateral lobes 6-7 mm. long, 7.5-8 mm. wide, cordate, auriculate and much overlapping at base; lower lobe 7-7.5 mm. long, 8-9.5 mm. wide, suborbicular, auriculate and overlapping at base; two lower stamens with filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 2 mm. long, spirally upcurved, subulate; the 2 perfect anthers 1.9 mm. long, broadly ovate; connective ovate; the 2 lateral staminodia adnate to the tube to within 9 mm. of the throat, the upper one to within 10 mm., the free portion 0.6-0.8 mm. long, subulate, with a dark anther remnant on the tip; *style* 3-4 mm. long, terete, hirsute; 2 stigmatic lobes, 1.5 mm. long, ovate, capitate glandular hirsutulous on back, connate $\frac{1}{2}$ way up proximal side (one seen with 3 equal stigmas); *ovary* ovoid, 4.5 mm. long, glabrous, the base surrounded by a cupulate disk 0.7-1 mm. high; *berry* white, when fresh 14-16 mm. long, 8-12 mm. in diameter, ovoid, enclosed by the fruiting calyx which is 12-17 mm. long; seeds 0.32-0.34 mm. long, 0.16-0.21 mm. wide, broadly ellipsoid, olive brown, the body covered with raised cellular, broad oblong reticulations $\frac{1}{2}$ as long as the seed.

Distribution: Moist gulches or woods, 800 to 2,100 feet altitude, in the Ohia Zone, on the windward side of the Koolau Range from Kaluanui to Waiahole, and on the leeward side from the Anahulu Trail to Palolo, that is

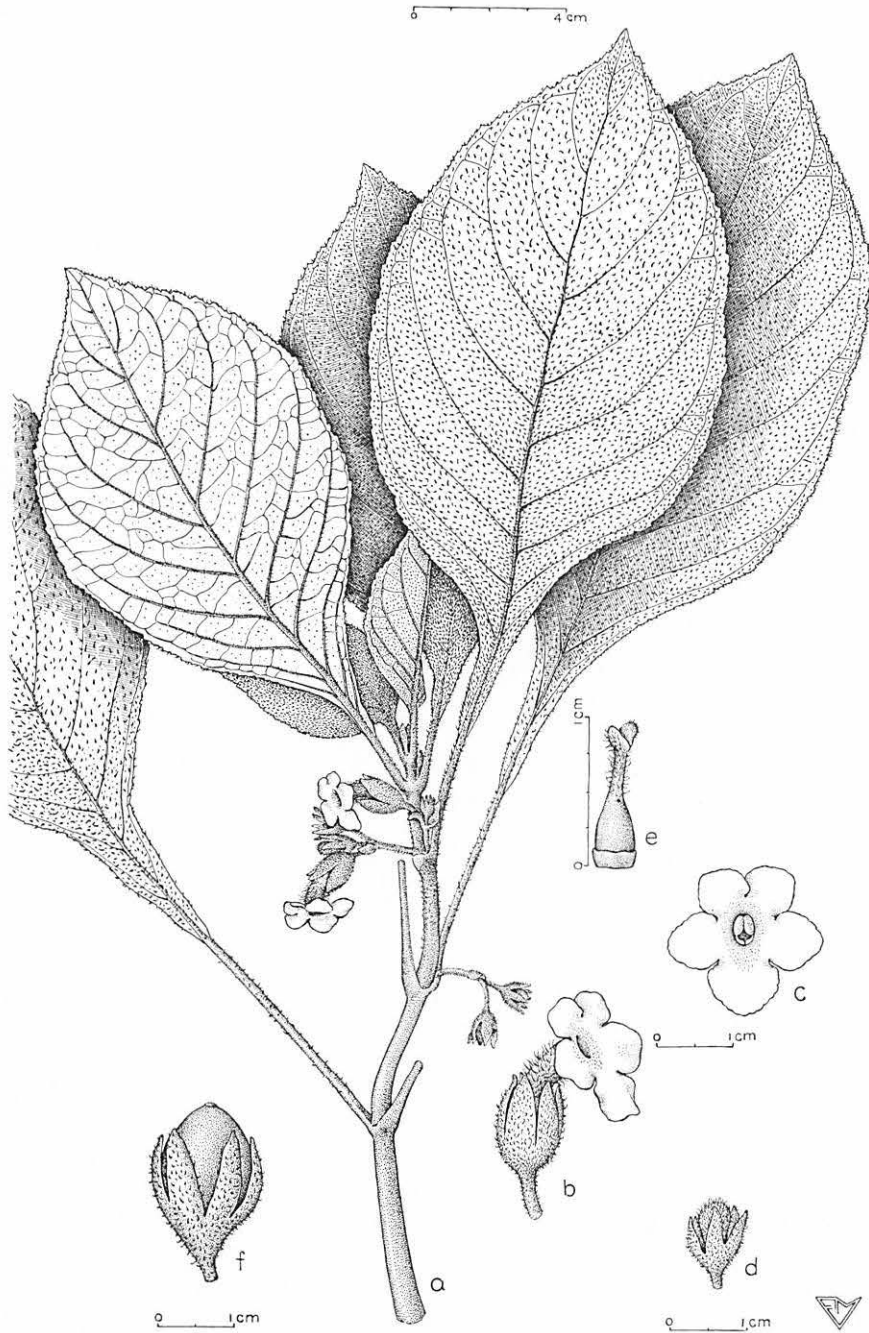


FIGURE 68.—*Cyrtandra kalichii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Poamoho, St. John 17,656.

for a distance of 25 miles along the mountain range; and wet forest above 3,500 feet altitude on Mt. Kaala in the Waianae Mountains, in the Ohia Zone.

Holotype: "Oahu, Felsschluchten des Kalichithals. 1788."

The type specimen is labeled Erdumsfahrt S. M. Fregatte "Donau," Hawaische Inseln, Oahu, H. Wawra 1788, (W), specimen examined and photographed (Fig. 69) in 1935. Clastotype (BISHOP MUS.) consists of two separate immature fruits of this species and one extraneous leaf of *Vaccinium* which matches *V. dentatum* Smith var. *angustifolium* (Hillebrand) Skottsberg well except for the pilosulous midrib of the lower side.

Specimens Examined: Koolau Range.

Windward Side: Hauula, Maakua-Papali ridge, Kaipapau For. Res., 1,600 ft. alt., moist wooded gulch, Oct. 15, 1933, *St. John 13,361*; ditto, *Yoshioka*; Kaluanui Stream, 1,900 ft. alt., wet forest by stream, May 23, 1948, *St. John 23,374*; ditto, above second waterfall, 2,000 ft. elev., July 4, 1931, *Storey 121*; ditto, *Storey 136*; Koolauloa Mts., [= Koolau] between Punaluu and Kaipapau [= Kaipapau], Nov. 14-21, 1908, *Forbes*; Punaluu, Maio 1910, *Faurie 606* (BM); Punaluu, wet slope, 1,000 ft. elev., Nov. 30, 1929, *Nitta (Degener 7,569)* (NY); Punaluu Mts., Nov. 14-21, 1908, *Rock 931*; ditto, Oct. 31, 1914, *Rock 1,795* (BISH, GH); Punaluu Valley along Castle Trail, 2,500 ft. elev., in woods near summit of ridge, Nov. 30, 1929, *Storey & Yamaguchi 146*; ditto, 2,700 ft. elev., Dec. 21, 1931, *Storey & Yamaguchi 150*; Waikane-Schofield Trail, Kahana, 700 m. alt., wet forest, *Fosberg & Duker 8,798*; ditto, 600 m. alt., Nov. 10, 1935, *Fosberg 12,323*; high ridge above Kahana, Sept. 17, 1926, *Skottsberg 1,838*; ditto, 1,800-2,000 ft., Apr. 17, 1932, *Storey 176*; Kahana Valley, Ditch Trail, 270 m. alt., wet forest, Nov. 26, 1933, *Fosberg 10,414*; ditto, moist wooded gorge of stream no. 10, Dec. 10, 1933, *St. John 13,420*; ditto, 800 ft. elev., Oct. 16, 1932, *Storey 198*; Waikane-Schofield Trail, Waikane, 800 ft. alt., moist woods, Oct. 16, 1932, *St. John 12,115*; Waiahole Valley, Dec. 1919, *Rock*.

Leeward Side: Anahulu Trail, 1,600 ft. elev., wooded slopes, moist shady habitat, Mar. 10, 1935, *Storey 266*; ridge S. of South Opaepala Gulch, Paalaa, 1,675 ft., moist densely vegetated, Sept. 25, 1932, *Fukuda*; ditto, Nov. 9, 1930, *Storey*; Poamoho Trail, rich wet shaded depression, Aug. 18, 1935, *Degener, Park, Bush, Topping & Potter 10,517* (NY); Poamoho Trail, Paalaa-Wahiawa ridge, 1,650 ft. alt., moist woods, Nov. 22, 1936, *St. John 17,656*; ditto, 1,900 ft. alt., *St. John 20,185*; ditto, dry gulch, 2,100 ft., Mar. 2, 1941, *Wong*; North Fork of Kaukonahua Gulch, Wahiawa, May 15, 1909, *Hosmer & Rock 3,028*; Kipapa Gulch, S. ridge, Waipio, 1,700 ft. elev., July 4, 1932, *Hosaka 606*; ditto, 1,700 ft. elev., near stream bed, Sept. 18, 1932, *Hosaka 702*; ditto, 1,800 ft. elev., May 6, 1933, *Hosaka 1,021*; ditto, 2,100 ft. elev., Aug. 6, 1933, *Hosaka 1,150*; ditto, 2,000 ft. alt., Sept. 18, 1932, *St. John 12,073*; North Halawa Stream, wet woods by stream, 1,700 ft. alt., Dec. 12, 1943, *St. John*

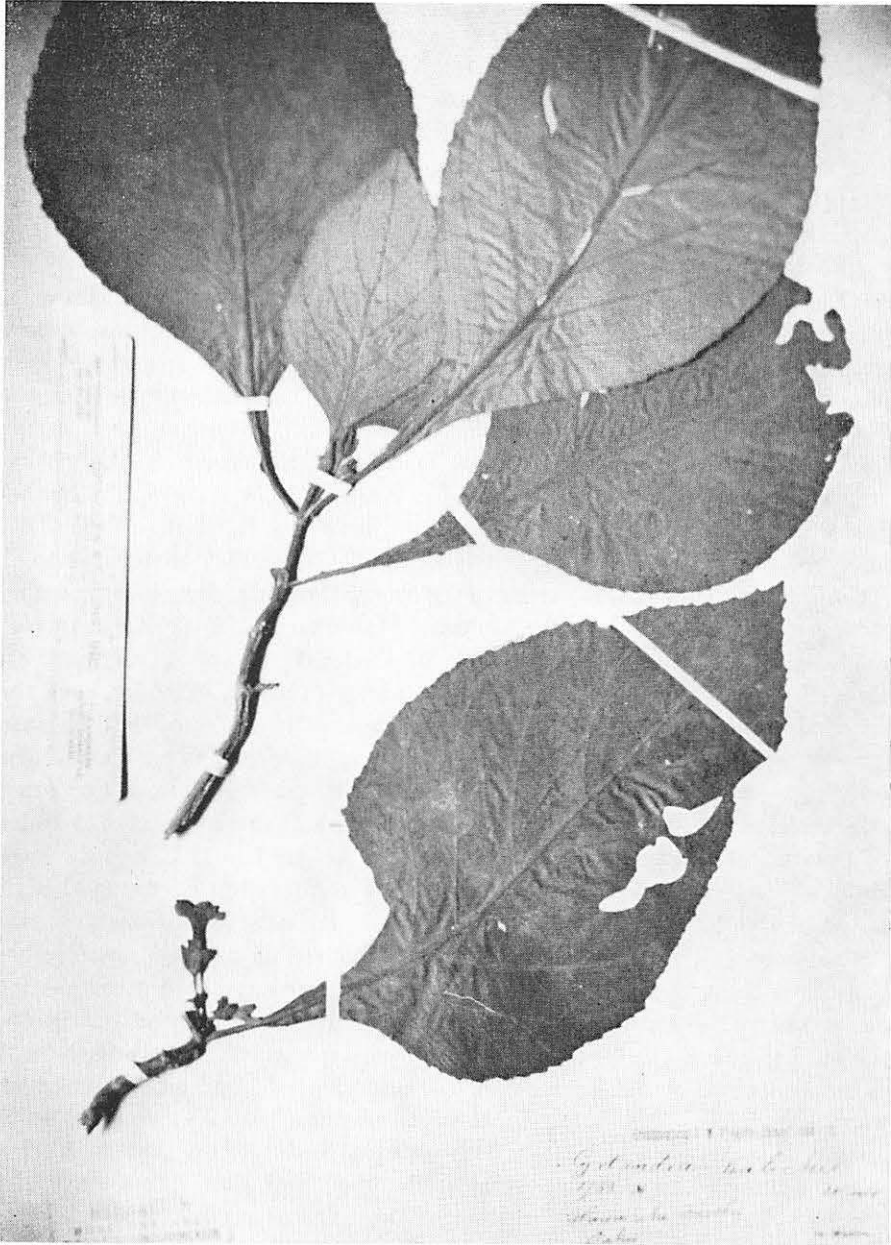


FIGURE 69.—*Cyrtandra kalichii*, holotype (Vienna). Oahu, Kalichithals, Wawra 1,788.

20,404; Manoa, Kalihi, Hillebrand (BM); Konahuanui-Olympus trail, first gulch, Mar. 17, 1919, *Forbes* 2,543.O; apparently from valley east of Wilhelmina Rise, July 7, 1923, *Degener* 7,664 (NY).

Koolau Mountains: Dec. 3-14, 1908, *J. F. Rock* 152.

Waianae Mountains: top of Kaala, 1,200 m. alt., Apr. 3, 1931, *Christopher-sen, Wilder & Hume* 1,691; Puu Kaala, Waianaueka, 3,700 ft. alt., wet forest by spring, Apr. 18, 1948, *St. John* 23,366.

Oahu: in deep gulches, 18—, Hillebrand (GH).

Hawaiian Islands: Hillebrand (E, US).

Discussion: *C. kalichii*, a member of the section *Schizocalyces*, is a common and widely distributed species in the Koolau Range, and it also occurs on Mt. Kaala in the Waianae Mountains. The leaves of the species are very characteristic. It is easily recognized by the spaced stiff hirsute hairs on the blades, which give it a roughness like that of a cat's tongue.

The discoverer of the species was H. Wawra, a German-speaking Austrian, who recorded the locality name as Kalichi. This is the valley behind Honolulu now called in American-Hawaiian, Kalihi. C. B. Clarke (1883: 219) accepted the original spelling, but Hillebrand (1888: 334) changed it to *C. Kalihii*. Rock (1919: 63-64) retained the original spelling, though commenting that Wawra in identifying "the aspirated Hawaiian *h* with the German *ch*," published an improper spelling, *C. kalichii*. Under the botanical practice of his time, that was permissible. Later, Skottsberg (1936: 177) again uses the changed spelling *C. Kalihii* and defends it saying "It is absurd that, because WAWRA was unable to interpret the native geographical names, we shall be obliged to misspell them ever after." This is Skottsberg's opinion and practice, but it is not in accord with the detailed rules of the International Rules of Botanical Nomenclature, Cambridge 1930, Amsterdam 1935, and the later codes of Stockholm 1950 and Paris 1954. The alteration of the epithet of *C. kalichii* violated Article 59 (Cambridge Rules ed. 1935: 18) which said "A name or epithet must not be rejected, changed or modified, merely because it is badly chosen, or disagreeable, or because another is preferable or better known." As revised in Paris (1954) it is Article 62 and it still applies: "legitimate name or epithet must not be rejected, merely because it is inappropriate, or disagreeable, or because another is preferable or better known, or because it has lost its original meaning." Also applicable in the 1954 code is Art. 73 which states "The original spelling of a name or epithet must be retained, except that typographic or orthographic errors should be corrected." As examples of retention of the original spelling it gives: *Triaspis mozambica* must not be altered to *T. mossambica*; *Lespedeza* must not be altered to *Cespedesa*, though it commemorates V. M. de Céspedes. The epithet of *C. kalichii* is comparable to thousands of other geographic epithets that were based on a spelling no longer current or even an erroneous idea of

one as, for example, *owhyheensis*, *maviensis*, *pensilvanica*, *noveboracensis*, *gallica*, *persica*, or *aegyptiacus*. All of these are legitimate by botanical law and practice.

Effective in 1936 when Skottsberg published was Article 4 of the Cambridge Rules (1930) which stated: "The essential points in nomenclature are: (1) to aim at fixity of names; . . . Other considerations, such as absolute grammatical correctness, regularity or euphony of names, more or less prevailing custom, regard for persons, etc., notwithstanding their undeniable importance are relatively accessory." It is certain that *C. kalichii* is a legitimate name and that no one now has the authority to change it.

C. kalichii was placed by Hillebrand (1888: 334) in the section *Chaetocalyces*. Because of its lance-elliptic calyx lobes, it is here reallocated to the section *Schizocalyces*.

There is an excellent specimen (BISHOP MUS.) of the set with the printed label, Flora Hawaiiensis, *Hillebrand and Lydgate*, and an original ticket. This bears in Hillebrand's hand in pencil, "Molokai 1st exc. June 18 *Cyrtandra triflora*," and in another's hand in ink "*Cyrtandra kalichii* Wawra." It is a good flowering specimen of *C. kalichii* known only on Oahu. This Hillebrand and Lydgate set of the Hillebrand collections is notorious for its many confusions of data. This record is rejected until there is confirmation of the occurrence of this species on the island of Molokai.

46. *Cyrtandra kaneoheensis* St. John, sp. nov. (Figs. 70, 187).

Diagnosis Holotypi: Frutex 1 m. alta, ramulis 5-8 mm. diametro teretibus pallide brunneis glabratis carnosus sed in sicco valde contractis et sulcatis, cicatricibus 3-4 mm. altis depresso-scutelliformibus pallidis suberosis late interconnectis et annulatis, fasciculis 7 et uno in connectivo, ramulis foliosis ad 5 mm. diametro quadrangularibus dense brunneo-hirsutulis, internodis 6-40 mm. plerumque 12 mm. longis, novellis dense brunneo-hirsutulis, *foliis* oppositis subaequalibus divergentibus non aggregatis in 3-5 nodis superis affixis, petiolis 17-29 mm. longis validi dense hirsutulis basi perfoliata vittaeformi carnosa hirsutula 2 mm. lata, *laminis* 7-21 cm. longis 32-85 mm. latis chartaceis oblanceolatis apice acuto vel subacuminato basi longe cuneata supra viridibus et sparse hirsutis infra pallide viridibus et molliter pilosulis in nervis principalibus dense pilosulis marginibus serrato-denticulatis nervis secundariis 5-8 in uno latere adscendentibus et subarcuatis interconnectis et in dentibus apiculato-salientibus, *cymis* axillaribus 3-7-floriferis dense hirsutulis, pedunculis 5-9 mm. longis, pedicellis 4-11 mm. longis, bracteis 6-9 mm. longis lanceolatis foliaceis, alabastris fusiformibus lobis calycis evidentis, *calycibus* in flore 15-16 mm. longis (in sicco 11-13 mm.) viridibus extra dense hirsutulis tubo 7-8 mm. longo anguste obovoideo in basi cuneata extra hirsutulo intra glabro, limbo 8-11 mm. longo extra hirsutulo bilabiato inter labias 9-11 mm. partito simulante 4-lobata sed binis labis in labia supera connatis, lobis separatis labiae superae 8-8.5 mm. longis 2-2.5 mm. latis (in sicco 6-7 mm. longis 1.5 mm. latis) lineari-lanceolatis in basi latissimis intra hirsutulis, labia infera bilobata lobis 9-11.5 mm. longis 3-3.5 mm. latis lineari-lanceolatis lobis binis plerumque separatis raro connatis, *corollis* in vivo 24-25 mm. longis (in sicco 17-19 mm.) albis tubo 19-20 mm. longo subcylindrico subrecto extra ad mediam glabro e media ad apicem albo villosulo intra glabro in basi 3 mm. diametro in medio 5 mm. in orifice 6 mm., limbo bilabiato 5-lobato extra ad basim et in partibus expositis villosis intra ad orificem capitato-glanduloso-puberulis

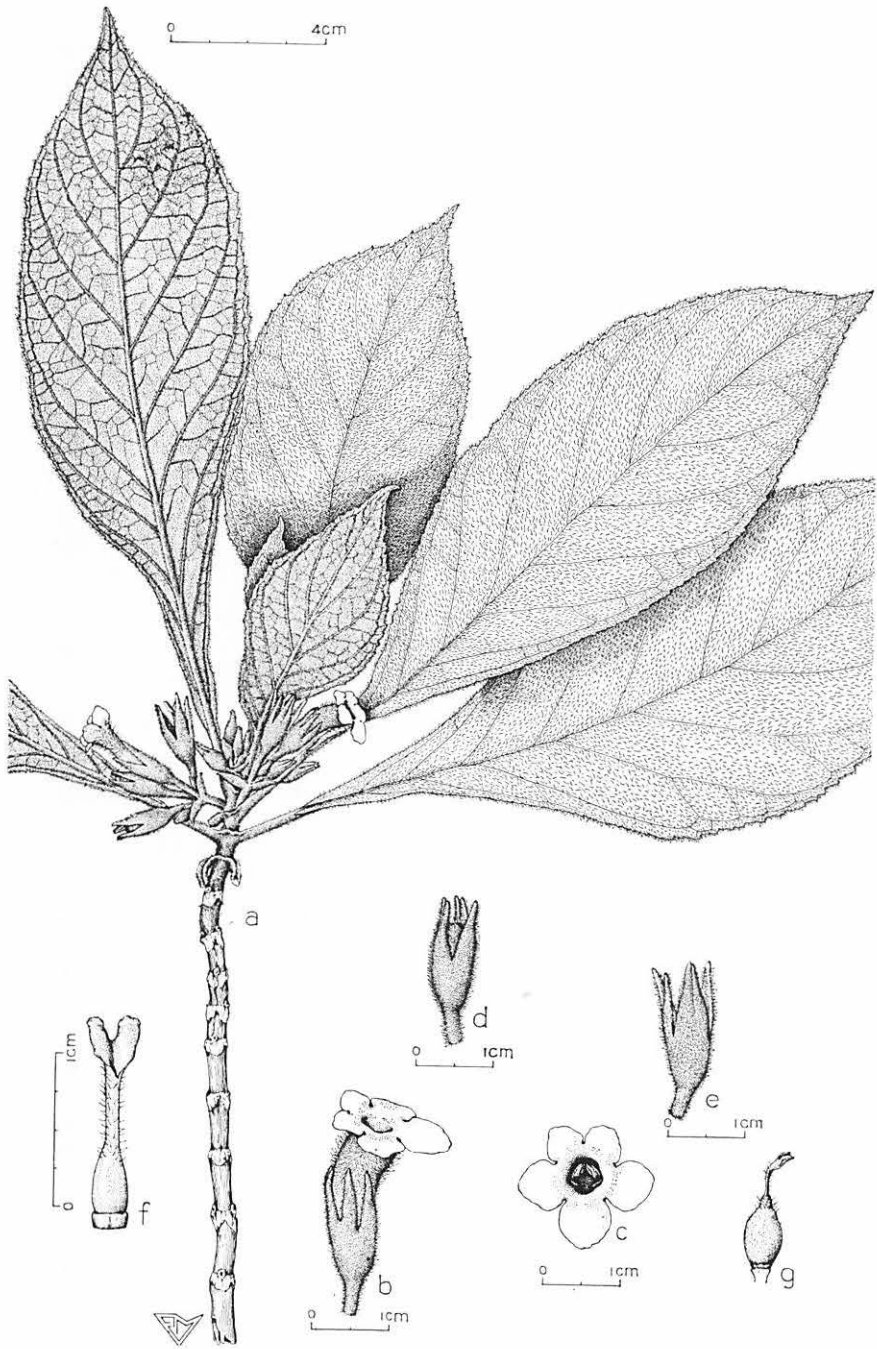


FIGURE 70.—*Cyrtandra kaneoheensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, g, fruit, $\times 1$; f, pistil, $\times 2$. Kaneohe, St. John 20,226, holotype (Bishop Mus.).

in partibus alteris glabris, lobis superioribus in 70° divergentibus 3.5 mm. longis 4.5-5.5 mm. latis depresso-reniformibus in basi auriculatis et impensis, labia inferiora 3-lobata, lobis lateralibus 5.5-6 mm. longis et latis suborbicularibus, loba inferiora 6-7 mm. longa lataque ovato-suborbiculari, staminibus inferioribus fertilibus filamentis in tubo 7 mm. ex orifice affixis partibus liberis 2.5 mm. longis teretibus contorte adscendentibus in apice inflatis, antheris 2-2.3 mm. longis 1.8 mm. latis oblique ovatis connectivo crasso oblique ovato, staminodiis lateralibus in tubo in 8 mm. ex orifice adnatis parte libera 0.4 mm. longa subulata apice subulato compresso, *stylo* 6 mm. longo capitato-glanduloso-hirsuto, lobis inferioribus stigmatis 4 mm. longis ellipticis in latere proximo sparse hirsutis et $\frac{1}{2}$ connatis, *ovario* 5-6 mm. longo lanceoloideo glabro excepta in apice sparse glanduloso-puberulo in basi disco cupulato 1.5 mm. alto cincto, *fructu* immaturo non calyce excedenti lanceoloideo glabro sed rostro hirsuto.

Diagnosis of Holotype: Shrub, 1 m. tall; branchlets 5-8 mm. in diameter, terete, pale brownish, glabrate, fleshy and on drying with many longitudinal furrows and ridges; leaf scars 3-4 mm. high, low shield-shaped, pale, corky, interconnected by a broad band, thus annular; bundle scars 7 and with 1 in each connecting band; leafy branchlets as much as 5 mm. in diameter, quadrangular, densely brownish hirsutulous; internodes 6-40 mm., averaging 12 mm. in length; young shoots densely brownish hirsutulous; *leaves* opposite, diverging, not crowded, borne at the 3-5 upper nodes, those of a pair subequal; petioles 17-29 mm. long, stout, densely hirsutulous, the base perfoliate, interconnected by a fleshy, hirsutulous band about 2 mm. wide; *blades* 7-21 cm. long, 32-85 mm. broad, chartaceous, oblanceolate, the apex acute or subacuminate, the base long cuneate, above green and sparsely hirsute, below pale greenish and softly pilosulous, more densely so on the principal veins, the margins serrate-denticulate, the secondary veins 5-8 on a side, ascending and gently arcuate, the tips inarched interconnecting and apiculate salient in the teeth; *cymes* axillary, 3-7-flowered, densely hirsutulous; peduncles 5-9 mm. long; pedicels 4-11 mm. long; bracts 6-9 mm. long, lanceolate, foliaceous; buds lance-fusiform, with the calyx lobe tips evident; *calyx* in anthesis 15-16 mm. long (when dried 11-13 mm.), green, densely hirsutulous without; calyx tube 7-8 mm. long, narrowly obovoid, tapering at base, without hirsutulous, within glabrous; the limb 8-11 mm. long, without hirsutulous, 2-lipped, cleft down 9-11 mm. between the lips, apparently 4-lobed as two of the upper lobes are connate, but actually 5-lobed; upper lip really 3-lobed but with two of the lobes fully connate, the single lobe 8-8.5 mm. long, 2-2.5 mm. wide (when dried 6-7 mm. long, 1.5 mm. wide), linear-lanceolate, broadest at base, it and the other lobes hirsutulous within; lower lip 2-lobed, the lobes 9-11.5 mm. long, 3-3.5 mm. wide, linear-lanceolate, the two lobes usually separate but in some instances connate to the tip; *corolla* when fresh 24-25 mm. long (when dried 17-19 mm.), white, the tube 19-20 mm. long, subcylindric, almost straight, without glabrous to the middle, shaggy white villous above it, within glabrous, at base 3 mm. in diameter, at the middle 5 mm. and at the throat 6 mm. in diameter; limb 2-lipped, 5-lobed, without the lobes villous at base except where covered in veneration, within glabrous except near the capitate glandular puberulous throat; 2 upper lobes spreading at about 70° to the axis of the throat, 3.5 mm. long, 4.5-5.5 mm. wide, depressed reniform, auriculate and overlapping at base; lower lip 3-lobed; lateral lobes 5.5-6 mm. long and wide, suborbicular; lower lobe, 6-7 mm. long and wide, ovate-suborbicular; two lower stamens fertile, with filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 2.5 mm. long, terete, inflated at apex, spirally upcurved; anthers 2-2.3 mm. long, 1.8 mm. wide, obliquely ovate, as is the heavy connective; staminodia adnate to the corolla tube to within 8 mm. of the throat, the free part 0.4 mm. long, subulate, the apical part similar but flatter and thinner; *style* 6 mm. long, capitate glandular hirsute; two stigmatic lobes 4 mm. long, elliptic, on proximal side sparsely hirsute, and connate half way up; *ovary* 5-6 mm. long, lanceoloid, glabrous elsewhere but at the summit sparsely glandular puberulous, surrounded by a cupulate disk 1.5 mm. high; immature *fruit* not exceeding the calyx, lanceoloid, glabrous, with a hirsute style beak.

Distribution: Koolau Range, windward side, low, wet thickets, at base of precipice, alt. 600 ft., at the base of the Ohia Zone, in Kaneohe.

Holotypus: Kaneohe, Luluku Stream, 600 ft. alt., shady stream bank above intake, under *Hibiscus tiliaceus*, Apr. 27, 1941, *H. St. John 20,226* (BISHOP MUS.).

Discussion: *C. kaneoheensis* is a member of the section *Schizocalyces*. The closest relative is *C. kalichii* Wawra which has the petioles finally subglabrate; blades ovate to broadly oval, below hirsute; fresh calyx in anthesis 11-12 mm. long, without densely brownish scabrous hirsute, the tube 2-4 mm. long, the lobes 8-9 mm. long, 4 mm. wide lance-oblong; corolla tube deflected at the middle at 50° or 55°, above the middle long crinkly hirsute without; and the stigma lobes 1.5 mm. long. In contrast, *C. kaneoheensis* has the petioles densely hirsutulous; blades oblanceolate, below softly pilosulous; fresh calyx in anthesis 15-16 mm. long, without densely hirsutulous, the tube 7-8 mm. long, the lobes 8-11 mm. long, 2-3.5 mm. wide, linear-lanceolate; corolla tube straight, above the middle shaggy villous without; and the stigma lobes 4 mm. long.

The new specific name is formed from the geographic name Kaneohe; and the Latin adjectival place ending *-ensis*, in reference to the type locality.

47. *Cyrtandra Lessoniana* Gaudichaud, Voy. Uranie, Bot., 447, 1826 [=1829]; Atlas, pl. 54, 1826-1830, as *C. lessoniana*.

C. Lessorianana Gaudichaud sensu Wawra, Flora 55: 561 (or p. 17 in reprint), 1872, an error for *C. Lessoniana* Gaud.

Description of Species: Shrub to 3 m. tall; branchlet as much as 8 mm. in diameter, glabrate, smooth, pale brown; leaf scars 2-4 mm. high, pale; bundle scars 7; young shoots densely appressed brown pilose-sericeous; leafy branchlets 2-4 mm. in diameter, quadrangular, densely subappressed brown pilose; internodes 3-80, averaging 20 mm. in length; leaves opposite, divergent, not crowded, borne at the 3-6 upper nodes, those of a pair rarely equal, usually unequal, one of a pair being as much as 1/8 larger; petioles 0.8-6.2 cm. long, densely appressed brown pilose; blades 3.5-21 cm. long, 11-72 mm. wide, thick, firm chartaceous or subcoriaceous, narrow-lanceolate, lanceolate, lance-ovate, or oblanceolate, the base cuneate or abruptly so, the apex short acuminate to an obtuse tip or merely acute, above dark green and somewhat shiny, sparsely appressed pilose from pustulate bases, below whitish green and closely appressed pilose sericeous or semi-appressed pilosulous or puberulent generally so or merely on the veins, the hairs drying brown, the margins commonly revolute, entire or especially towards the apex minutely low serrulate, the secondary veins 7-9 on a side, ascending straightish, then near the margin upward arcuate and inarched interconnecting; cymes axillary, appressed pilose, 1-(2-)-flowered; peduncles 6-20 mm. long, terete, stout, accrescent and in fruit as much as 20 or 28 mm. long; pedicels 5-24 mm. long, stout; bracts 3-18 mm. long, lance-linear or lanceolate, white or greenish, foliaceous, appressed pilose; buds subglobose to campanulate, the calyx lobes ascending; calyx in anthesis 13-22 mm. long, white, cyathiform, the base broad, loose, not closely enclosing the corolla, the lobe tips diverging in a campanulate pattern, without appressed pilosulous but towards the tip more sparsely so, within glabrous or puberulent; the tube 2-4 mm. long; the limb cleft down 7-18 mm. between the lips, 5-lobed; the lobes of the two lips subequal but perceptibly differing in size and posture; upper lip

3-lobed, the lobes 5-18 mm. long, 4-9 mm. wide, narrowly elliptic-lanceolate, ovate, or with an ovate base abruptly narrowed and tapering into a lanceolate acuminate tip, the lateral margins revolute; lower lip of 2 lobes, these slightly the larger; *corolla* 21-27 mm. long, without densely shaggy villous; the tube about 19 mm. long, cylindric, straight; two upper lobes 3.5-4 mm. long, 4.4-7 mm. wide, reniform; lateral lobes 5-7 mm. long, 5.5-8 mm. wide, rhombic-suborbicular; lower lobe 4-6 mm. long, 5-8 mm. wide, reniform; *style* 0-2 mm. long, glabrous; stigmatic lobes 2-3 mm. long, oval; *ovary* 7-8 mm. long, ovoid, glabrous; *berry* white, 10-22 mm. long, 7-16 mm. in diameter, ovoid, the apex short tapering and abruptly apiculate, exposed; seeds 0.35-0.45 mm. long.

The species consists of three varieties.

48. *Cyrtandra Lessoniana* Gaudichaud var. *Lessoniana* (Figs. 71, 72, 188).

C. Lessoniana Gaudichaud var. *typica* St. John & Storey, B. P. Bishop Mus., Occ. Papers, 20 (6) : 87, 1950. Illustrations: Gaudichaud, Voy. Uranie, Bot., Atlas, tab. 54, 1826-30.

Description of All Specimens Examined: Shrub 2 m. tall; branchlets glabrate, smooth, pale brown, as much as 8 mm. in diameter, slightly shrinking on drying; leaf scars 2-4 mm. high, depressed obcordate-shield-shaped, pale, corky; bundle scars 7; young shoots densely appressed brown pilose-sericeous; leafy branchlets 2-4 mm. in diameter, quadrangular, densely subappressed brown pilose; internodes 3-80 mm., averaging 20 mm. in length; *leaves* opposite, divergent, not crowded, borne at the 3-6 upper nodes, those of a pair rarely equal, usually unequal, one of a pair being as much as $\frac{1}{8}$ larger; petioles 0.8-6.2 cm. long, densely appressed brown pilose; *blades* 3.5-19.5 cm. long, 11-72 mm. wide, thick, firm chartaceous, lanceolate or lance-ovate, the base cuneate or abruptly so, the apex short acuminate to an obtuse tip, or merely acute, above dark green and somewhat shiny, sparsely appressed pilose from pustulate bases, below densely and closely appressed pilose sericeous, the hairs white but on drying becoming brown, the margins commonly revolute, entire or especially towards the apex minutely low serrulate, the secondary veins 7-9 on a side, ascending straightish, then near the margin upward arcuate and inarched interconnecting; *cymes* axillary, appressed pilose, 1-(-2)-flowered; peduncles 6-20 mm. long, terete, stout; pedicels 8-24 mm. long, terete, stout; bracts 3-10 mm. long, lance-linear, foliaceous, appressed pilose; buds subglobose to campanulate, the calyx lobes ascending; *calyx* in anthesis 15-21 mm. long (when dried 9-21 mm. long), pure white, cyathiform, the base broad, loose, not closely enclosing the corolla, the lobe tips diverging in a campanulate pattern, without appressed pilosulous but toward tip and margins more sparsely so, within glabrous; the tube 2-4 mm. long; the limb cleft down 7-18 mm. between the lips, 5-lobed; the lobes of the two lips subequal but perceptibly differing in size and posture; upper lip 3-lobed, the lobes 7-18 mm. long, 4-9 mm. wide, the base ovate, then abruptly narrowed and tapering into a lanceolate, acuminate tip, the lateral margins revolute; lower lip of 2 lobes, these slightly larger; *corolla* 21-25 mm. long (when dry 19-24 mm. long), without densely shaggy villous, within completely glabrous; the tube 19 mm. long, cylindric, straight and of almost uniform diameter, at the middle 8 mm. in diameter, at the throat 7 mm. in diameter; the limb 2-lipped, 5-lobed; upper lobes 2, recurving at about 80° to the axis of the throat, 3.5 mm. long, 7 mm. wide, reniform, overlapping at base; lower lip 3-lobed; lateral lobes 7 mm. long, 8 mm. wide, rhombic-suborbicular; lower lobe 6 mm. long, 8 mm. wide, reniform; two lower stamens with filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 2 mm. long, 1.5 mm. wide, thick ligulate, ascending; the 2 perfect anthers 3.8-4 mm. long, 2.5 mm. wide, very asymmetric ovate, the connective ovate, the 2 lateral staminodia adnate to the corolla tube to within 8 mm. of the throat, the free filament 2 mm. long, stout subulate, spirally upcurved, bearing a sterile anther 2 mm. long, ovoid, 2-celled; upper

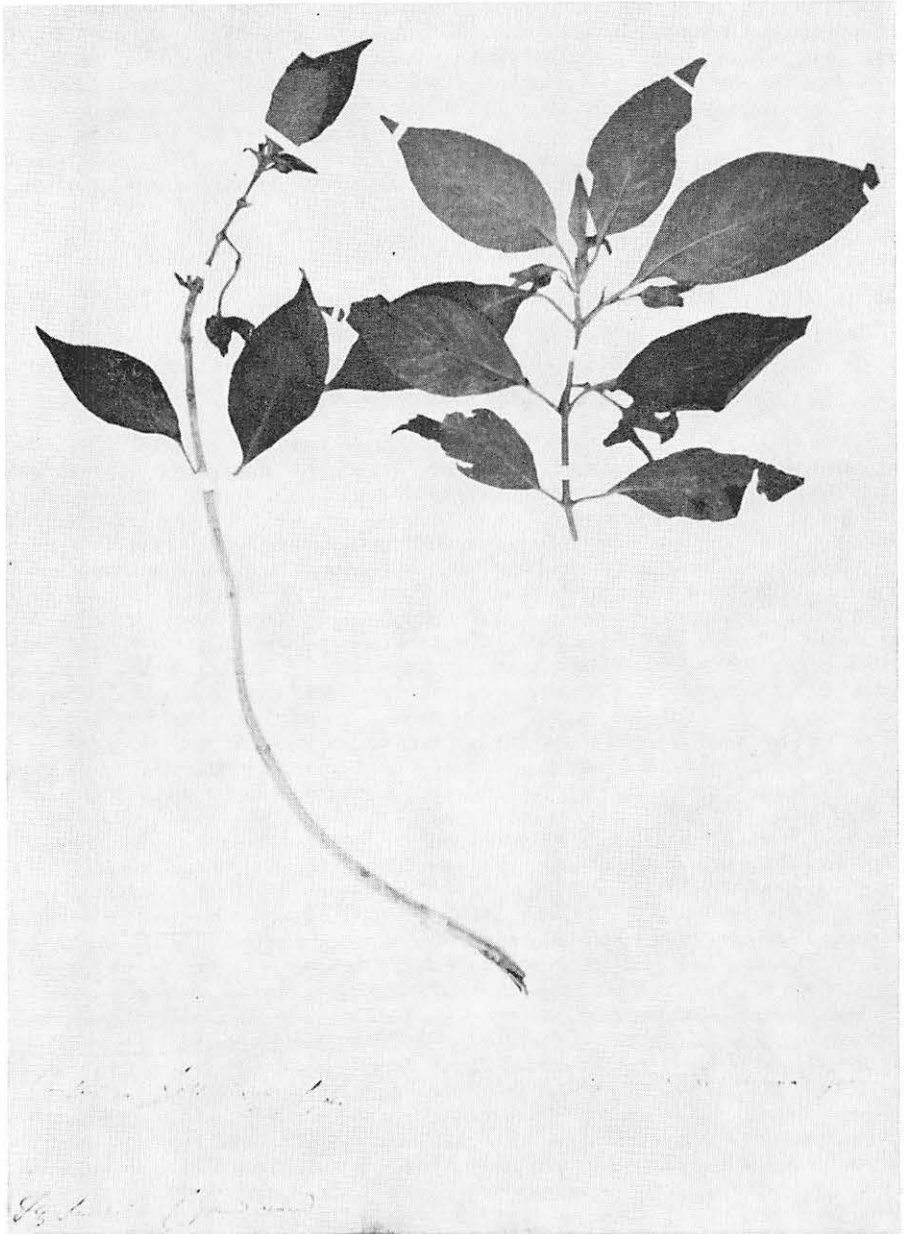


FIGURE 71.—*Cyrtandra Lessoniana*, holotype (Paris). Insulis Sandwicensibus, Gaudichaud.

staminodium adnate to the corolla tube to within 10 mm. of the throat, bearing a sessile ovoid tip 0.9 mm. long; style 0-2 mm. long, glabrous; stigmatic lobes 2.5-3 mm. long, oval opposite, equal; ovary 7-8 mm. long, ovoid, glabrous, the base surrounded by a cupulate disk 1-2 mm. high; berry white, 10-22 mm. long, 7-16 mm. in diameter, ovoid, the apex short tapering and abruptly apiculate, exposed since the calyx lobes become reflexed in fruit; seeds 0.35-0.45 mm. long, 0.21-0.32 mm. in diameter broadly ellipsoid, amber-colored, the body covered with prominent raised cellular reticulations that are $\frac{1}{6}$ to $\frac{1}{7}$ as long as the seed, quadrangular or hexagonal and mostly isodiametric.

Distribution: Koolau Range, on the leeward side, from Kipapa Gulch to Niu, at from 1,500 to 1,700 feet altitude, in moist gulches and rain forest, in the Ohia Zone.

Type: "In insulis Sandwicensibus (Alt. 100-300 hex.); cum sequentibus." *C. Gaudichaud*. The type specimen also bears on the label "Uranie 1817-1820, pl. 54" (P). Type examined. (See Fig. 71.) There are also isotypes (E, two in FI, and one in G).

Specimens Examined: Koolau Range.

Leeward Side: Kipapa Gulch, C.C.C. trail to summit at about 1,500 ft., Feb. 10, 1935, *Storey 255*; mountains, Pearl River, 1838-42, *Wilkes Expedition* (GH); Kalauao Ridge, moist woods, 1,500 ft. alt., March 29, 1933, *St. John 13,031*; ditto, woods along trail, 1,500 ft. elev., Apr. 30, 1933, *Storey 238*; Aiea, C.C.C. Trail, forest near summit, Feb. 16, 1936, *Degener and Topping 10,513* (NY); Kalihi Valley, Aug. 18, 1908, *Forbes* (BISH); ditto, Aug. 2, 1916, *Hitchcock 14,108* (BISH, US); the duplicate in Honolulu was renumbered by *Rock* as *College of Hawaii Herbarium No. 13074*; Waiolani ridge, Oct. 14, 1908, *Forbes*; 1852, Honolulu, *Andersson* (S); ditto Dec, 10, 1908, *Forbes*; Pacific Heights, Dec. 20, 1903, *W. A. Bryan*; Pauoa-Pacific Heights ridge, Mar. 21, 1920, *Garber 353*; Tantalus, moist shaded east slope, June 11, 1923, *Degener 7,764* (NY); ditto, open rain forest, Mar. 20, 1926, *Degener 7,689* (NY); ditto, Apr. 11, 1893, *Heller 2,113* (UC); Konahuanui, ridge, *W. A. Bryan 529*; ditto, Jan. 6, 1909, *Forbes 1,011*; lower slopes of Konahuanui, above Manoa, May 13, 1895, *Heller 2,300A* (GH, US); ditto, May 23, 1895, *Heller 2,351* (GH, UC, US); ditto, Nov. 12-13, 1895, *Heller 2,896* (BISH, GH, L, US); trail to Konahuanui, Jan. 7, 1909, *Rock 1,066*; Palolo Valley, Nov. 7, 1908, *Forbes and Rock*; ditto, *Hillebrand and Lydgate*; ditto, Nov. 7, 1908, [*Rock*] 726; ditto, June 14, 1908, collector unknown, no. 1,181; Wailupe, *Hillebrand and Lydgate*, in part, mixed with var. *angustifolia*; Niu, *Hillebrand and Lydgate*, in part, loose bud and fruit only, mixed with *C. oulophylla*; ditto, Apr. 1930, *Russ*; ditto, Sept. 1924, *Topping 2,844* (UC), 2,847 (UC); ditto, Kulepiamo Ridge, thicket on moist ridge, 1,700 ft. alt., Nov. 10, 1940, *St. John 20,118*.

Oahu: written as *Woahoo*, Maio 1825, *Macrae* (BM, G); written as *Wahoo*, montes, Herb. *Nuttall* (BM); ditto Herb. *Nuttall* (BM), this one bearing a manuscript new specific name; Oahu, *Mann & Brigham 77* (BISH, G, GH);



FIGURE 72.—*Cyrtandra Lessoniana* var. *Lessoniana*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Niu, St. John 20,118.

ditto, *Mann & Brigham 617 (447)* (BISH, GH); Wilkes Expedition (US); Oahu, *Wawra 1,692* (BISH, W).

Sandwich or Hawaiian Islands, 1839, *Gaudichaud 7*, and *196 (G)*; Plantae Hawaiienses, *Hillebrand (BM, E, GH, S, US)*: ditto, received July 1865, *Hillebrand 331 (GH)*; Flora Hawaiiensis, *Mann & Brigham (CU)*; Panama or Sandwich Is., Apr. 1852, *Andersson (S)*.

Discussion: *C. Lessoniana* is a member of the section *Schizocalyces*. It is a very strongly marked species, easily recognized by its calyx, loose and cupulate at base and with the sides of the calyx lobes strongly revolute, and the usually single-flowered inflorescences. It has no closely similar, related species.

The type specimen is preserved in the Museum National d'Histoire Naturelle, in Paris. It is a small but good specimen showing herbage, flowers, and fruit. The folio-sized illustration published by Gaudichaud (1826-1830: pl. 54) may well have been taken from the twig on the right hand side of the type sheet, even though this lacks the lower stem. The published illustration is bold and clear. Since the heavy shading of the stem and petioles is by parallel lining, no pubescence there is shown. The marginal teeth on the leaf blades are overemphasized or exaggerated. Otherwise the habit drawing is good; so also are the detailed drawings of flower, pistil, sessile opposite stigmas, and the stamen with its heavy broad, slightly curved filament.

The locality, mountains of Pearl River, for the Wilkes Expedition collection, is not easy to locate. None of the maps show Pearl River, though in the narrative the terms Pearl Harbor and Pearl River are used interchangeably. Yet for the locality with mountains of Pearl River, a definite stream must have been meant. It was apparently not Waikakalaua or Kipapa Stream which merge to form Waikele Stream leading into West Loch of Pearl Harbor, as this was apparently then called the Ewa Stream. Instead the collectors, Rich and Brackenridge, probably referred to some of the streams heading in the Koolau Range and entering the middle Loch, that is the Waiawa, or entering the East Loch, that is the Punanani, Waimālu, Kalauao, Aiea, or Halawa Streams. Because of the size of its estuary, this old locality, Pearl River, has been tentatively mapped as the drainage of Waiawa Stream.

The collection, *Mann & Brigham 617* in the Gray Herbarium bears the data Kaala Mts., but not the number 447. Of Mann's collection list, the part preserved is from No. 408 to 471. In this 447 is an Apocynaceous tree from Makawao, Maui. After determining his plants, Mann sorted them and often assembled several that he considered the same species under a single number, really a species number. His No. 617 from Kaala Mountains is doubtless *C. Wilderi*.

Hillebrand (1888: 331) accepted *C. Lessoniana* Gaudichaud but added three new varieties to it. His β var. was unnamed. The specimens from the Waianae Mountains, with green calyx, and smaller, narrower calyx, lobes, etc.,

was named *C. Lessoniana* Gaudichaud var. *stenoloba* Skottsberg in 1936, but is here classified as *C. Wilderi* St. John & Storey. Hillebrand's γ var. *angustifolia* was rejected and reduced to the species by Rock (1919: 48-49), but it is here restored and accepted in the sense of Hillebrand. It has differences of leaf shape and pubescence and its range in the northwestern end of the Koolau Range is largely distinct from that of the species. Hillebrand's δ var. *pachyphylla* is here classed as *C. oulophylla* St. John & Storey.

As Gaudichaud stated, this species was named in honor of René-Primevert Lesson (1794-1849), pharmacist and zoologist of the French Navy, member of the world voyage on "La Coquille."

49. *Cyrtandra Lessoniana* Gaudichaud var. *angustifolia* Hillebrand, Fl. Hawaiian Is. 331, 1888 (as γ *angustifolia*). (Figs. 73, 188.)

"Leaves narrow—lanceolate, 6-8' x $\frac{3}{4}$ -1', the tomentum confined to rib and veins. Calycine lobes ovate to lanceolate.

"Eastern portion of the main range of Oahu! Wailupe."

Holotype: Oahu, Wailupe Valley, 1870, *Willie* [Hillebrand], (B). Type examined. Known only from the type. Isotype seen (BM).

Discussion: The type was examined and photographed in Berlin in 1936, but not critically studied. Measurements made from this photograph (Fig. 73) show the leaf blades to be 12.5-17.5 cm. long, 2.3-2.8 cm. wide, linear-oblancoate. In shape they much more closely resemble the leaves of *C. Lessoniana* var. *koolauloensis* than those of var. *Lessoniana*, but neither of these nor any of the other varieties have the intervals of the lower leaf surface glabrous. Only buds are present, and in this young stage the calyx lobes are ovate, as is commonly the case in youth. This variety has not been collected since Hillebrand's time, but the native vegetation of the lower and middle parts of Wailupe Valley which is on the lee side of the dry eastern end of the Koolau Range and close to urban Honolulu, has been destroyed.

50. *Cyrtandra Lessoniana* Gaudichaud var. *intrapubens*, St. John var. nov. (Fig. 188).

Diagnosis Holotypi: A *C. Lessoniana* var. *koolauloensis* differt in lobis calycis intra adpressi-puberulentis.

Description of Holotype: Differing from *C. Lessoniana* var. *koolauloensis* by having the calyx lobes appressed puberulent within.

Distribution: Waianae Mountains, windward side, in woods, near the summit of Puu Kanehoa.

Holotypus: Waianae Mts., Puu Kanehoa, in shade of woods near summit, Jan. 24, 1932, *W. B. Storey 143* (BISHOP MUS.).

Specimens Examined: Waianae Mts., Windward Side: Puu Kanehoa, E. ridge of, Honouliuli, 2,500 ft. alt., in upper woods, Jan. 7, 1934, *St. John 14,041*.

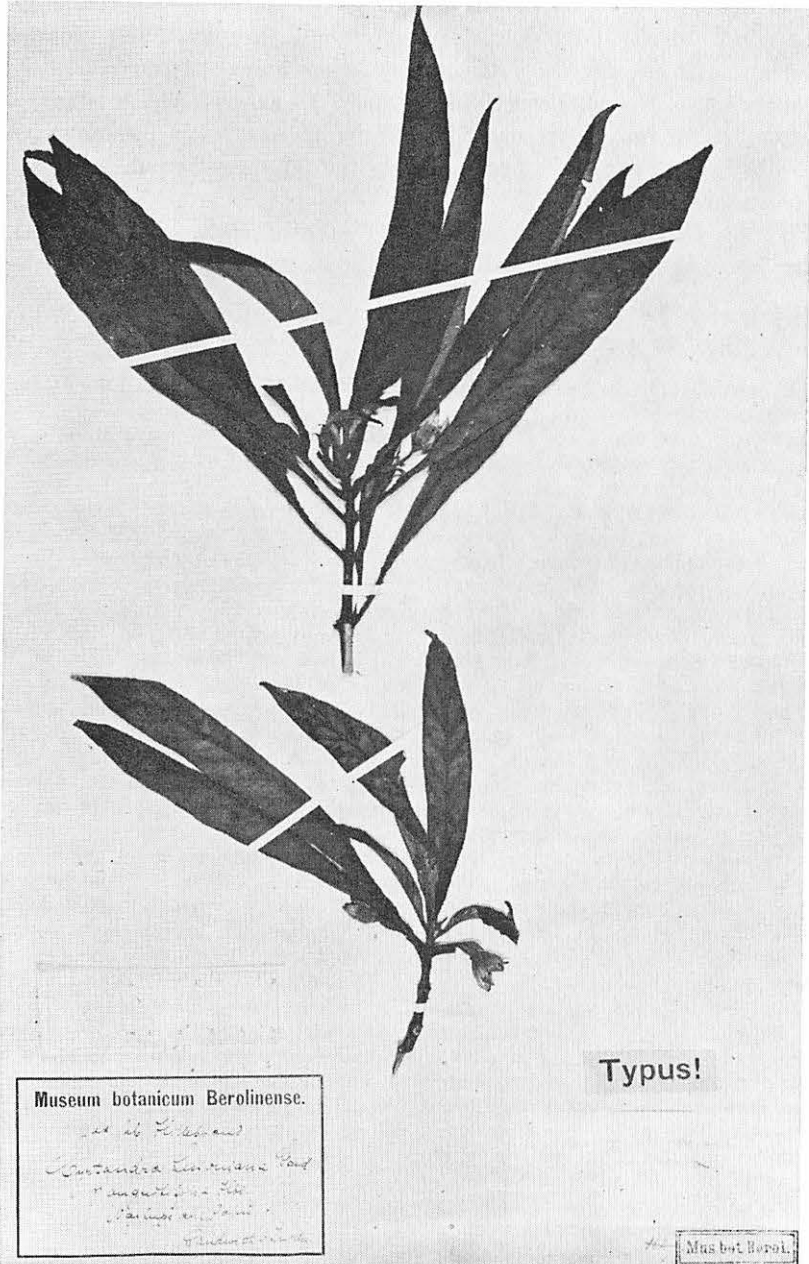


FIGURE 73.—*Cyrtandra Lessoniana* var. *angustifolia*, holotype (Berlin). Wailupe, Hillebrand.

Discussion: The type specimen has the calyx markedly puberulent within. The second collection cited has the calyx only very sparsely puberulent within and is thus intermediate, but by being hairy differs from the var. *koolauloensis* of the northern Koolau Range. Also these collections from Puu Kanehoa are the only representatives of the species in the Waianae Mountains. The leaves are all of a broad oblanceolate shape. The pubescence is like that of var. *koolauloensis*.

The new varietal name is coined from the Latin, *intra*, within; *pubens*, becoming hairy or pubescent, in allusion to the hairy calyx.

51. *Cyrtandra Lessoniana* Gaudichaud var. *koolauloensis*, St. John var. nov. (Figs. 74, 188).

Diagnosis Holotypi: Frutex ad 3 m. alta, *laminis* 6.5-15 cm. longis 1.6-3.4 mm. latis oblanceolatis abrupte acutis infra subadpressi-puberulentis, *cymis* 1-floris, bracteis pedunculorum 8-14 mm. longis, *cymis* pedicellis calycibus corollisque albis, *calycibus* 16-18 mm. longis cyathiformibus, lobis lanceolatis marginibus revolutis, *corollis* 25-27 mm. longis intra glabris extra pilosis.

Description of All Specimens Examined: Shrub up to 3 m. tall; bundle scars 5; internodes 3-60 mm., averaging 10 mm. long; young shoots with green color not obscured by the appressed brown pilosity; *leaves* opposite, curved and arched divergent, approximate; petioles 10-40 mm. long, 1-5 mm. in diameter, terete; *blades* 3-22 cm. long, 1.2-5.2 cm. wide, thick, firm, subcoriaceous, oblanceolate, abruptly acute, below whitish green, semiappressed puberulent, or pilosulous, the hairs drying brown, midrib and primary laterals raised; *cymes* 1-flowered, in bud and flower pale, white or nearly so; peduncles in anthesis ascending, 14-17 mm. long, accrescent and in fruit 20-28 mm. long, green, and divergent, bearing at the summit 2 bracts 8-18 mm. long, lanceolate, white, becoming greenish, sparsely appressed brownish pilose; pedicel in anthesis 5-15 mm. long, 2.5-3 mm. in diameter, recurving, stout and enlarged to the apex, in fruit 22-35 mm. long, and greenish; *calyx* 13-22 mm. long, cyathiform, the tissue pure white or the tips only slightly greenish, perhaps 2-lipped with the 3 lower lobes the longer, but so nearly equal to one of the two upper lobes, that at best they can be described as subequal, parted $\frac{10}{11}$ way to base, the tube 2 mm. long, saucer-shaped, the lobes narrowly elliptic-lanceolate, 5-6 mm. wide, calyx accrescent and in fruit the lobes 20-22 mm. long, and pale greenish, translucent, 3-nerved, rotate with the tips reflexed; *corolla* 25-27 mm. long, white, the tube at base 4 mm. in diameter, at the throat 3 mm. in diameter; limb 2-lipped, 5-lobed, the lobes almost rotate at 90° to the axis of the upper tube, the two upper lobes 4-4.5 mm. long, 4.5-5.5 mm. wide, oblate-orbicular, thick and fleshy, within glabrous, without shaggy white villous; lower lip with the two lateral lobes 5-6 mm. long, 5.5-7 mm. wide, orbicular, within glabrous, without pilose, the lower lobe 4-5.5 mm. long, 5-7 mm. wide, suborbicular, within glabrous, without white pilose; three staminodia fused to within 10 mm. of the throat, the filaments wholly adnate, each bearing an abortive anther 0.4 mm. long, lance-cordate, white; *style* none; the 2 terminal stigmatic lobes 2 mm. long, deltoid ovate, truncate, fused $\frac{1}{4}$ way up the proximal side; *ovary* 7 mm. long, narrowly ovoid, glabrous; *berry* 10-15 mm. long, lance-ovoid to ovoid, glabrous; seeds 0.25-0.28 mm. long, 0.09-0.11 mm. in diameter, narrowly ellipsoid, straight or more commonly asymmetric, honey-colored with dark brown obtuse ends, the surface with prominent raised cellular reticulations that are narrowly oblong and $\frac{1}{4}$ - $\frac{1}{5}$ as long as the seed.

Distribution: Koolau Range, on the crest of the range and on the windward side, in moist forests, at 1,800 to 2,200 ft. alt., from Malaekahana to Waikane; on the leeward side in dense forests from the northern summit at



FIGURE 74.—*Cyrtandra lessoniana* var. *koolauloensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, $\times 1$; f, pistil, $\times 2$; g, fruit, $\times 1$. Anahulu Trail, St. John 22,872, holotype (Bishop Mus.).

Pupukea at 1,800 ft. alt., and southward in wet forests to Kipapa Gulch from 1,000 to 2,800 ft. alt., in the Ohia Zone.

Holotypus: Oahu, Kawailoa, Anahulu Trail, Koolau Range, moist shady gulch, 1,400 ft. alt., 3 m. shrub, flowers white, calyx and pedicels white, Nov. 30, 1947, *H. St. John* 22,872 (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Pupukea-Kahuku trail, Malaekahana-Waimea, 1,800 ft. alt., rain forest, Apr. 4, 1937, *St. John* 17,976; Laie-Waimea, Koolau divide, moist woods, 2,200 ft. alt., Apr. 15, 1933, *St. John* 13,077; ditto, *St. John* 13,078; ditto, *St. John* 13,081; Hauula ridge, Kaipapau Forest Reserve, wooded moist forest, 1,800 ft., Oct. 15, 1933, *Kitamura*; ditto, *Suehiro*; Koolauloa [= Koolau] Mts., between Punaluu and Kaipapau [= Kaipapau], Nov. 14-21, 1908, *Forbes*; ditto, May 8-13, 1909, *Forbes & Thompson*; Kaula-nui Valley, along banks of stream in densely wooded region, 2,000 ft. elev., July 4, 1931, *Storey* 139; ditto, 1,900 ft. elev., *Storey* 147; Punaluu, Pig-God Trail, forest, June 22, 1932, *Degener* 17,126 (NY); Punaluu, maio 1910, *Faurie* 636 (BISH, BM) (renumbered as *Rock* 13,073); ditto, 2,000 ft. elev., Nov. 30, 1929, *Hosaka* 36; ditto, Aug. 1908, *Rock*; ditto, Aug. 8, 1908, *Rock* 14; Punaluu camp near stream, Dec. 7, 1908, *Rock* 140; Punaluu Mts., Dec. 7, 1908, *Rock* 150 and 154; Punaluu Mt. camp, Dec. 3-14, 1908, *Rock* 153 and 159; Koolau Mt. [= Punaluu], Dec. 3-14, 1908, *Rock* 179 and 180; ditto, Dec. 3, 1908, *Rock* 182; ditto, Nov. 14-21, 1908, *Rock* 288; ditto, *Rock* 305 and 314 (BISH, GH); ditto, *Rock* 917; ditto, Oct. 31, 1914, *Rock* 13,072; Main divide, crest of Koolau Mts., between head of Helemanu [= Helemano] Gulch and Punaluu Valley, wet brushy ridge 825 m., May 30-31, 1937, *Fosberg & Hosaka* 13,944; Waikane Mts., Jan. 23, 1909, *Rock* 1,136.

Leeward Side: Kawailoa, Anahulu Trail (see type); Peahinaia Trail, dense forest, Apr. 28, 1940, *Degener, Ordonez & Kepaa* 12,780; Puu Peahinaia, 1,600-1,800 ft. elev., in wooded region, Oct. 4, 1931, *Storey* 155; Paalaa-Kawailoa Divide, 1,800 ft. elev., shaded, humid ravine, Oct. 4, 1931, *Storey* 123; Poamoho Trail, Nov. 1935, *Meebold* 21,156 (M); ditto, near 4 mile post, Paalaa-Wahiawa, 2,100 ft. alt., wet woods, Feb. 14, 1941, *St. John* 20,186; ditto, in grove of banana trees, 2,000 ft., Mar. 2, 1941, *Wong*; Wahiawa Gulches, Apr. 9, 1911, *Forbes* 1,708.O; Schofield Barracks, eastern range, July 11, 1916, *Hitchcock* 14,024 (BISH, US), (renumbered by *Rock* as College of Hawaii Herbarium No. 13,075); Kaukonahua Gulch, May 15, 1909, *Rock* 3,055; Waipio, Kipapa Gulch, S. ridge, 1,000 ft. elev., moist woods, May 15, 1932, *Hosaka* 552; ditto, wet ridge, 2,800 ft. elev., Aug. 6, 1933, *Hosaka* 1,143; ditto, 550 m. alt., wet forest, Aug. 8, 1933, *Fosberg* 9,793; ditto, 1,200 ft. elev., narrow damp ravine draining into the main stream, May 15, 1932, *Storey* 191; ditto, 1,500 ft. elev., humid woods, *Storey* 219; ditto, 1,200 ft. elev., wooded slopes, Nov. 13, 1932, *Storey* 215.

Waianae Mts.: Windward Side: East ridge of Puu Kanehoa, Honouliuli, in upper woods, 2,500 ft. alt., Jan. 7, 1934, *St. John 14,041*.

Discussion: There is also in Bishop Museum a full sheet, labeled Flora Hawaiiensis, collected by Dr. William Hillebrand and J. M. Lydgate, Ex Herbarium Rev. J. M. Lydgate, Oahu, Wailupe. The sheet contains four flowering branches of *C. Lessoniana* var. *Lessoniana* which may well have come from Wailupe; and also two branches with buds or old calyx which are of var. *koolauloensis* and certainly came from some other locality. As we have often recounted, this set was sent back from Germany by Hillebrand to Lydgate. One or the other man must have assembled numerous, more or less similar, collections under a single label. In this particular collection it is common to find two or three species mingled, mounted on a single sheet with but a single label. This one has in a pocket three small tickets, only one of which says Wailupe. There is also a large ticket in Hillebrand's hand saying "Cyrtrandra Lessoniana Gaud., Oahu."

One specimen from the Punaluu trail, *Rock 182*, is somewhat anomalous, in that the calyx lobes on the inner side from the middle down are sparsely pilosulous. This we consider an intermediate condition, but even so the specimen seems best placed in var. *koolauloensis*.

The new variety *koolauloensis* differs in several details, but is easily recognized by its slender oblanceolate blades merely subappressed puberulent beneath. Its geographic range is distinct, as it occurs from Waikane and Kaukonahua Gulch northward in the Koolau Range, while var. *Lessoniana* is only on the leeward side of the mountains from Kipapa Gulch (which is adjacent to Kaukonahua) southeastward.

It should be noted that Forbes and Rock explored the Punaluu region together. They camped for ten days where the trail crosses the stream in Kaluanui. Their specimens were labeled as from Punaluu or from Koolau Mt. Some may have come from Punaluu, but probably most of them came from Kaluanui, Hauula, or Kaipapau, along the course of the trail to the summit of the Koolau Range. For some of Rock's collections, this is proven by his notes on the original pressing sheet of unmounted duplicates.

Rock in his revision (1919: 48-49) treated as the single species *C. Lessoniana* Gaud., plants with white calyx or green calyx, reflexed calyx lobe margins or plane-lobes, coriaceous blades or chartaceous blades, slender styles or no styles; and occurring nearly the full length of the Koolau Range, on both sides, and also on the Waianae Mts. He said of Hillebrand, "His varieties *angustifolia* and *pachyphylla* cannot well be retained as we have numerous intermediates with leaves ranging from linear-lanceolate to obovate-oblong to ovate leaves, with corresponding variation in the calycine lobes." Rock's and Hillebrand's material has been available in our prolonged study, and in this group our conclusions are closer to those of Hillebrand than to those of Rock. Hillebrand's β var. is our *C. Wilderi*. His γ var. *angustifolia* we main-

tain. His δ var. *pachyphylla* is our *C. oulophylla* and *C. carinata*. These have smaller, compact ranges, and each has distinctive characters, as indicated in our key and descriptions.

C. B. Clarke (1883: 224) maintained the species *C. Lessoniana* Gaud., but had no named variations of it.

The name is taken from the name of the district Koolauloa, including the regions from Hauula to Punaluu, where the variety is abundant. It ends in the Latin place termination, *-ensis*.

52. *Cyrtandra leucocalyx* St. John, sp. nov. (Figs. 75, 193).

Diagnosis Holotypi: Frutex 4 m. alta, caule 10 cm. diametro, ramis subquadrangularibus pallide brunneis deinde glabratis carnosus in sicco contractis et sulcatis, cicatricibus 3.5-6 mm. altis scutelliformibus, fasciculis 5, novellis dense crebre villosis, ramulis foliosis 2.5-10 cm. longis, 2-6 mm. diametro quadrangularibus crebre catenulato-villosis pilis in sicco lutescentibus, internodiis 14-58 mm. plerumque 25 mm. longis, foliis oppositis divergentibus aequalibus vel uno ad $\frac{1}{6}$ majore non aggregatis in 3-5 nodis superis affixis, petiolis 3-10.5 cm. longis crebre villosis, lamina 9-17.5 cm. longis 5.5-12.3 cm. latis tenuiter chartaceis late ovatis vel late ovalibus acutis in basi breve cuneatis sed asymmetricis supra obscure viridibus et modice villosis pilis non aggregatis infra pallide viridibus et modice villosis in nervis densiore villosis marginibus denticulatis excepta in quarta parte infera integra, nervis secundariis 7-10 in uno latere proxima marginem arcuatis et reticulato-interconnectis et apicibus in dentibus excurrentibus, cymis axillaribus 5-9-floriferis dense crebre villosis, pedunculis 30-48 mm. longis, pedicellis 10-35 mm. longis, bracteis 15-30 mm. longis late ovatis ad ellipticis foliaceis dense villosis, alabastris campanulatis ab initio lobis calycis adscendentibus, calycibus in flore 16-17 mm. longis (in sicco 11-13 mm.) campanulatis sed in basi cuneatis non accrescentibus subviridibus vel subalbis extra et intra capitato-glanduloso-pilosis minime bilabiatis in fructu reflectis inter labias in 2 mm. ex basi partitis, tubo 2-2.5 mm. longo, labia supera trilobata, lobis superis 13-14 mm. longis 4-4.5 mm. latis in 3 mm. ex basi partitis lanceolatis crasse foliaceis extra concavis, labia infera bilobata lobis 12 mm. longis 3.5 mm. latis lanceolatis in 2.5 mm. ex basi partitis pauce brevioris quam lobis superis, corollis 23-24 mm. longis in vivo albis tubo 20 mm. longo extra capitato-glanduloso-puberulo intra glabro subcylindrico in basi 6 mm. diametro in media 7 mm. in orifice 6 mm. in media in 15° decurvato, limba glabra bilabiata 5-lobata, lobis superis binis in 85° recurvatis 5.3 mm. longis 8 mm. latis transverse ovalibus in basi auriculatis et valde impensis, lobis lateralibus 6-6.5 mm. longis 8.5 mm. latis transverse ovalibus in basi impensis extra in media infera pilosis, loba infera 5.5 mm. longa 9 mm. lata transverse ovali glabra, staminibus inferis binis in tubo 5 mm. ex orifice adnatis parte libera 2.5 mm. longa validi tereti contorte ascendenti, antheris 3.2 mm. longis 1.5 mm. latis connectivo tereti validi, staminodiis lateralibus in tubo 9 mm. ex orifice affixis, parte libera 0.3-0.8 mm. longa deltoidea antheroidea nulla, stylo 4 mm. longo glabro, lobis stigmatis binis sessilibus 3 mm. longis late ovalibus in latere proxima $\frac{1}{3}$ connatis, ovario 9-11 mm. longo lanceoloideo infra glabro sed rostro sparse glanduloso-puberulis in basi disco cupulato 1.5 mm. alto cincto, fructu immaturo 13 mm. longo lanceoloideo in media supera sparse puberulo.

Description of All Specimens Examined: Shrub 2-4 m. tall, 3-10 cm. in diameter at base; branches subquadrangular, pale brown, at length glabrate, fleshy, on drying forming longitudinal ridges and furrows; leaf scars 3.5-6 mm. high, shield-shaped; bundle scars 5; young shoots densely shaggy villous, leafy branchlets 2.5-10 cm. long, 2-6 mm. in diameter, quadrangular, shaggy, catenulate villous, the hairs drying yellowish, internodes 14-58 mm. averaging 25 mm. in length; leaves opposite, becoming divergent, not crowded, borne at the 3-5 upper nodes, those of a pair subequal or one

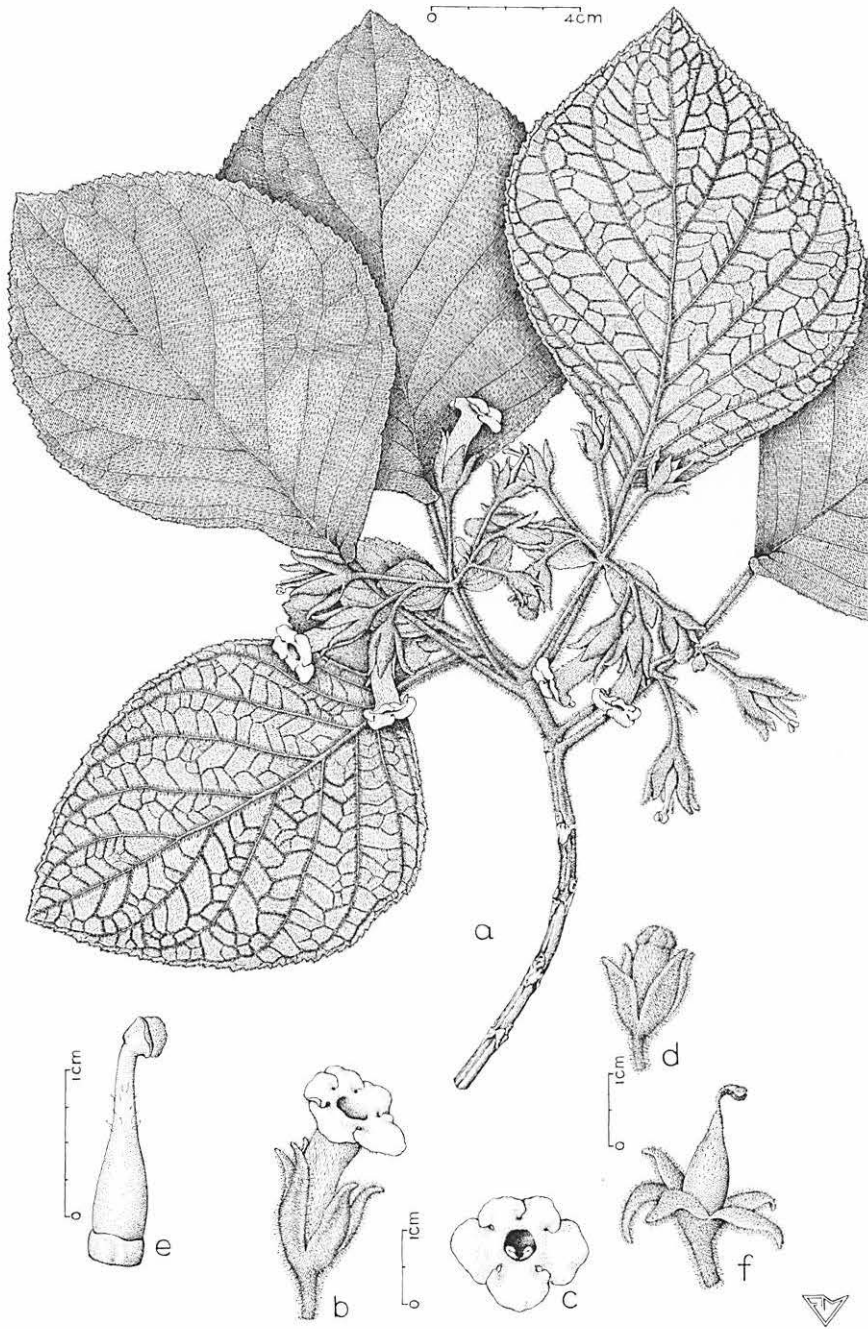


FIGURE 75.—*Cyrtandra leucocalyx*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Anahulu Trail, St. John 20,277, holotype (Bishop Mus.).

of the pair as much as $\frac{1}{2}$ the larger; petioles 3-10.5 cm. long, shaggy villous; *blades* 8-17.5 cm. long, 5-12.3 cm. wide, thin chartaceous, broadly ovate to broadly oval, acute, the base unequal-sided, and short cuneate, above deep green, and moderately villous, the hairs mostly separate and not crowded, below pale green, and moderately villous, more densely so on veins, margins denticulate except on the basal quarter, the secondary veins 7-10 on a side, near the margin arching upward and with reticulate interconnections and excurrent at the teeth tips; *cymes* axillary, 5-9-flowered, densely shaggy villous throughout; peduncles 16-48 mm. long; pedicels 10-35 mm. long; peduncular bracts 15-30 mm. long, broadly ovate to elliptic, foliaceous, densely villous; buds campanulate, at first the calyx lobes ascending; *calyx* in anthesis 16-17 mm. long (when dried 11-13 mm.), campanulate but cuneate at base, not accrescent, greenish or whitish, capitate glandular pilose without and within, perceptibly 2-lipped, reflexing in fruit; tube 2-2.5 mm. long; upper lip 3-lobed, the lateral sinus to within 2 mm. of the base, the lobes cleft to within 3 mm. of the base, lanceolate, 13-14 mm. long, 4-4.5 mm. wide, thick foliaceous, outer side concave; lower lip with 2 lobes 12 mm. long, 3.5 mm. wide, lanceolate, cleft to within 2.5 mm. of the base, slightly shorter than the upper ones; *corolla* 23-24 mm. long, white, the tube 20 mm. long, capitate glandular puberulent without, glabrous within, subcylindric, 6 mm. in diameter at base, 7 mm. at the middle, and 6 mm. at the throat, at the middle gently decurved at 15° to the axis of the lower tube; limb glabrous, 2-lipped, 5-lobed; upper lobes 2, recurving at about 85° to the axis of the throat, 5.3 mm. long, 8 mm. wide, transversely oval, at base auriculate and much overlapping; lateral lobes 6-6.5 mm. long, 8.5 mm. wide, transversely oval, overlapping at base, without glandular pilose on the lower half; lower lobe 5.5 mm. long, 9 mm. wide, transversely oval, glabrous; two lower stamens with filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 2.5 mm. long, spirally upcurved, stout, terete, the 2 perfect anthers 3.2 mm. long, 1.5 mm. wide, the connective terete, stout, the staminodia adnate to the corolla tube to within 9 mm. of the throat, the free portion 0.3-0.8 mm. long, deltoid, lacking an anther rudiment; *style* 4 mm. long, glabrous; stigmatic lobes 2, sessile, 3 mm. long, broadly oval, connate $\frac{1}{3}$ way up proximal side; *ovary* 9-11 mm. long, lanceoloid, glabrous below, the beak sparsely glandular puberulous, the base surrounded by a cupulate disk 1.5 mm. high; *berry* 13-15 mm. long, lance-ellipsoid, puberulous except at base; seeds 0.37-0.44 mm. long, 0.13-0.15 mm. in diameter, ellipsoid, olive brown, body covered with raised cellular oblong reticulations $\frac{1}{4}$ as long as seed (from St. John 20160).

Distribution: Koolau Range, windward side from Oio to Punaluu, from 800-1,900 ft. alt., in dry or moist forest; and leeward side from Kaunala to Kawailoa, in moist forests at about 1,000 ft. alt., in the Koa Zone and the Ohia Zone.

Holotypus: Oahu, Anahulu Trail, Kawailoa, Koolau Range, moist forest on ridge, 1,300 ft. alt., shrubs 4 m. x 1 dm., Nov. 16, 1941, *H. St. John 20,277* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Oio, Paumalu Trail, June 16, 1940, *Degener 17,189* (NY); ditto, lower forest, June 16, 1940, *Degener 17,591* (NY); Oio Gulch, Hanakaoe, Kahuku Forest Res., 1,200 ft. alt., moist woods, Feb. 9, 1941, *St. John & Hosaka 20,168*; Laie Trail, Kahawainui Gulch, moist *Metrosideros* forest by stream, 1,200 ft. alt., Mar. 25, 1956, *St. John 25,957*; Hauula, ridge S.E. of Maakua Gulch, 430 m. alt., wet forest, bottom of gulch, Oct. 15, 1933, *Fosberg 10,347*; Malaekahana, head of Malaekahana Stream, wet gulch, 1,900 ft. alt., Mar. 22, 1953, *Ozaki 395*; Punaluu, semi-dry slope, Nov. 30, 1929,

Nitta (Degener 7,564) (NY); Punaluu, Castle Trail, 800 ft. alt., wooded gulch, Nov. 3, 1940, *St. John* 20,113; ditto, *Wong*.

Leeward Side: Kaunala Gulch, Kaunala, 1,000 ft. alt., moist shady gulch, Feb. 9, 1941, *St. John & Hosaka* 20,158; ditto 20,160; ditto, 1,050 ft. alt., 20,161; Paumalu, Nov. 1935, *Meebold* 20,742 (M); Pupukea-Kahuku region, wet forest, May 28, 1932, *Degener, Park & Nitta* 7,498 (NY); Pupukea-Kahuku Trail, Kaunala, 450 m. alt., wet forest, Feb. 19, 1933, *Fosberg & Duker* 9,201; ditto, Paumalu, 1,250 ft. alt., wet forest, Mar. 6, 1932, *Kinoshita*; Pupukea Trail, Paumalu-Waimea Ridge, along stream, Feb. 9, 1947, *Donaghho*; Kawailoa, see type; Pupukea Trail, Paumalu-Waimea Ridge, along stream, Feb. 9, 1947, *Donaghho*; Anahulu Trail, forest, Mar. 23, 1939, *Degener & Foster* 12,306 (NY).

Discussion: *C. leucocalyx* belongs to the section *Schizocalyces*. It is most similar to *C. propinqua* which differs in having the blades broadly oval to sub-orbicular, the base mostly cordate; cymes 3-7-flowered; bracts lance-ovate; calyx in anthesis 20-25 mm. long, the lobes linear-lanceolate, 4 mm. wide, corolla tube decurved at the middle at 35° to 45° to the axis of the lower tube; ovary and berry glabrous. In contrast *C. leucocalyx* has the blades broadly ovate to broadly oval, the unequal base short cuneate; cymes 5-9-flowered; bracts broadly ovate to elliptic; calyx in anthesis 16-17 mm. long, the lobes lanceolate, 3.5-4 mm. wide; corolla tube gently decurved at the middle at 15° to the axis of the lower tube; ovary glabrous below, sparsely glandular puberulous on the beak; berry more densely puberulous.

The two species grow over much the same range but *C. propinqua* is found as far south as Kipapa on the leeward side of the Koolau Range, while *C. leucocalyx* stops at Kawailoa.

The specific name is derived from the Greek *leukos*, white; *kalux*, cup, or the calyx.

53. *Cyrtandra longiloba* St. John, sp. nov. (Fig. 76, 192).

Diagnosis Holotypi: Frutex 1.5 m. alta, ramulis brunneo-pilosis deinde viridibus glabratibus ad 8 mm. diametro carnosus obtuse subquadrangularibus, cicatricibus 2-4 mm. altis late semiorbiculari-scutelliformibus deinde pallidis et corticescentibus, fasciculis 5, novellis dense olivaceo-brunneis adpressi-pilosis, ramulis foliosis ad 7 mm. diametro subquadrangularibus dense olivaceo-brunneis adpressi-pilosis, internodis 8-36 mm. plerumque 20 mm. longis, foliis oppositis in 6-8 nodis superioribus affixis plus minusve inaequalibus, petiolis 23-63 mm. longis validis carnosus pallide brunneis adpressi-pilosis, laminis 7-13 cm. longis 33-54 mm. latis rigidis coriaceis ellipticis acutis in basi semicuneatis supra obscure viridibus valde impresse exigue rugosis remote adpressi-pilosis infra pallide viridibus et albo-subadpressi-hirsutulis nervis primariis secundariis tertiariisque carnosus salientibusque marginibus sime serrulatis nervis secundariis 7-10 in uno latere ascendentibus subarcuatis interconnectis et in serris salientibus, cymis 1-floriferis axillaribus propinque olivaceo-brunneis adpressi-pilosis, pedunculis 7 mm. longis, pedicellis 7-9 mm. longis, bracteis 8-10 mm. longis lineari-lanceolatis foliaceis, alabastris lanceoloideis lobis calycorum erectis, calycibus in florente 20-21 mm. longo (in vivo) viridibus sed propinque olivaceo-brunneo adpressi-pilosis, tubo 3-4 mm. longo cupulato, limbo anguste campanulato bilabiato extra adpressi-piloso intra in dimidio inferiore



FIGURE 76.—*Cyrtandra longiloba*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, $\times 1$; f, ovary, $\times 2$. Mt. Kaala, St. John 24,822, holotype (Bishop Mus.).

copiose glanduloso-atomifero in dimidio superiore sparse adpressi-piloso, labia superiore trilobata lobis 18-19 mm. longis 3 mm. latis tertia inferiore anguste linearilanceolata marginibus revolutis parte distali planis linearibus subacutis, labia inferiore bilobata, lobis 16 mm. longis ad apicem valde arcuatis, *corollis* albis in alabastris magnis calycibus aequilongis 20 mm. longis dense albo-villosis et obscuratis, tubo 17 mm. longo 3 mm. diametro subcylindraco recto intra glabro bilabiatis 5-lobatis, lobis extra dense albi-villosis intra glabris, lobis superis binis 2.5 mm. longis 3.5 mm. latis ovato-suborbicularibus auriculis basilis impensis, labia infera 3-lobata, lobis lateralibus 3.5 mm. longis 4.5 mm. latis ovato-suborbicularibus, loba inferiore 4 mm. longa 5 mm. lata suborbiculare, staminibus binis inferis perfectis filamentis cum corollae affixis usque 4 mm. ab ore, filamentis liberis 2 mm. longis rectis subulatis, antheris 3 mm. longis oblique late ovatis connectivo anguste elliptico, staminodiis affixis usque 5 mm. ab ore partibus liberis 0.5 mm. longis apice antheroidea 1 mm. longa rhomboideo-lanceolata, *style* nullo, lobis binis stigmatis 1.3 mm. longis ellipticis $\frac{1}{4}$ connatis, *ovario* 5-8 mm. longo ovoideo glabro ad basim disco cupulato 1 mm. alto cincto, fructu ignoto.

Description of Holotype: Shrub 1.5 m. tall; branchlets brown hairy, later green and glabrate, as much as 8 mm. in diameter, fleshy, obtusely subquadrangular; leaf scars 2-4 mm. high, broad, semiorbicular-shield-shaped, becoming pale and corky; bundle scars 5; young shoots densely appressed olive-brown pilose; leafy branchlets as much as 7 mm. in diameter, subquadrangular, closely appressed olive-brown pilose; internodes 8-36 mm., averaging 20 mm. in length; *leaves* opposite, borne at the 6-8 upper nodes, from slightly to very unequal in blade and petiole; petioles 23-63 mm. long, fleshy and stout, appressed brownish pilose; *blades* 7-13 cm. long, 33-54 mm. wide, stiff coriaceous, elliptic, acute, the base cuneate on the upper side of the petiole, above dark green, deeply impressed finely rugose, remotely appressed pilose with one (or few) hairs to each areole, below pale green, and white subappressed hirsutulous, the midrib, secondary, and tertiary veins fleshy, thickened and salient, the margin flat serrulate, the secondary veins 7-10 on a side, ascending, gently arcuate, interconnected and salient in the teeth; *cymes* 1-flowered, axillary, closely appressed olive-brown-pilose; peduncles 7 mm. long; pedicels 7-9 mm. long; bracts 8-10 mm. long, linear-lanceolate, foliaceous; buds lanceoloid, the calyx lobes erect; *calyx* in anthesis 20-21 mm. long (when fresh), green, but closely appressed olive-brown pilose, the tube 3-4 mm. long, cupulate; the limb narrowly campanulate, perceptibly 2-lipped but cleft to about 3-4 mm. from the base between all the lobes, appressed pilose without, within sparsely so on the upper half, while on the lower half abundantly glandular atomiferous; upper lip of 3 lobes 18-19 mm. long, 3 mm. wide, the lower third, the widest part, narrowly linear-lanceolate, channeled from revolute margins, the upper part flat and linear, subacute; the lower lip of 2 lobes, similar to the upper but only 16 mm. long and the tips more strongly arcuate spreading; *corolla* white, in large bud when fresh equaling the calyx, densely shaggy white villous, obscured by the pubescence, 20 mm. long, the tube 17 mm. long, 3 mm. in diameter, subcylindric, straight, glabrous within; limb 2-lipped, 5-lobed, the lobes densely white shaggy villous without, glabrous within; upper lip 2-lobed, the lobes 2.5 mm. long, 3.5 mm. wide, ovate-suborbicular, the base auriculate overlapping; lower lip 3-lobed; lateral lobes 3.5 mm. long, 4.5 mm. wide, similar; lower lobe 4 mm. long, 5 mm. wide, suborbicular; the two lower stamens perfect, adnate to the corolla tube to within 4 mm. of the throat, the free portion 2 mm. long, straight, subulate; the two perfect anthers 3 mm. long, obliquely broad ovate, the connective narrowly elliptic; the staminodia adnate to the corolla tube to within 5 mm. of the throat, free filament 0.5 mm. long, the antheroid tip 1 mm. long, rhombic-lanceolate; *style* none; two stigmatic lobes 1.3 mm. long, elliptic, connate $\frac{1}{4}$ way up proximal side; *ovary* 5-8 mm. long, ovoid, glabrous, surrounded at base by a cupulate disk 1 mm. high; fruit unknown.

Distribution: Known only from the type collection, in the Waianae Mountains, near summit of the highest peak, Mt. Kaala, on the windward side in the wet part of the Ohia Zone.

Holotypus: Oahu, Mt. Kaala, Waianaeka, Waianae Mts., 3,550 ft. alt., in rain forest near *Gunnera*, *Metrosideros* & *Coprosma ochracea* var. *kaalae*, May 25, 1952, *H. St. John* 24,822 (BISHOP MUS.).

Discussion: *C. longiloba* is a member of the section *Schizocalyces*. Its close relative *C. hirsutula* St. John & Storey is also restricted to Mt. Kaala. The latter may be recognized by having the blades 2.5-6 cm. long, narrowly oblanceolate, ascending hirsutulous; calyx 12-15 mm. long, moderately ascending hirsutulous, the lobes 8-13 mm. long, narrowly linear lanceolate; and the style 1.5 mm. long. *C. longiloba* has the blades 7-13 cm. long, elliptic, above remotely appressed pilose, below white subappressed hirsutulous; calyx 20-21 mm. long, closely appressed pilose, the lobes 16-19 mm. long, with the lower third narrowly linear-lanceolate, the remainder linear; and the style none.

The specific epithet is coined from the Latin, *longus*, long; *loba*, lobe, in allusion to the characteristic long, narrow calyx lobes.

54. *Cyrtandra Mannii*, St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 87, 1950. (Figs. 77, 185.)

Description of All Specimens: Apparently a shrub; young branches subquad-rangular, brown, the villosity somewhat persistent; leaf scars 3 mm. high, broad shield-shaped gray corky raised; bundle scars 5; internodes 20-27 mm. averaging 20 mm. long; leafy branches subquad-rangular, densely brown villous, bearing about 4 pairs of ascending, well-spaced leaves; young shoots obscured by dense ascending brown villosity; *leaves* opposite, subequal; petioles 3-6 cm. long, terete, densely appressed brown villous; *blades* 14-15 cm. long, 6.3-7.1 cm. broad, elliptic with a sub-cuncate base and a short acuminate apex, texture firm, chartaceous, above sparsely appressed crinkly hirsute, below brown villous especially on the veins, the margin in the upper $\frac{3}{4}$ callous tipped, low flat serrulate; principal lateral veins 10-12 on a side, curved ascending to the margin, there interconnecting; *cymes* from the leaf axils, 3-flowered, blanketed by a dense ferrugineous pilosity, the hairs subappressed or ascending, nonglandular; peduncles 21-28 mm. long, slightly diverging; pedicels 8-18 mm. long; bracts 10-12 mm. long, narrowly lance-elliptic; buds broadly campanulate, the calyx lobes diverging at tip; *calyx* 14-17 mm. long, campanulate, the outer surface obscured by the dense ferrugineous subappressed pilosity, slightly 2-lipped, the sinus between the lobes reaching to within 3 mm. of base, the tube 2-3 mm. long; upper lip of 3 lobes, these 10-15 mm. long, with the intervening sinus reaching to within 4 mm. of the base, the lobes narrowly elliptic-lanceolate, subacuminate, 5-nerved, obscured by the ferrugineous, ascending or subappressed abundant pilosity; lower lip of 2 lobes, cleft $\frac{5}{6}$ way, 9-12 mm. long, similar in shape to the upper; *corolla* 28 mm. long (shrinking to 22 mm. when dried), white, the tube 20 mm. long, cylindrical, straight, 4.5 mm. in diameter, the throat 2.5 mm. wide, 3.5 mm. high, the tube glabrous within, the outside densely shaggy villous; limb 2-lipped, 5-lobed, upper lip of 2 lobes, these apparently recurving at 70° to the axis of the throat, 4 mm. long, 5.5 mm. wide, deltoid-subcordate, obtuse, overlapping at base, within glabrous, without densely villous; lower lip of 3 lobes, apparently reflexed at 90° to 100° to the axis of the throat, the 2 lateral lobes 5.5 mm. long, 7 mm. wide, transversely oval; lower lobe 7.5 mm. long, 6.5 mm. wide, oval, like the others glabrous within, without densely villous; the two lower stamens perfect, the filaments adnate to the corolla to within 10 mm. of the throat, the free portion 3.5 mm. long, stout, spirally upcurved; the 2 perfect anthers 3 mm. long, obliquely elliptic, connate at apex; staminodia 1 mm. long, sigmoid, shrivelled; *style* 2.5 mm.



FIGURE 77.—*Cyrtandra Mannii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Waianae Uka, Waianae Mts., Kitamura, holotype (Bishop Mus.).

long, stout, ascending pilosulous; stigmatic lobes 2, 0.7 mm. long, broadly oval, connate $\frac{1}{4}$ way up proximal side; ovary 7 mm. long, lanceoloid, densely ascending pilose, the base surrounded by a cupulate disk 1 mm. high; fruit when dried 12 mm. long, 6 mm. in diameter, narrowly ovoid, pilosulous.

Holotype: Waianae Mts., west side of Waianaekua, 2,575 ft., moist wooded slope, Nov. 5, 1933, Frank Kitamura (BISHOP MUS.).

Specimens Examined: Waianae Mountains, windward side, Kaala, southeast slope of, wet forest, Sept. 25, 1938, Degener, Ordonez & Selling 12,250 (NY).

Discussion: *C. Mannii* is a member of the section *Schizocalyces*. Its closest relative is *C. crassior* St. John & Storey. The diagnostic differences between these are stated in the key.

The holotype collection, consisting of a single sheet has, as the locality data, west side of Waianaekua, thus gives a general idea of the locality. However, the collector, F. Kitamura, was a student of the author's and accompanied him that day on a class trip to the summit of Mt. Kaala by the trail from Schofield Barracks and the Firebreak Trail. The altitude given would indicate a place halfway up the wooded slope from the crossing of Haleauau Stream to the "Three Thousand Foot Ridge." This is the favorite trail up Kaala and in the last few decades many botanists have collected along it, yet the species has been rediscovered only once, by Degener and his associates. Their locality, southeast slope of Kaala, may well have been the same place. The species has numerous diagnostic characters and is abundantly distinct.

The specific name honors Horace Mann, Jr., early explorer and capable student of the Hawaiian flora.

55. *Cyrtdandra niuensis* St. John, sp. nov. (Figs. 78, 192).

Diagnosis Holotypi: Frutex, ramulis ad 6 mm. diametro quadrangularibus mox glabratibus pallide griseis carnosus in sicco contractis et sulcatis, cicatricibus 1.5-3.5 mm. altis late scutelliformibus, fasciculis 5, novellis adpresse brunneo-villosis, ramulis foliosis 2-4 mm. diametro quadrangularibus dense adpresse brunneo-villosis, internodis 3-14 mm. plerumque 5 mm. longis, foliis oppositis inaequalibus uno $\frac{1}{2}$ - $\frac{1}{3}$ majore divergentibus aggregatis in 4-6 nodis superis affixis, petiolis 7-18 mm. longis dense brunneo-villosis, laminis 2-5.3 cm. longis 8-25 mm. latis coriaceis late ellipticis acutis in basi breve cuneatis marginibus depresso-serrulatis in media supra supra obscure viridibus in costa adpresse brunneo-villosis sparse itaque in partibus alteris infra ex dense brunneo-villosis obscuratis, nervis secundariis 5-8 in uno latere arcuatis apicibus clausis, cymis 1-2-floriferis dense adpresse brunneo-villosis, pedunculis 6-10 mm. longis, pedicellis in flore 6-10 mm. in fructu 15-18 mm. longis, bracteis 4-6 mm. longis lanceolatis foliaceis dense adpresse villosis, alabastris late campanulatis dense villosis, calycibus in flore 10-10.5 mm. longis quando bullitis (in sicco 9-10 mm.) viridibus late campanulatis dense adscendente albi-villosis subbilabiatis lobis subaequalibus, tubo 2-2.5 mm. longis, labia supra trilobata lobis 8-8.5 mm. longis 5 mm. latis lanceo-ovatis crassis firmis intra ad apicem glabris ad basem minute capitato-glanduloso-puberulis vel atomiferis, labia infera bilobata lobis 8.5 mm. longis 5 mm. latis lanceo-ovatis, corollis albis 19-20 mm. longis (in sicco 17-18 mm.) dense crebre albo-villosis, tubo 17 mm. longo recto cylindrico 4 mm. diametro intra glabro, limbo bilabiato 5-lobato extra crebre

albo-villoso obscurato, lobis superis 2.5 mm. longis 3.5 mm. latis reniformi-cordatis auriculis impensis intra glabris in 45° divergentibus, labia infera trilobata lobis lateralibus 3 mm. longis 5 mm. latis reniformibus intra et loba infera simuliter e media ad orificem capitato-glanduloso-puberulis, loba infera 3.5 mm. longa 4.5 mm. lata reniformi, staminibus inferis binis in tubo 6 mm. ex orifice affixis parte libera 2 mm. longa subulata contorte adscendente, antheris 2.5-2.8 mm. longis 1.9 mm. latis oblique oblongo-ovatis connectivo subnigro 1.2 mm. lato, staminodiis lateralibus binis in tubo



FIGURE 78.—*Cyrtandra niuensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Niu, Russ, holotype (Bishop Mus.).

6 mm. ex orifice affixis parte libera 0.6 mm. longa oblonga apice antheroidea 0.3 mm. longa itaque lata, stylo nullo, lobis stigmatis binis 4 mm. longis 2 mm. latis late ellipticis aequaliter partitis, ovario 5-6 mm. longo lanceo-ovoideo glabro in basi cum disco cupulato 1 mm. alto cincto, bacca in sicca 10-11 mm. longa 5-6 mm. diametro ovoidea apiculata, seminibus 0.45-0.51 mm. longis 0.19-0.23 mm. diametro anguste ellipsoideis obscure brunneis apicibus ambis obtusis subnigris cuti cum reticulis elevatis cellulosis oblongis $\frac{1}{4}$ - $\frac{1}{5}$ longis quam semine.

Description of All Specimens Examined: Shrub; branchlets as much as 6 mm. in diameter, quadrangular, early glabrate, pale gray, fleshy and shrinking on drying and forming longitudinal furrows; leaf scars 1.5-3.5 mm. high, broad shield-shaped; bundle scars 5; young shoots densely appressed brownish villous; leafy branchlets 2-4 mm. in diameter, quadrangular, densely appressed brownish villous; internodes 3-14 mm., averaging 5 mm. long; *leaves* opposite, wide spreading, crowded, borne at the 4-6 upper nodes, those of a pair unequal, one being $\frac{1}{2}$ - $\frac{1}{3}$ larger; petioles 6-18 mm. long, densely ascending brownish villous; *blades* 2-6.8 cm. long, 8-29 mm. wide, broadly elliptic, coriaceous, the apex acute, the base short cuneate, the margin low serrulate from the middle to the apex, above dark green, appressed brownish villous on the midrib and sparsely so elsewhere, below completely covered with a dense brownish appressed villosity, the secondary veins 5-8 on a side, arched ascending, the tips obscured; *cymes* 1-2-flowered, densely appressed brownish villous; peduncles 6-10 mm. long; pedicels in anthesis 6-10 mm. long, in fruit 15-18 mm. long; bracts 4-6 mm. long, lanceolate, foliaceous, densely appressed villous; buds broadly campanulate, densely villous; *calyx* in anthesis 10-10.5 mm. long when boiled (9-10 mm. long when dried), green, broad campanulate, almost equally lobed, but perceptibly 2-lipped, densely ascending white villous; tube 2-2.5 mm. long; upper lip 3-lobed, the lobes 8-8.5 mm. long, 5 mm. wide, lance-ovate, thick and firm, within glabrous towards the tip but towards the base minutely capitate glandular puberulous or atomiferous; lower lip 2-lobed, the lobes 8.5 mm. long, 5 mm. wide, lance-ovate; *corolla* white, 19-20 mm. long (when dried 17-18 mm. long), densely shaggy white villous without, the tube 17 mm. long, straight cylindrical, 4 mm. in diameter, glabrous within; limb 2-lipped, 5-lobed, without obscured by the shaggy white villosity; upper lobes 2.5 mm. long, 3.5 mm. wide, reniform-cordate, the auricles overlapping, within glabrous, spreading at about 45° to the axis of the throat; lower lip 3-lobed; lateral lobes 3 mm. long, 5 mm. wide, reniform, within like the lower lobe capitate glandular puberulous from the middle to the throat; lower lobe 3.5 mm. long, 4.5 mm. wide, reniform; two lower stamens with filaments adnate to the corolla to within 6 mm. of the throat, the free portion 2 mm. long, subulate, spirally upcurved; the two perfect anthers 2.5-2.8 mm. long, 1.9 mm. wide, obliquely oblong-ovate, the dark elliptic connective 1.2 mm. wide; two lateral staminodia with their filaments adnate to the corolla tube to within 6 mm. of the throat, the free part 0.6 mm. long, oblong, the pale antheroid tip 0.3 mm. long, equally broad; *style* none; 2 stigmatic lobes, 4 mm. long, 2 mm. wide, broadly elliptic, equally cleft on proximal and distal sides; *ovary* 5-6 mm. long, lance-ovoid, glabrous, the base surrounded by an annular disk 1 mm. high; *berry* when dried 10-11 mm. long, 5-6 mm. in diameter, ovoid with an apiculate tip; seeds 0.45-0.51 mm. long, 0.19-0.23 mm. in diameter, narrowly ellipsoid, dark brown, the blunt ends blackish, the body covered with raised narrow oblong cellular reticulations $\frac{1}{4}$ to $\frac{1}{5}$ as long as the seed.

Distribution: Koolau Range; on the leeward side, from the Kalihi-Nuuanu ridge and from Niu, altitude and zone unknown.

Holotypus: Niu, Apr. 1930, *G. W. Russ* (BISHOP MUS.).

Specimens Examined: Koolau Range, Leeward Side: Waiolani Ridge, June 28, 1909, *Forbes*; Niu Ridge, Sept. 7, 1924, *Topping 2,844* (NY).

Discussion: *C. niuensis* is a member of the *Schizocalyces*. It has a superficial resemblance to *C. Lessoniana*, but differs in having a green calyx with the lobes flat or slightly concave, and a corolla tube twice as long as the calyx.

56. *Cyrtandra partita* St. John, sp. nov. (Figs. 79, 185).

Diagnosis Holotypi: Frutex, ramis ad 7 mm. diametro mox glabratis quadrangularibus pallide brunneis subcarnosis in sicco contractis et sulcatis, cicatricibus 3-4 mm. altis late rotundato-scutelliformibus anguste interconnectis et annulatis, fasciculis 5,

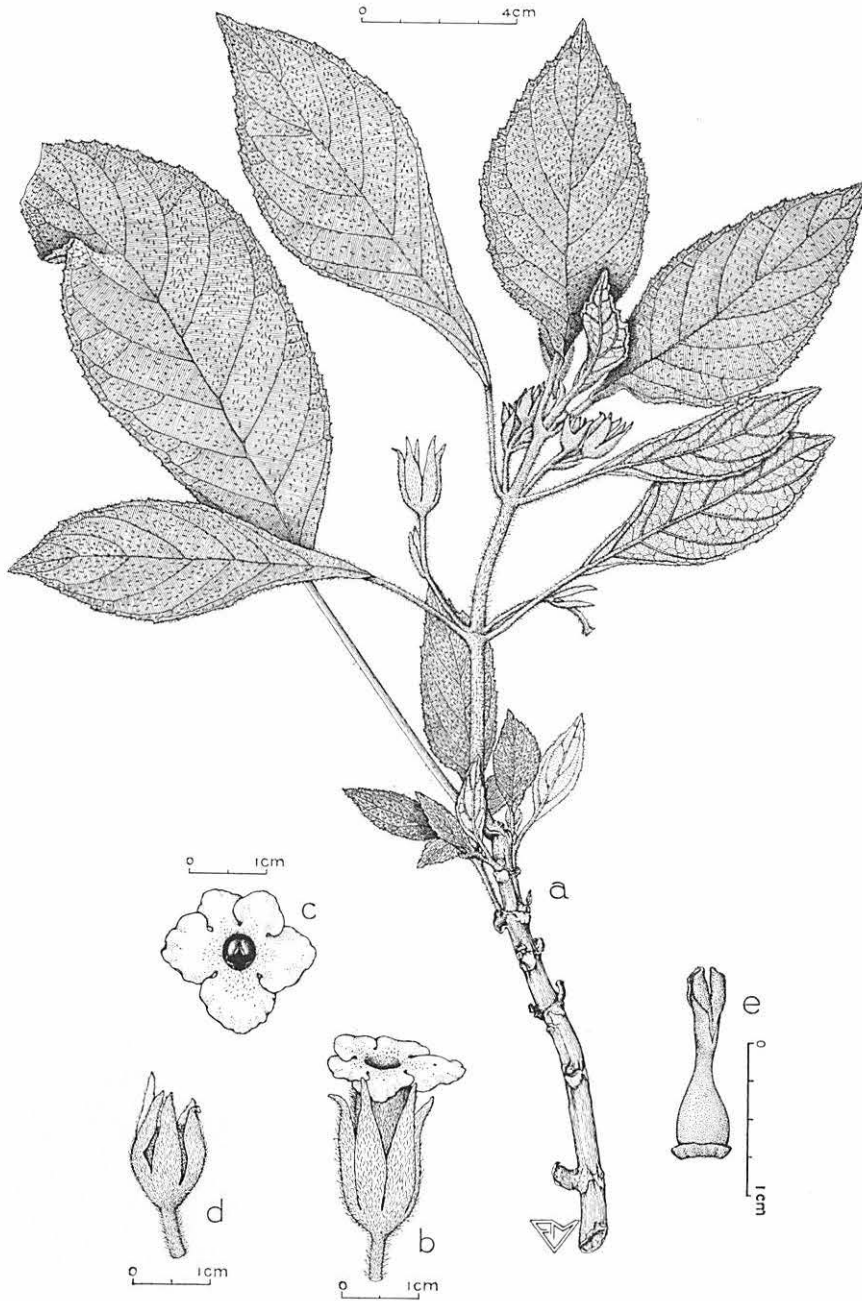


FIGURE 79.—*Cyrtandra partita*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Punaluu, Rock 389, holotype (Bishop Mus.).

ramulis foliosis ad 5 mm. diametro brunneo-hirsutis ad basim sparse itaque, novellis dense adpresse brunneo-hirsutis, internodis 1-4 cm. plerumque 3 cm. longis, *foliis* oppositis inaequalibus uno $\frac{1}{3}$ - $\frac{1}{2}$ majore ascendentibus remotis in 5 nodis superis affixis, petiolis 20-85 mm. longis validis et adpresse brunneo-hirsutis deinde subglabris, *laminis* 8-13 cm. longis 28-58 mm. latis firme chartaceis ellipticis vel lanceolatis acutis in basi longe cuneatis supra obscure viridibus et sparse brunneo-hirsutis infra molliter densiore hirsutis marginibus irregulariter serrulatis, nervis secundariis 6-8 in uno latere arcuatis apicibus interconnectis et in serris excurrentibus, *cymis* trifloriferis adpresse brunneo-hirsutis, pedunculis 15-19 mm. longis, pedicellis 13-14 mm. longis, bracteis 12-16 mm. longis lineari-lanceolatis foliaceis adpresse hirsutis, alabastris aperte campanulatis hirsutis, *calycibus* in flore quando bullitis 19-21 mm. longis viridibus foliaceis campanulatis extra adpresse brunneo-hirsutulis ad basim densiter itaque in partibus alteris pauciter itaque intra glabris subbilabiatis quoniam lobis minime in longo inaequalibus sed sinibus omnibus in profundo aequalibus, tubo 2 mm. longo campanulato, labia supera trilobata lobis 16-18 mm. longis lineari-lanceolatis subacutis trinerviatis, labia infera bilobata lobis 13-15 mm. longis similibus sed obliquis, *corollis* quando bullitis 25 mm. longis extra crebre albo-hirsutis excepta in basi, tubo 20 mm. longo cylindrico recto 5 mm. diametro intra in tertia supera capitato-glanduloso-puberulo, limba bilabiata 5-lobata, lobis superis binis 6 mm. longis 9 mm. latis late rotundato-deltoidis in basi subcordatis et valde impensis extra ad basim hirsutis intra glabris in 70° recurvatis, labia infera trilobata, lobis lateralibus 8 mm. longis 9 mm. latis late rotundato-rhombicis obtusis in basi impensis intra in linea centrali ad basim capitato-glanduloso-puberulis, loba infera 7 mm. longa 8 mm. lata suborbiculari-rhombica extra hirsuta intra ad orificem lobis omnibus capitato-glanduloso-puberulis, staminibus inferis binis in tubo 9 mm. ex orifice adnatis partibus liberis 2.5 mm. longis teretibus contorte ascendentibus, antheris 2 mm. longis 1.5 mm. latis oblique late-ellipticis connectivo pullo 1.3 mm. lato, staminodiis in tubo 11 mm. ex orifice affixis parte libera 0.8-0.9 mm. longa deltoideo-subulata apice antheroideo 0.1 mm. longo acuto, *stylo* nullo lobis stigmatibus binis 6 mm. longis elliptico-oblongis in latere proximo $\frac{1}{2}$ connatis, *ovario* 7 mm. longo glabro ovoideo apice subacuminato in basi disco cupulato 1 mm. alto cincto, fructu ignoto.

Description of Holotype: Shrub; branches as much as 7 mm. in diameter, early glabrate, quadrangular, pale brownish, somewhat fleshy and on drying forming longitudinal ridges and furrows; leaf scars 3-4 mm. high, broad rounded shield-shaped, narrowly connected around the node and thus annular; bundle scars 5; leafy branchlets as much as 5 mm. in diameter, brownish hirsute, but sparsely so towards the base; young shoots densely appressed brown hirsute, internodes 1-4 cm., averaging 3 cm. in length; *leaves* opposite, ascending, remote, borne at the 5 upper nodes, those of a pair unequal, one being $\frac{1}{3}$ to $\frac{1}{2}$ larger; petioles 20-85 mm. long, stout and appressed brown hirsute, later subglabrate; *blades* 8-13 cm. long, 28-58 mm. wide, firm chartaceous, elliptic to lanceolate, acute, the base long cuneate, above dark green and sparsely brown hirsute, below more densely and softly hirsute, the margin unevenly serrulate, secondary veins 6-8 on a side, ascending arcuate, the tips inarched interconnecting and excurrent in the teeth; *cymes* 3-flowered, appressed brown hirsute; peduncles 15-19 mm. long; pedicels 13-14 mm. long; bracts 12-16 mm. long, linear lanceolate, foliaceous, appressed hirsute; buds open campanulate, hirsute; *calyx* in anthesis (when boiled), 19-21 mm. long, green and foliaceous, campanulate in outline, appressed brown hirsutulous without, densely so at base, sparsely so above it, within glabrous, perceptibly 2-lipped since the lobes differ slightly in length but the sinuses of equal depth; calyx tube 2 mm. long, campanulate, upper lip 3-lobed, the lobes 16-18 mm. long, linear-lanceolate, subacute, 3-nerved; lower lip 2-lobed, the lobes 13-15 mm. long, similar but oblique; *corolla* 25 mm. long (when boiled), without white shaggy hirsute except at base, the tube 20 mm. long, cylindric, straight, 5 mm. in diameter, within capitate glandular puberulous in the upper third; limb 2-lipped, 5-lobed; upper lobes two, 6 mm. long, 9 mm. wide, broadly rounded deltoid, at base subcordate and much overlapping, without hirsute toward base, within glabrous, recurving at about 70° to the

axis of the throat; lower lip 3-lobed; lateral lobes 8 mm. long, 9 mm. wide, rounded broad rhombic, obtuse, overlapping at base, within on the middle line towards the throat capitate glandular puberulent; lower lobe 7 mm. long, 8 mm. wide, suborbicular-rhombic, without hirsute, within all the lobes capitate glandular puberulent towards the throat; two lower stamens with filaments adnate to the corolla to within 9 mm. of the throat, the free portion 2.5 mm. long, terete, spirally upcurved; the two perfect anthers 2 mm. long, 1.5 mm. wide, obliquely broad elliptic, the dark ovate connective 1.3 mm. wide; the two lateral staminodia with their filaments adnate to the corolla tube to within 11 mm. of the throat, the free part 0.8-0.9 mm. long, deltoid-subulate, the pale antheroid tip 0.1 mm. long, acute; *style* none; stigmatic lobes two, 6 mm. long, elliptic oblong, connate $\frac{1}{6}$ way up proximal side; *ovary* 7 mm. long, glabrous, ovoid, the tip tapering, the base surrounded by a cupulate disk 1 mm. high; mature fruit unknown.

Distribution: Koolau Range, windward side, known only from Punaluu.

Holotypus: Punaluu, Koolau Mt., Dec. 24-29, 1908 [J. F. Rock] 389 (BISHOP MUS.).

Discussion: *C. partita* is a member of the section *Schizocalyces*. It was labeled by Rock himself as *C. Oliveri* Rock?, but he did not cite this collection under that species in his revision. That species is now considered a synonym of *C. scabrella* and it differs from the one here described among other characters in having the calyx lobes lance-ovate, the petioles not connate perfoliate; the blades subcoriaceous, oval or elliptic, above scabrous hirsutulous, below appressed puberulent, the calyx lobed about $\frac{1}{2}$ way, etc.

This collection has remained unnamed till the present as it did not fit into any described species. It most closely resembles *C. propinqua* which is distinguished by having the stems villous; petioles shaggy catenulate brown villous; blades 9-20 cm. long, 6-15 cm. wide, broadly oval to suborbicular, catenulate white villous and below on the veins shaggily so, the apex subacuminate, the base mostly cordate; cymes shaggy tawny villous; bracts lance-ovate; calyx densely white gland-tipped villous; corolla without shaggy white villous; and the stigmatic lobes 4 mm. long. On the other hand, *C. partita* has the stems appressed hirsute; petioles appressed brown hirsute; blades 8-13 cm. long, 2.8-5.8 cm. wide, elliptic to lanceolate, acute, the base long cuneate, above coarsely brown hirsute, below more densely and softly hirsute; cymes appressed hirsute; bracts linear-lanceolate; calyx appressed brown hirsutulous; corolla without shaggy white hirsute, and the stigma lobes 6 mm. long.

It is our understanding that the type specimen was collected on a camping trip up the Castle Trail, beginning in Punaluu, and crossing the ridges into Kaluanui, Hauula, and Kaipapau where it reaches the Koolau divide. The fixed camp was by the Kaluanui Stream. The specimen may have been collected in any of these regions. No other collection of the species is available, but in the rich flora of the Punaluu region there are many species of *Cyrtandra*.

The name is taken from the Latin participle, *partitus*, divided, in allusion to the deeply parted calyx.

57. *Cyrtandra poamohoensis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 87, 1950. (Figs. 80, 190.)

Description of All Specimens Examined: Shrub 1.5-3 m. tall, with ascending branches; stem to 7-10 mm. diameter, densely brownish spreading pilose; leaf scars 4-6 mm. high, sinuous shield-shaped, pale brownish, corky; bundle scars 7; internodes 1-6.5 cm., averaging 2.5 cm. long; leafy branches subcarinose, noticeably subquadrangular, shaggy brownish pilose, ascending with 3-5 pairs of leaves, these ascending or diverging, not crowded; young shoots obscured by the dense brownish pilosity; *leaves* opposite, unequal, one leaf of the pair about $\frac{1}{4}$ larger than the other, leaves at first ascending, later widely diverging but not at right angles; petioles 25-73 mm. long, densely brown, spreading pilose; *blades* 6-23 cm. long, 2.3-10.8 cm. wide, thick chartaceous, elliptic lanceolate to oval but tapering to either end, the apex short acuminate, the blades plane, above dark green, impressed rugose, remotely jointed pilose, the hairs from papillose bases, below pale green, the surface softly white pilosulous, the midrib and principal lateral veins shaggy pilose, the margin irregularly callous serrate, more finely so near base; *cymes* 2-5-flowered, shaggy pilose throughout; peduncles 3-4.5 cm. long; pedicels 22 (-30) mm. long; bracts 1.5-2 cm. long, 8-9 mm. wide, lanceolate, foliaceous; buds subglobose, the calyx lobes arcuate ascending; *calyx* 12-17 mm. long, subglobose, loose at base and not closely enclosing the corolla, the lobes arcuate ascending, not revolute, but in fruit spreading or even recurving, slightly 2-lipped, within and without densely pilose, the hairs spreading or at most ascending; the tube 2-3 mm. long; upper lip of 3 lobes, cleft $\frac{7}{8}$ way, the lobes narrowly elliptic-lanceolate, subacute; *corolla* when fresh 26-30 mm. long (but shrinking on drying to 21 mm.) white, the tube 20-21 mm. long, cylindrical but at the middle sharply deflected at 35°, 9-10 mm. in diameter, the throat 7-9 mm. in diameter, the inside glabrous, the outside shaggy white villous, densely so on the exposed parts, less so at base; limb 2-lipped, 5-lobed; upper lip spreading at about 90°-120° to the axis of the throat, the two lobes 4 mm. long, 5.5-6 mm. wide, cordate, broad based; lower lip 3-lobed, spreading at about 80°; the 2 lateral lobes 6.5 mm. long and 6.5-9 mm. wide, rhombic-suborbicular, broadly obtuse; lower lobe 7-8 mm. long, 7.5-9 mm. wide, suborbicular, short stalked; all corolla lobes within glabrous, without shaggy villous; two lower stamens perfect, the filaments adnate to the corolla tube to within 8 mm. of the throat, the free portion stout, 4 mm. long, spirally upcurved; the 2 perfect anthers, 4.5 mm. long, very obliquely elliptic ovate, connivent at the apices; the 3 staminodia with filaments 0.3 mm. long, recurving, bearing abortive, empty anthers 0.5 mm. long; *style* none; stigmatic lobes two, 1.7 mm. long, semiorbicular, connate $\frac{2}{3}$ way up proximal side; *ovary* 8 mm. long, lanceoloid, villous, the base surrounded by a cupulate disk 1 mm. high; *fruit* villous, said to be white.

Distribution: Koolau Range, leeward side, known only from the Poamoho Trail, at 2,000 ft. alt. in the Ohia Zone.

Holotype: Oahu: Koolau Range, Poamoho Trail, Paalaa-Wahiawa, 2,000 ft. alt., only one shrub near 4-mile post, moist Ohia woods, February 16, 1941, *H. St. John 20,187* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Leeward Side: See type; Helemano-Wahiawa, 2,000 ft. alt., open clearing along trail, Feb. 20, 1949, *Inouye*; Poamoho Trail, Paalaa-Wahiawa, 2,000 ft. alt., moist ferny woods under *Metrosideros collina* and *Eugenia sandwicensis*, Nov. 4, 1951, *St. John 24,705*.

Discussion: *C. poamohoensis* is a member of the section *Schizocalyces*, and finds as its closest relative *C. Mannii* St. John & Storey which occurs in the Waianae Mountains and has the corolla with a straight tube, the ovary with

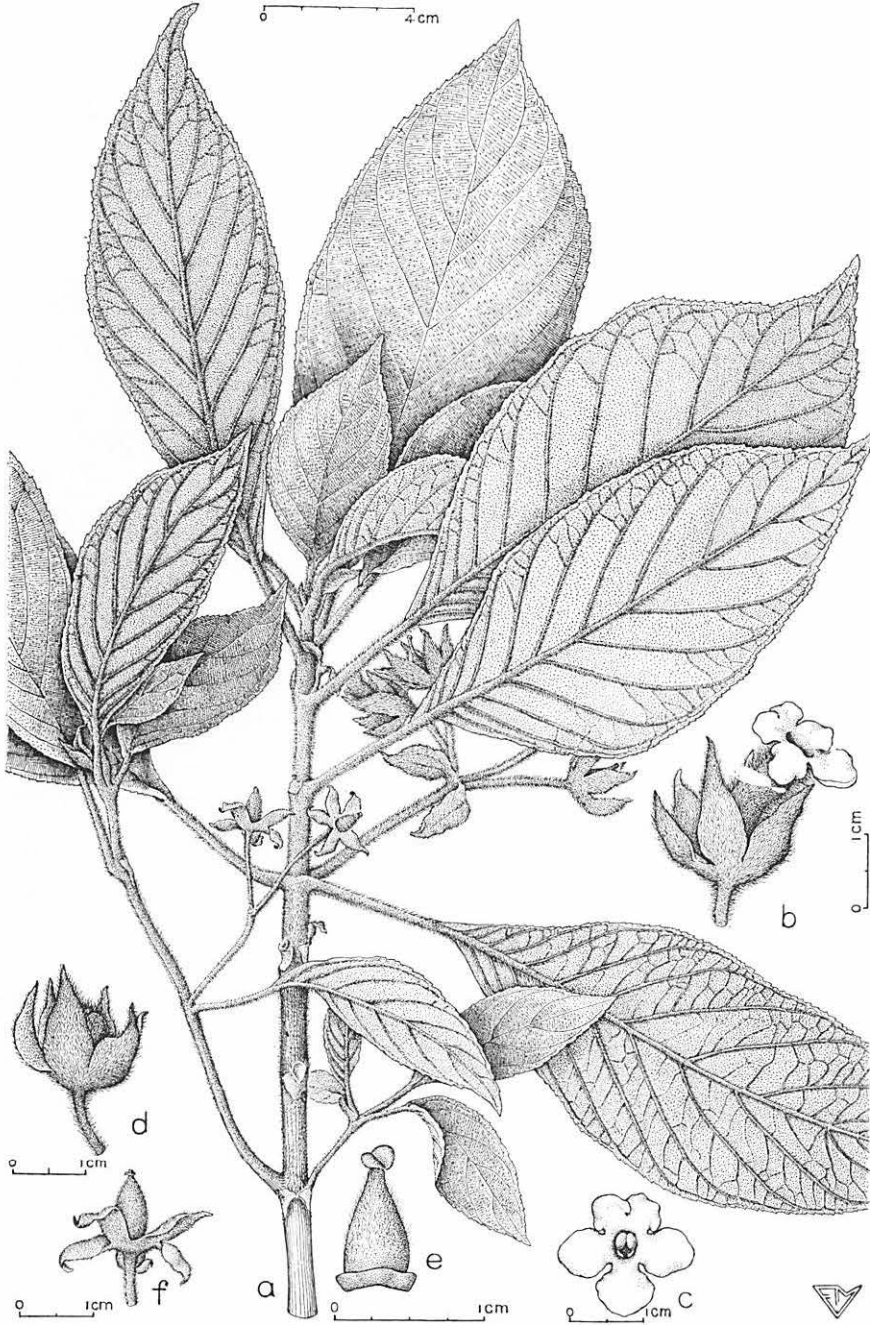


FIGURE 80.—*Cyrtandra poamohoensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Heleman, St. John 20,187, holotype (Bishop Mus.); flower from Poamoho Trail, Inouye.

a short style, and the calyx lobes and petioles appressed villous. *C. poamohensis* differs by having the corolla tube sharply bent at the middle, the ovary without a style, and the calyx lobes and petioles spreading pilose or villous.

The specific name is taken from the name of the locality, Poamoho; and *-ensis*, the Latin adjectival place ending.

58. *Cyrtandra propinqua* C. N. Forbes, B. P. Bishop Mus., Occ. Papers 7 (3) : 35-36, pl. 7, 1920. (Figs. 81-83, 185.)

Description of All Specimens Examined: Shrub, 2-5.7 m. tall, widely branching; branches as much as 9 mm. in diameter, quadrangular, brown to grayish, glabrate, fleshy and shrinking on drying, forming longitudinal furrows; leaf scars 4-7 mm. high, shield-shaped, separate, pale and corky; bundle scars 7, V-shaped; young shoots densely shaggy villous; leafy branchlets as much as 6 mm. in diameter, quadrangular; internodes 1.5-8 cm., averaging 3 cm. long; *leaves* opposite, widespreading, not crowded, borne at the 3-4 upper nodes, those of a pair unequal, one being $\frac{1}{10}$ - $\frac{1}{4}$ larger; petioles 3-13 cm. long, stout and shaggy long catenulate brown villous; *blades* 9-20 cm. long, 6-15 cm. wide, broadly oval to suborbicular, the apex subacuminate, the base mostly cordate (small blades on weak lateral branches may be only oval), chartaceous, the margin serrate-dentate, above dark green and catenulate villous throughout, when young densely so but when mature sparsely so, below pale green and softly densely catenulate villous and shaggily so on the veins, the secondary veins 7-10 on a side, straight below, forward arching above and reticulate interconnecting and excurrent in teeth; *cymes* 3-7-flowered, axillary, shaggy tawny villous; peduncles 2-5.5 cm. long; pedicels 12-37 mm. long, slender; bracts 14-38 mm. long, lance-ovate, foliaceous; buds campanulate, villous; *calyx* in anthesis 20-25 mm. long (when dried 12-22 mm. long), campanulate but tapering at base, in fruit 15-25 mm. long, whitish, densely white gland-tipped villous, perceptibly 2-lipped; upper lip 3-lobed, the lobes cleft to within 2 mm. of the base, linear-lanceolate, 4 mm. wide, the lateral ones obliquely so and 5 mm. wide, within villous towards the tip, becoming puberulent towards the base; lower lip with 2 lobes cleft to within 1 mm. of the base, 4 mm. wide; *corolla* white, 22-25 mm. long, shaggy white villous without, glabrous within; the tube 18-19 mm. long, subcylindric, 5 mm. in diameter at the middle, 6 mm. at the throat, at the middle decurved at 35° to 45° to the axis of the lower tube; limb 2-lipped, 5-lobed; 2 upper lobes, 4-4.5 mm. long, 6-8 mm. wide, asymmetric transversely oval, recurving at about 70° to the axis of the throat, lateral lobes 5.5-6.5 mm. long, 6-9 mm. wide, oval-suborbicular; lower lobe 6 mm. long, 8-9 mm. wide, transversely oval, the lobes all glabrous within; 2 lower stamens with filaments adnate to the corolla tube to within 8 mm. of the throat, the free portion 4 mm. long, spirally upcurved, stout subulate, the 2 perfect anthers 3 mm. long, 2 mm. wide, obliquely oval, connective oval; the staminodia with filaments 0.3-0.7 mm. long and abortive wider anthers 0.5-0.9 mm. long; *style* 2.5 mm. long, glabrous; stigmatic lobes 2, 4 mm. long, broad oval, connate $\frac{1}{2}$ way up proximal side; *ovary* 8-10 mm. long, narrow lanceoloid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; *berry* 16-23 mm. long, 10-12 mm. in diameter, ellipsoid, white; seeds 0.44-0.53 mm. long, 0.16-0.22 mm. wide, honey-colored, ellipsoid or obliquely so, dark umbonate at each end, the body covered with raised, narrow oblong cellular reticulations $\frac{1}{3}$ to $\frac{1}{4}$ as long as the seed.

Distribution: Koolau Range on the windward side from the north end at Kahuku south to Punaluu at from 700-2,000 ft. alt. in the Ohia Zone; and on the leeward side from Pupukea south to Kipapa at from 930-1,700 ft. alt., in the Koa Zone and the Ohia Zone.

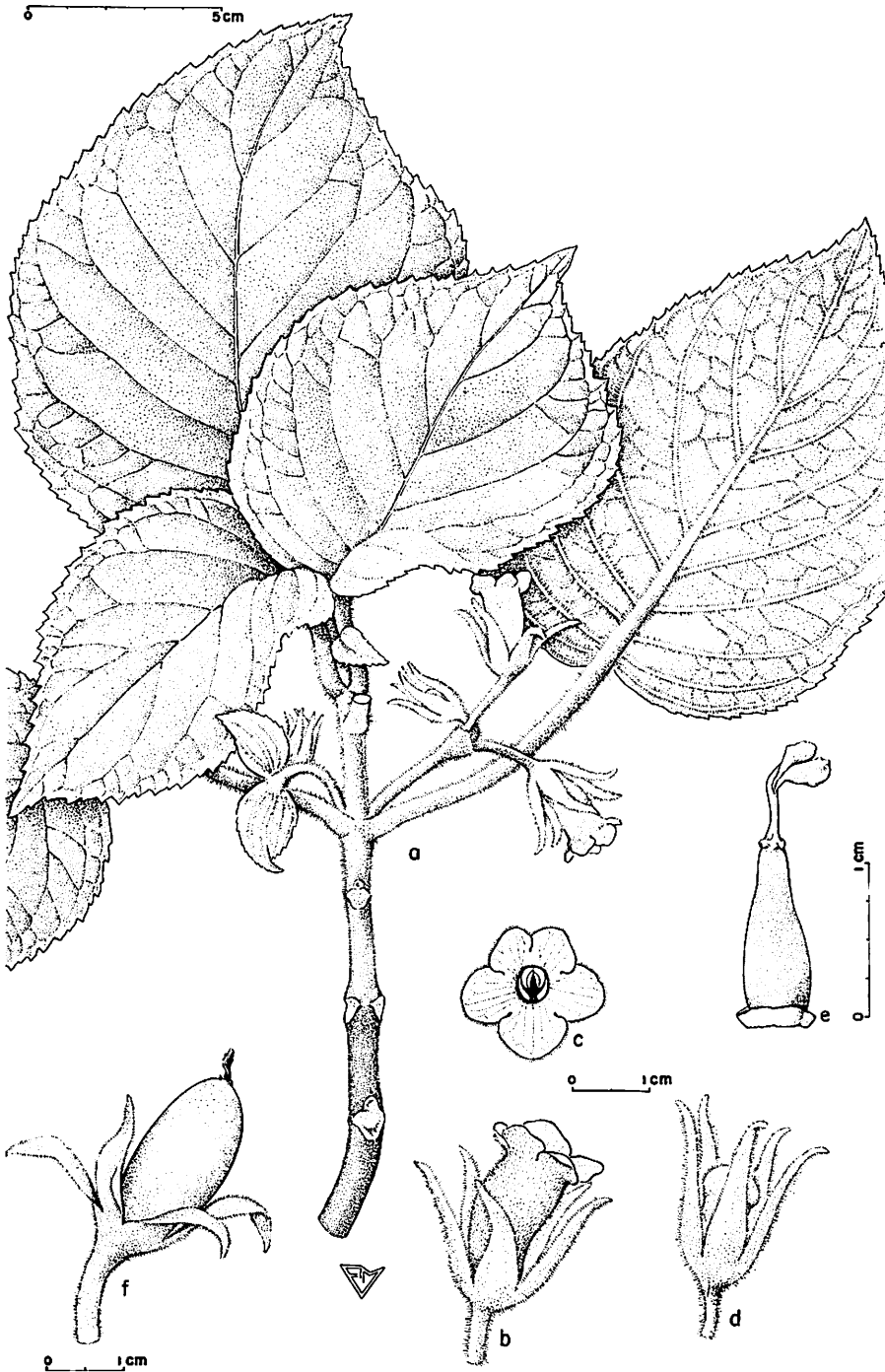


FIGURE 81.—*Cyrtandra propinqua*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Punaluu, Cowan 680, pistil from Pupukea-Kahuku Trail, Ohia Ai Gulch, St. John 20,223.

Holotype: "Koolauloa [= Koolau] mountains between Punaluu and Kai-paupau, Oahu, T.H., Nov. 24-21, 1909, by C. N. Forbes, No. 2563.0" (BISHOP MUS.). Type examined.

Specimens Examined: Koolau Range.

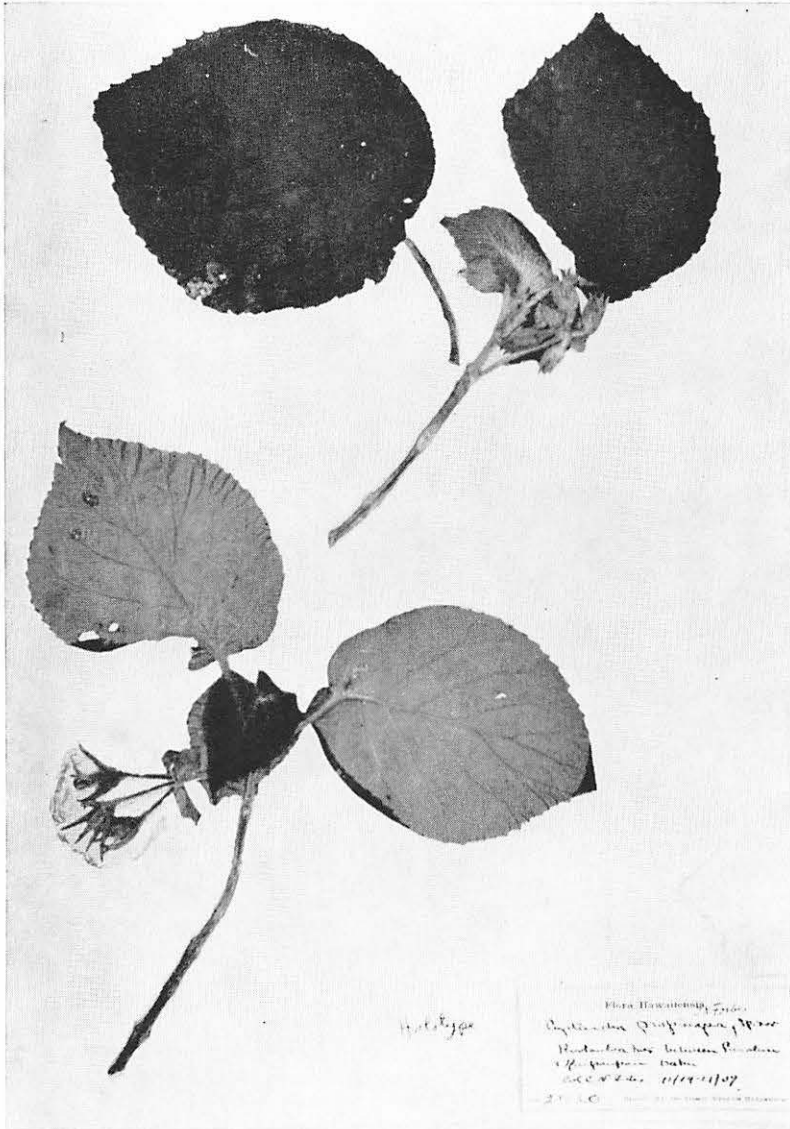


FIGURE 82.—*Cyrtandra propinqua*, holotype (Bishop Mus.). Between Punaluu and Kai-paupau, Forbes 2563.0.

Windward Side: Kahuku, Ohia Ai Gulch, Pupukea-Kahuku Trail, 1,300 ft. alt., common, moist wooded gulch, April 6, 1941, *St. John* 20,223; Kahuku, near summit, 1 mile southeast of Black Junction, forest, Feb. 26, 1950, *Degener & Carroll* 20,539; Kahuku Forest Reserve, windward side of summit ridge, Pupukea summit trail, 1,900 ft. elev., in small opening of rain forest, Sept. 19, 1950, *Hatheway & Degener* 378; Kaipapau, Maakua-Papali ridge, Hauula Forest Reserve, 1,600 ft. alt., Oct. 15, 1933, *St. John* 13,360; Hauula, near head of Papali Gulch, 1,700 ft., rain forest, on side bank of stream, Oct. 26, 1952, *Wilson* 156; and *Wilson & Park* 162; Punaluu, Castle Trail, 2,000 ft. alt., under shrub on upper slopes, Oct. 14, 1934, *E. H. Bryan, Jr.* 834; ditto, *Cowan* 680; Punaluu, Nov. 30, 1929, damp slope, *Nitta* 7,566 (NY); ditto, Pig-God Trail, in rain forest, May 31, 1931, *Degener et al.* 7,514 (NY); ditto, Punalu [Punaluu] Maio 1910, *Faurie* (BM); ditto, 700 ft. elev., Dec. 21, 1931, *Hume* 442; ditto, see type; ditto, small, not densely shaded ravine, 1,200 ft., July 4, 1931, *Storey* 134.

Leeward Side: Pupukea-Kahuku trail, in forest, 300 m. alt., Aug. 12, 1930, *Christophersen* 1,378; ditto, near summit, open rain forest, April 1, 1929, *Degener* 7,555 (NY); ditto, Pupukea, 1,500-1,700 ft. alt., middle forest, Feb. 19, 1933, *Krauss*; ditto, Pupukea forest reserve, 300 m. alt., Sept. 15, 1926, *Skottsberg* 1,805 (S); ditto, common in woods at 1,500 ft., March 6, 1932, *Storey* 163; and March 11, 1934, *Storey* 247; ditto, April, 1925, *Topping* 3,086 (UC); ditto, Nov. 21, 1932, *Yuncker* 3,436 (US); Anahulu Ridge Trail, 1,500-1,700 ft. alt., woods, March 10, 1935, *Storey* 263; South Opaulea Gulch, 1,700 ft., woods, April 29, 1934, *Storey* 251; North Fork of Kipapa Gulch, 1,200 ft. elev., along dry stream bed, Feb. 15, 1931, *Storey* 128.

Discussion: *C. propinqua* is a large shrub, and is common and conspicuous in the lower forest and the middle forest on the northern third of the Koolau Range. It has large, villous, cordate leaves and its calyx is large and often reflexed in fruit. These structures give it a superficial resemblance to *C. cordifolia* which is just as common in the southern two-thirds of the Koolau Range, and well known to all plant collectors. Perhaps this habitual resemblance to *C. cordifolia* may explain why none of the early collectors gathered this species, the very first collection being by Forbes in 1909. Skottsberg collected it in 1926 and wrote (1936: 173) that it was "A little known species . . ." Be that as it may, it is now often collected and well known.

Forbes in describing the species contrasted it with *C. waiolani*, and apparently chose the specific name because he considered it near to or in the propinquity of that species. As Skottsberg indicated, there are marked differences from that species. We now consider it much more closely related to *C. villicalyx*, with which it is contrasted in the key.

C. propinqua is one of the few species with large, cordate-based blades, but, on weak lateral branches, it may bear leaves that are merely oval.

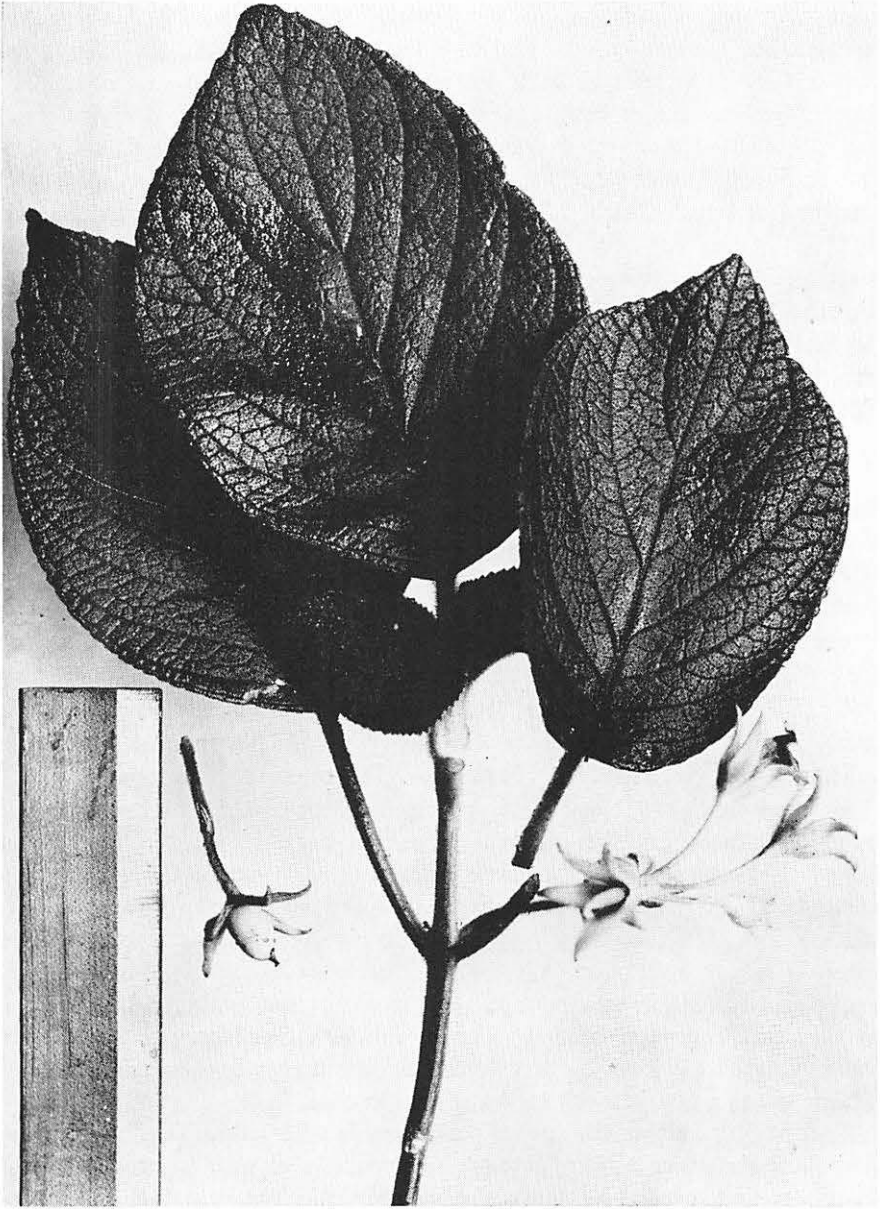


FIGURE 83.—*Cyrtandra propinqua*, Pupukea, Storey 247.

59. *Cyrtandra pruinosa* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 87-88, 1950. (Figs. 84, 195.)

Description of Holotype: Shrub 1.5-2.5 m. tall; branches straw-colored, smooth, quickly glabrate, at first quadrangular, as much as 8 mm. in diameter, naked below; leaf scars 2.5-3 mm. high, pale straw-colored, rounded shield-shaped but interconnected by a narrow band; bundle scars 5; leafy branchlets as much as 2-3 mm. in diameter subquadrangular, somewhat fleshy, and shrinking on drying to form a single furrow up each flat side, the young shoots closely pruinose and remotely puberulent, finally glabrate; internodes 7-50 mm., averaging 12 mm. long; *leaves* opposite, borne at the upper 2-4 nodes, spreading, not crowded, unequal, one of the pair from $\frac{1}{4}$ the larger to twice as large; petioles 15-80 mm. long, pruinose and sparsely puberulent, the base enlarged to form a perfoliate rim which, after leaf fall, makes a scar which connects leaf scars; *blades* 7-16 cm. long, 32-90 mm. wide, chartaceous, ovate to lanceolate, subacuminate, short decurrent at base, the margins serrate, above the surface green and at first abundantly pruinose, below pale green and capitate glandular puberulent, lateral veins, 7-9 on a side, ascending, very gently curved, then the tips inarching; *cymes* from the leaf axils, reduced to a 1-flowered inflorescence, pruinose throughout; peduncles 9-20 mm. long, from ascending in flower to divergent or even reflexed in fruit, at first hirsutulous (as are the pedicels) with a few scattered hairs, these soon deciduous, leaving the peduncles only pruinose; pedicels in flower 14-20 mm. long, accrescent and in fruit 20-27 mm. long, also becoming thicker and at apex clavate; bracts 10-18 mm. long, lanceolate, foliaceous, sparsely pruinose and hirsutulous; *calyx* 12-21 mm. long (when dried), pruinose, foliaceous, scarcely 2-lipped, lobed almost to the base, the 5 (-6) lobes subequal; calyx tube 1 mm. long, obconic; *corolla* 22-24 mm. long (18-20 mm. when dried), white, pruinose, the tube 17 mm. long, 4.5 mm. in diameter at base, the throat 5 mm. wide, 6 mm. high, the tube cylindrical and straight for the lower half, in the outer half enlarged towards the throat and slightly deflexed, the inside glabrous, limb 2-lipped; upper lip with the lobes 2, apparently rotate, 3.5-4.5 mm. long, 4.5-6.5 mm. wide, deltoid-cordate, obtuse, glabrous within; lower lip with 3 lobes, apparently rotate, glabrous within, the 2 lateral ones, 7 mm. long and wide, suborbicular; lowest lobe 7 mm. long, 8 mm. wide, orbicular; 2 lower stamens perfect, the filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 6 mm. long, subulate, stout, spirally upcurved; the 2 perfect anthers 3 mm. long, obliquely oval, connate at apex: the staminodia 0.2-0.3 mm. long, subulate, curved; *style* 4-6 mm. long, stout, pruinose; 2 stigmatic lobes, 1.8 mm. long, oval, equally cleft on both sides; *ovary* 4-6 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; *berry* 1-1.9 cm. long (dried), ovoid, white, the tip acute and apiculate; seeds 0.37-0.48 mm. long, 0.18-0.21 mm. wide, fusiform, straight or sigmoid or arcuate, dark brown, covered with high raised thick cellular reticulations, the areolae oblong, longitudinal $\frac{1}{4}$ the length of the seed.

Distribution: Koolau Range, leeward side, in Kalauao Valley, at 1,500 ft. alt., in woods of the Ohia Zone; known only from the type collection.

Holotype: Oahu, E. ridge of Kalauao Valley, Koolau Mts., 1,500 ft. elev., in woods below ridge trail, in company with *Hesperomannia*, April 30, 1933, *W. B. Storey* 240 (BISHOP MUS.).

Discussion: *C. pruinosa* is a member of the section *Schizocalyces*. No other member of this section has pruinose herbage and inflorescence or perfoliate petiole bases. Hence, it seems that *C. pruinosa* does not have any very close relatives.

The specific name is taken from the Latin, *pruinus*, covered with hoar frost.

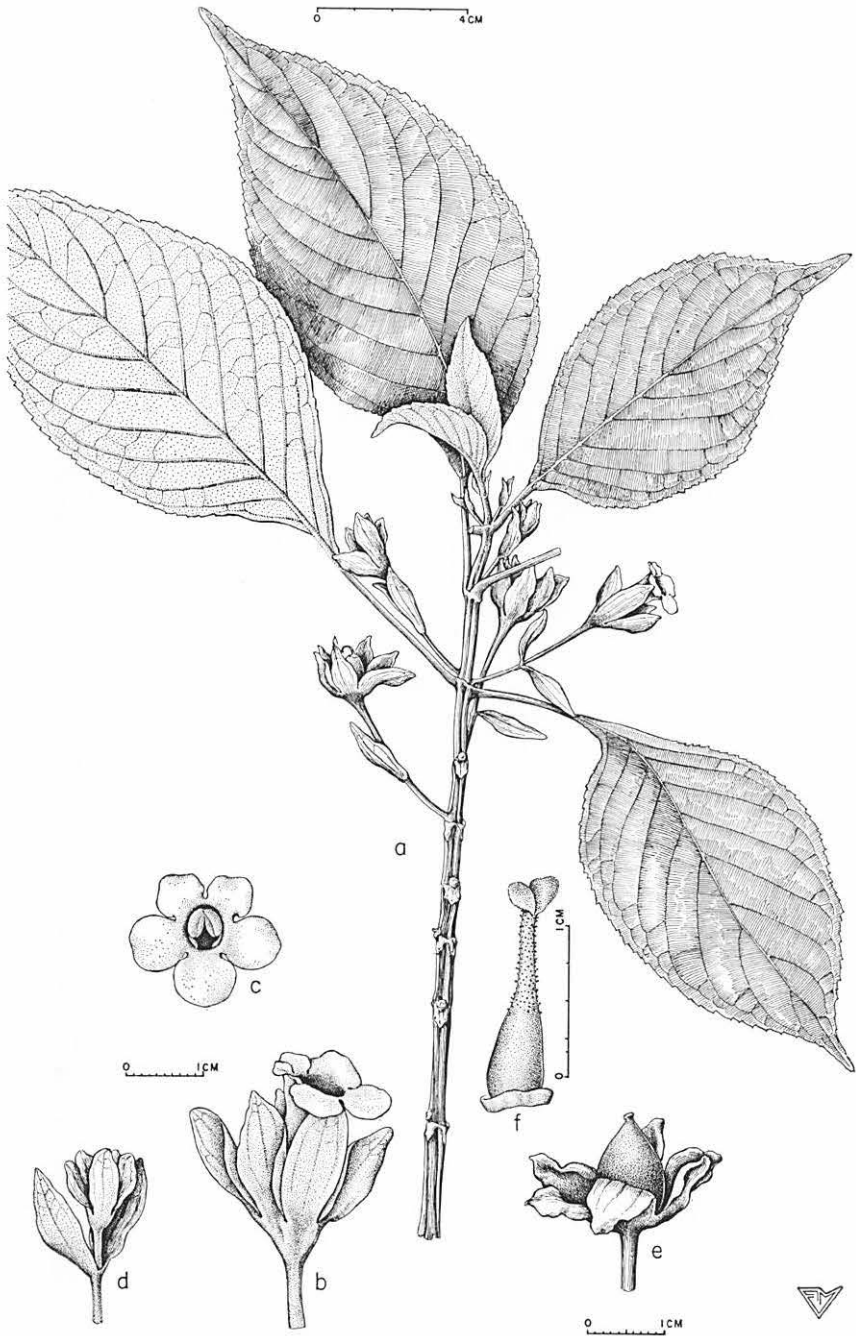


FIGURE 84.—*Cyrtandra pruinosa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, fruit, $\times 1$; f, pistil, $\times 2$. Kalauao, Storey 240, holotype (Bishop Mus.).

60. *Cyrtandra pubens* St. John, sp. nov. (Figs. 85, 191).

Diagnosis Holotypi: Frutex, ramulis foliosis 8 mm. diametro quadrangularibus dense villosis pilis in sicco brunneis, internodis 25-40 mm. longis, cicatricibus 10 mm. altis obovato-scutelliformibus pallidis suberosis late interconnectis et annulatis, fasciculis 7, novellis dense crebre villosis, *foliis* oppositis adscendentibus non aggregatis in 4 nodis superis productis, petiolis 4-10 cm. longis validis brunneo-villosis, *laminis* 21-26 cm. longis 14-19 cm. latis chartaceis ovali-suborbicularibus acutis in basi longe cuneatis supra obscure viridibus et remote crebre catenulato-hirsutis infra pallide viridibus et molliter pilosis in nervis principalibus crebre pilosis marginibus apiculato-denticulatis nervis secundariis 8-9 in uno latere adscendentibus rectis vel gradatim sigmoideis interconnectis et in dentibus salientibus, *cymis* axillaribus villosis 3-7-floriferis, pedunculis 15-17 mm. longis, pedicellis 15-23 mm. longis, bracteis 10-12 mm. longis ovatis acutis foliaceis, *calycibus* in fructu sicco 18 mm. longis extra dense brunneo-villosis, tubo 5-7 mm. longo cyathiformi viridi chartaceo vel membranaceo intra piloso, limba bilabiata inter labias 7-10 mm. partita 5-lobata lobis intra villosis, labia supera trilobata, lobis 8 mm. longis in basi 4 mm. latis lanceo-ovatis subacuminatis, labia infera bilobata inter lobas 7 mm. partita lobis 4-5 mm. latis ovato-lanceolatis subacuminatis, *haccis* 10-15 mm. longis albis ovoideis apiculato-rostratis.

Description of All Specimens Examined: Shrub; leafy branchlets 8 mm. in diameter, quadrangular, densely villous, the hairs brownish when dry; internodes 25-40 mm. long; leaf scars 10 mm. high, obovate-shield-shaped, pale, corky, connected and annular by a broad band; bundle scars 7; young shoots densely shaggy villous; *leaves* opposite, ascending, not crowded, borne at the 4 upper nodes, those of a pair unequal, one being $\frac{1}{2}$ the larger; petioles 4-10 cm. long, stout, brownish villous; *blades* 21-30 cm. long, 12.5-19 cm. wide, chartaceous, oval-suborbicular, the apex acute, the base long cuneate, above dark green, and generally but not closely crinkly catenulate hirsute, below pale green and softly pilose, on the principal veins shaggy pilose, the margins apiculate denticulate, the secondary veins 8-10 on a side, ascending, straight or gently sigmoid, the tips gently curving, inarched interconnecting and salient in the teeth; *cymes* axillary, villous, 3-7-flowered; peduncles 10-17 mm. long; pedicels 7-23 mm. long; peduncular bracts 8-12 mm. long, ovate, acute, foliaceous; buds campanulate, concealed by the shaggy villosity; *calyx* in fruit (when boiled) 16-18 mm. long (13-16 mm. long when dried) without densely brownish villous, the tube 5-7 mm. long, shaped like a wine glass, green, chartaceous to membranous, within pilose; the limb 2-lipped, cleft down 7-10 mm. between the lips, 5-lobed, the lobes villous within; upper lip 3-lobed, the lobes 8 mm. long, 4 mm. wide at base, lance-ovate, subacuminate; lower lip with 2 lobes, cleft down 7 mm. between the lobes, the lobes 4-5 mm. wide, ovate-lanceolate, subacuminate; *corolla* white, 18-20 mm. long when boiled, the tube 15 mm. long, nearly straight cylindrical, 5 mm. in diameter at base and throat, 4 mm. at middle, without on the exposed parts densely white villous, within glabrous; limb 2-lipped, 5-lobed; 2 upper lobes, 3 mm. long, 4.5 mm. wide, semiorbicular-reniform, strongly auriculate and overlapping, and like other lobes glabrous within but without villous toward the base; lower lip 3-lobed; lateral lobes 6 mm. long and wide, rhombic-suborbicular, 5 mm. long, 7 mm. wide, oblate suborbicular; the two lower stamens with filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 4 mm. long, stout subulate, spirally upcurved; the two perfect anthers 2.3 mm. long, 1.8 mm. wide, obliquely suborbicular-ovate, the similar shaped connective 1.2 mm. wide, dark; 2 lateral staminodia with their filaments adnate to the corolla tube to within 7 mm. of the throat, the free part 1-1.2 mm. long, subulate, the linear pale antheroid tip 0.2 mm. long; *style* 5 mm. long, it and the upper half of the ovary capitate glandular pilose; 2 stigmatic lobes 4 mm. long, 1.8 mm. wide, oval, connate $\frac{1}{3}$ way up the proximal side; *ovary* 5 mm. long, the base surrounded by a cupulate disk 1 mm. high; *berry* 10-18 mm. long, white, ovoid, apiculate, beaked; seeds 0.26-0.42 mm. long, 0.16-0.21 mm. in diameter, ellipsoid or slightly fusiform, honey-colored except for the dark brown ends, the body covered with raised, cellular, oblong reticulations $\frac{1}{3}$ as long as the seed.

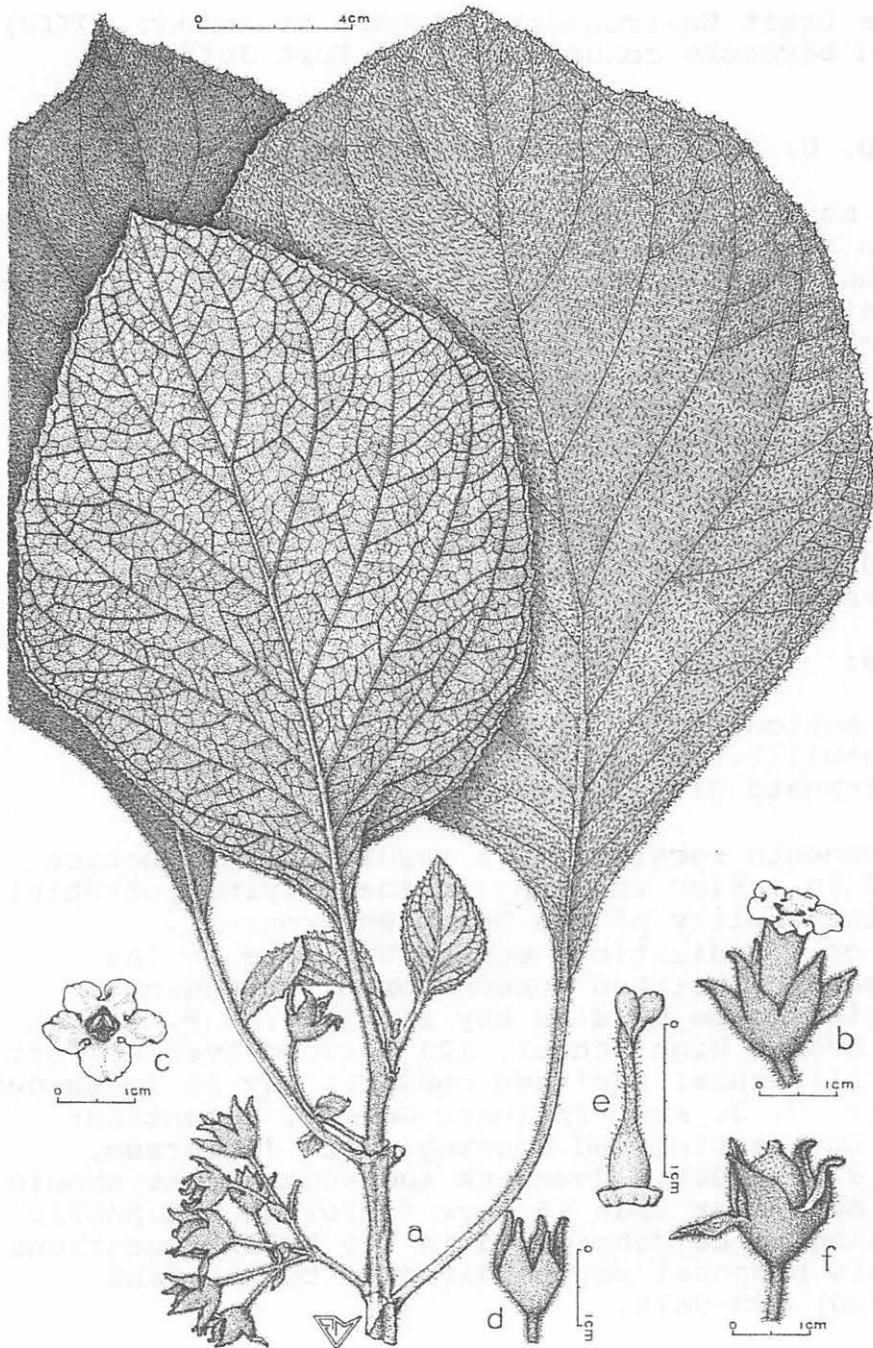


FIGURE 85.—*Cyrtandra pubens*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. a, Kahana Valley, Storey 201, holotype (Bishop Mus.); b-e, Kipapa Gulch, Storey 209; f, Kipapa Trail, Storey 260.

Distribution: In moist woods in the Koolau Range at Kahana on the windward side and at Kipapa, nearby on the leeward side, from 800 to 1,200 feet altitude, in the Ohia Zone.

Holotype: Oahu, Kahana Valley, Koolau Range, 800 ft. alt., in more or less open woods along trail leading down into Kahana Valley from the Wai-kane-Schofield Trail, Oct. 16, 1932, *W. B. Storey 201* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Leeward Side: North Fork of Kipapa Gulch, in small dark ravine, moist and shaded, 1,200 ft. elev., Nov. 13, 1932, *Storey 209*; Kipapa Trail, along new C.C.C. Trail leading to the summit of the range, in damp, shaded ravines at 2,000 ft. alt., Feb. 10, 1935, *Storey 260*.

Hawaiian Islands, without locality: ex Herb. J. M. Lydgate (as *C. Kalihii*), *Hillebrand & Lydgate* and mixed with leaves of *C. tristis*; ex Herb. J. M. Lydgate (as *C. Kalihii* and *C. tristis*), *Hillebrand & Lydgate* and mixed with one leaf of *C. tristis*.

Discussion: *C. pubens* is a member of the section *Schizocalyces*. The most similar species is *C. kalichii* but it differs in having the blades with the base broadly rounded and abruptly short acuminate, hirsute below; calyx 7-12.5 mm. long, densely hirsute, the lobes lance-oblong; ovary and fruit glabrous. *C. pubens* differs from the above by having the blades long cuneate at base, below softly pilose; calyx 13-16 mm. long, obscured by the dense brown villosity, the lobes lance-ovate; ovary and fruit pilose.

The specific name is from the Latin participle meaning, becoming soft hairy, in allusion to the hairy fruit.

61. *Cyrtandra reflexa* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 88, 1950. (Figs. 86, 188.)

Illustrations: Rock, Am. Jour. Bot. 6: pl. XXIX, 1919 (as *C. laxiflora*).

Description of All Specimens Examined: Shrub; branches terete, pale brown, the leaf scars 4-7 mm. high, shield-shaped, pale, corky, raised; bundle scars 7; internodes 0.7-6 cm. long; leafy branchlets 2-5 mm. in diameter, villous; young shoots densely shaggy villous, drying tawny; leaves opposite, subequal, nearly straight and symmetric, remote and divergent; petioles 5-12 cm. long, shaggy villous; blades 5-24 cm. long, 4-17 cm. wide, chartaceous, oval to suborbicular, the apex acute or abruptly subacuminate, the base rounded or abruptly cuneate and short decurrent, above dark green, distinctly villous but the hairs remote, below whitish green, generally villous and abundantly so on the veins, the margin coarsely and irregularly serrate or serrate-dentate; secondary veins 6-8 on a side, nearly straight, then near the margin arcuate, inarching and apiculate excurrent in the teeth; cymes subumbellate, from the leaf axils or in fruit persisting at the uppermost naked node, 5-32-flowered, densely spreading, glandular villous throughout; peduncles 3.5-5 cm. long, divergent; pedicels 3-34 mm. long, slender; lowest pair of bracts 1.5-2.5 cm. long, broadly oblanceolate, foliaceous; the other bracts similar, 3-15 mm. long; buds broadly campanulate, the calyx lobes erect, distinct; calyx 11-18 mm. long (when dried 8-10 mm.), densely spreading villous without, densely villous within almost to the base, when young white, becoming green at or after anthesis, campanulate, slightly 2-lipped, parted almost to the base, not accrescent, the lobes linear-lanceolate, the calyx sharply reflexed soon after flowering and in fruit

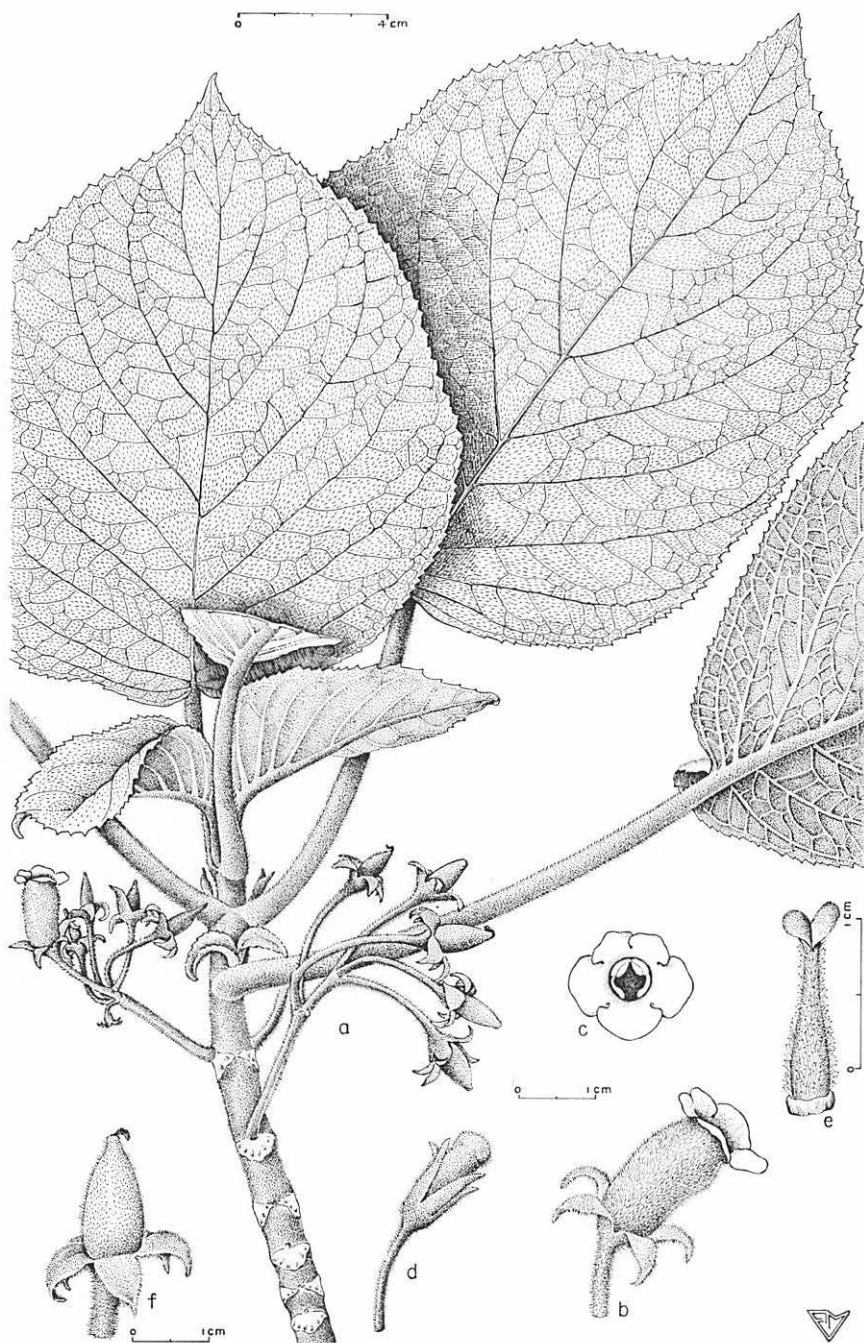


FIGURE 86.—*Cyrtandra reflexa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Kawaiiki Ditch, St. John 22,863.

persistent; *corolla* 14-22 mm. long, 4-8 mm. in diameter, the tube 12-17 mm. long, nearly straight and tubular, white villous without and glabrous within, the lobes unequal, villous without or near to the margin, glabrous within, suborbicular, the upper 2-3 mm. long, the lower 3-4 mm. long, the lobes spreading at about 90° from the axis of the tube; filaments fused to within 4 mm. of the throat, the free portion 3 mm. long, subulate, spirally incurved; anthers 2.2-3 mm. long, obliquely deltoid ovate, asymmetric, one cell the smaller; staminodia scalelike, 0.5 mm. long, attached to within 6 mm. of the throat; *style* densely glandular villous, the 2 terminal stigmatic lobes 1.5 mm. long, oval-spatulate, opposite, distinct, thickened; *ovary* narrowly lanceoloid densely glandular villous; *berry* 16 mm. long, 7 mm. in diameter, ovoid, beaked, densely glandular villous.

Distribution: Koolau Range, leeward side, from Kawaihoa and Paalaa, in shaded ravines, at about 1,200 to 1,800 ft. alt. in the Ohia Zone.

Holotype: Oahu, Kawaihoa Ditch Trail, Kawaihoa, moist wooded gulch, 1,200 ft. alt., Nov. 9, 1941, *Harold St. John 20,272* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Leeward Side: See type above; Kawaihoa Ditch Trail, Aug. 15, 1922, *Skottsberg 204*; Kawaihoa Ditch Trail, Kawaihoa, moist wooded gulch, 1,250 ft. alt., Nov. 9, 1941, *St. John 20,275*; ditto, 1,070 ft. alt., Oct. 14, 1951, *St. John 24,702*; ditto, 1,100 ft. alt., Nov. 2, 1947, *St. John 22,863*; Kawaihoa-Opaulea Divide, small densely shaded ravine, elev. 1,800 ft., Oct. 4, 1931, *Storey 166*; Waialua Mts., *Mann & Brigham 615* in part (BISHOP MUS. ex Yale; CU in part, the leafy branch and the two cymes with lanceolate calyx lobes, in the pocket).

Discussion: *C. reflexa* is a member of the section *Schizocalyces*, but seems to be most closely related to *C. waianaensis* of the section *Crotonocalyces*. That species differs in having the calyx more cupulate and cleft only $\frac{2}{3}$ way to the base, in smaller, heavier leaves with harsher pubescence. *C. cordifolia*, the new *C. reflexa*, and *C. waianaensis* are noteworthy for having early reflexed calyces. It is a question whether or not to group them together and set them off as a section upon this character.

C. reflexa was collected in 1864-65 by Mann and Brigham, but it was not distinguished. Their no. 615, the type collection of *C. laxiflora* Mann contained a mixture of the two species. For a discussion of this confusion and a contrast between the two, see the treatment of *C. laxiflora*.

The new specific name is taken from the Latin, *reflexus*, bent backward, which is given in allusion to the reflexed calyx.

62. *Cyrtandra Rockii* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 88, 1950, emend. (Figs. 87, 192.)

Description of Holotype: Shrub 2 m. tall; branches at first somewhat villous but quickly glabrate and tawny, fleshy and on drying shrinking and with many longitudinal furrows and ridges, as much as 8 mm. in diameter; leaf scars 3-4 mm. high, broad, rounded shield-shaped; bundle scars 7: young shoots densely brown villous; leafy branchlets as much as 4 mm. in diameter, subquadrangular, densely shaggy brown villous; internodes 7-17 mm., averaging 12 mm. long; *leaves* opposite, divergent, not



FIGURE 87.—*Cyrtandra Rockii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Hauula, St. John 13,357, holotype (Bishop Mus.).

crowded, those of a pair unequal, one being $\frac{1}{2}$ larger; petioles 22-32 mm. long, densely brown villous; *blades* 20-23 cm. long, 7-9 cm. wide, chartaceous, oval-oblongate, the base cuneate and short decurrent, the apex short acuminate, above dark green, appearing glabrous, but with a remote pilosity, below whitish green and pilose on the veins, sparsely so on the intervals, the margins serrulate, the secondary veins 10-11 on a side, near the margin arcuate and the tips long paralleling the sides; *cymes* axillary, 3-5-flowered, densely rusty, subappressed villous; peduncles 15-18 mm. long; pedicels 6-10 mm. long; bracts 10-13 mm. long, lance-elliptic foliaceous; unopened buds not seen; *calyx* at anthesis 36 mm. long (33 mm. when dried), without and within densely brown villous, 2-lipped, 5-lobed, the sinus between the lobes 18-23 mm. deep; upper lip 3-lobed, the lobes 11-15 mm. long, narrowly linear-lanceolate, the outer two-thirds broad linear, straight; lower lip 2-lobed, the lobes 20-24 mm. long, arching outwards, the lower half lanceolate, the outer half broad linear; *corolla* when fresh 33 mm. long, white, narrowly funnelform, but halfway from the base deflected at 30°, within glabrous, without glabrous at base, the rest fine white lanate, at base 3.5 mm. in diameter, at the middle 6 mm. in diameter, at the throat 8 mm. in diameter; limb 2-lipped, 5-lobed; upper lip spreading at about 90° to the axis of the throat, the two lobes when fresh 7 mm. long, 7 mm. wide, rhombic-suborbicular, obtuse, without villous up the back but the tip and broad margins glabrous, within sparsely pilose from the throat to the middle; lower lip 3-lobed, the two lateral lobes 10 mm. long, 9 mm. wide, broadly ovate, similarly pubescent but without the hairs borne almost to the tip; lower lobe 9.5 mm. long and wide, broadly ovate, without villous throughout; the two lower stamens perfect, the filaments adnate to the corolla tube to within 8 mm. of the throat, the free portion terete, stout, 4.5 mm. long, spirally upcurved; the two perfect anthers connivent, 3.5 mm. long, 2 mm. wide, obliquely elliptic; the connective obliquely elliptic; three staminodia subequal, their filaments adnate to the corolla to within 10 mm. of the throat, their free filaments 0.7-0.8 mm. long, subulate, bearing sterile antheroid tips 0.8-1 mm. long, dark at base, pale at tip; *style* 9 mm. long, glabrous, stout filiform; 2 stigma lobes 3.5 mm. long, broadly obovate, connate half way up proximal side; *ovary* 10 mm. long, linear-lanceoloid, glabrous, the base surrounded by a cupulate disk 1.7 mm. high; fruit unknown.

Distribution: Koolau Range, windward side, known only from the type collection, at 1,600 ft. alt., in the Ohia Zone.

Holotype: Maakua-Papali Ridge, Kaipapau Forest Reserve, Hauula, moist wooded gulch, 1,600 ft. alt., Oct. 15, 1933, *H. St. John 13,357* (BISHOP MUS.).

Discussion: *C. Rockii* is a member of the section *Schizocalyces*. It is a very distinct species, not closely similar to any of the others.

It is named in honor of Dr. Joseph F. Rock, first professor of botany at the infant University of Hawaii. His wide explorations and his many excellent publications on Hawaiian botany have revealed to his successors much of the island wealth of vegetation. He also published an intensive revision of the Hawaiian species of the genus *Cyrtandra*.

63. *Cyrtandra stupantha* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 88, 1950. (Figs. 88-91, 191.)

C. triflora Gaudichaud β var. *grandifolia* Hillebrand, Fl. Hawaiian Is., 332, 1888, not *C. grandifolia* Elmer, Leaflet. Philipp. Bot. 7 : 2,663, 1915.

C. laxiflora Mann var. *grandifolia* (Hillebrand) Rock, Am. Jour. Bot. 6 : 207-208, 1919.

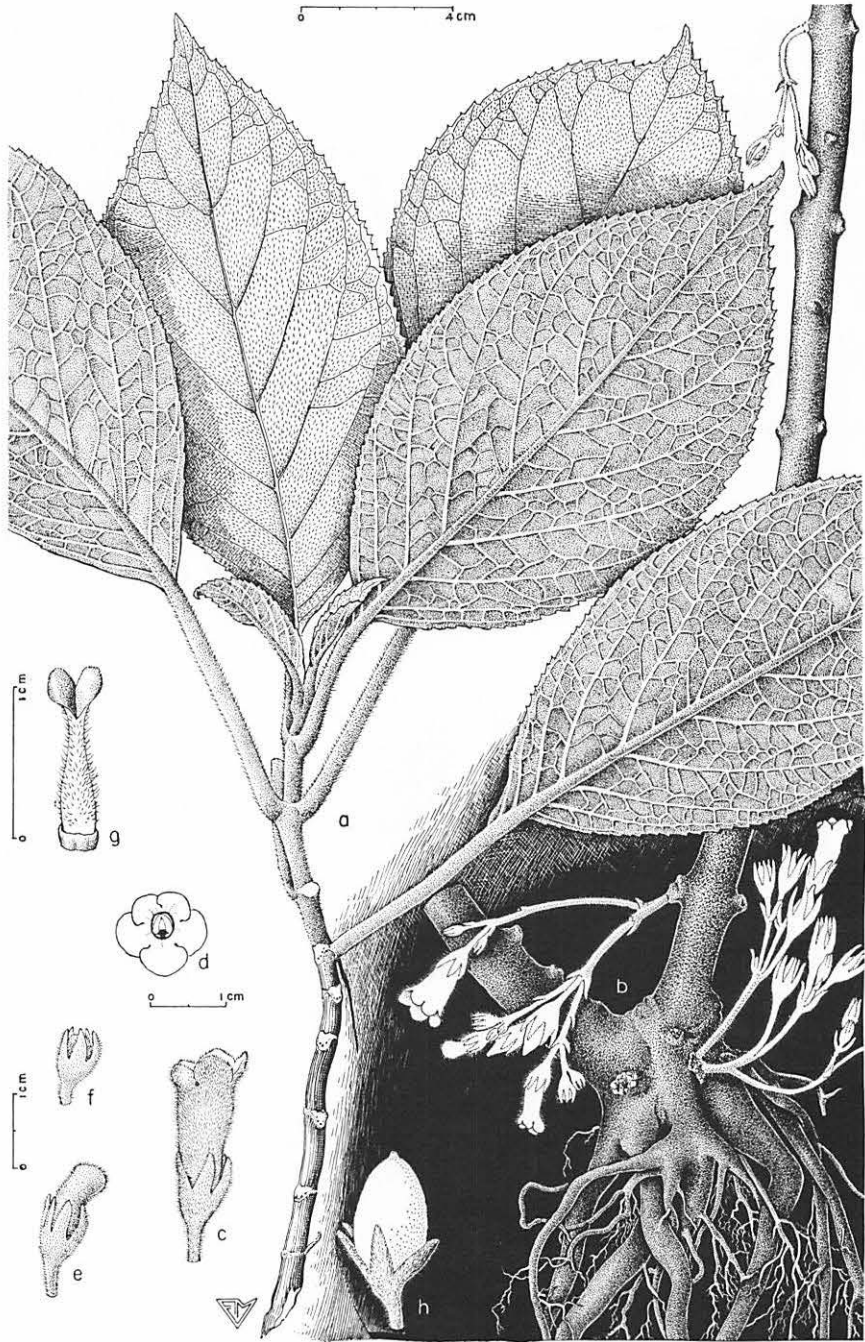


FIGURE 88.—*Cyrtandra stupantha*: a, habit, $\times \frac{1}{2}$; b, inflorescence and root habit, $\times \frac{1}{2}$; c, d, flower, $\times 1$; e, f, bud, $\times 1$; g, pistil, $\times 2$. Kawaiiki Ditch, St. John 22,864, holotype (Bishop Mus.).

C. laxiflora Mann var. *rhizantha* Rock, Am. Jour. Bot. 6: 207, 1919, not
C. rhizantha Kränzlin, Linn. Soc. Bot., Jour. 37: 277, 1906.

Description of All Specimens: Shrub 1-4 m. tall; stems 9-30 mm. in diameter, terete; older bark pale brownish, smooth or lightly furrowed longitudinally; leaf scars 3.5-7 mm. high, pale, obcordate shield-shaped; bundle scars 7 or 9; bare branchlets soon glabrate; young shoots densely pale pilosulous; leafy branchlets densely pilosulous, quadrangular, 1-3 mm. in diameter; internodes 10-80 mm., averaging 15 mm. in length; *leaves* opposite, ascending, not crowded, borne at the 3-5 upper nodes, those of a pair subequal, or one of the pair as much as $\frac{1}{2}$ larger; petioles 20-100 mm. long, slender, pilosulous; *blades* 6-23 cm. long, 18-135 mm. wide, chartaceous, obliquely lance-ovate or obovate to elliptic, or broadly so cuneate at base, apex acute or subacuminate, above sparsely appressed hirsutulous or pilose, dark green, below pale greenish, the veins loosely pilosulous, the intervals sparsely appressed puberulous, softly pilose, the margin irregularly denticulate or serrate, secondary veins 5-9 on a side, below almost straight, above gently arching towards the tip, excurrent in the teeth and interconnecting; *cymes* 5-18 cm. long, cauliflorous, mostly at the base or up to the middle of the stem but aerial, 3-33-flowered, rarely in part axilliflorous, white throughout, softly white pilose; peduncles 0-45 mm. long, slender; pedicels 3-15 mm. long, slender; bracts 2-7 mm. long, lance-linear; buds lanceoloid, the calyx lobes erect and connivent; *calyx* in anthesis when fresh 10-13 mm. long (when dried 7-9 mm. long), the tissue at first white, but in age greenish, white spreading hirsutulous or puberulent without, the tube 3-5 mm. long, lanceoloid; the limb 5-lobed, 2-lipped, cleft down 9 mm. between the lobes; upper lip 3-lobed, the lobes equal or the middle one slightly shorter, the lobes 8 mm. long, 1.5 mm. wide at base, narrowly lance-linear, obtuse, within glabrous below, sparsely puberulent towards the tip; lower lip with two lobes, cleft down 9 mm. between the lobes, the lobes 2.5 mm. wide at base, narrowly lance-linear, obtuse; *corolla* when fresh 18-20 mm. long (when dried 12-14 mm. long), white, without capitate glandular pilosulous, the tube 14-15 mm. long, subcylindric or slightly enlarged above, gently decurved at the middle at from 10° to 20° from the axis of the lower tube, at the base 2.5-3 mm., at the middle 4.5-5 mm., at the throat 5-6 mm. in diameter; limb 2-lipped, 5-lobed; upper lobes 2, reflexing at about 130° from the axis of the throat, 2 mm. long, 4.5-5 mm. wide, reniform, the bases much overlapping, within glabrous, without capitate glandular pilosulous on the halves exposed in bud; lower lip 3-lobed; the lateral lobes 4 mm. long, 5 mm. wide, suborbicular, within glabrous, without capitate glandular pilosulous; lower lobe 4 mm. long and wide, spreading at about 90° , within glabrous, without capitate glandular pilosulous; two lower stamens perfect, with the filament adnate to the corolla tube to within 5 mm. of the throat, the free portion 1 mm. long, stout, subulate, spirally upcurved, the 2 perfect anthers 2.9 mm. long, 1.8 mm. wide, connate at apex, obliquely oblong ovate, the connective oval; staminodia adnate to the corolla tube to within 6 mm. of the throat, the lateral pair with the free portions 0.5-0.8 mm. long and bearing an abortive anther, the upper staminodium 0.3 mm. long, subulate; *style* 2 mm. long, pilose; stigmatic lobes 2-2.2 mm. long, oval, connate $\frac{2}{3}$ way up proximal side; *ovary* 5 mm. long, puberulent the base surrounded by a cupulate disk 1 mm. high; *berry* white, 16 mm. long, 10 mm. in diameter, ovoid, closely puberulent apiculate; seeds 0.37-0.48 mm. long, 0.23-0.29 mm. wide, broad ellipsoid, pale brown, the body covered with raised cellular oblong reticulations $\frac{1}{4}$ as long as the seed.

Distribution: Koolau Range, windward side, moist shady woods or gulches, from 190 ft. alt. under *Eugenia malaccensis* up to 2,000 ft. alt. under *Metrosideros collina*, from the Koa Zone to the Ohia Zone, from Laie to Kaaawa; leeward side, from 700 ft. to 1,400 ft. alt., in forests of *Eugenia malaccensis*, *Aleurites* and *Metrosideros*, from the Koa Zone to the Ohia Zone, from Kaula to Waialua, and again at Waimano.

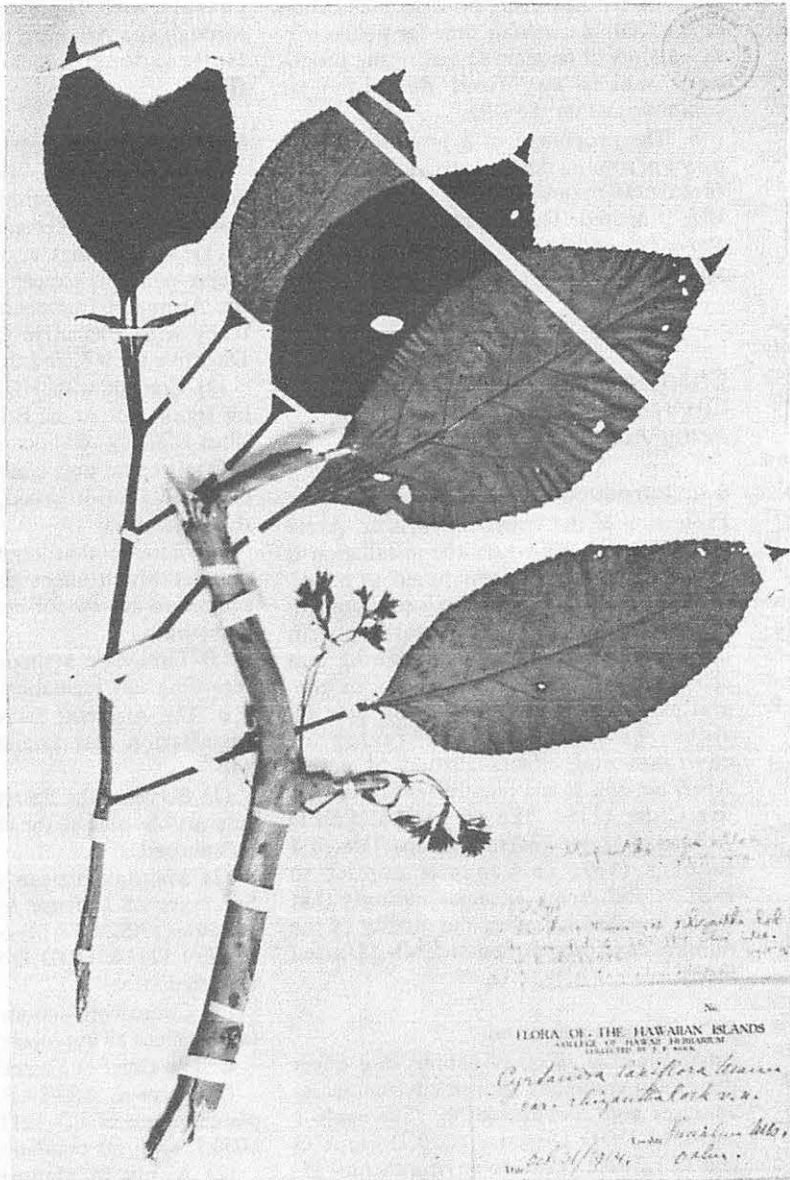


FIGURE 89.—*Cyrtandra laxiflora* var. *rhizantha*, holotype (Bishop Mus.). Punaluu Mts., Rock, now a synonym of *C. stupantha* St. John and Storey.

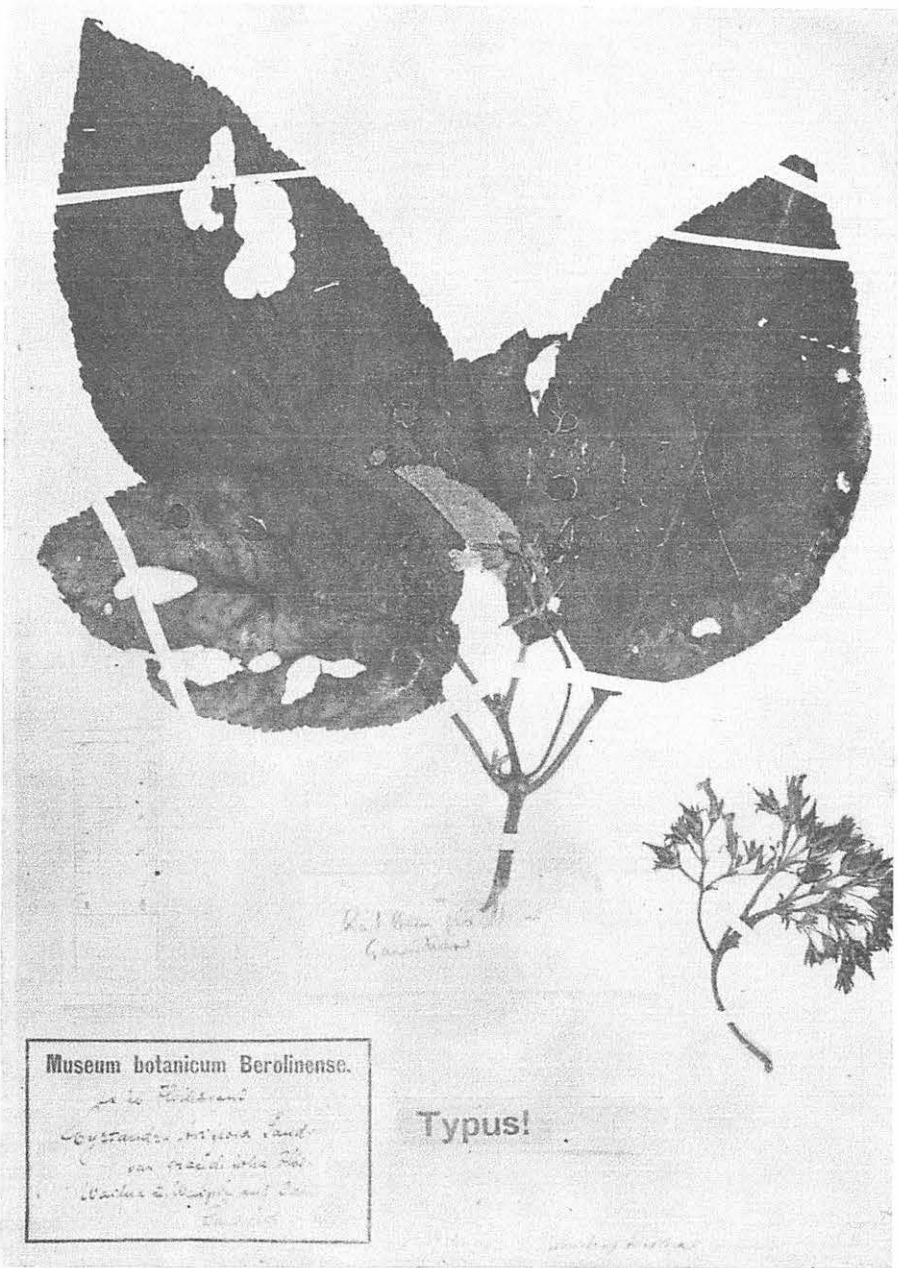


FIGURE 90.—*Cyrtandra triflora* β var. *grandifolia*, holotype (Berlin). Waialua and Waipio, Hillebrand; now classed as *C. stupantha* St. John and Storey.

Holotype: Koolau Range, Kawaiiiki Ditch Trail, Kawaihoa, 1,100 ft. alt., in dense moist forest in valley, Nov. 2, 1947, *H. St. John 22,864* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Laie Trail, Kahawainui Gulch, wooded stream bank, 1,200 ft. alt., March 25, 1956, *St. John 25,958*; Kaipapau, wet woods near stream, March 27, 1932, *Degener, Potter, Westgate & Bush 7,497* (NY); Kaipapau, Maakua-Papali ridge, wooded ridge 1,300 ft., Oct. 15, 1933, *St. John 13,358*; ditto, 1,500 ft., *St. John 13,359*; ditto, S. slope, 2,800 ft. alt., Oct. 15, 1933, *Suehiro*; Hauula, Waipilopilo Gulch, 600-800 ft. el., Dec. 2, 1933, *Krauss*; Kaluanui, near Kaliuwaa Falls, July 4, 1920, *Garber 443*, and 474; ditto, below Kaliuwaa, 190 ft. alt., shaded moist basalt walls, April 20, 1941, *St. John 20,225*; ditto, Aug. 1908 [probably *Rock*]; Kaliuwaa Valley [Kaluanui, but marked Punaluu on the second rubber-stamped label], Dec. 29, 1908, *Rock 444*; Punaluu, wet steep cliffs, 650 m. alt., *Fosberg 12,961*; ditto, wet slope, 2,000 ft. el., Jan. 11, 1931, *Hume 69*; ditto, damp slope, Nov. 30, 1929, *Nitta 7,563* (NY); ditto, Punaluu or Punaluu Mts., Oct. 31, 1914, *Rock* (five duplicate sheets, without numbers, but surely the holotype collection of *C. laxiflora* var. *rhizantha* Rock); ditto, Sept. 27, 1938, *Selling 3,623*; ditto, woods on windward slopes, 1,800 ft., July 4, 1931, *Storey 122*; ditto, Castle trail, 1,200 ft., July 4, 1931, *Storey 138*; ditto, woods, 1,800 ft., July 4, 1931, *Storey 140*; Kaaawa, W. ridge, 510 m. el., April 12, 1931, *Hume 152*; ditto *Hume 154*.

Leeward Side: Kaunala Gulch, Kaunala, 1,000 ft. alt., Kahuku For. Res., moist wooded gulch, Feb. 9, 1941, *St. John & Hosaka 20,162*, and 20,163; Kawaihoa, Kawaiiiki Ditch Trail,—see holotype; ditto, Feb. 9, 1936, *Degener 10,514* (NY); ditto, moist wooded gulches, 1,200 ft. alt., Nov. 9, 1941, *St. John 20,273*; ditto, 1,250 ft. alt., *St. John 20,274*; ditto, Aug. 15, 1922, *Skottsberg 202*; ditto, 1,000 ft. alt., Jan. 18, 1953, *Urata*; Waialua, Feb. 10, 1907, *Rock 12,773* (but published by Rock as *Swezey 12,773*); Waialua and Waipio, *Hillebrand* (type of *C. triflora* var. *grandifolia* Hbd.); Waimano, Waimano Trail, moist shaded bank of ditch, 700 ft. alt., March 23, 1941, *St. John 20,219*.

Discussion: *C. stupantha* is one of the few local species with the cauliflorous habit. The shrubs flower abundantly and the plants in moist shady places typically have the inflorescences on the lower half of the old leafless stems. In anthesis the peduncles, bracts, pedicels, calyces, and corollas are all white. In fruit the calyx becomes pale greenish.

C. stupantha is a marked species and very easily learned and recognized. There are, however, several collections that approach the character of *C. Garnotiana* in having the calyx lobed only about halfway down and in having more firmly chartaceous and more densely hairy blades. The existence of these specimens raises questions as to the distinctness of the two species. In dried

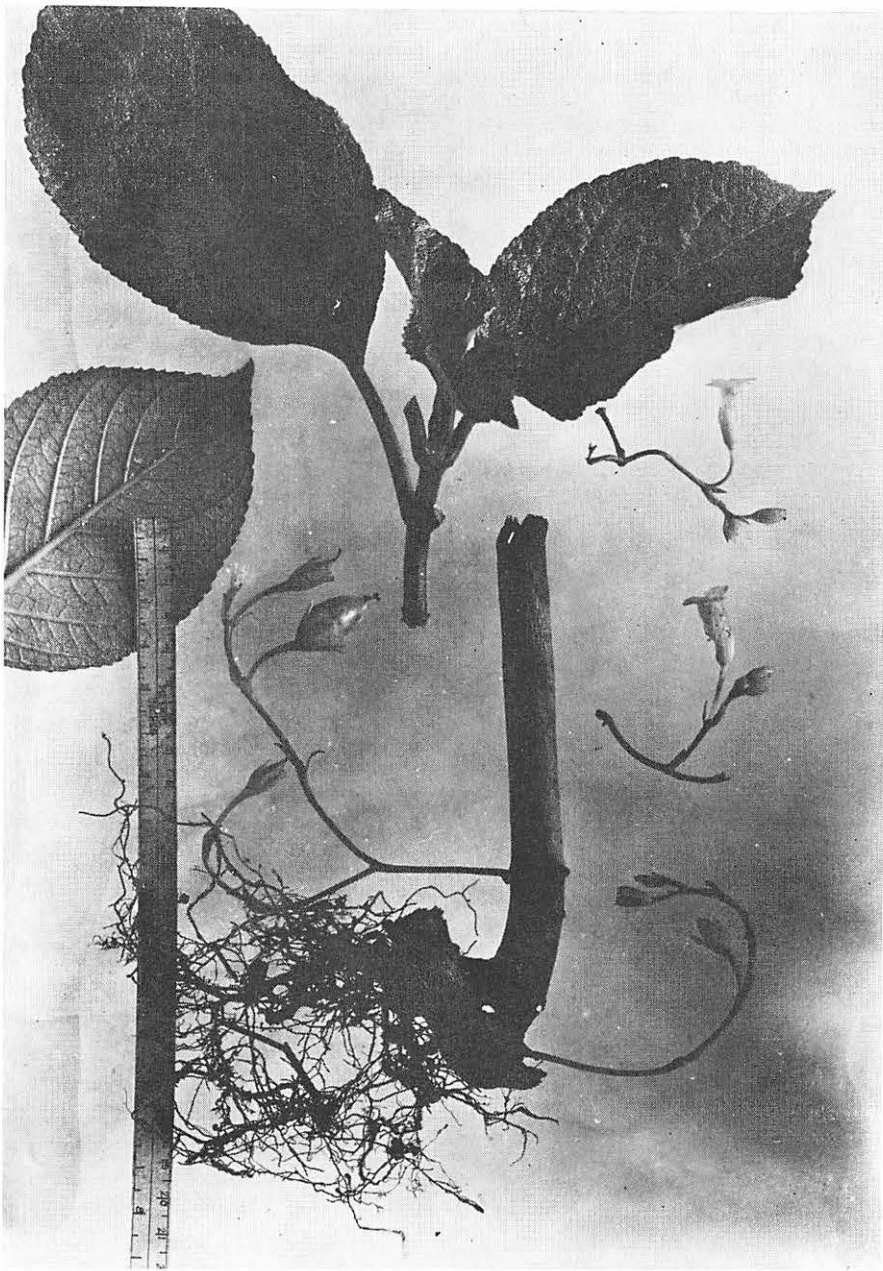


FIGURE 91.—*Cyrtandra stupantha*, Kaliuwa Falls, Kaluanui, Storey.

specimens of *C. stupantha*, the calyx and inflorescence appear greenish through darkening on drying. However, it can be distinguished by having the inflorescence cauline, the peduncles weak and forked, often right at the base, in flower all white and the calyx white; calyx lobed $\frac{3}{4}$ way down, the subappressed pilosulous fruit lanceoloid; and the blades chartaceous or membranous and below softly appressed puberulous. On the other hand, *C. Garnotiana* has the inflorescence in the leafy axils with a single stout, elongate peduncle, the inflorescence green; calyx green, lobed to about the middle, viscid pilosulous canescent; and the blades firm chartaceous and below moderately or densely pilosulous. Even though there is some variability in the calyx, all the doubtful specimens have been assigned to one or the other species, and they do not really disturb the specific boundaries. The ranges of the two touch, but are largely distinct. When all of the diagnostic characters are considered, it is easy to place these aberrant individuals in one or the other species. After a review of all the specimens and an evaluation of the diagnostic characters it seems correct to recognize the two populations as definitely distinct and worthy of specific rank, maintaining them as *C. Garnotiana* and *C. stupantha*.

The specific name is coined from the Greek, *stupos*, stem or stump; *anthos*, flower, in allusion to the cauliflorous habit of the species.

64. *Cyrtandra subintegra* St. John, sp. nov. (Figs. 92, 193).

Diagnosis Holotypi: Frutex, ramulis ad 5 mm. diametro laevibus hinnuleo-coloratis carnosus in sicco contractis et sulcis formantibus, cicatricibus 3-3.5 mm. altis distinctis pallidis suberosis scutelliformibus, fasciculis 5, novellis dense adpresse brunneo-pilosulis, ramulis foliferis 2-3 mm. diametro subquadrangularibus adpresse brunneo-pilosulis, internodiis 10-40 mm. plerumque 15 mm. longis, *foliis* oppositis divergentibus exaggregatis in 3-4 nodis superis affixis uno jugi $\frac{1}{4}$ minori, petiolis 1-2 cm. longis gracilibus et crebre adpresse brunneo-pilosulis, *laminis* 8-11.5 cm. longis 40-50 mm. latis graciliter chartaceis oblique ellipticis apice acuminato basi cuneato et decurrento marginibus subintegris supra remote brunneo-pilosulis et in midnervo dense ita infra pallide viridescentibus et molliter pilosulis sed in nervis primariis et secundariis dense ita, nervis secundariis 7-9 in uno latere adscendente arcuatis et interconnectis, *cymis* axillaribus 3-5-floriferis dense adpresse brunneo-pilosulis, pedunculis 15-20 mm. longis, pedicellis 3-7 mm. longis, bracteis 7-8 mm. longis foliaceis lanceolatis dense adpresse brunneo-pilosulis, alabastris campanulatis apicibus calycis adscendentibus, *calycibus* in flore quando bullitis 18 mm. longis (16 mm. in sicco) anguste campanulatis infra sinus angulatis, firme chartaceis extra dense adpresse brunneo-pilosulis intra glabris $\frac{3}{2}$ partitis tubo 6 mm. longo infra sinibus cucullatis labia supera bilobata lobis 11.5 mm. longis 6 mm. latis per 3 mm. connatis valde oblique lanceo-ovatis, lobis inferis binis 11.5 mm. longis 7 mm. latis oblique lanceo-ovatis acutis, *corollis* albis quando bullitis 23 mm. longis (19 mm. in sicco) extra dense brunneo-pilosulis, tubo 17 mm. longo cylindrico 4 mm. diametro in loco submediali in 20° deflexo intra glabro, limbo bilabiato 5-lobato lobis extra dense brunneo-pilosulis intra ex media ad orificem capitato-glanduloso-puberulis, labia supera cum lobis binis 4 mm. longis 3 mm. latis late ellipticis, labia infera 3-lobata, lobis lateralibus 5 mm. longis 7 mm. latis rhombico-suborbicularibus, loba infera 5 mm. longa 4.5 mm. lata late ovali, staminibus inferis binis perfectis filamentis in tubo 6 mm. ex orifice affixis parte libera 2 mm. longa subulata contorte adscendenti antheris 2.5 mm. longis 2.1 mm. latis oblique ovatis connectivo 1 mm. lato ovato subnigro, staminodeis lateralibus in tubo 6 mm. ex orifice affixis parte libera 0.5 mm. longa subulata,

apice antheroideo minuto subulato translucenti, *stilo* 2.5 mm. longo glabro, stigmatibus binis ovatis 2 mm. longis $\frac{1}{2}$ connatis, *ovario* 6 mm. longo lanceo-ovoideo glabro in basi cum disco cupulato 0.9 mm. alto cincto, fructibus incognitis.

Description of Holotype: Shrub; branchlets up to 5 mm. in diameter, smooth, fawn-colored, fleshy and on drying much shrunken, forming strong longitudinal furrows and ridges; internodes 8-38 mm., averaging 13 mm. long; leaf scars 3-3.5 mm. high, separate, shield-shaped, pale, corky; bundle scars 5; young shoots densely appressed

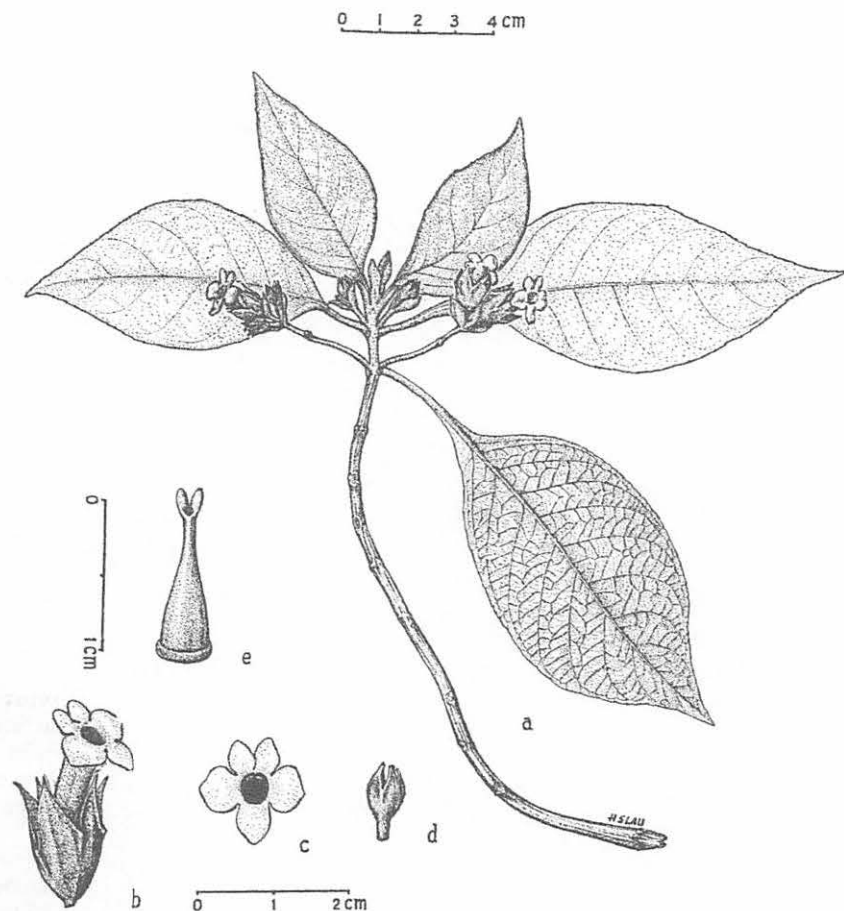


FIGURE 92.—*Cyrtandra subintegra*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Tantalus, Degener 7,688, holotype (New York).

brown pilosulous; leafy branchlets 2-3 mm. in diameter, subquadrangular, appressed brown pilosulous; internodes 10-40 mm., averaging 15 mm. long; *leaves* opposite, diverging, not crowded, borne at the 3-4 upper nodes, those of a pair unequal, one being $\frac{1}{4}$ smaller; petioles 1-2 cm. long, slender and densely appressed brown pilosulous; *blades* 8-11.5 cm. long, 40-50 mm. wide, thin chartaceous, obliquely elliptic, the apex acuminate, the base cuneate and decurrent, the margin subentire, above remotely

brown pilose but on the midrib closely so, below pale greenish and softly pilosulous but densely so on the midrib and secondaries; secondary veins 7-9 on a side, ascending, arcuate, inarched interconnecting; *cymes* axillary 3-5-flowered, densely appressed brown pilosulous; peduncles 15-20 mm. long; pedicels 3-7 mm. long; bracts 7-8 mm. long, foliaceous, lanceolate, densely brown appressed pilosulous; buds campanulate, the calyx lobes ascending; *calyx* in anthesis when boiled 18 mm. long (16 mm. long when dried), narrowly campanulate, angled upwards by salient ridges running to the sinuses, with ascending lobes, green, firm chartaceous, without densely appressed brown pilosulous, within glabrous, parted $\frac{3}{4}$ way to base; calyx tube 6 mm. long, cucullate widened below each sinus; upper lip 2-lobed, lobes 11.5 mm. long, 6 mm. wide, united for 3 mm., very obliquely lance-ovate; lower lobes two, 11.5 mm. long, 7 mm. wide, obliquely lance-ovate, acute; *corolla* white, 23 mm. long when boiled (19 mm. when dried), densely brown pilose without; the tube 17 mm. long, cylindric, 4 mm. in diameter, just below the middle deflexed at 20° to the axis of the lower tube, within glabrous; limb 2-lipped, 5-lobed, the lobes densely brown pilose without, but within capitate glandular puberulous from the middle to the throat; upper lip of two upper lobes 4 mm. long, 3 mm. wide, broadly elliptic; lower lip 3-lobed; lateral lobes 5 mm. long, 7 mm. wide, rhombic-suborbicular; lower lobe 5 mm. long, 4.5 mm. wide, broadly oval; two lower stamens perfect, with the filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 2 mm. long, subulate, spirally upcurved, the two perfect anthers 2.5 mm. long, 2.1 mm. wide, obliquely ovate, the connective 1 mm. wide, ovate, dark; lateral staminodia adnate to the corolla tube to within 6 mm. of the throat, the free portion 0.5 mm. long, subulate, the antheroid tip minute, subulate, translucent; *style* 2.5 mm. long, glabrous; stigmas 2 mm. long, ovate, united $\frac{1}{2}$ way up proximal side; *ovary* 6 mm. long, lance-ovoid, glabrous, the base surrounded by a cupulate disk 0.9 mm. high; fruit unknown.

Distribution: Known only from the type locality in the Koolau Range, leeward side, at Manoa-Pauoa, in the Ohia Zone.

Holotype: Tantalus, open rain forest, O. Degener 7,688 (NY).

Discussion: *C. subintegra* is a member of the section *Schizocalyces*. Its closest relative is *C. intrapilosa* with which it is well contrasted in the key.

The specific epithet is coined from the Latin *sub*, somewhat; *integer*, entire, in reference to the nearly entire blades.

65. *Cyrtandra tristis* Hillebrand in C. B. Clarke, in De Candolle, Monogr. Phanerog. 5 (1): 227, 1883. (Figs. 93, 94, 192.)

C. kalichii Wawra var. *tristis* (Hillebrand) Rock, Am. Jour. Bot. 6: 64-65, 1919.

Description of All Specimens Examined: Shrub, 2 m. tall; old stems to 3 cm. diameter; branches 6-10 mm. in diameter, greenish, fleshy, long persistent pilose; leaf scars 3-9 mm. high, depressed low shield-shaped, pale, corky, connected by a broad band 1-2 mm. wide and hence annular; bundle scars 7; leafy branchlets as much as 6-9 mm. in diameter, quadrangular, densely brown pilose; internodes 5-40 mm., averaging 15 mm. long; young shoots densely brownish pilose; *leaves* opposite, divergent, not crowded, borne at the 4-5 upper nodes, those of a pair unequal, one being $\frac{1}{2}$ to $\frac{1}{3}$ larger; petioles variable, winged to the base or as much as 4 cm. long, thick and fleshy, as much as 13 mm. in diameter, brownish pilosulous, base broadly perfoliate, connate around the node, forming a raised flange 2-7 mm. wide spreading laterally or on the larger fleshier shoots white and revolute as much as 4 mm.; *blades* 8-45 cm. long, 8-18 cm. wide, chartaceous, broadly oval or oval, apex acute, base cuneate or commonly decurrent winged and on large fleshy specimens even to the base, above green and

rather stiffly papillose hirsute, below whitish green and pilosulous, more densely so on the principal veins, the margins doubly serrate, the secondary veins 5-8 on a side ascending, nearly straight, then just before the margin arcuate, the tips inarched and interconnecting and salient in the teeth; *cymes* axillary, hirsutulous, 8-11-flowered; peduncles 6-10 mm. long; pedicels 4-12 mm. long; peduncular bracts 5-10 mm. long, linear-lanceolate, foliaceous, caducous; buds obliquely lanceoloid, the calyx lobes ap-

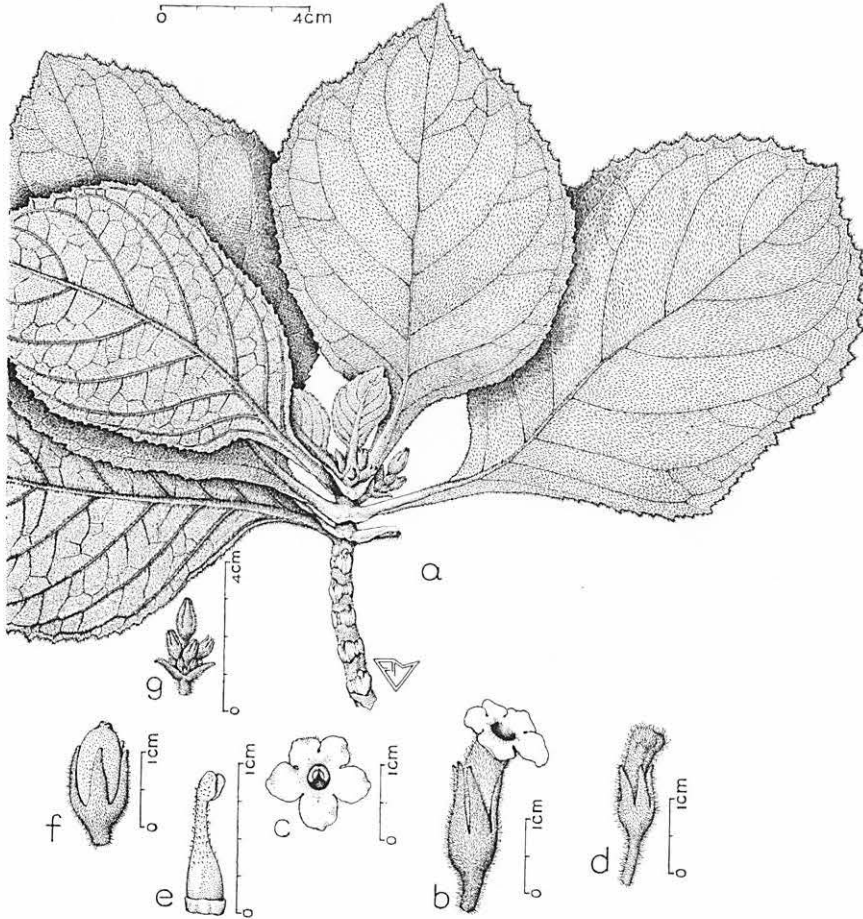


FIGURE 93.—*Cyrtandra tristis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$; g, young buds, $\times \frac{1}{2}$. Waiomao Stream, Palolo, St. John 24,782.

pressed ascending; *calyx* in anthesis when fresh green, 10-16 mm. long (when dried 10-16 mm. long), hirsutulous, the tube 2-3 mm. long, narrow funnellform, within glabrous; the limb 8-13 mm. long, 5-lobed, perceptibly 2-lipped, upper lip 3-lobed, the lobes ascending, cleft down 5 mm. between the lobes, the lobes 2.5 mm. wide, narrowly linear-lanceolate or narrowly obtuseform, within puberulous towards the tip, glabrous at base; lower lip with 2 lobes, cleft down 6 mm. between the lobes, the lobes 2.5 mm. wide; *corolla* when fresh 18 mm. long (when dried 13-20 mm.) the tube 15 mm. long,

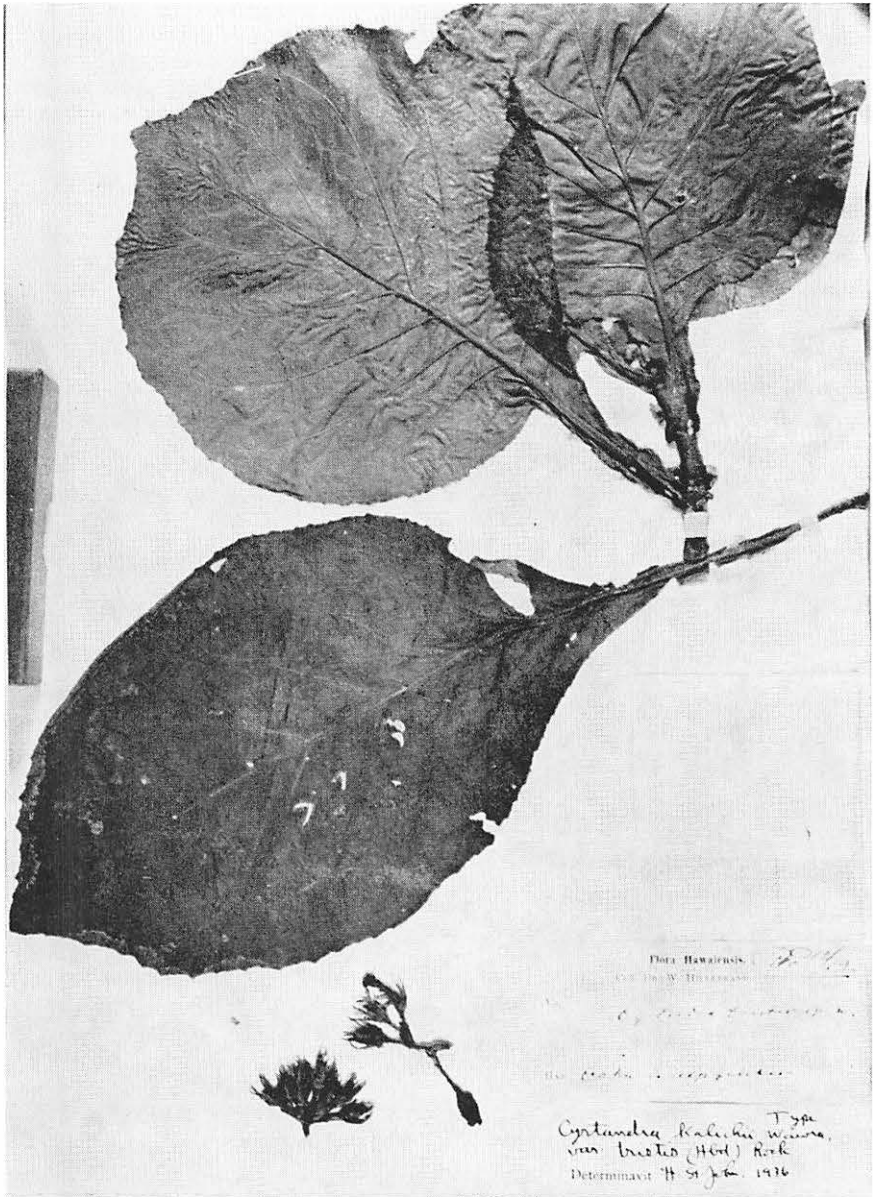


FIGURE 94.—*Cyrtandra tristis*, holotype (Kew). Oahu, Hillebrand.

cylindric, 3 mm. in diameter at base, 4 mm. at the middle, 4.5 mm. at the throat, gently decurved at $\frac{1}{3}$ way from the base at 20° from the axis of the lower tube, without densely glandular pilose, within glabrous; limb 2-lipped, 5-lobed, the lobes glabrous within except for several capitate glandular hairs of a puberulous type just at the throat; upper lobes 2, spreading at 50° from the axis of the throat, 1.8 mm. long, 4.5 mm. wide, transversely oval, overlapping at base, without hirsutulous except for the slice covered in imbrication in the bud; lower lip 3-lobed; lateral lobes 4 mm. long, 4.5 mm. wide, depressed oblique suborbicular, hirsutulous without; lower lobe 5 mm. long, 4.5 mm. wide, suborbicular, the middle basal portion hirsutulous; two lower stamens fertile, with filaments adnate to the corolla tube to within 5.5 mm. of the throat, the free portion 2 mm. long, spirally upcurved, subulate; the 2 perfect anthers 2.3 mm. long obliquely oblong-ovate; connective 2 mm. long, obliquely ovate; staminodia adnate to the corolla tube to within 8 mm. of the throat, the free portion 0.2 mm. long, subulate; style 3 mm. long, capitate glandular puberulent; 2 stigmatic lobes 2.5 mm. long oval, puberulous on the back, connate $\frac{1}{4}$ way up proximal side; ovary 5 mm. long, capitate glandular puberulous at the apex and toward the base similarly but more shortly so, or hirsutulous on the upper quarter and glabrous below, the base surrounded by a cupulate disk 1.2 mm. high; nearly mature berry white, when fresh 11-14 mm. long, 5-6.5 mm. in diameter, ellipsoid with a distinct apiculate beak, the surface finely puberulous, enclosed by and only slightly exceeding the calyx; seeds 0.29-0.35 mm. long, 0.13-0.19 mm. in diameter, chestnut brown, ellipsoid, obtuse, the surface with raised, nearly square, tetragonal cellular reticulations $\frac{1}{10}$ to $\frac{1}{12}$ as long as the seed.

Distribution: Moist gulches in deep mountain valleys 1,000 to 1,700 ft. alt. in the Ohia Zone, on the leeward side of the Koolau Range from Kipapa Gulch to Wailupe.

Holotype: "Ins. Sandwich; in vallibus arctis (Hillebrand, in hh. Kew, Berol.)." Isotype at Kew examined and photographed. It is an ample specimen with stem, three large leaves, and detached inflorescences. On the label the data were given as "Oahu, in deep gulches."

Specimens Examined: Koolau Range.

Leeward Side: Kipapa Gulch, 2nd N. branch, Waipio, 1,000 ft. elev., Feb. 16, 1930, *Hosaka 154*; ditto, 1,700 ft. elev., Nov. 13, 1932, *Hosaka 846*; ditto, N. ridge, moist stream bed, 1,200 ft. el., July 10, 1932, *Hosaka 647*; ditto, S. ridge, 1,700 ft. elev., near stream bed, Sept. 18, 1932, *Hosaka 702A*; ditto, N. Fork, dark ravine, 1,200 ft. el., Nov. 13, 1932, *Storey 210*; ditto, small densely shaded, humid ravine leading into the main stream, 1,500 ft. elev., Feb. 11, 1935, *Storey 259*; Kalauao Trail, densely wooded humid gully below the trail, 1,600 ft. elev., April 30, 1933, *Storey 242*; Moanalua Valley, up right hand side to a fall, Dec. 8, 1909, *Forbes 1,413.O*; Kalihi Valley, ridge W. of, Oct. 3, 1908, *Forbes*; Pauoa-Nuuanu trail, March 14, 1920, *Garber 328*; Manoa Valley, Aug. 27, 1922, *Skottsberg 356* (BISH, S); Olympus trail, Sept. 1917, *Rock 5,755*; Palolo Valley, right hand side to the falls and up lateral ravine, Oct. 22, 1914, *Forbes 1,960.O* and *1,965.O*; ditto, Right fork, Aug. 1, 1920, *Garber 511*; ditto, Feb. 9, 1918, *Rock 13,081* (BISH, GH); ditto, Waiomao Stream, 1,200 ft. alt., wet *Metrosideros* forest near stream, Feb. 12, 1952, *St. John 24,782*; Wailupe Valley, dense woods along stream approaching the range summit, 1,500 ft. elev., June 25, 1933, *Storey 245*.

Oahu: 1908, *Forbes*; in deep gulches, *Hillebrand* (GH) in part; *W. Hillebrand* (GH).

Discussion: *C. tristis* Hillebrand in C. B. Clarke is a member of the section *Schizocalyces*. It is apparent that Hillebrand at first considered it a new species and sent a named specimen of it to Clarke at Kew who, agreeing that it was distinct, published it, crediting it to Hillebrand. Clarke's monograph was published in 1883, but it was never seen by the aged and ailing Hillebrand who was traveling for his health in Europe and the Atlantic Islands, and died in 1886. He had his *Flora of the Hawaiian Islands* partly in press at the time, and his son arranged for its continuation and publication in 1888. In this *Flora*, Hillebrand accepted *C. kalichii* Wawra (as *Kalihii*) and mentioned in its synonymy, *C. tristis* Hillebrand in herb., thus retracting his earlier proposed species. Rock (1919: 64-65) studied both species and listed and discussed their differences in petioles, corolla, calyx lobes, and leaf blades, then decided that *tristis* was best maintained as a variety of *C. kalichii*. To these differences we have added those of shape and size of calyx lobes, and of the corolla, and have decided that *C. tristis* should be maintained as a species. The character which was emphasized was the petiole: naked in *C. kalichii*, broadly decurrent winged to the base in *C. tristis*. This character is conspicuous and an easy key character, but a careful study of the herbarium specimens, or better, a study in the field, quickly reveals that in *C. tristis* this character is variable. It is well shown on large leaves of strong shoots, less so on weaker ones and small leaves may completely lack the decurrent wings. It seems that this conspicuous but variable character may have influenced Rock in his decision to class *C. tristis* as a variety of *C. kalichii* Wawra. Rock published his combination as a trinomial, *C. kalichii tristis*, but in the discussion refers to it "as a variety of *C. kalichii*." Hence his name was a legitimately published varietal name.

In the original description there was the statement "bacca . . . glabra," or berry glabrous. Since this was at variance with our present observations, a request was sent to Kew that the type, Oahu in deep gulches, W. Hillebrand, be re-examined. This was kindly done and notes on it and camera lucida drawings were made by Dr. R. Melville and communicated by Sir Edward Salisbury. The lanceoloid berry is glabrous and warty on the lower three-quarters, but on the upper quarter is hirsutulous with "a few shaggy hairs, similar to those on the calyx and corolla." Consequently Clarke's statement that the berry was glabrous needs correcting. The only complete flower with corolla has six calyx lobes, thus being freakish.

The ranges of the two species partially overlap, but *C. kalichii* occurs on the windward as well as the leeward side of the Koolau Range and extends almost to its northern tip.

This is one of the species with broad, perfoliate petiole bases and the consequent annular leaf scars. On large, strong shoots this leafy collar at the node

is very striking, being white, fleshy, as much as 7 mm. in width on each side and the margins of it revolute as much as 4 mm.

The specific name chosen was the Latin adjective, *tristis*, sad; the cause of or evidence of the grief being unknown to the present writer.

66. *Cyrtandra Wilderi* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 88, 1950. (Figs. 95-97, 195.)

C. Lessoniana Gaudichaud var. β Hillebrand, Fl. Hawaiian Is., 331, 1888.

C. Lessoniana Gaudichaud var. *stenoloba* Skottsberg, Göteborg Bot. Trädgård, Med. 10 : 173, 1936.

Description of All Specimens Examined: Shrub 0.2-3 m. tall; branches brown, later gray, at first pilose, then glabrate, as much as 7 mm. in diameter, fleshy, on drying shrinking to form longitudinal ridges and furrows; leaf scars 2-4 mm. high, obcordate-shield-shaped, pale corky; bundle scars 5; young shoots olive brown hairy; leafy branchlets as much as 5 mm. in diameter, quadrangular, densely appressed ferruginous pilose; internodes 8-40 mm., averaging 15 mm. long; *leaves* opposite or rarely subopposite, borne at the 4-11 upper nodes, those of a pair distinctly unequal, one being about $\frac{1}{2}$ larger; petioles 8-44 mm. long, appressed ferruginous pilose; *blades* 3-14.4 cm. long, 10-55 mm. wide, coriaceous, oval to elliptic, acute, the base short decurrent, above dark olive green, impressed rugose, sparsely brown hirsute, below pale green, velvety with dense brown pilosity, the margins subentire or minutely flattened serrulate, the secondary veins 8-11 on a side, ascending arcuate, excurrent in the teeth; *cymes* 1-flowered (rarely 3-flowered), densely appressed ferruginous pilose; peduncles 6-20 mm. long; pedicels 7-26 mm. long; bracts 3-5 mm. long lanceolate, foliaceous; buds campanulate, the calyx lobes erect; *calyx* in anthesis 10-15 mm. long when fresh (when dried 9-12 mm.), green but densely ferruginous appressed pilose, the tube 1-2 mm. long, cupulate; the limb campanulate, almost equally 5-lobed, but barely perceptibly 2-lipped; upper lip of 3 lobes 12-13 mm. long, 4.5 mm. wide, ascending, lanceolate, thick, fleshy, appressed ferruginous pilose without, within glandular atomiferous; the lower lip of 2 similar lobes 13-14 mm. long, 5.5 mm. broad; *corolla* 23-25 mm. long, when fresh, white, straight; the tube 18 mm. long, 2-3 mm. in diameter, at the throat 2 mm. in diameter, without densely shaggy white villous within glabrous; limb 2-lipped; lobes all villous without, glabrous within and reflexed at about 70°; upper lip 2-lobed, the lobes 3-3.5 mm. long, 5-5.5 mm. wide, depressed broad cordate; lower lip 3-lobed; lateral lobes 4.5-5 mm. long, 6-7 mm. wide, low rhombic-cordate; lower lip 3.5 mm. long, 7 mm. wide, depressed cordate, all the lobes strongly auriculate and much overlapping; two lower stamens perfect, the filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 2 mm. long, straight, thick ligulate, with a shoulderlike expansion above the juncture; the 2 perfect anthers 3.2 mm. long, connate at tip, asymmetric oval, the connective ovate; the staminodia adnate to the tube to within 11 mm. of the throat, the free portion 0.5 mm. long, subulate; *style* 1 mm. long, glabrous; stigmatic lobes 2, sessile, 2-3 mm. long, broadly ovate, opposite, equally cleft on both sides; *ovary* 6-8 mm. long, lanceoloid, glabrous, tip tapering; *berry* 20 mm. long, 8 mm. in diameter, white, lance ellipsoid, ending in a stout beak 1.5 mm. long; seeds 0.45-0.64 mm. long, 0.22-0.29 mm. in diameter, spindle-shaped to ellipsoid, symmetric, or asymmetric, honey-colored, the ends brown, the body covered with raised heavy, cellular, oblong reticulations $\frac{1}{6}$ to $\frac{1}{2}$ as long as the seed.

Distribution: Waianae Mts., on the windward slope or slightly over the leeward edge but still in the upper, wet, Ohia Zone, from 3,000 to 4,025 ft. alt., from Mt. Kaala and southeastward on Puu Kalena.

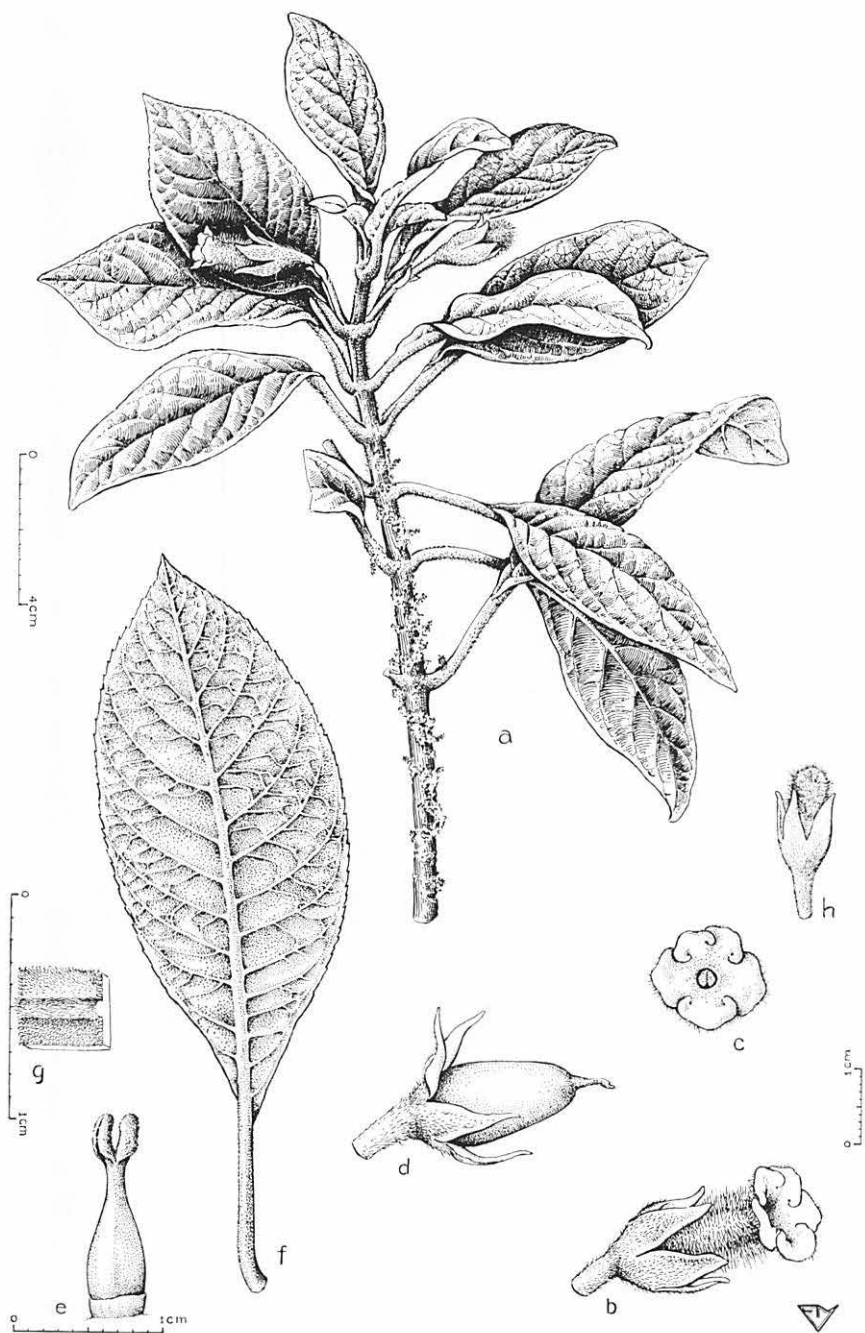


FIGURE 95.—*Cyrtandra Wilderi*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, fruit, $\times 1$; e, pistil, $\times 2$; f, leaf, $\times \frac{1}{2}$; g, lower leaf surface, $\times 3$; h, bud, $\times 1$. Makaha, Mt. Kaala, St. John 22,275, holotype (Bishop Mus.).

Holotype: Waianae Mts., Mt. Kaala, Makaha, 4,000 ft. alt., in elfin forest, Nov. 17, 1946, *H. St. John* 22,275 (BISHOP MUS.).

Specimens Examined: Waianae Mts.

Windward Side: Kaala (or Puu Kaala or Mt. Kaala), wet forest near top, Feb. 11, 1928, *Bergman*; ditto, upper slopes along Schofield trail, el. 900-1,200 m., April 3-4, 1931, *Christophersen, Wilder & Hume* 1,689; ditto, top, 1,696; ditto, wet forest, top, el. 1,200 m., May 10, 15, 1931, 1,768; ditto, top, wet forest, 1,200 m. alt., 1,793; ditto, east slope, forest near summit, May 1, 1938, *Degener, Salu cop & Arlantino* 12,177 (NY); ditto, southeast slope, wet forest, Dec. 19, 1937, *Degener, Salu cop & Arlantino* 11,572; ditto, summit plateau, north edge at top of cliff, 1,230 m. alt., wet marshy forest, *Fosberg* 12,622; ditto, west side, Waianaueka, 1,200 m. alt., muddy ground along trail in wet forest, March 27, 1937, *Fosberg* 13,675 (BISH, US); ditto, 2,000-4,000 ft., July 9, 1916, *Hitchcock* 13,990 (US); ditto, in woods, 3,000 ft. elev., Feb. 2, 1930, *Hosaka* 127; Kaala Mts., *Mann & Brigham* 617 (BISH, CU, GH); ditto, swampy woods on summit, 4,000 ft. alt., Nov. 5, 1933, *St. John* 13,388; ditto, mossy elfin forest on summit, 4,025 ft. alt., Jan. 12, 1941, 20,131; ditto, Waianaueka, steep moist wooded slope below spring 3,400 ft. alt., Jan. 12, 1941, 20,132; ditto, in elfin forest, gentle slope just below crest, 3,700 ft. alt., April 18, 1948, 23,367; ditto, woods near summit, 3,500-4,000 ft. alt., Nov. 30, 1930, *Storey* 130; ditto, woods along trail from 3,000-4,000 ft., Jan. 10, 1932, 152a; ditto, along trail in humid woods at 3,700 ft. elev., Jan. 10, 1932, 152; ditto, swampy woods at 3,800 ft. elev., Jan. 10, 1932, *Yamaguchi* 1,171 (*Storey* 151); Puu Kalena, Waianaueka, 3,500 ft. alt., moist *Metrosideros* woods, near summit, Feb. 16, 1947, *St. John* 22,570; Waianae Mts., *Hillebrand* (lectotype of *C. Lessoniana* var. *stenoloba* Skottsbl., B, BM).

Leeward Side: Makaha Valley, Kaala Range, Feb. 12-19, 1909, *Forbes*.

Discussion: *C. Wilderi* is a member of the section *Schizocalyces*. Its closest relative is *C. hirsutula* St. John & Storey which also grows on Mt. Kaala and can be singled out by its blades 9-16 mm. wide, narrowly oblanceolate, above glabrous, below sparsely hirsutulous on the intervals and veins; bracts glabrous above; and the calyx moderately hirsutulous. On the other hand, *C. Wilderi* has the blades 10-55 mm. wide, above sparsely brown hirsute, below velvety with dense brown pilosity; bracts pilose; and the calyx densely ferruginous appressed pilose.

C. Wilderi is common on the summit of Mt. Kaala, the highest peak of the island of Oahu, and it was collected there as early as 1864 or 1865 by Mann and Brigham. Mann included it in his enumeration (1867:190) listing it as *C. Lessoniana* Gaud. Rock concurred and so listed (1919:49) the *Mann and Brigham* collection, but had no more recent ones. The two species have a general similarity, but *C. Lessoniana* is easily distinguished by its white calyx

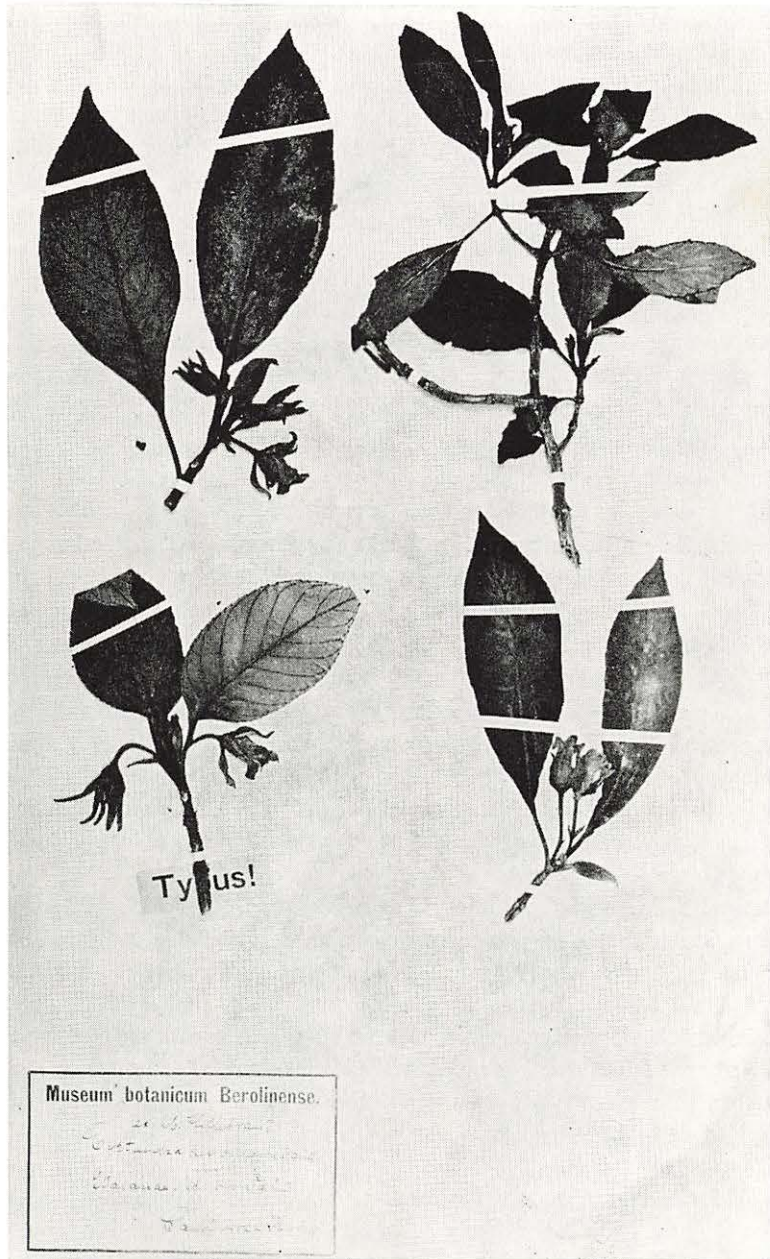


FIGURE 96.—*Cyrtandra Lessoniana* var. β , lectotype of *C. Lessoniana* Gaudichaud var. *stenoloba* Skottsberg. Waianae Mts., Hillebrand (Berlin); now classified as *C. Wilderi*.

with the broader, lance-ovate lobes laterally revolute and there are differences in leaves, corollas, styles, etc. There is no question about the distinctness of the Mt. Kaala plant.

The new name *C. Lessoniana* Gaud. var. *stenoloba* was published in 1936 by Skottsberg. He merely supplied a varietal name for the unnamed var. β of

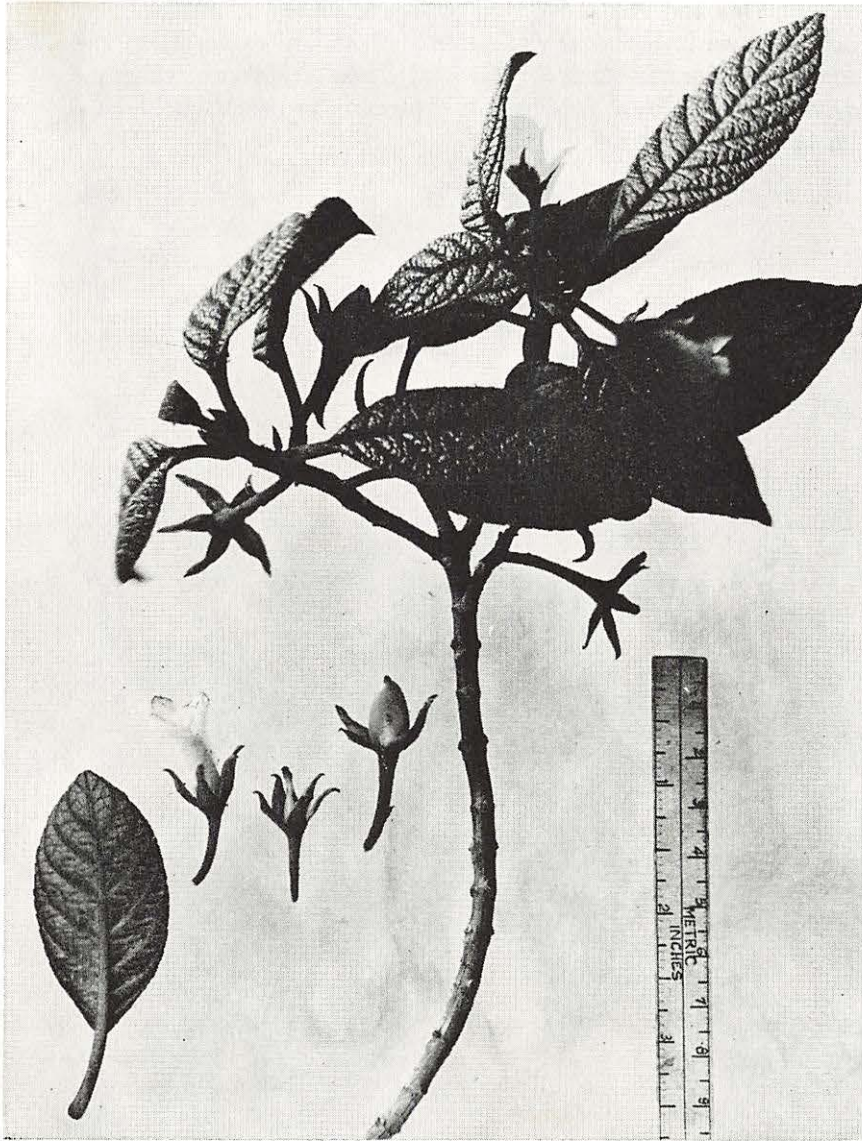


FIGURE 97.—*Cyrtandra Wilderi*, Mt. Kaala, Storey 236.

Hillebrand. Since Skottsberg did not supply a Latin diagnosis for his newly named variety, we chose to rename it in the specific category.

The specific name is given in honor of Gerrit Parmile Wilder (1863-1935), lover of plants whether wild or cultivated, who, when 68 years of age, still had the energy and enthusiasm to back-pack food and camp outfit to the top of Mt. Kaala, and spend a week on that cold, rainy, summit and with young Christophersen and Hume make an ecological survey of the flat summit. He is better known in botanical circles for his botanical explorations and publications on the flora of islands of Rarotonga, and of Makatea. Having enjoyed a warm friendship with Wilder, it is a pleasure to name this Oahu endemic in his honor.

4. Section *Crotonocalyces*

67. *Cyrtandra cordifolia* Gaudichaud, Voy. Uranie, Bot. 446-447, 1826 [= 1829]; Atlas pl. 56, 1826-1830.

Joint Description: Shrub; young shoots villous or pilose; *leaves* opposite; petioles 5-19.5 cm. long villous or pilose; *blades* 10-24 cm. long, 7-22 cm. wide chartaceous, orbicular to oval, symmetric or asymmetric, the base cordate or subcordate, the apex acute or subacuminate, the margin dentate or doubly so or subentire, above villous or pilose, below villous or pilosulous; *cymes* axillary 3-7-flowered; buds cupulate; *calyx* in anthesis 9-16 mm. long foliaceous, cup-shaped outside villous or pilose; inside villous or puberulous, equally 5-lobed $\frac{1}{2}$ way to base, the lobes lanceolate to lance-ovate; calyx accrescent; *corolla* 17-22 mm. long, the tube 13-16 mm. long, villous; *style* 1 mm. long, villous; *ovary* linear-lanceoloid, villous or above middle pilose; *fruit* pubescent.

As here treated, *C. cordifolia* consists of the two varieties, var. *cordifolia* and var. *brevipilata*.

68. *Cyrtandra cordifolia* Gaudichaud var. *cordifolia* (Figs. 98, 99, 185).

C. cordifolia Gaudichaud, Voy. Uranie, Bot. 446-447 (1826) [= 1829],

Atlas pl. 56, 1826-30, not *C. cordifolia* de Vriese, Pl. Ind. Bat. Orient.

itin. Reinwardt. 16, 1856[-57] = *C. aurea* Jack (fide C. B. Clarke).

Native Name: *Hahala* (*Fafara* of Gaudichaud).

Description of All Specimens: Shrub, 1-7 m. tall, with a few assurgent, mostly basal branches, naked except for the terminal tuft of leaves, the branches stout, pale grayish brown, tardily glabrate, the leaf scars 6-8 mm. high, broad obcordate, pale, corky, raised; bundle scars 7; internodes 25-40 mm., usually about 30 mm. long; leafy branchlets 5-7 mm. in diameter, somewhat quadrangular, densely tawny villous; young shoots shaggy, tawny villous; *leaves* opposite, subequal, widespreading, in a few pairs; petioles 5-19.5 cm. long, densely shaggy, tawny villous; *blades* 10-24 cm. long, 7-22 cm. wide, chartaceous, orbicular to broadly oval, symmetric or asymmetric, often markedly so, especially at base, the base cordate, usually deeply so, the apex subacuminate, margin dentate or doubly so, the surface above bright green, remotely but softly and permanently tawny villous, below pale green and densely tawny villous, nerves shaggy villous; *cymes* from leaf axils, 3-7-flowered, subumbellate, densely shaggy, tawny villous throughout; peduncles 2.5-6.5 cm. long, pedicels 3-35 mm. long, divergent; bracts 10-42 mm. long, foliaceous, ovate, acute; buds cupulate, the calyx lobes erect; *calyx* in anthesis 9-16 mm. long, foliaceous, chartaceous, whitish or greenish, from broadly cup-shaped to saucer-shaped, densely shaggy, viscid villous inside and out, equally 5-lobed fully or nearly $\frac{1}{2}$ way to base, the lobes lanceolate to lance-ovate; calyx accrescent, in fruit 16-19 mm. long, reflexed; *corolla* 17-22 mm. long when fresh, white, the tube 13-16 mm. long, 3-7 mm. in diameter, subcylindric, slightly swollen below the throat,

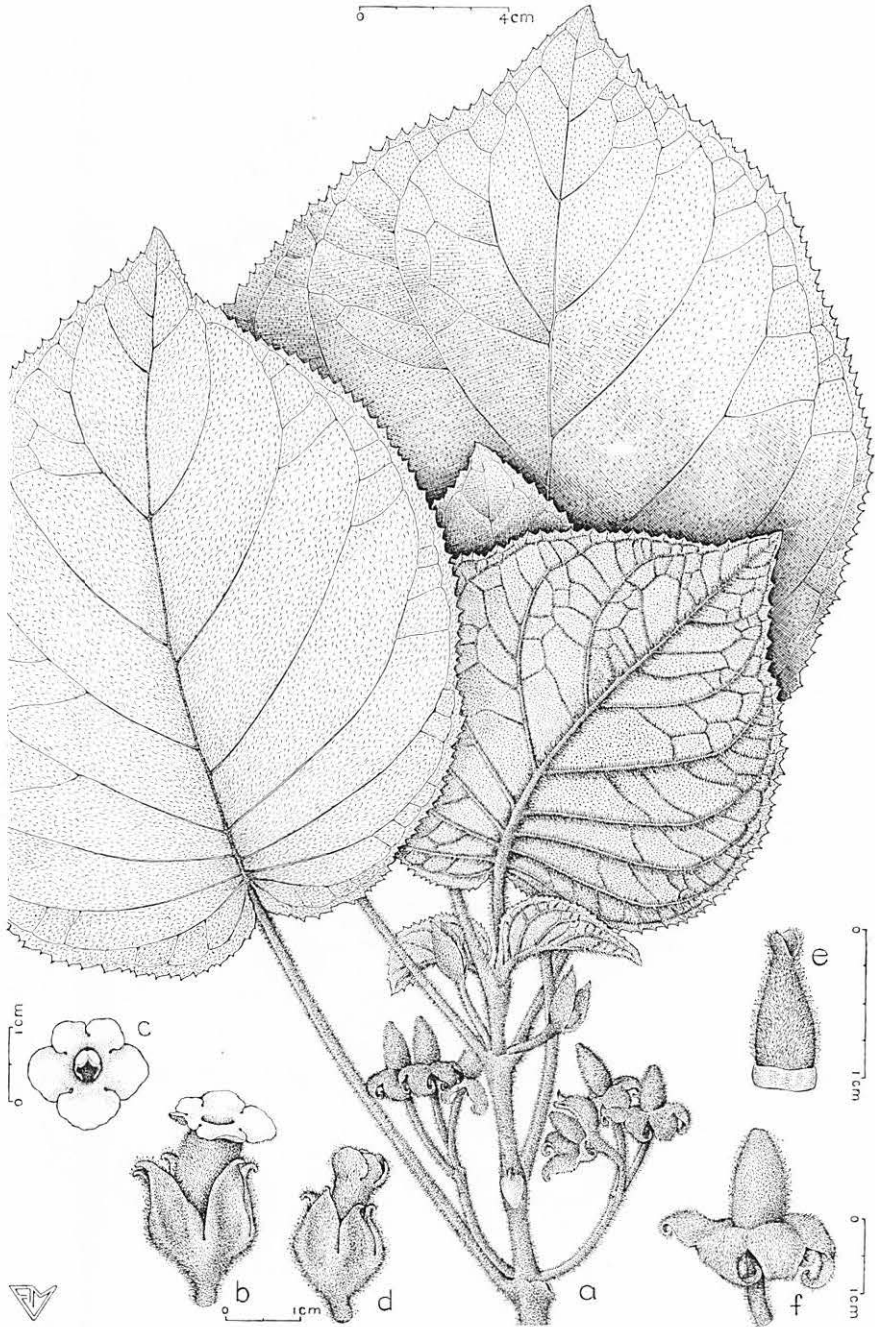


FIGURE 98.—*Cyrtandra cordifolia*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Poamoho Trail, St. John 17,657.

shaggy viscid villous outside except at base, the throat open, the lobes unequal, the two upper 4 mm. long, semiorbicular, the three lower 4-5 mm. long, semiorbicular, all spreading at about 90° or even reflexed to 130° from the axis of the throat, the outer side viscid villous, the inner side glabrous; filaments fused to corolla to within 4 mm. of the throat, the free portion 3 mm. long, thick, spiraled; anthers 3.3 mm. long, asymmetric, obliquely deltoid; *style* 1 mm. long, viscid villous; stigma 2-3 mm. long, villous on the back, the two lobes thick, plano-convex, connate on the proximal edge,

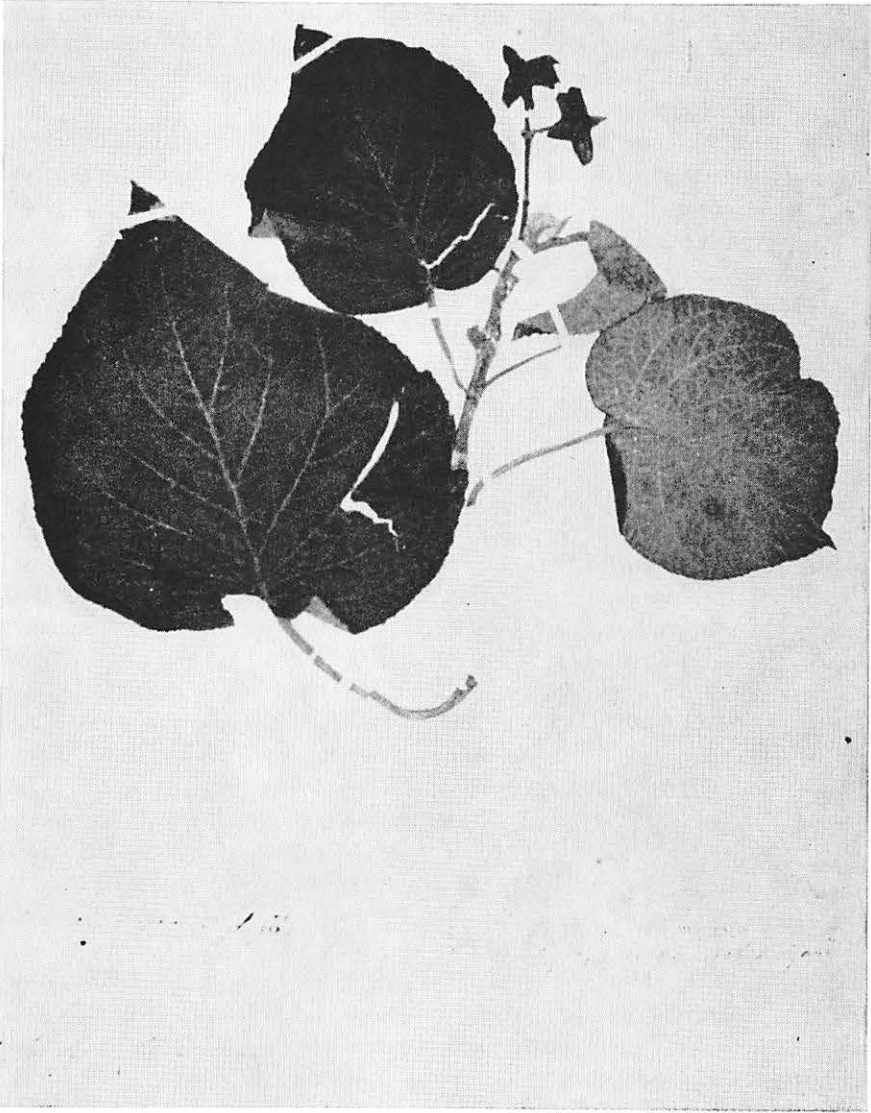


FIGURE 99.—*Cyrtandra cordifolia*, holotype (Paris). Insulis Sandwicensibus, C. Gaudichaud.

the united body obcordate; ovary linear-lanceoloid, densely spreading capitate glandular viscid villous, the base surrounded by a glabrous cupulate disk; berry 10-23 mm. long, 8-14 mm. in diameter, ovoid to lance-ovoid, white, densely spreading capitate glandular villous; seeds 0.36-0.51 mm. long, 0.18-0.25 mm. wide, ovoid to ellipsoid or lunate-ellipsoid, shining greenish stramineous but the prominent boss at either end chestnut brown, the body covered with raised oblong reticulations $\frac{1}{5}$ - $\frac{1}{4}$ as long as the seed, formed by the heavy lateral walls of integumentary cells with the outer wall shrunken or collapsed.

Distribution: Koolau Range, leeward side, in moist gulches, common from 1,000 to 1,500 feet altitude in the Koa Zone and the Ohia Zone, but occasional in gulches as low as 600 feet altitude; and at one locality on the windward or Kailua side of Puu Konahuanui.

Holotype: "In insulis Sandwicensibus (Alt. 100-300 hex.)." The holotypic specimen is labeled Uranie 1817-1820, îles Sandwich, C. Gaudichaud (P). Type examined.

Specimens Examined: Koolau Range.

Windward Side: Kailua, South Fork of Kahanaiki Stream, 800 ft. alt., open scrub, Aug. 2, 1955, Pearsall; ditto, fourth branch of South Fork, 875 ft. alt., in brush of staghorn, *Clermontia*, Dec. 4, 1955, Pearsall 20.

Leeward Side (observed by St. John at Pupukea, 1,500 ft. alt., in 1941); Puu Peahinaia, right of ridge to, brook bed, 1,600 ft. elev., Oct. 4, 1931, Hume 210; South Opauala Gulch, Paalaa, damp wooded ridge, 1,100-1,500 ft. alt., Nov. 9, 1930, Storey 7; Poamoho trail, wet forests, 1,900 ft. alt., Oct. 20, 1946, Larsen; ditto, Nov. 1935, Meebold 21,204 (M); ditto, Paalaa-Wahiawa ridge, moist woods, 1,700 ft. alt., Nov. 22, 1936, St. John 17,657; ditto, 1,900 ft. alt., Feb. 16, 1941, St. John 20,184; ditto, rocky damp gulch, 2,100 ft. alt., March 2, 1941, Wong; Marsh Trail, Paalaa, 1,200-1,400 ft. elev., Dec. 10, 1933, Krauss; along north border of Ewa Forest Reserve, forest, 400-550 m. elev., Feb. 20, 1931, Christophersen, Wilder and Hume 1,601; Koolau Mt., u. Wahiawa, Aug. 1908, without collector, no. 28; east range, Schofield Barracks, July 11, 1916, Hitchcock 14,037 (US); Kipapa Gulch, south ridge, Waipio, 1,200-1,400 ft. elev., May 15, 1932, Bryan Jr., Suehiro and Fukuda; ditto, bottom of deep gulch, 550 m. alt., Aug. 8, 1933, Fosberg 9,799; ditto, in woods, 1,000 ft. elev., Feb. 16, 1930, Hosaka 148; ditto, second North Fork, on wooded slope, 1,500 ft. elev., Nov. 12, 1932, Hosaka 849; ditto, along wooded stream bed, 1,700 ft. elev., Aug. 8, 1933, Hosaka 1,212; ditto, 425 m. elev., Feb. 15, 1931, Hume 96; ditto, 1,400 ft. alt., Oct. 29, 1929, St. John 9,967; ditto, east of Puu Kamana, moist gulch, 1,500 ft. alt., May 15, 1932, St. John 11,647; ditto, North Fork, along stream, 1,100-1,500 ft. elev., Nov. 13, 1932, Storey 212; ditto, North Fork, along stream in woods, 1,500 ft. alt., Nov. 13, 1932, Storey 220a; ditto, North Fork, along stream banks, 1,500 ft. alt., Feb. 10, 1935, Storey 261; Waimano trail, Waimano, opening in woods, 1,400 ft. alt., March 23, 1941, St. John 20,216; Kalauao-Waimalu Ridge, 1,700 ft. alt., Mar. 29, 1933, St. John 13,023; North Halawa-South Halawa Ridge, open forest

in Koa Zone, 1,100 ft. alt., Dec. 12, 1943, *St. John* 20,379; Moanalua Valley, March 9, 1909, *Forbes* 1,189; Moanalua Valley, E. ridge, $\frac{2}{3}$ way up, moist shaded gulch, 1,200 ft. alt., *St. John* 20,288; upper Moanalua Valley, Sept. 1924, *Topping* 2,883 (BISH, UC); Kalihi-Moanalua, Kahauiki Gulch, wet forest, 600 ft. elev., Dec. 25, 1933, *Yoshioka*; ridge west of Kalihi, Oct. 3, 1908, *Forbes*; Kapalama District, Keana Mano, damp woods, 400 ft. alt., Aug. 28, 1930, *Wilder* 458; Nuuanu pali, Oct. 1909, *Faurie* 602 (BISH, BM); Pauoa-Nuuanu trail, July 11, 1920, *Garber* 504; Konahuanui-Olympus ridge, higher gulches, March 17, 1919, *Forbes* 2,548.O; Pauoa Valley, Oct. 24, 1908, *Rock* 702; Tantalus, Dec. 2, 1906, *Swezey* 12,774; Tantalus Crater rim, wet woods, Feb. 7, 1928, *Degener* 7,578 (NY); ditto, July 26, 1931, *Degener & Park* 7,520 (NY); ditto, shaded wet slope, March 20, 1926, *Degener* 7,687 (NY); ditto, April 11, 1895, *Heller* 2,112 (GH, US); between Konahuanui and Pauoa Flats, April 18, 1926, *Degener* 7,684 (NY); Manoa Valley, east ridge, forest, March 29, 1936, *Degener, Takamoto, Tam & Martinez* 10,516 (NY); ditto, Dec. 1917, *Rock* 13,082; Palolo Valley, 1915, *Rock* 1,198 (GH); ditto, Waiomao Stream, 750 ft. alt., lower woods among ferns and *Aleurites*, May 17, 1942, *St. John* 20,298; ditto, Oct. 23, 1915, *Skottsberg* 892 (BISH, S); Waialae Nui Gulch, 900 ft. alt., April 11, 1943, *St. John* 20,332; Waialae Iki, Oct. 1908, *Forbes*; Wailupe, Right Fork, Jan. 12, 1920, *Garber & Forbes* 157; West Wailupe, moist shaded stream bank, 1,700 ft. alt., June 21, 1951, *Kondo*; ditto, moist woods near stream, 1,300 ft. alt., March 16, 1952, *St. John* 24,794.

Oahu (without further data): *Hillebrand*; *Mann & Brigham* 63 (BISH, BM, CU, GH); also 116 (CU); *Wilkes Expedition* (GH, US); Woahoo, maio 1825, *Macrae* (BM, G).

Sandwich Islands: Bonite, *Gaudichaud* (BM, GH); *W. Hillebrand* (BM, US); *J. Remy* 432 (L).

Discussion: *C. cordifolia* is a member of the section *Crotonocalyces*. Its large cordate leaves, shaggy pubescence, and saucer-shaped, shallowly lobed calyx which reflexes in fruit, make it one of the most distinct and easily recognized species in the genus.

The original description by Gaudichaud is only sixteen words in length, but is diagnostic, so that subsequent botanists have easily recognized the species. Gaudichaud's plate is large and beautiful, but not accurate. His artist showed the habit and structural details well, but left out the shaggy villosity that blankets the plant throughout. This inaccuracy was also noted by Asa Gray in 1862. The type specimen in Paris (see Fig. 99) is much more meager than the drawing, having only two fruits, two full-grown attached leaves, and one detached leaf, and it lacks flowers which were shown in the drawing. It is probable that several unmounted duplicates were available for drawing, then later sent out in exchange. There is no real difficulty here, for Gaudichaud's

brief description and inaccurate plate are certainly to be identified, as has been done by all subsequent botanists, with the large, villous, cordate-leaved species of Oahu. The only type locality was "insulis Sandwicensibus," but this species and the five others described by Gaudichaud are all native to Oahu, occurring in the mountains just behind Honolulu, where the vessel "Uranie" was anchored.

C. cordifolia is abundant in the Koolau Range, from Wailupe to Puu Peahinaia. On April 6, 1941 the writer observed the species along the Pupukea Trail at about 1,500 feet altitude. This locality, which extends the range to nearly the whole length of the Koolau Range, is shown on the distribution map, though not vouched for by a specimen.

There is a collection from the windward side of the Koolau Range, at Waihole ditch trail, June 1932, *Meebold*, in part. The specimen is a moldy, rather poor specimen, mixed with material of *C. Garnotiana*. The locality is of easy access and has been repeatedly visited by other collectors. Because of the mixture of the two species and because no other collector has obtained *C. cordifolia* from this windward area, this record is deemed dubious and in need of confirmation. There is a specimen labeled from Punaluu, collected Nov. 30, 1929, by *Nitta* (*Degener 7,568*), (NY). It has a good representative branch, but the pocket contains loose flowers and fruits and one glabrous fruit. This is certainly a mixture of material. Since there are no other records of this species from Punaluu, one of the best known areas of the mountains, this record by *Nitta* will be held in abeyance awaiting confirmation. The same applies to a similar collection from Punaluu by *Nitta* (*Degener 7,535*), (NY).

The specific name given by Gaudichaud was from the Latin, *cor*, *cordis*, the heart; *folium*, leaf, alluding to the heart-shaped leaves.

69. *Cyrtandra cordifolia* Gaudichaud var. *brevipilata* St. John var. nov. (Fig. 186).

A *C. cordifolia* var. *cordifolia* differt in novellis petiolis laminis calycibusque pilosis, marginibus laminarum subintegrissimis vel in termino venularum subapiculatis, ovariis infra mediam glabris.

Differing from *C. cordifolia* var. *cordifolia* by having the young shoots, petioles and blades, and calyx pilose instead of villous; the margins of the blades subentire or somewhat low apiculate at the vein ends instead of dentate or doubly dentate; and the ovary glandular pilose above the middle, glabrous towards the base, instead of wholly densely villous.

Holotypus: Koolau Range, Oahu, Waimano, 1944, *Clarence Y. C. Wong* (BISHOP MUS.). This is on the leeward side.

Discussion: Consideration was given to giving this plant specific status. Other possible characters were that the blades were 13-16 cm. long, 9.5-13 cm. wide, broad oblique ovate, the apex acute, the base only subcordate, very oblique, the upper surface sparsely pilose, the lower surface pilosulous with the veins pilose; and the calyx without pilose, but within pilose on the lobes and puberulous on the tube. The specimen, which is a single large branch, looks

different from var. *cordifolia*, but this apparent difference is in its lack of the abundant shaggy villosity and in its smaller, less symmetrical blades. The significant structures of inflorescence, calyx, and corolla are closely similar to those of var. *cordifolia*. It grows within the range of that variety. At least until it is known better in the field and more collections have been made, it seems best to classify this smaller leaved, less hairy plant as a variety of *C. cordifolia*.

The new varietal name is from the Latin, *brevis*, short; *pilus*, a hair; *ita*, an adjectival ending meaning, provided with; that is, provided with a shorter pubescence.

70. *Cyrtandra crassior* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 78-79, 1950. (Figs. 100, 195.)

Description of Holotype: Shrub, branches subterete, the bark nearly smooth, finally glabrate, pale brownish to straw-colored; leaf scars 3-5 mm. high, semiorbicular-shield-shaped, pale, corky, slightly raised, interconnected and annular; bundle scars 7; internodes 1-2 cm., averaging 12 mm. long; leafy branchlets slightly quadrangular, 2-3 mm. in diameter, densely and permanently brown, crinkled, spreading villous; young shoots covered with a dense, brownish villosity; *leaves* opposite, subequal, of several pairs, divergent; petioles 16-29 mm. long, densely and permanently brown, crinkled, spreading villous, their bases perfoliate, interconnected by a low, fleshy ridge; *blades* 5.5-9.5 cm. long, 3.3-6.5 cm. wide, thick chartaceous, oval, base rounded or short cuneate, the tip acute or abruptly so, the halves of the blade slightly asymmetric, plane, above distantly subappressed villous, below pale green, subappressed pilose, but the veins densely spreading villous, the margin unevenly and coarsely denticulate-serrate; *peduncles* from the leaf axils, 1-flowered, 9-11 mm. long; the inflorescence densely spreading, brownish villous throughout; pedicels 12-13 mm. long; bracts 9-10 mm. long, lanceolate, acute; *calyx* 11-13 mm. long, funnellform, obscured by the dense brown, spreading or subappressed villosity, slightly 2-lipped, lobed almost $\frac{3}{2}$ way to base, the tube 3-5 mm. long, the upper lip of 3 lobes, these 7 mm. long with the intervening sinus reaching to within 6 mm. of the base, the lobes ovate but abruptly narrowed to an acuminate, subulate tip; lower lip of 2 lobes, cleft to within 6 mm. of the base, the lobes 8 mm. long, lanceolate, acuminate; *corolla* (when boiled) 20 mm. long, white, the tube 17 mm. long, 6 mm. in diameter, straight, slightly broadened from base to throat, the exposed part densely villous, the hairs decreasing within the calyx towards the base, the throat 5.5 mm. wide, the tube glabrous within; corolla limb 2-lipped, the lobes spreading at about 50° from the axis of the throat; upper lip of two lobes, these 3 mm. long, 4 mm. wide, suborbicular, overlapping at base, glabrous within, densely white villous without; lower lip 3-lobed, the two lateral lobes 4 mm. long, 4.7 mm. wide, transversely rhomboid-oval; lower lobe 4.3 mm. long, 5.5 mm. wide, deltoid-suborbicular, obtuse; two lower stamens perfect, the filaments fused to the corolla tube to within 5 mm. of throat, the free portion 1.5 mm. long, spirally upcurved; the two perfect anthers 2.5 mm. long, obliquely oval, flattened, somewhat asymmetric, one cell the smaller; staminodia 0.3-0.5 mm. long, subulate; *style* 3 mm. long, villous; stigma with two flattened ovate-oval stigmatic lobes 1.3 mm. long, connate $\frac{3}{4}$ way up proximal side; *ovary* 6 mm. long, lanceoloid, densely villous; fruit unknown.

Distribution: Koolau Range, known only from the type from the windward side of the mountains at Punaluu.

Holotype: Oahu, Koolau [Range], Punaluu Mountains, Aug. 1908, *J. F. Rock 10* (BISHOP MUS.).

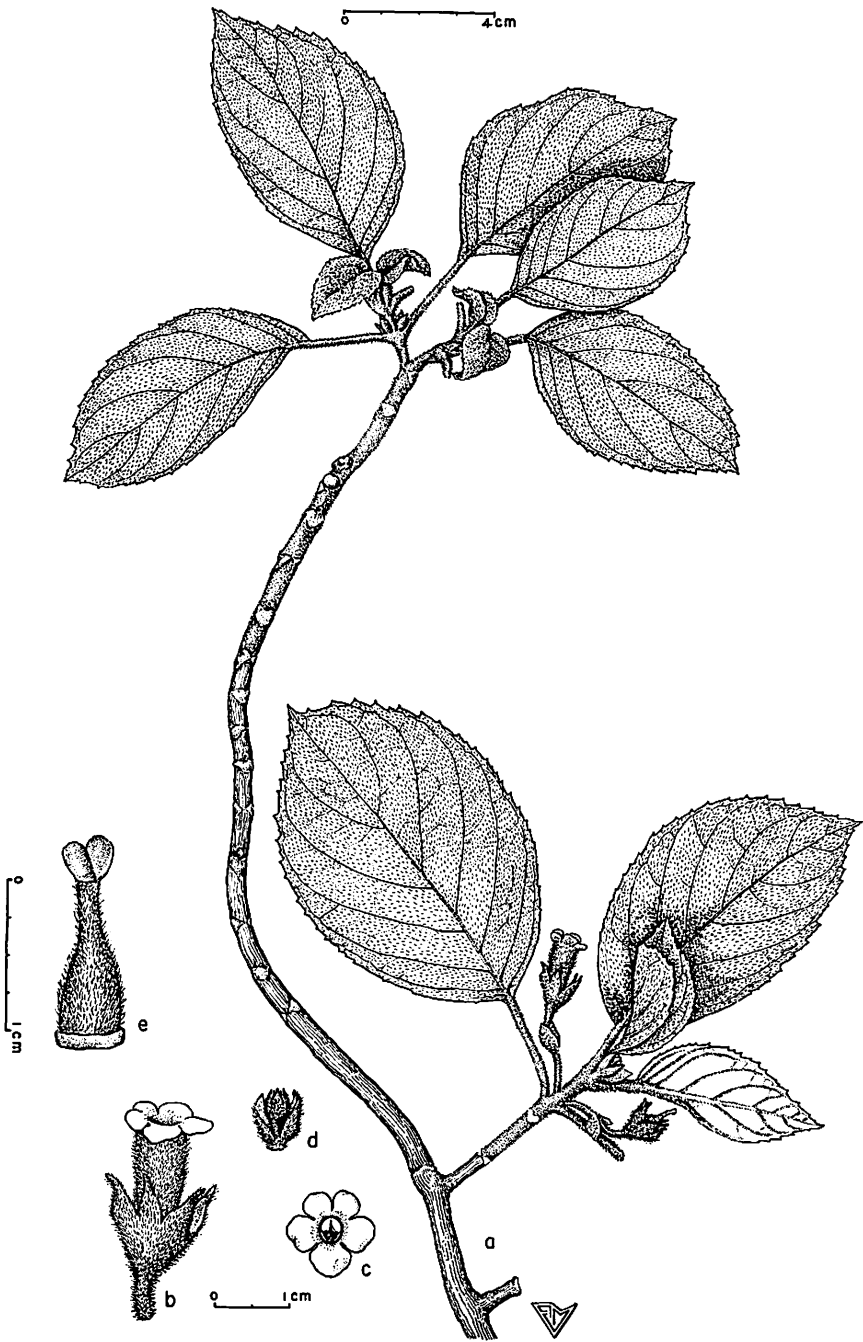


FIGURE 100.—*Cyrtandra crassior*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Punaluu Mts., Rock 10, holotype (Bishop Mus.).

Discussion: *C. crassior* is a member of the section *Crotonocalyces*. It seems to be most closely related to *C. Mannii* St. John & Storey which occurs on Mt. Kaala in the Waianae Mountains. The diagnostic differences between these two plants are stated in the key. This specimen, *Rock 10*, from Punaluu, was determined by Rock as *C. Pickeringii* var. *honolulensis*, which combination he later rejected and accepted it as *C. honolulensis* Wawra. Besides Wawra's holotype and an old collection by Hillebrand, this was the only other collection he cited as *C. honolulensis*. That species, from the mountains behind Honolulu, and now extinct, differs in numerous characters: in having the blades 7-15 cm. long, broadly oval to almost suborbicular; petioles 4-8 cm. long; plant with viscid villosity; cymes 3-flowered; and the calyx funnelform, lobed $\frac{1}{2}$ way to base, the lobes ovate, acute.

C. crassior resembles *C. opaepalae* St. John & Storey, but that species of the Koolau Range, which seems to be the closest relative, has the ovary and style glabrous; the peduncles 2-5-flowered; and the blades oval or elliptic, more abruptly tapered to the pointed ends. Also similar to *C. crassior* is *C. rivularis* St. John & Storey which differs in having the calyx pilose, cleft $\frac{1}{3}$ - $\frac{1}{2}$ way to the base into lance-deltoid lobes; the ovary and style glabrous; and the young shoots viscid pilose.

The data for the type specimen are not precise, lacking altitude, exact locality, habitat, and the day of the month. This number is one of a large set of collections made by Rock in Aug. 1908. He ascended the Castle Trail which crosses the north ridge of Punaluu, descends to the stream in Kaluanui, then mounts Hauula and Kaipapau to the summit of the Koolau Range. Prof. Rock camped by Kaluanui Stream at the pig hunter's camp for about a fortnight, and made extensive collections. They all bear similar data, and the locality Punaluu. There is little rain forest until one tops the divide and crosses from Punaluu into Kaluanui or one of the succeeding land divisions (or "ahupuaa"). It is not unlikely that the specimen was collected in another "ahupuaa" than Punaluu. The heads of their several deep valleys converge and cut the high ridges into an intricate mountain mass. Though often visited, only the region near the trail is well explored. Since Rock found the original specimen, no one has found it again.

The specific name is derived from the Latin *crassior*, thicker, given in allusion to the texture of the leaves.

71. *Cyrtandra ferruginosa* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 79, 1950. (Figs. 101, 187.)

Description of Holotype: Shrub 2 m. tall, erect unbranched; stem 1 cm. in diameter, more or less brown pilose; the leaf scars 8 mm. high, cordate-shield-shaped, pale, corky; bundle scars 7; internodes 4-7 cm., but usually about 5 cm. long; leafy branches subquadrangular, stout, densely soft brownish pilose; ascending shoot strong, with 8 or more pairs of well-spaced leaves; young shoots sericeous from the dense brownish ascending pilosity; leaves opposite, unequal, one of a pair $\frac{1}{2}$ smaller, at first ascend-

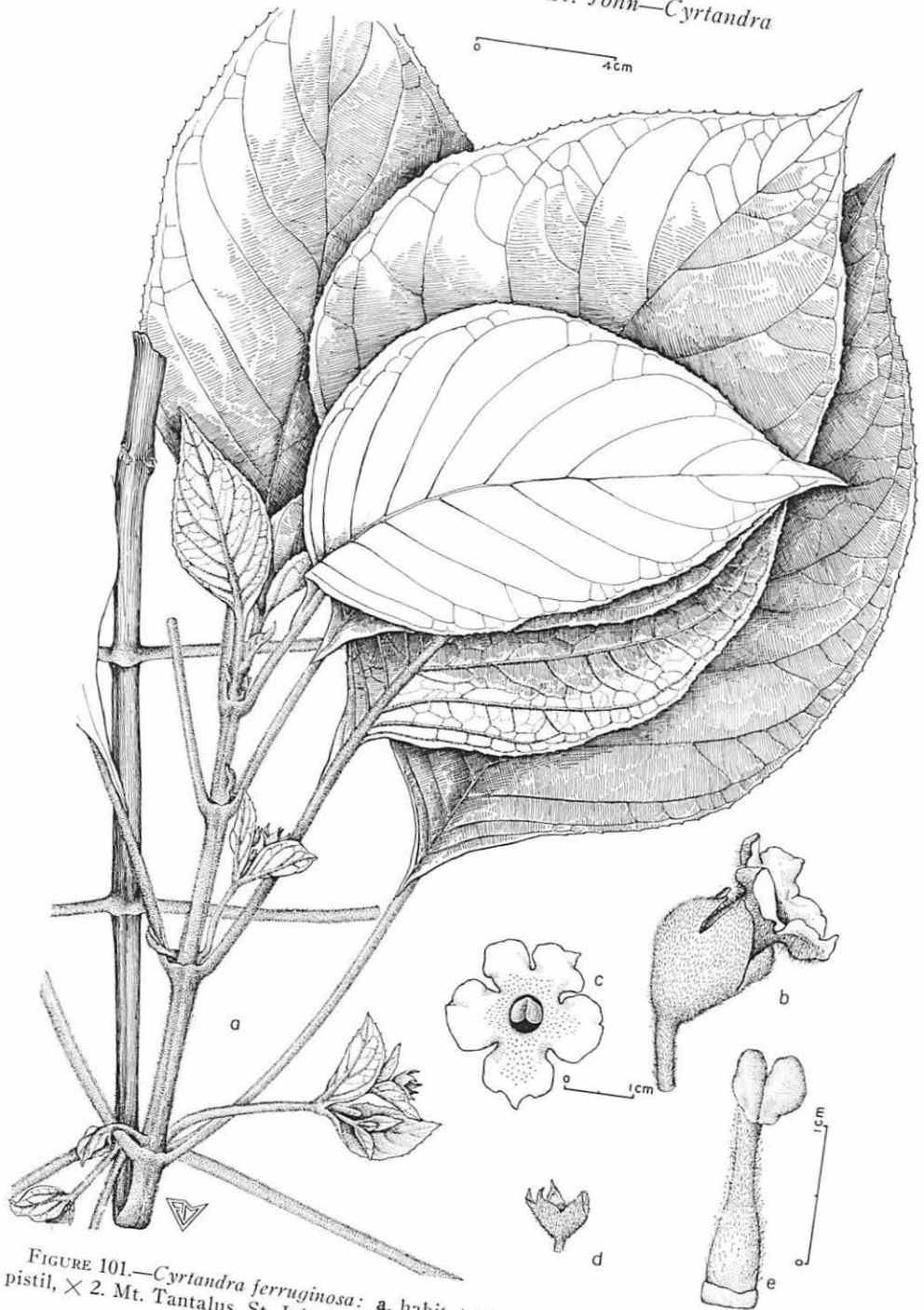


FIGURE 101.—*Cyrtandra ferruginosa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Mt. Tantalus, St. John 20,257, holotype (Bishop Mus.).

ing, later wide-spreading; petioles 4-10 cm. long, closely brownish ascending pilose; *blades* 15-25 cm. long, 9-14.5 cm. wide, oval, slightly asymmetric, the apex short acuminate, the base abruptly cuneate decurrent for 1-2.5 cm., texture chartaceous, above dark green, when young remotely white appressed pilosulous, below whitish and sparsely pilosulous, the principal veins spreading white pilose, the margin callous denticulate by the vein endings; principal lateral veins 8-9 on a side, alternate, ascending, the tips arcuate upcurved and joining; *cymes* from the leaf axils, 3-5-flowered, ascending soft pilosulous throughout; peduncles 25-50 mm. long, at first ascending, later diverging; pedicels in anthesis 8-10 mm. long; bracts 15-30 mm. long, broadly lanceolate or oblanceolate, green and foliaceous; bud broad funnellform, open; *calyx* 20 mm. long (but 13 mm. when dried), without ascending white pilose, within sparsely pilosulous, broadly funnellform but the tips of the lobes inflexed, lobed about $\frac{3}{5}$ way to the base; the tube 12-13 mm. long; upper lip of 3 lobes cleft $\frac{1}{2}$ way, the lobes ovate-deltoid, abruptly narrowed to the mucronate tip; lower lip of 2 lobes, cleft $\frac{3}{5}$ to $\frac{1}{2}$ way, the lobes 9-10 mm. long (7 mm. when dried), deltoid-ovate, abruptly short mucronate tipped; *corolla* 28-30 mm. long (18-22 mm. when dried), white, the tube 20-21 mm. long, 3 mm. in diameter at base, 8 mm. at the middle, 7 mm. at the apex, subcylindric, abruptly contracted at base, slightly so above the middle, sharply reflexed at 30° at the middle, the outside spreading white pilose except at the very base, the inside glandular puberulous in the throat, glabrous below; limb almost rotate, 2-lipped, 5-lobed; upper lip with 2 lobes 5-6 mm. long, 7-8 mm. wide, transversely oval, obtuse or subacute, minutely glandular puberulous within, spreading pilose without; lower lip with 3 lobes, within capitate glandular puberulent from the throat almost to margin, without white villous, the 2 lateral lobes 6-7 mm. long, 9-10 mm. wide, transversely oblong-oval, obtuse; lowest lobe 6-7 mm. long, 9.5 mm. wide, transversely oval-oblong, abruptly contracted to a subacuminate tip; 2 lower stamens perfect, the filaments adnate to the corolla to within 5 mm. of the throat, free portion 3 mm. long subulate, spirally upcurved; the 2 perfect anthers 2.1 mm. long, somewhat obliquely oval, connate at apex; 2 stout lateral straight staminodia 2 mm. long, but of filament solely; upper staminodium 0.5 mm. long, subulate; *style* 6-7 mm. long, stout, and capitate glandular villous; 2 stigmatic lobes 5-5.5 mm. long, obliquely oval, connate $\frac{3}{5}$ way up proximal side, villous on the back; *ovary* 7-8 mm. long, lanceoloid, capitate glandular villous except at base, the base surrounded by a cupulate disk 1.5 mm. high, fruit unknown.

Distribution: Koolau Range, leeward side, Ohia Zone, known only from this type collection.

Holotype: Mt. Tantalus, trail on N.E. side, open, weedy, decadent woods, alt. 1,800 ft., Oct. 5, 1941, *H. St. John 20,257* (BISHOP MUS.).

Discussion: Described from one flowering plant, obtained after a three years' watch on a colony of several young plants discovered by W. B. Storey. It is a species very distinct from its Hawaiian relatives. It may well be extinct now, as the locality was close to a road and the forest has become sparser and more overrun by weeds.

The specific name is derived from the Latin *ferrugineus*, iron-colored, and is given in allusion to the rusty pubescence.

72. *Cyrtandra grossecrenata* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 79, 1950. (Fig. 102.)

Description of Holotype: Shrub; leafy branchlets as much as 3 mm. in diameter, quadrangular, densely ascending pilosulous; internodes 7-12 mm. long; young shoots densely soft pilosulous; leaf scars not seen; *leaves* opposite, divergent, borne at 3 or more upper nodes, those of a pair subequal, one being $\frac{1}{6}$ to $\frac{1}{10}$ larger; petioles

17-35 mm. long, densely ascending pilosulous; *blades* 7-12.5 cm. long, 40-58 mm. wide, thick firm chartaceous, oval, the apex subacuminate, the base abruptly cuneate, above sparsely appressed puberulent, dark green, below densely appressed tawny soft pilosulous, the margins coarsely crenate, the secondary veins 7-9 on a side, their tips arcuate, then excurrent in the teeth; *cymes* axillary, 1-3-flowered, densely appressed pilosulous; peduncles 18-25 mm. long; pedicels 2-5 mm. long; peduncular bracts 7-10 mm. long,

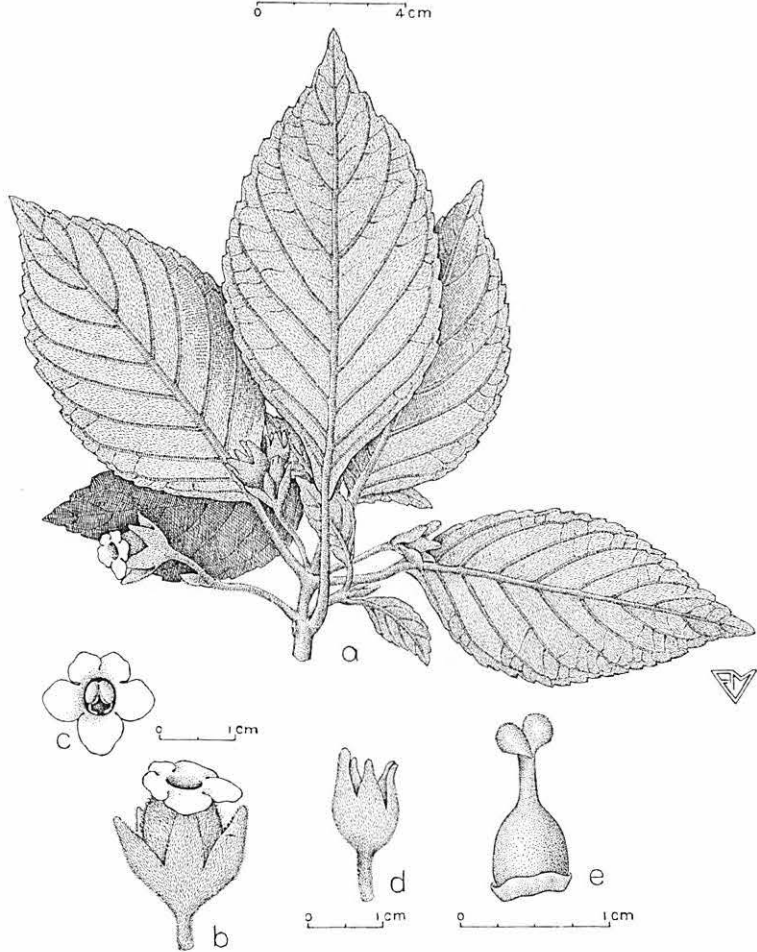


FIGURE 102.—*Cyrtandra grossecrenata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Probably Oahu, Mann and Brigham 723 or 441, holotype (Bishop Mus.).

oblanceolate, foliaceous; buds lance-ovoid with the calyx lobes approximate; *calyx* in anthesis 14-16 mm. long when boiled (9-14 mm. long when dried), broad funnelform, green, without closely appressed pilosulous, within minutely glandular puberulous and the lobes with a high, thickened central keel, perceptibly 2-lipped and strongly 5-lobed, but the sinus between lip or lobe subequal, 7-9 mm. deep, the tube 5-6 mm. long; upper

lip 3-lobed; lower lip 2-lobed, lobes lance-ovate obtuse; *corolla* 18 mm. long (when boiled), corolla tube 14 mm. long, straight, ovoid-subglobose, 8 mm. in diameter at the middle, 7 mm. at throat, within glabrous, without shaggy white villous; limb 2-lipped, 5-lobed; upper lip with 2 lobes 3 mm. long, 4.5 mm. wide, transversely oval, within glabrous, without villous except near the broad margins; lower lip 3-lobed; lateral lobes 4.5 mm. long, 6 mm. wide, broadly oval, within glabrous, without densely white villous all over; lower lobe 4.5 mm. long, 5.5 mm. broad, oval, within glabrous, without villous; two lower stamens perfect, with their filaments adnate to the corolla tube to within 3 mm. of the throat, the free portions 2 mm. long, stout subulate spirally upcurved; the 2 perfect anthers 2.5-2.8 mm. long, connate at apex, very obliquely ovate, the connective ovate; staminodia with filaments adnate to the tube to within 6 mm. of the throat, the free portion 0.3 mm. long, subulate; *style* 3 mm. long, glabrous; 2 stigmatic lobes, 3 mm. long, broadly oval, connate half way up proximal side; *ovary* 6 mm. long, ovoid, glabrous, the base surrounded by a cupulate disk 1 mm. high; fruit unknown.

Holotype: Flora Hawaiiensis, *H. Mann & W. T. Brigham 723* or *441* (BISHOP MUS.).

Discussion: *C. grossecrenata* is a member of the section *Crotonocalyces*. In that section is the closest relative, *C. Skottsbergii* St. John & Storey, which is distinguished by having the blades chartaceous, with the margins shallowly undulate serrate; peduncles 20-40 mm. long; pedicels 5-14 mm. long; calyx lobes equaling the tube; corolla tube subcylindric, the lobes villosulous within; and the style sparsely hirsute. On the other hand *C. grossecrenata* has the blades thick firm chartaceous, with the margins coarsely crenate; peduncles 18-25 mm. long; pedicels 2-5 mm. long; calyx lobes longer than the tube; corolla tube ovoid-subglobose, the lobes glabrous within; and the style glabrous.

This species is known only from the type specimen and the documentation of that is confused. It is quite possible, but not certain, that the species occurs on Oahu.

The specific name is derived from the Latin *grosse*, coarsely; *crenatus*, crenate, or with rounded teeth, on the leaf margin.

73. *Cyrtandra honolulensis* Wawra, *Flora* 55: 567, 1872 (p. 21 in reprint) (published as *C. Honolulensis*). (Figs. 103-105, 194.)

Cyrtandra Pickeringii Gray var. *honolulensis* (Wawra) Rock, *Am. Jour. Bot.* 5: 277, 1918 (as *C. Pickeringii honolulensis*).

Cyrtandra Pickeringii Gray β var. *crassifolia* Hillebrand, *Fl. Hawaiian Is.*, 327, 1888, non *C. crassifolia* sensu Rock, 1918.

Description of All Specimens Examined: Shrub, freely branching; the branches moderately thick (4-6 mm.), smooth, the bark pale brown, glabrous, the internodes 5-20 mm. long; leafy branchlets subterete, densely spreading viscid villous, the hairs drying buff-colored; young shoots densely soft pilose; *leaves* opposite, subequal, divergent, the several pairs not crowded; petioles 4-8 cm. long, densely spreading viscid villous; *blades* 7-15 cm. long, 3.5-10.5 cm. wide, chartaceous or firmly so, oval or broadly so to almost suborbicular, subacuminate or acute, the base rounded or in the smaller and younger leaves abruptly cuneate, equilateral or slightly inequilateral, above dark green, and sparsely subappressed, viscid pilose, below whitish green and closely

pilose, the veins densely spreading viscid villous, the margin unevenly callous serrate or serrate-denticulate; *cymes* from leaf axils, 3-flowered, with dense, spreading, viscid villosity throughout; peduncles 15-30 mm. long; pedicels 5-15 mm. long, slender; bracts 7-10 mm. long, lance-ovate, foliaceous; buds subglobose, the calyx lobes erect; *calyx* 10-12 mm. long (14 mm. when boiled), crateriform, the dense spreading viscid villosity more or less obscuring the tissue, subequally lobed $\frac{1}{2}$ way to base, the upper lobes 5 mm. long, 4 mm. wide, ovate, acute, villous within, less so towards the base, the lower lobes 9 mm. long, 5.2 mm. wide, the tube 5-6 mm. long; *corolla* 19 mm. long when

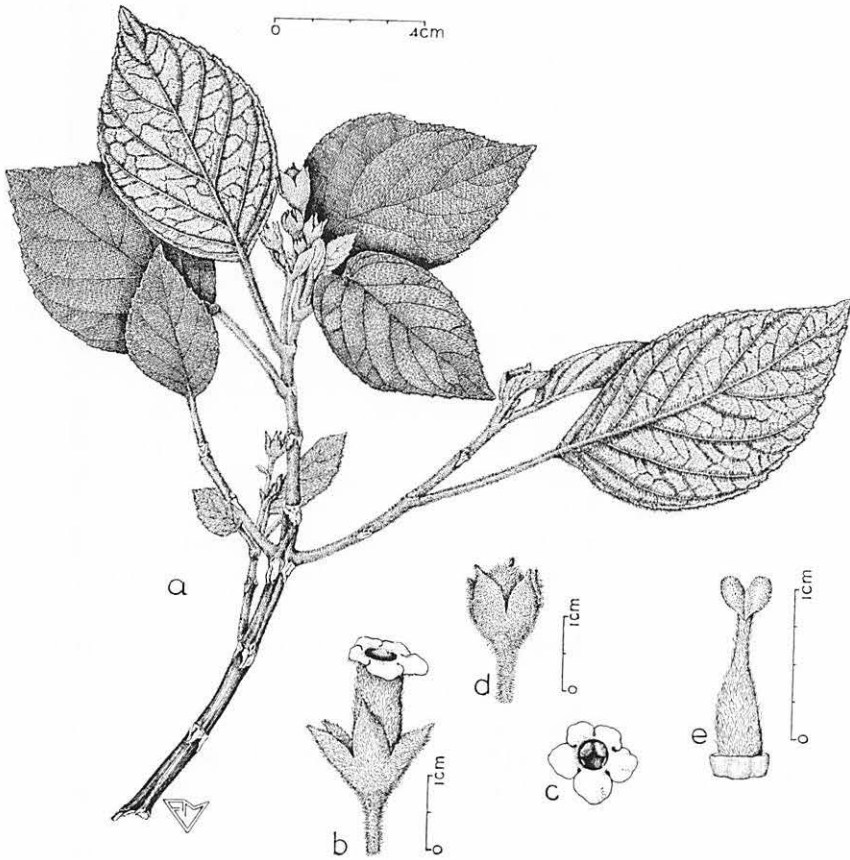


FIGURE 103.—*Cyrtandra honolulensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. "Umgebung von Honolulu," holotype (Vienna), H. Wawra 1,720.

boiled, white, the tube 15 mm. long, 7-8 mm. in diameter, straight cylindric, without densely villous, the limb 2-lipped, 5-lobed; 2 upper lobes 2.5 mm. long, 4-4.5 mm. wide, depressed cordate, broadly obtuse, without villous, within glabrous; lower lip 3-lobed, with similar pubescence, lateral lobes 3.5 mm. long, 5-5.5 mm. wide, obliquely ovate-suborbicular; lower lobe 3.5 mm. long, 5 mm. wide, ovate-suborbicular; two lower stamens perfect, with filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 2.5 mm. long, stout subulate, spirally upcurved, the two perfect anthers

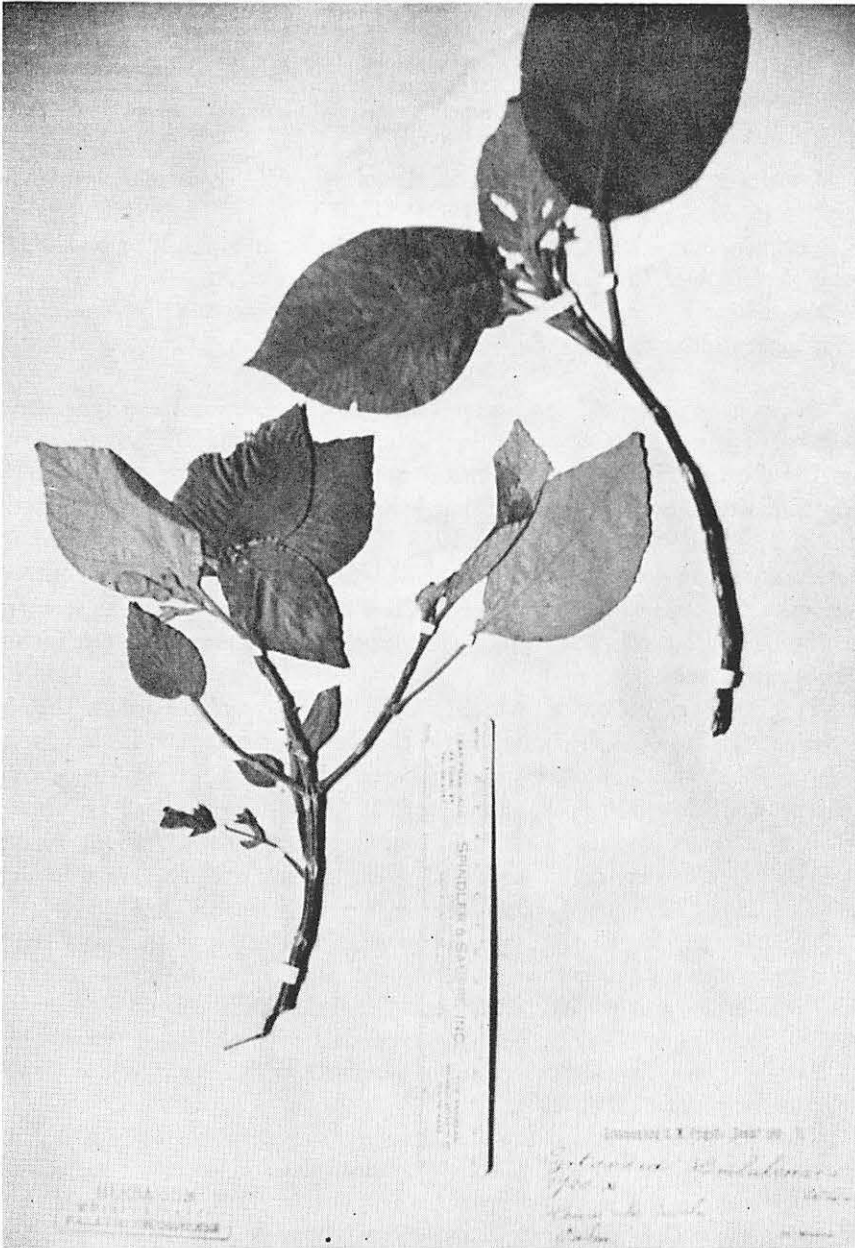


FIGURE 104.—*Cyrtandra honolulensis*, holotype (Vienna). Oahu, Wawra 1,720.

2.5 mm. long, 2 mm. wide, obliquely ovate, the ovate connective 1.5 mm. wide; the two lateral staminodia adnate to the corolla tube to within 6 mm. of the throat, the free portion 0.2 mm. long, subulate, the antheroid tip 0.3-0.5 mm. long, subulate; *style* 4 mm. long, terete, ascending pilosulous; stigmatic lobes two, 2.9 mm. long, 1.3 mm. wide, oval, on the back puberulent except near the margins, connate $\frac{1}{2}$ way up the proximal side; *ovary* 7 mm. long, lanceoloid, densely ascending pilose, surrounded at base by a cupulate disk 1.1 mm. high; fruit unknown.

Holotype: "Oahu, Umgebung von Honolulu" (*H. Wawra 1,720*) (W, 2 sheets; and small clastotype in BISHOP MUS.).

Specimens Examined: Oahu, *W. Hillebrand* (B; and 328, K); Niu, *Hillebrand* (holotype of *C. Pickeringii* var. *crassifolia*), (B).

Discussion: *C. honolulensis* is a member of the section *Crotonocalyces*, and is most similar to *C. Bryanii* which is next to and is contrasted with it in the key.

Wawra gave an ample description of his new species, and two type sheets (*Wawra 1,720*) are preserved in the herbarium at Wien. The accompanying Fig. 104 shows one of them. Wawra did not cite this collection number in the body of his text, and added confusion by stating in his Corrigenda that the number 1,981 should be added. In 1935 when the writer photographed the Wawra types, no such sheet labeled 1,981 was found, while on the contrary there were two type sheets numbered 1,720. This same no. 1,720 was seen and cited by C. B. Clarke in 1883 and a clastotype of it was given to Rock for the Honolulu herbarium.

The Hillebrand collection, which is cited here, was also cited in part by Clarke (1883: 224) as Hillebrand 328 in the Kew Herbarium. It is also doubtless an exact duplicate, though it is numbered while the Hillebrand specimens in Berlin and Honolulu are unnumbered. It is well known that Hillebrand early sent a set of duplicates to Kew, numbered but mostly without locality data, and that these are really duplicates of Hillebrand's own set, now in Berlin, which latter were mostly unnumbered, but with locality data.

The writer's concept of *C. honolulensis* is identical with that of Clarke. Other writers on the group have mostly added other collections unlike the type and Hillebrand's single early collection. Hillebrand himself did not understand this species, not having seen the type. His specimen he determined as *C. Pickeringii* Gray, and he refers *C. honolulensis* to the synonymy of Gray's species in his Flora (1888: 327).

Heller in 1897 suggested that *C. honolulensis* might be really a distinct species, but he failed to marshal substantiating facts or to draw conclusions.

Prof. Rock, in the second part of his revision of the Hawaiian species of *Cyrtandra*, made *C. honolulensis* Wawra a variety or trinomial under *C. Pickeringii* Gray. He added another collection, Rock 10, from Punaluu, which the writer here excludes from *C. honolulensis* as it was made the type of a new species, *C. crassior*. Soon afterwards in the third part of his revision Rock

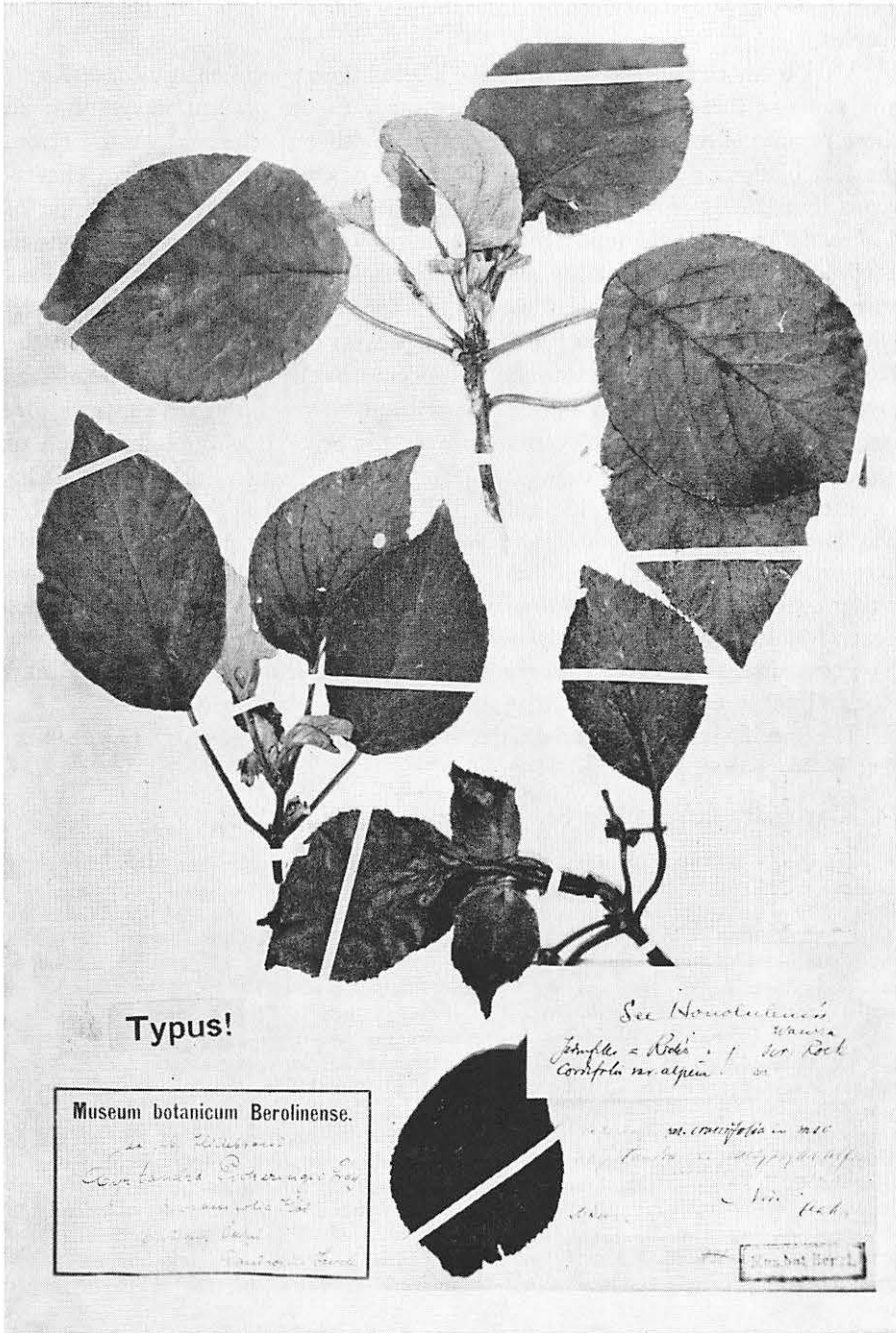


FIGURE 105.—*Cyrtandra Pickeringii* β var. *crassifolia*, holotype (Berlin); synonym of *C. honolulensis* Wawra. Niu, Hillebrand.

(1919: 59) reversed his opinion and affirmed that *C. honolulensis* was a good species.

Various more recent collectors have labeled their specimens *C. honolulensis* and some of these records have been printed. In the present monograph all these recent collections have been relegated to other species. Wawra describes the leaf blades as subcoriaceous. The writer describes them as firm chartaceous, but this is only a difference in terminology. Hillebrand's collection of *C. honolulensis* was made in 1865 or earlier. Wawra's collection was made in 1869-1870. Wawra named his plant from Honolulu, and gave its locality as surroundings of Honolulu. Hillebrand published that this plant, when fused with *C. Pickeringii*, grew on the main range with *C. cordifolia*. He meant the Koolau Range, where *C. cordifolia* still occurs in the lower native forests as low as 600 feet in Kalihi Valley. It is well known that the native forests formerly extended to lower elevations nearer the sea. Hillebrand did much of his collecting in Nuuanu Valley not far from his home. Back of the Oahu Country Club is an open side gulch, still known as Hillebrand's Glen. This was formerly densely forested with wet native rain forest. Collections made here or lower down might well have been labeled Honolulu even in 1869. The writer concludes that *C. honolulensis* was restricted to the lower forested slopes near Honolulu, now completely deforested.

For a discussion of *C. Pickeringii* Gray β var. *crassifolia* Hillebrand and Rock's interpretation of it, see the treatment of *C. viridiflora*.

The specific name is a coined adjective from the Latin, *-ensis*, a place suffix, that is, from the place called Honolulu.

74. *Cyrtandra infrapallida* St. John, sp. nov. (Figs. 106, 187).

Diagnosis Holotypi: Frutex 1 m. altus, ramis subquadrangularibus pallide brunneis lucidis carnosus et in sicco sulcatis, ramulis foliferis 2-4 mm. diametro quadrangularibus crebre adpresse olivaceo-brunneo-pilosulis, internodiis 6-30 mm. plerumque 20 mm. longis, cicatricibus 6-7 mm. altis et bene separatis rotundati-scutelliformibus pallidis suberosis prominentibus, fasciculis 9, novellis crebre adpresse adscendente olivaceo-brunneo-pilosulis, *foliis* oppositis divergentibus deinde extendentibus congregatis in 3-4 nodis superis affixis inaequalibus uno $\frac{1}{4}$ minore, petiolis 10-18 mm. longis ad 4-5 mm. crassis et in latere distali inflatis dense adpresse olivaceo-brunneo-pilosulis, *laminis* 11-18.5 cm. longis 50-95 mm. latis crasse chartaceis et in sicco subcoriaceis late ellipticis in basi cuneatis et sinuiter ad 1-2 cm. decurrenti-alatis in apice acutis vel subacuminatis marginibus depresso semi-serrulatis supra obscure viridibus midnervo et nervis secundariis dense adpresse brunneo-hirsutulis intervallis remote itaque infra albo-viridibus nervis dense adpresseque brunneo-pilosulis intervallis minute molliter puberulis nervis secundariis 8-9 in uno latere rectis adscendentibus sed ad apicem arcuatis et interconnectis, *cymis* axillaribus 3-5-floriferis divergentibus dense adpresse adscendente olivaceo-brunneo-pilosulis 5 cm. longis, pedunculis 31-33 mm. longis, pedicellis 7-9 mm. longis, bracteis 10-14 mm. longis lanceo-ovatis foliaceis, alabastris late campanulatis lobis calycis adscendentibus vel extrinsecus curvatis, *calycibus* 11 mm. longis quando bullitis (9-10 mm. in sicco) viridibus sed extra intraque dense adpresse olivaceo-brunneo-pilosulis campanulatis in basi subtruncatis bilabiatis inter labias 7.5 mm. partitis, labia supera trilobata inter lobas 4 mm. partitis lobis adscendentibus in basi

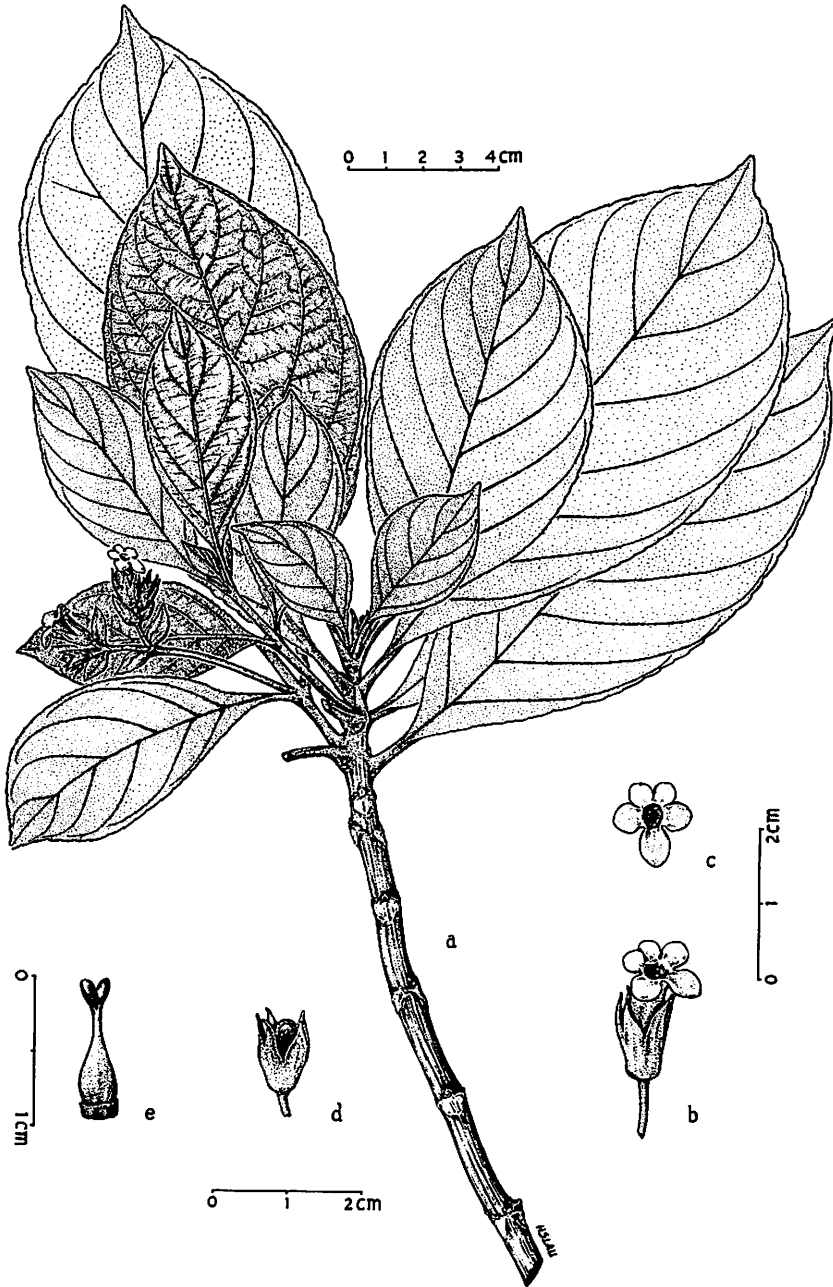


FIGURE 106.—*Cyrtandra infrapallida*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Kailua, Pearsall 9, holotype (Bishop Mus.).

3 mm. latis dimidia infera lanceo-ovata diminuenda ad dimidia supera subulata, labia infera bilobata lobis 7.5 mm. longis 3.8 mm. latis oblique elliptico-ovatis sed supra diminuendis in apice subulato 2 mm. longo, *corollis* 17 mm. longis quando bullitis albis evidenter exsertis extra puberulentis excepta in basi, tubo 11 mm. longo in basi 4 mm. in medio 3.3 mm. in orifice 5 mm. diametro tertia supera in latere distali gibbosa et in orifice sub microscopo glanduloso-puberulo, limbo bilabiato 5-lobato, lobis superis binis 2.5 mm. longis 3 mm. latis suborbicularibus intra glabris, labia infera trilobata, lobis lateralibus 3-5 mm. longis 4.5 mm. latis rhombico-suborbiculatis, loba infera 5 mm. longa 4 mm. lata late elliptica, staminibus binis inferis in tubo 4 mm. ex orifice affixis parte libera 2 mm. longa valide subulata contorta, antheris non visis, staminodeis lateralibus in tubo 5 mm. ex orifice affixis parte libera 1 mm. longa validi subulata apice antheroideo 0.3 mm. longo lineari-oblongo pallidi, *stylo* 2 mm. longo glabro, lobis stigmatis binis 2 mm. longis ellipsoideis in latere proximali $\frac{1}{2}$ connatis, *ovario* 4 mm. longo ovoideo glabro in basi cum disco cupulato 1.5 mm. alto cincto, fructibus ignotis.

Description of Holotype: Shrub 1 m. tall; branches subquadrangular, glabrate, light brown, shiny, fleshy and, on drying, forming longitudinal furrows and ridges; leafy branchlets 2-4 mm. in diameter, quadrangular, densely appressed olive brown pilosulous; internodes 6-30 mm., usually about 20 mm. long; leaf scars 6-7 mm. high, well separated, rounded shield-shaped, pale, corky, prominent; bundle scars 9; young shoots densely appressed ascending olive brown pilosulous; *leaves* opposite, diverging, then spreading, crowded, borne at the 3-4 upper nodes, unequal, one of a pair about $\frac{1}{4}$ the smaller; petioles 10-18 mm. long, as much as 4-5 mm. thick and with rounded swellings on the distal side, densely appressed olive brown pilosulous; *blades* 11-18.5 cm. long, 50-95 mm. wide, thick chartaceous and on drying subcoriaceous, broadly elliptic, base cuneate then sinuous decurrent winged for 1-2 cm., the apex acute or sub-acuminate, the margins flattened low serrulate, above dark green, the midrib and secondaries densely appressed brown hirsutulous, the intervals remotely so, below whitish green, the veins densely appressed brown pilosulous, the intervals minutely soft puberulous, the secondary veins 8-9 on a side, straight, ascending, but towards the tip upward arching and interconnected; *cymes* 5 cm. long, axillary, 3-5-flowered, divergent, densely appressed ascending olive brown pilosulous; peduncles 31-33 mm. long; pedicels 7-9 mm. long; bracts 10-14 mm. long, lance-ovate, foliaceous; buds broadly campanulate with the free calyx lobe tips ascending or outcurving; *calyx* 11 mm. long when boiled (9-10 mm. when dried), green but without and within densely appressed olive brown pilosulous, campanulate, base subtruncate, 2-lipped, cleft 7.5 mm. between the lips, the upper lip 3-lobed, cleft 4 mm. between the ascending lobes, these 3 mm. wide at base, the lower half lance-ovate, tapering to the subulate upper half; lower lip bilobed, lobes 7.5 mm. long, 3.8 mm. wide, oblique elliptic-ovate, but tapering upwards into the 2 mm. subulate tip; *corolla* (when boiled) 17 mm. long, white, well exerted, the outside puberulent except at the very base, the tube 11 mm. long, at base 4 mm. in diameter, at the middle 3.3 mm., at the throat 5 mm., the upper third gibbous on the distal side, and microscopically glandular puberulous in the throat; limb 2-lipped, 5-lobed; 2 upper lobes 2.5 mm. long, 3 mm. broad, suborbicular, glabrous within; lower lip 3-lobed; lateral lobes 3.5 mm. long, 4.5 mm. wide, rhombic-suborbicular; lower lobe 5 mm. long, 4 mm. wide, broad elliptic; two lower stamens with their filaments adnate to the corolla tube to within 4 mm. of the throat, the free portion 2 mm. long, stout subulate, spirally upcurved; anthers not seen; lateral staminodia with filaments adnate to the tube to within 5 mm. of the throat, the free portion 1 mm. long, stout subulate, bearing a 0.3 mm. linear-oblong pale antheroid tip; *style* 2 mm. long, glabrous; 2 stigmatic lobes 2 mm. long, ellipsoid, connate $\frac{1}{2}$ way up proximal side; *ovary* 4 mm. long, ovoid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; fruit unknown.

Distribution: Koolau Range, windward side, known only at Kailua at 900 ft. alt., in the upper Koa Zone.

Holotypus: Oahu, Kailua, Fourth Branch South of South Fork of Kaha-naiki Stream, open brush of guava, *Clermontia*, *Wikstroemia*, kukui, *Dioscorea*, 900 ft. alt., Nov. 7, 1955, G. Pearsall 9 (BISHOP MUS.).

Discussion: *C. infrapallida* is a member of the section *Crotonocalyces*. The closest relative is surely *C. subintegra* St. John of Oahu, which is recognizable by having the leaf scars 3-3.5 mm. high; bundle scars 5; petioles 0.9-1.2 mm. thick; blades 8-11.5 cm. long, 40-50 mm. wide, the apex acuminate, the margin subentire, above remotely brown pilose; peduncles 15-20 mm. long, pedicels 3-7 mm. long; bracts 7-8 mm. long, lanceolate; calyx 18 mm. long, narrowly campanulate, angled upwards by a salient ridge to each sinus, the lobes 6 mm. wide, the lower lobes 11.5 mm. long; corolla 23 mm. long, brown pilose without, the tube deflexed at 20°, upper lobes 4 mm. long; and the lateral lobes 5 mm. long. *C. infrapallida* has the distinguishing characters: leaf scars 6-7 mm. high; bundle scars 9; petioles 2-5 mm. thick; blades 11-18.5 cm. long, 50-95 mm. wide, the apex acute or subacuminate, the margin flattened low serrulate, above remotely brown hirsutulous; peduncles 31-33 mm. long; pedicels 7-9 mm. long; bracts 10-14 mm. long, lance-ovate; calyx 11 mm. long, campanulate, the base subtruncate, the lobes 3-3.8 mm. wide, the lower lobes 7.5 mm. long; corolla 17 mm. long, puberulent without, the tube nearly straight; upper lobes 2.5 mm. long; and the lateral lobes 3.5 mm. long.

The specific epithet is formed from the Latin *infra*, below; *pallida*, pallid or pale, in reference to the paler under surface of the blades.

75. *Cyrtandra kipapaensis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 79, 1950. (Figs. 107, 185.)

Description of Holotype: Shrub; branches rather slender, the bark pale silvery brown, smooth or with low longitudinal ridges, glabrous, the leaf scars 3-6 mm. high, obcordate, paler, corky and raised; bundle scars 7; internodes 5-35, usually about 10 mm. long; leafy branchlets somewhat quadrangular, spreading white villous; young shoots densely spreading white villous; leaves opposite, unequal, one of a pair as much as ½ the larger, in several pairs, well spaced, divergent; petioles 20-44 mm. long, slender, spreading white villous; blades 4.7-13.2 cm. long, 3-7.5 cm. wide, chartaceous, elliptic to oval, the apex acute, the base cuneate to decurrent, slightly asymmetric or sigmoid, plane, above dark green, sparsely pilose, below whitish, the surface white pilosulous and more densely so on veins, margin unevenly or doubly denticulate, especially above middle; cymes from the leaf axils or rarely a fruiting one from the nearest naked node, 4-7-flowered, spreading white villosulous throughout; peduncles 10-21 mm. long; pedicels 5-15 mm. long, diverging; bracts 9-14 mm. long, ovate, acute or acuminate, foliaceous; calyx 9-14 mm. long, slightly accrescent funnelliform, spreading white villosulous without and within more sparsely so, subequally 5-lobed ½-¾ way to base, the lobes 3.5-8 mm. long, lance-ovate, the tube 3-6 mm. long; corolla 13-18 mm. long, 3-4 mm. in diameter, subcylindric and nearly straight, densely white villous without except near the base which is glabrous, glabrous within, throat open; limb 2-lipped; upper lip with 2 lobes 2.5-3 mm. long, 4-5 mm. wide, spreading at about 45° to axis of the throat, strongly depressed cordate, obtuse, the inside glabrous, the outside glandular villous except near the margin; lower lip 3-lobed, the lobes reflexed at about 120° to the axis of the throat, the inside glabrous, the outside glandular villous; the 2 lateral lobes 3.5-4 mm. long, 5-5.5 mm. wide, transversely oval; lower lobe 4 mm. long,

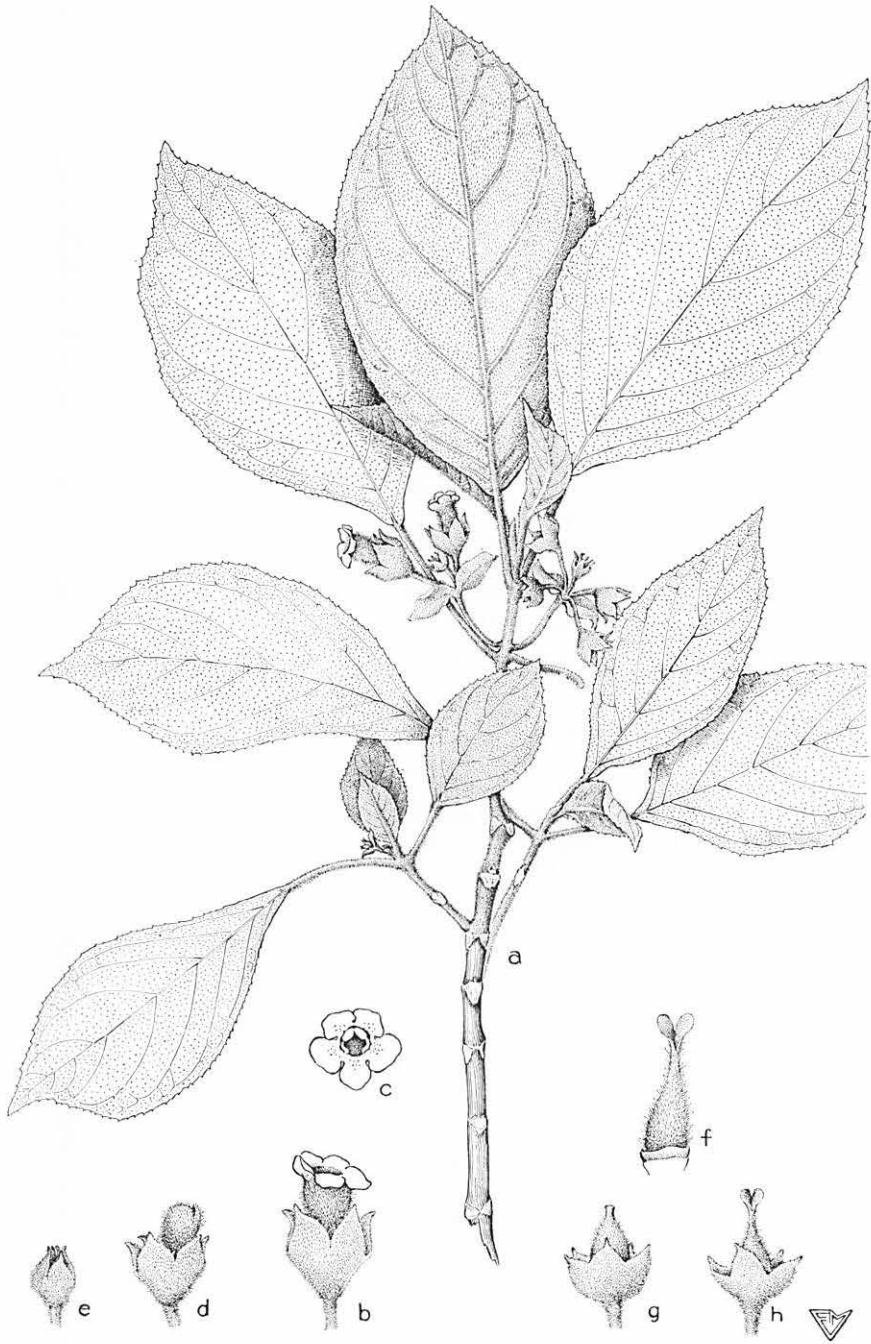


FIGURE 107.—*Cyrtandra kipapaensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, $\times 1$; f, pistil, $\times 2$; g, h, fruit, $\times 1$. Kipapa Gulch, Storey, 220, holotype (Bishop Mus.).

4.5 mm. wide, broadly ovate; 2 lower stamens perfect, the filaments fused to the corolla tube to within 4 mm. of the throat, the free portion 2.5 mm. long, subulate, spiralled, the base flattened; anthers 2.5 mm. long, deltoid-oval, flattened, asymmetric, the cells very unequal; staminodia 3, minute, subulate, 0.3 mm. long or less; style 2 mm. long, stout, spreading white glandular villous; stigma with 2 equal opposite, oval lobes, pilose on the back; connate $\frac{1}{3}$ way up proximal side; ovary lanceoloid, spreading white glandular villous; base surrounded by a cupulate disk 0.5 mm. high; berry when half grown 8 mm. long, lance-ovoid, villous.

Distribution: Koolau Range, leeward side, Kipapa and Palolo in the Ohia Zone in a woods at 1,600 feet altitude.

Holotype: Oahu, Kipapa Gulch, in a small side valley, along partially shady, dry stream bed, elevation 1,600 feet, in association with *Pipturus* and *Metrosideros*, Nov. 13, 1932, *W. B. Storey 220* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Leeward Side: Palolo, Mt. Olympus Trail just south of Water Reserve fence, Manoa-Palolo Ridge, 1,600 ft. alt., semi-exposed slope in middle forest with *Euphorbia multififormis*, Feb. 11, 1945, *Kruckeberg*.

Discussion: *C. kipapaensis* is a member of the section *Crotonocalyces*. The closest related species is *C. honolulensis* Wawra. In the key these two species are side by side, and there the important diagnostic differences are given.

The specific name indicates the geographic locality of the species.

76. *Cyrtandra paloloensis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 79, 1950. (Figs. 108, 190.)

Description of All Specimens Examined: Shrub 2 m. tall; branches somewhat quadrangular, the bark pale brown, corky, at length smooth, the leaf scars 3-4 mm. high broadly obcordate-shield-shaped, pale, prominent, corky; bundle scars 7; internodes 0.8-6 cm., averaging 1 cm. long; leafy branchlets 2-5 mm. in diameter, densely villous, the hairs drying brown; young shoots densely brown ascending villous; leaves opposite, or at a few nodes on strong branches ternate, subequal, ascending to divergent, the pairs about three, distant; petioles 3-7 cm. long, densely brown pilose; blades 7-15 cm. long, 4.5-8.3 cm. wide, thick chartaceous ovate (or obovate), subacuminate (or acuminate), the base abruptly cuncate or rounded, the two sides markedly unequal at base, above green, sparsely pustulate pilose, below pale green, pilose, prominent midrib and lateral veins shaggy pilose, the margin shallowly and unevenly denticulate except towards the base, secondary veins 8-12, ascending, the lower part nearly straight, but near margin gently curved and the tips inarching; cymes from the leaf axils, 3-7-flowered, densely ascending castaneous pilose; peduncles 8-25 mm. long; pedicels 8-18 mm. long; bracts present on the several-flowered cymes 13-14 (-21) mm. long, foliaceous, lance-ovate, acuminate, ascending pilose, especially below; buds at first turbinate, later erect densely brown pilose, calyx at anthesis when fresh 20-23 mm. long, pale green, campanulate, without 15-ribbed, the submarginal ribs fusing with the midrib just below the mucro, ascending brown pilose particularly on the ribs, strongly 5-ridged below the sinuses and 5-furrowed along the midnerves, within pilose above, sparsely so to the base, lobed $\frac{1}{3}$ way to the base, 2-lipped, the sinus between the lips 12 mm. deep, upper lip 3-lobed, the clefts 7 mm. deep, the lobes 6-7 mm. long, deltoid; lower lip 2-lobed, the sinus 11 mm. deep, the lobes 11-12 mm. long, ovate-deltoid, mucronate; corolla when fresh 25-27 mm. long, white, the tube 18-19 mm. long, 8 mm. in greatest diameter, subcylindric, the lower half nearly straight, though distinctly distended on the upper side between the

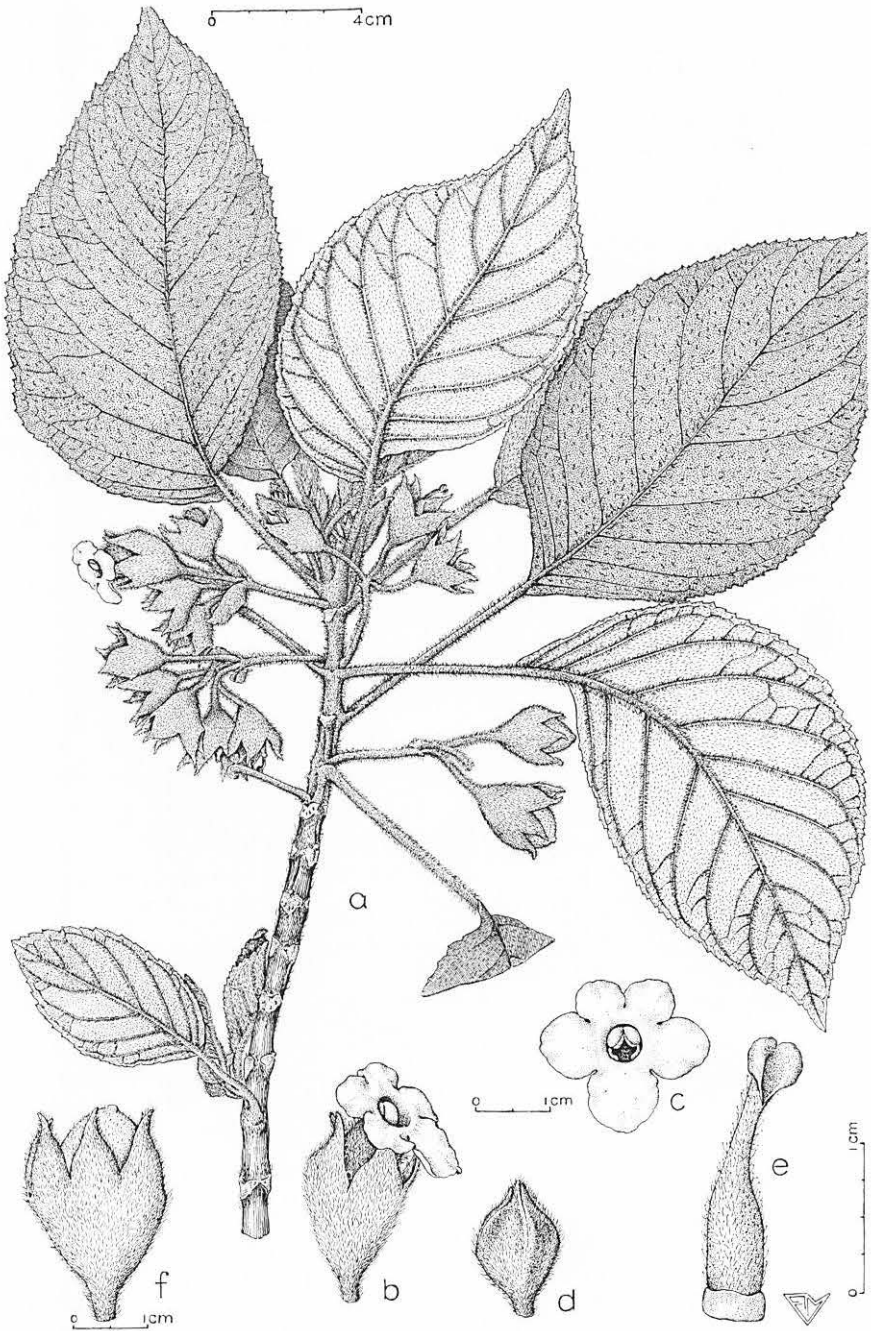


FIGURE 108.—*Cyrtandra paloloensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Waiomao Stream, Palolo. St. John 20,299, holotype (Bishop Mus.).

tip of the calyx lobes and the throat of the corolla, the upper section of the tube deflexed at 20°, without glabrous at very base, elsewhere densely villous, within glabrous, the throat 5 mm. in diameter, limb 2-lipped, corolla lobes 5, the 2 upper 5 mm. long, 7 mm. wide, transversely oval; spreading at about 80° from the axis of the tube, the lower lateral ones 7 mm. long, 8 mm. wide, obliquely broad oval, villous without at base, above glabrous, except for a few hirsutulous patches, within nearly glabrous or very remotely hirsutulous, spreading at about 90° from the axis of the tube; lowest lobe 8 mm. long, 9 mm. wide, suborbicular; two lower filaments fused to within 7 mm. of the throat, the free portion 3 mm. long, subulate, spirally incurved; anthers 3.2 mm. long, 2.1 mm. wide, obliquely ovoid, one cell the smaller, connective broad shield-shaped, the two anthers connate at tip; three staminodia 0.7 mm. long, subulate; *style* 6 mm. long, slender, densely ascending capitate glandular pilose; the stigma 5 mm. long, deeply obcordate, cut and flattened into one plane, the equal lobes separate for 2 mm., strongly veined; *ovary* lanceoloid, densely ascending brown capitate glandular pilose; the base surrounded by a glabrous cupulate disk 2 mm. high; *berry* 22 mm. long, 12 mm. in diameter, ovoid, white; seeds 0.35-0.48 mm. long, 0.21-0.24 mm. wide, broad ellipsoid, umbonate at the hilum, the ends dark brown, the rest pale brown, shining, the surface with a high raised cellular reticulation, the areolae polygonal, $\frac{1}{6}$ the length of the seed.

Distribution: Koolau Range, Leeward Side: From Kalihi to Palolo Valleys, at about 800 ft. alt., in the Koa Zone.

Holotype: Palolo, Waiohao Stream, open kukui forest, 800 ft. alt., May 17, 1942, *H. St. John 20,299* (BISHOP MUS.).

Specimens Examined: Koolau Range, Leeward Side, Honolulu, Kalihi Valley, Aug. 2, 1916, *Hitchcock 14,087* (US sheet 894,054); lower Palolo Valley, Kaau Crater Trail, March 5, 1945, *Kruckeberg*.

Discussion: *C. paloloensis* is a member of the section *Crotonocalyces*. It is unusual in producing either opposite or ternate leaves on nodes of the same vigorous shoot. The close relative seems to be *C. Pearsallii* St. John which differs by having constantly opposite leaves, the blade margins callous serrulate or doubly so; corolla tube without densely villous. *C. paloloensis* is distinguished by having the leaves opposite or ternate, the blade margins shallowly and unevenly denticulate, and the corolla tube without capitate glandular villous. Other diagnostic characters are stated in the key.

The specific name was coined from the geographic name, Palolo, plus the Latin adjectival suffix, *-ensis*, indicating place origin.

77. *Cyrtandra Pearsallii* St. John, sp. nov. (Figs. 109, 194).

Diagnosis Holotypi: Frutex 2-3 m. alta, ramis ad 13 mm. diametro validis pallide griseo-brunneis glabratis, ramulis foliosis ad 7 mm. diametro subquadrangularibus viridibus subcarnosis pilosis, internodis 7-27 mm. longis, cicatricibus 3-7 mm. altis deltoideo-vel lunato-scutelliformibus pallidis suberosis, fasciculis 7, novellis dense albo-pilosis, *foliis* oppositis divergentibus exaggregatis inaequalibus uno $\frac{1}{4}$ - $\frac{1}{6}$ majore in 4-6 nodis superis affixis, petiolis 1.2-8 cm. longis validibus pilosis, *laminis* 5-16 cm. longis 28-111 mm. latis crasse molliter chartaceis late ovalibus in apice acuto et basi subcordato subasymetrico marginibus apiculato-serrulatis vel duplo serrulatis supra distante adpresse pustulato-hirsutulis deinde subglabris infra pallide viridibus intervallis subglabris sed nervis et nervulis pilosis, *cymis* axillaribus umbellatis 3-, 5-, 7-floriferis albo-pilosis, pedunculis 12-25 mm. longis, pedicellis 12-22 mm. longis, bracteis

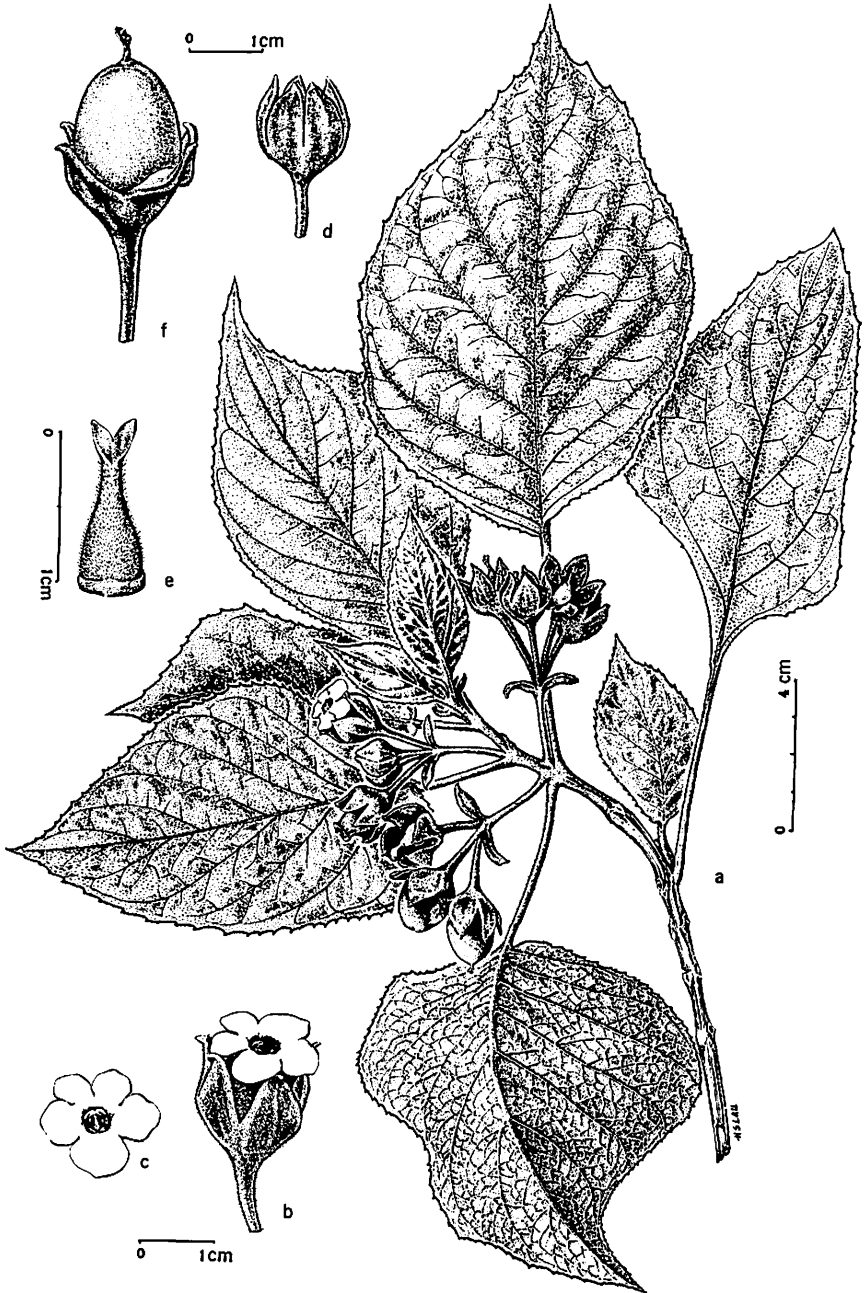


FIGURE 109.—*Cyrtandra Pearsallii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Kailua, Pearsall 4, holotype (Bishop Mus.).

12-18 mm. longis foliaceis lanceo-ovatis, alabastris lanceo-ovoideis deinde campanulatis, *calycibus* 11-14 mm. longis in vivo viridibus exaccrescentibus late campanulatis valde 5-angulatis albo-pilosis subbilabiatis subaequaliter 5-lobatis inter labias 7-8 mm. partitis, labia supera 3-lobata lobis conniventibus porrectisque inter lobas 5 mm. partitis, lobis 5-9 mm. longis 5-7 mm. latis late deltoideis calloso-apiculatis, labia infera bilobata lobis 7-9.5 mm. longis 8-8.5 mm. latis erectis late ovato-deltoideis apicibus calloso-subacutis, tubo 5-7 mm. longo late infundibuliforme intra glabro, *corollis* in vivo 16-20 mm. longo extra excepta in basi albo-pilosis, tubo 13-15 mm. longo in basi 4.5-5 mm. diametro in media 6.5-8 mm. in orifice 5-6 mm. subcylindrico minime decurvato, limbo bilabiato 5-lobato lobis in 45°-60° divergentibus, lobis superis binis 3 mm. longis 5 mm. latis deltoideo-reniformibus in basi auriculatis et impensis lobis omnibus intra glabris et extra in partibus in alabastro impensis glabris, labia infera 3-lobata, lobis lateralibus 4-5 mm. longis 4.5-6 mm. latis oblique suborbicularibus, loba infera 4-5 mm. longa 6-7.5 mm. lata reniforme, staminibus inferis binis in tubo 5 mm. ex orifice affixis parte libera filamentae 2 mm. longa contorte adscendentibus teretibus validi, antheris 2.5 mm. longis 1.9 mm. latis oblique sagittato-ovatis connectivo 1.5 mm. lato ovato, staminodeis lateralibus in tubo 6.5 mm. ex orifice affixis parte libera 0.8 mm. longa subulato-deltoidea apice staminodea non distincta, *stylo* 2 mm. longo capitato-glanduloso-pilosulo, lobis stigmatis binis 2.5 mm. longis obovatis in latere proxima $\frac{2}{3}$ connata ad basim glanduloso-pilosulis, *ovario* 8 mm. longo lanceoloideo cum rostro 1-2 mm. longo et dense capitato glanduloso-pilosulo in basi disco cupulato 1.5 mm. alto cincto, *baccis* 12-15 mm. longis 9-10 mm. diametro albis ovoideis acutis albo-capitato-pilosulis, seminibus 0.21-0.24 mm. longis 0.06-0.12 mm. diametro arcuato-fusiformibus pallidis (immaturis) in superficie reticulis validi cellulosis anguste oblongis quam semine $\frac{1}{3}$ - $\frac{1}{4}$ longis.

Description of Holotype: Shrub 2-3 m. tall; branches up to 13 mm. in diameter, stout, pale grayish brown, glabrate; leafy branchlets up to 7 mm. in diameter, subquadrangular, green and somewhat fleshy, white but later brownish pilose; internodes 7-37 mm. long; leaf scars 3-7 mm. high triangular- or lunate-shield-shaped, pale corky; bundle scars 7; young shoots densely white pilose; *leaves* opposite, divergent, not crowded, unequal, one of a pair being $\frac{1}{4}$ - $\frac{1}{6}$ the larger, attached at the 4-6 upper nodes; petioles 1.2-8 cm. long, stout, and spreading pilose; *blades* 5-16 cm. long, 28-111 mm. wide, thick soft chartaceous, broadly elliptic, the acute tip and subcordate base somewhat asymmetric, margin apiculate serrulate or doubly so, the surface above distantly pustulate appressed hirsutulous but at length more or less subglabrate, below pale green with intervals essentially glabrous but the prominent veins and veinlets spreading pilose; *cymes* axillary, umbellate, 3-, 5-, 7-flowered, spreading white pilose; peduncles 12-25 mm. long; pedicels 12-22 mm. long; bracts 12-18 mm. long, foliaceous, lance-ovate; buds lance-ovoid, becoming campanulate; *calyx* 11-14 mm. long (when fresh), green, not accrescent, broadly campanulate, prominently angled by salient ribs, one leading to each sinus, spreading white pilose, subbilabiate, almost equally 5-lobed, cleft 7-8 mm. between lips, and appearing to be lobed about $\frac{1}{2}$ way, the upper lip with the three lobes connivent and porrect, cleft 5 mm. between the lobes, the lobes 5-9 mm. long, 5-7 mm. wide, broadly deltoid, callous tipped; lower lip bilobed, the lobes 7-9.5 mm. long, 8-8.5 mm. wide, erect, broadly ovate-deltoid, the tip callous subacute; the calyx tube 5-7 mm. long, broad funnelform, it and the lobes glabrous within; *corolla* when fresh 16-20 mm. long and except at base white pilose without, the tube 13-15 mm. long, 4.5-5 mm. in diameter at base, 6.5-8 mm. at the middle, 5-6 mm. at the throat, subcylindric, the tube gently and very slightly decurved; limb 2-lipped, 5-lobed, the lobes spreading at 45° to 60° from the axis of the throat; upper lobes two, 3 mm. long, 5 mm. wide, deltoid reniform, at base auriculate and overlapping, like all the other lobes glabrous within and glabrous without where covered in veneration; lower lip 3-lobed; lateral lobes 4-5 mm. long, 4.5-6 mm. wide, obliquely suborbicular; lower lobe 4-5 mm. long, 6-7.5 mm. wide, reniform; two lower stamens perfect, their filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 2 mm.

long, spirally upcurved, terete, stout, the two perfect anthers 2.5 mm. long, 1.9 mm. wide, obliquely sagittate-ovate, the connective 1.5 mm. wide, ovate; lateral staminodia adnate to the corolla tube 6.5 mm. from the throat, the free portion 0.8 mm. long, subulate-deltoid, the tip undifferentiated; style 2 mm. long, capitate glandular pilosulous; 2 stigmatic lobes 2.5 mm. long, obovate, on the proximal side connate $\frac{2}{3}$ way and towards the base glandular pilosulous; ovary 8 mm. long, lanceoloid, including 1-2 mm. beak, densely capitate glandular pilosulous, surrounded at base by a cupulate disk 1.5 mm. high; berry 12-15 mm. long, including the 1-2 mm. beak, 9-10 mm. in diameter, white, ovoid, acute, white capitate glandular pilosulous; seeds 0.21-0.24 mm. long, 0.06-0.12 mm. in diameter, arcuate fusiform, pale (apparently immature), the body covered with narrowly oblong strong raised cellular reticulations $\frac{1}{3}$ - $\frac{1}{4}$ as long as the seed.

Distribution: Known only from the type collection, Koolau Range, windward side, Koa Zone.

Holotypus: Oahu, Kailua, fourth south fork of the South Fork of Kahani Stream, 800 ft. alt., open scrub of guava, *Clermontia*, *Rubus*, at base of large rock, Sept. 18, 1955, G. Pearsall 4 (BISHOP MUS.).

Discussion: *C. Pearsallii* is a member of the section *Crotonocalyces*. Its closest relative is the common and widely distributed species, *C. cordifolia* Gaud. var. *cordifolia* which differs by having leaf scars broad obcordate; the young shoots tawny villous; leaves of a pair subequal; blades 10-24 cm. long 7-22 cm. wide, orbicular to broadly oval, the base cordate and usually deeply so, the margin dentate or doubly so, the surface above remotely soft tawny villous, below densely tawny villous and the veins shaggy villous; cymes densely shaggy tawny villous; pedicels 25-65 mm. long; calyx 9-16 mm. long in anthesis, cup-shaped to saucer-shaped, strongly accrescent in fruit and then 16-19 mm. long, reflexed, densely shaggy viscid villous; style only 1 mm. long, not evident, capitate glandular villous; berry densely spreading capitate glandular villous. The new *C. Pearsallii* can be recognized by its having the leaf scars triangular- or lunate-shield-shaped; young shoots densely white pilose; one leaf of a pair $\frac{1}{4}$ - $\frac{1}{6}$ the larger; blades 5-16 cm. long, 2.8-11.1 cm. wide, asymmetric broad oval, the base subcordate, the margin apiculate serrulate or doubly so, the surface above distantly pustulate appressed hirsutulous and later subglabrate, below the intervals essentially glabrous but veins and veinlets spreading pilose; cymes spreading white pilose; pedicels 12-22 mm. long; calyx 11-14 mm. long, not accrescent, not reflexed, broadly campanulate, white pilose; style 2 mm. long, capitate glandular pilosulous; berry capitate glandular pilosulous.

The new species is named for the late Gordon Sawyer Pearsall, of the United States Bureau of Entomology and Plant Quarantine, who was a keen student of both the native and the cultivated plants in Hawaii.

78. *Cyrtandra Pickeringii* Gray, Am. Acad. Arts Sci., Proc. 5: 350-351, 1862. Illustrations: Rock, J. F., Am. Jour. Bot. 6: pl. XXXI, 1919. (Figs. 110, 111.)

Description: Shrub; branches of moderate size, bark smooth, tardily glabrate, the leaf scars pale, corky, raised; internodes 14-40 mm., averaging 33 mm. long; leafy

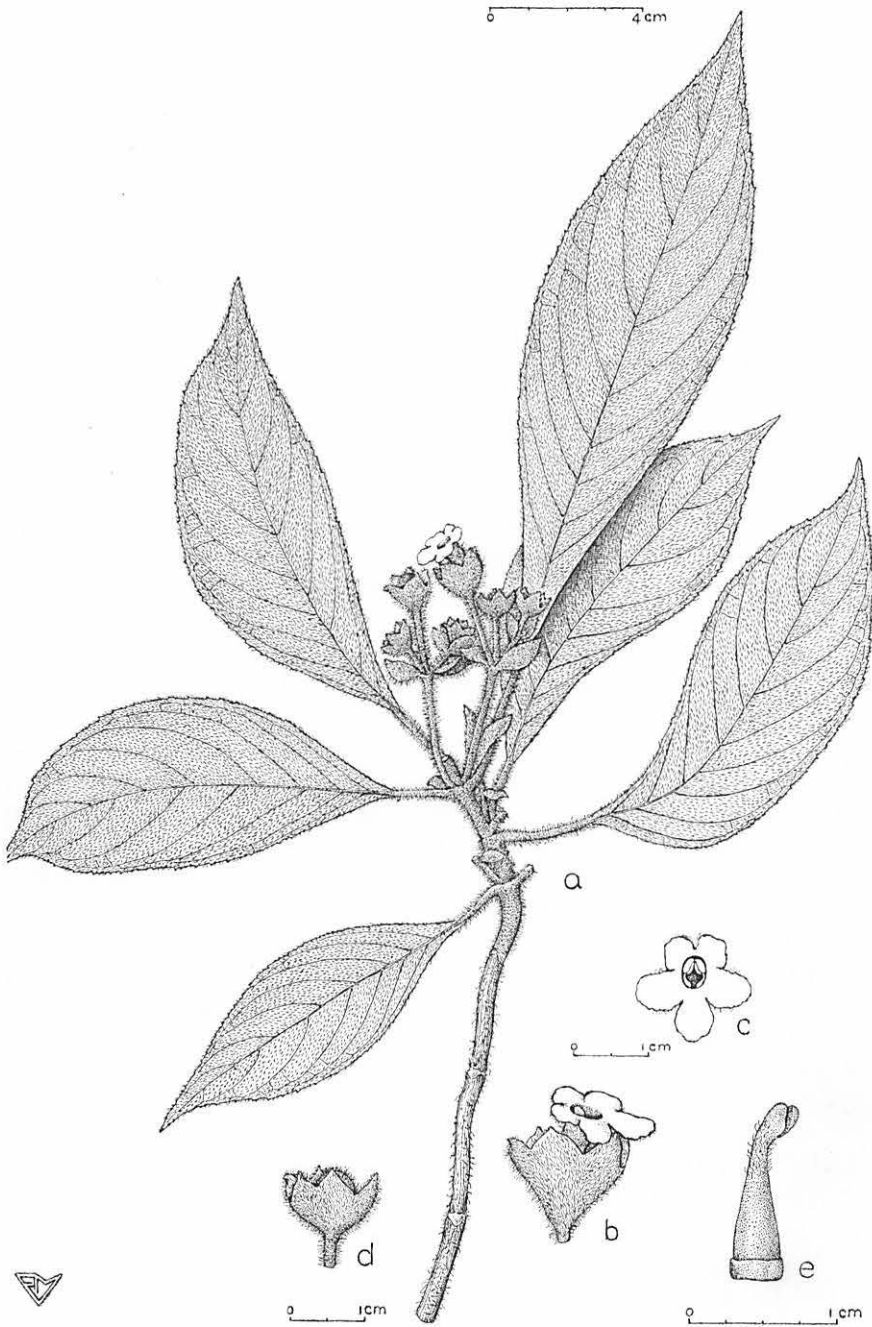


FIGURE 110.—*Cyrtandra Pickeringii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Hawaiian Is., Oahu, U. S. Exploring Expedition, Wilkes, holotype (U. S. National Herbarium).

branchlets subterete, 3-4 mm. in diameter, densely shaggy, ferrugineous villous; young shoots densely shaggy, ferrugineous villous; *leaves* opposite, subequal to unequal with one of the pair $\frac{1}{3}$ smaller, in a few pairs, divergent; petioles 12-37 mm. long, shaggy ferrugineous villous; *blades* 11-21 cm. long, 3-5 cm. wide, elliptic or elliptic-oblongate, acuminate to each end, the base decurrent on the petiole, from strongly asymmetric and arcuate to nearly straight and symmetric, above sparsely pustulose-based villous, below "soft and velvety fulvous-canescens"; the margin entire towards the base, but the upper two-thirds unevenly serrulate; *cymes* from the leaf axils, 3-5-flowered, spreading ferrugineous villous; peduncles 30-33 mm. long; pedicels 9-18 mm. long; bracts 7-10 mm. long, ovate-lanceolate; *calyx* 9-10 mm. long, narrowly crateriform, sparsely ferrugineous villous, subequally lobed $\frac{1}{2}$ way into ovate-suborbicular, acute lobes that overlap at base; *corolla* about 16 mm. long, the tube 12 mm. long, 4 mm. in diameter, nearly straight, the exposed part sparsely villous, the lobes unequal, the upper 3 mm. long, the lower 4 mm. long, depressed semiorbicular, apparently spreading at about 50° from the axis of the tube; stamens and pistil not examined; fruit unknown.

Distribution: Koolau Range, leeward side, known only from the type, from the mountains back of Honolulu.

Holotype: Mountains of Oahu, U. S. Exploring Expedition under Capt. Wilkes (US). Also small clastotype in (GH).

Discussion: In the original publication, Gray gave *C. Pickeringii* four and one-half lines of description and four and one-half lines of comment and citation of specimens. The description was clearly stated and ample according to the standards of the time. The species was certainly new and the name valid. Apparently all subsequent botanists dealing with this genus and area have accepted Gray's species, as did Clarke, Hillebrand, and Rock. They and others have determined and distributed numerous recent collections as of this species. It is now evident that none of these match the type, that all were misidentified, and that *C. Pickeringii* Gray has not been rediscovered. The several species in which these later collections are placed in the present revision may be noted on checking them in our List of Exsiccatae. Rock at first (1918: 275-276) accepted several recent collections as representing *C. Pickeringii*, then later (1919: 58-59, pl. 31), having seen in the Gray Herbarium a type specimen (his plate 31), he revised his judgment, removed the later collections and stated "The true *Cyrtandra Pickeringii* A. Gray has apparently not been re-collected." Skottsberg (1936: 169) confirmed this and pointed out that the type specimen in the Gray Herbarium was only a fragment, a single detached leaf and a piece of an undeveloped inflorescence, whereas the U. S. National Herbarium contains a sheet labeled by Gray, consisting of a large branch with several pairs of leaves, inflorescences, and a flower attached. Hence, this specimen in Washington is the real holotype (see our Fig. 111), and the one in the Gray Herbarium is a clastotype. Its leaf seems to have been taken from the lowest leafy node. There are several leaf shapes on this single branch, and such a single, detached leaf does not give a true concept of the leaf fluctuations that occur. Botanists have usually assumed that the Wilkes Expedition collections in the Gray Herbarium contain the true types. In some instances this is



FIGURE 111.—*Cyrtandra Pickeringii*, holotype (U. S. National Herbarium). Mountains of Oahu, U. S. Exploring Expedition, Wilkes.

so, and in most species Gray's notes and the drawings from dissections are on the Gray Herbarium sheets. However, these specimens are usually small, mere fragments removed from the single specimen collected. The larger, better, and more complete specimens are usually in the U. S. National Herbarium. It is obvious that Gray kept his notes, his drawings, and as full a specimen as he could without robbing the often meager sheet later returned to the government collection. Hence, in most instances, and certainly in this one, the types of the Wilkes Expedition collections are in the U. S. National Herbarium.

The type locality of *C. Pickeringii* was stated merely as "Mountains of Oahu," and the type in Washington is similarly labeled "Mts. Oahu," while the clastotype in the Gray Herbarium has only the printed Sandwich Islands. The printed labels in the two sets are different in form and wording.

The vicissitudes affecting the botanical collections of the Wilkes Expedition are well known. Emulating the British with their epoch-making Capt. Cook exploring expeditions, the U. S. Exploring Expedition was organized, and the leading scientists of the country were invited to participate. Dr. Asa Gray was chosen as botanist and he accepted and arranged for leave from Harvard. The organizing dragged on and on, so finally after years of delay, he resigned in disgust. When the expedition finally sailed, in 1842, it contained Charles Pickering as naturalist, William Rich as botanist, and W. D. Brackenridge as horticulturist. They obtained extensive collections, but were not in a position to identify and publish upon the higher plants. The collections were parceled out for study, the North American to Dr. John Torrey, the more distant ones to Dr. Asa Gray. Congress had provided ample funds for administration and publication and put Commander Wilkes in charge. His administration squandered the funds and caused constant quarrels with the cooperating scientists who met delay and trouble with their finished manuscripts, and if published, the authors were neither given nor permitted to buy a copy of the volume (see Bartlett, 1940). Torrey supplied the manuscript of his volume on botany, and it waited for years. After Torrey's death, so many years had passed that it had to be sent to Gray for revision before it was printed. Gray finished and handed in the manuscript of his own volume. Part of it was published as Vol. 15 (1) in 1854. The remaining part, ready for printing, remained in Washington. Finally in disgust, Gray extracted the descriptions of his new species from his own original manuscript of the second part, and published them from 1857 to 1862 in a series of articles in the Proceedings of the American Academy of Arts and Sciences. It was there that *C. Pickeringii* was published. These species and the others which were not novelties were the content of the additional volume on botany of the Wilkes Expedition, which was announced, but never published. Knowing the history of Dr. Gray and the Wilkes Expedition, a copy of Gray's manuscript relating to *C. Pickeringii* was re-

quested. This contains the same Latin diagnosis that was printed, but also a detailed discussion which we quote:

“*Hab.* Oahu, Sandwich Islands, on the mountains behind Honolulu.

“Only a single specimen was collected of this plant, which, if rightly referred to no. 16 of Dr. Pickering's printed memoranda, is ‘frequent on the mountains behind Honolulu, at the elevation of 1500 feet.’ I have met with it in no other collection. The young branches, petioles, inflorescence etc. are shaggy with dense, ferruginous, multiarticulated hairs, much as in the preceding species. The leaves (often moderately unequal in the pairs) are from 4 to 7 inches long by 1½ to 2 inches in width, conspicuously acuminate, and at the base tapering into a petiole of 6 to 18 lines in length, the pubescence nearly as in *C. platyphylla*, that of the lower surface soft and velvety, fulvous-canescens. Peduncles rather longer than the petioles; the fully developed pedicels an inch or less in length. Calyx sparsely ferruginous-villous, ampliate-expanding in the manner of *C. cordifolia*, but apparently crateriform or even cyathiform, rather than rotate, of the same herbaceo-membranaceous and veiny texture, only 3 to 4½ lines in length, much less deeply lobed than in *C. cordifolia*, the lobes very broadly triangular. Corolla hairy externally, somewhat bilabiate, half an inch long. Ovary ovoid-fusiform, glabrous, tapering into a rather short and stout, sparsely hairy style.

“Except for the calyx and the soft fulvous down of the lower face of the leaves, this might be taken for a variety of the following species.” (*C. triflora* Gaud.)

This quoted manuscript contains several points of interest. Noteworthy is the association of the type with “no. 16 of Dr. Pickering's printed memoranda.” At first we were not able to locate such a memorandum, and it was noted that neither the type nor the clastotype are numbered. Gray and Pickering were friends and almost neighbors, so doubtless Pickering made his notes available to Gray. We have finally found Pickering's no. 16 in print. In his *Geographical Distribution of Animals and Plants, the Hawaiian Cyrtandra* no. 16 appears on page 418. This is the volume of botany prepared by Pickering and printed in 1854 as Volume 19 of the Wilkes Expedition reports. The first 524 pages including the first half of the manuscript were printed in the official edition, but apparently never issued. Pickering states that “the printing of which was suspended in 1860.” This was reprinted by the author for the public edition, in Salem, Mass., in 1876. In this we find species of *Cyrtandra* from Oahu numbered 15 to 19, each being given a brief description and the locality. Now it is evident that Gray was referring to this enumeration which was later printed. The entry is as follows:

“(No. 16). Under surface of the leaves white woolly; calyx involucrel, or enlarged and rotate, white. Frequent on the mountains behind Honolulu, at the elevation of 1500 feet.” If these are the collector's data for *C. Pickeringii*, they would give more precise locality data. However, we differ from Dr. Gray's

choice. *C. Pickeringii* does not have a white calyx that is rotate or leaves white woolly beneath. This no. 16 is certainly *C. Lessoniana* Gaudichaud which was also collected on Oahu by the Wilkes Expedition, and is still common on the mountains behind Honolulu at 1,500 feet. To put them on record, we would name the Pickering collection numbers as follows: 15, *C. cordifolia*; 16, *C. Lessoniana*; 17, *C. Pickeringii*; 18, *C. grandiflora*; and 19, *C. paludosa*. No. 17, which we consider to stand for the type of *C. Pickeringii*, was listed as follows: "(No. 17), broad-lanceolate leaves, ferruginous pubescence. Oahu, (on the mountains behind Honolulu)." Hence, we are still ignorant of the exact type locality of *C. Pickeringii* Gray. The species was probably native to the lower forests on slopes now long deforested. The species is probably extinct.

C. Pickeringii Gray var. *latifolia* Skottsberg (1936: 170) is not considered close to the original species, so it is here described as a new species, *C. Skottsbergii*.

79. *Cyrtandra piligyna* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 79, 1950. (Figs. 112, 190.)

Description: Erect shrub 1 m. tall, 1 cm. in diameter at base; branches subterete, pale brownish, glabrate, leaf scars 4-4.5 mm. high, cordate-shield-shaped, pale, corky, raised; bundle scars 7; internodes 10-24 mm. long; leafy branches quadrangular, shaggy viscid white pilose, 5 mm. in diameter below the lowest leaves, bearing about six pairs of divergent, well spaced leaves; young shoots concealed by the dense white spreading pilosity; leaves opposite, those of a pair markedly unequal, the smaller only $\frac{2}{3}$ the size of the larger; petioles 5-12 cm. long, slender, subterete, channeled above, spreading white pilose and viscid pilosulous; blades 10-17 cm. long, 7-10 cm. wide, ovate or broadly ovate abruptly acute or subcuneate at apex, the base rounded or slightly subcordate, quite unequal, as are the two halves of the asymmetric blade, chartaceous, above dark green and pustulate appressed hirsutulous, below pale greenish and softly appressed pilosulous, whereas midrib and secondary veins are spreading white pilose, the margin callous denticulate at base, the teeth increasing in size to coarse dentations near the tip; principal lateral veins 8-10 on a side, ascending, their tips arched and interconnecting; cymes from the leaf axils, 1-flowered, white spreading glandular pilose; peduncles 27 mm. long, ascending; pedicels 22 mm. long; bracts 12 mm. long, lanceolate, foliaceous; flower unknown; fruiting calyx 1 cm. long when dried, campanulate, the inside glabrous, the outside densely spreading pilose, 2-lipped, the sinus between the lips reaching to within 4 mm. of the base; calyx tube 4-6 mm. long; upper lip of three lobes, these 4 mm. long, lanceolate, firm, the lower lip of two lobes, these 6 mm. long, ovate-lanceolate, all the lobes pilose within, especially towards tip; young fruit 10 mm. long, ovoid, tapering to a short beak, at apex pilose, the hairs smaller and sparser, down as far as the middle.

Distribution: Koolau Range, leeward side, in weedy woods, at 1,700 ft. alt., in the Koa Zone.

Holotype: Mt. Tantalus, 1,700 ft. alt., by trail on N. E. side, open weed-choked woods, Sept. 20, 1941, *H. St. John & W. B. Storey 20,255* (BISHOP MUS.).

Discussion: The type collection consists of a single leading stem of one single shrub. It was collected in 1941 after three years of watching younger

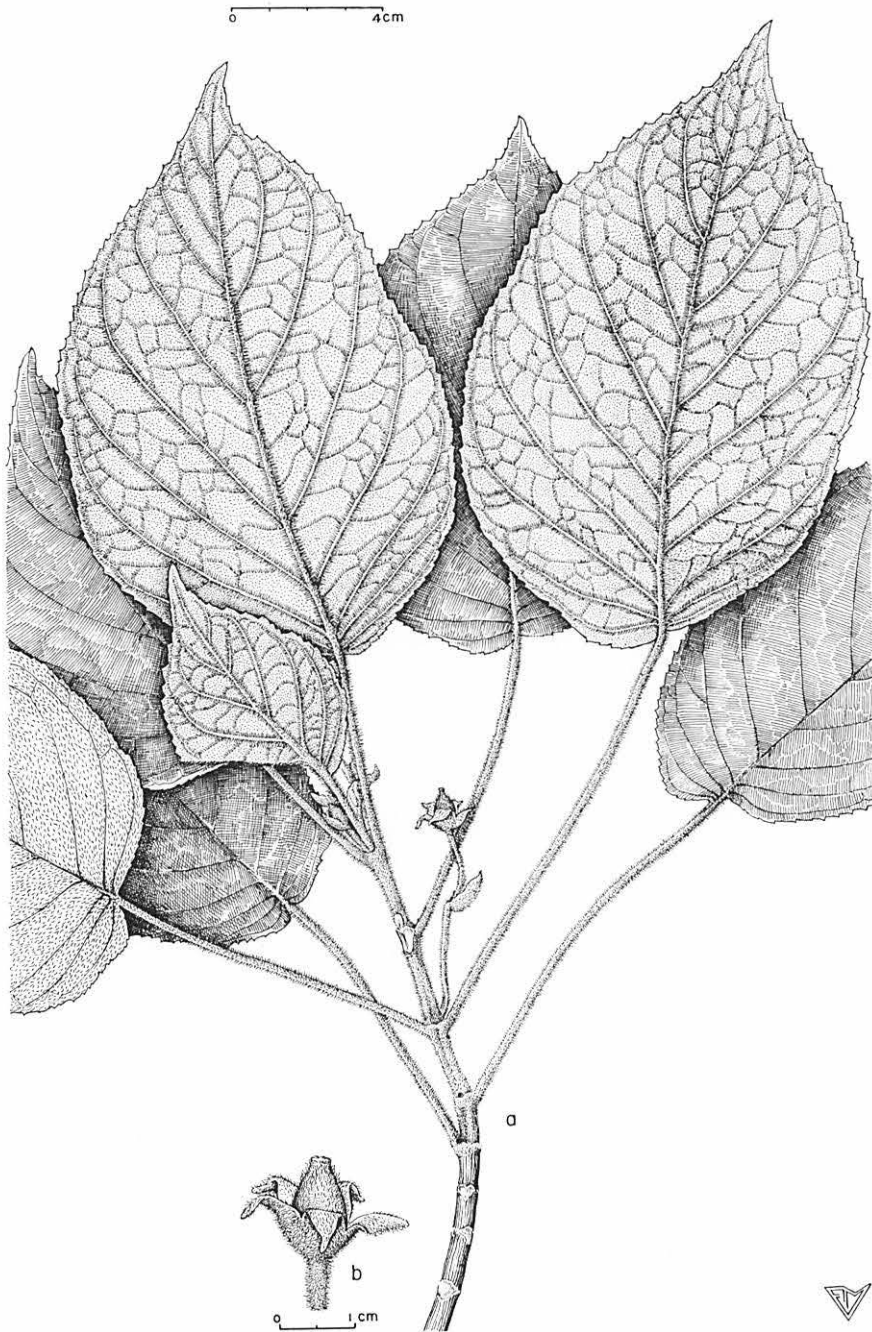


FIGURE 112.—*Cyrtandra piligyna*: a, habit, $\times \frac{1}{2}$; b, fruit, $\times 1$. Mt. Tantalus, St. John and Storey 20,255, holotype (Bishop Mus.).

plants. No subsequent collections have been made. Its closest relative is *C. crassior*, and the diagnostic differences between the two are stated in the key. *C. piligyna* also resembles *C. sandwicensis* but that species has narrower calyx lobes, smaller blades, cuneate at base, shorter petioles, etc.

80. *Cyrtandra scabrella* C. B. Clarke, in De Candolle, Monogr. Phanerog. 5 (1): 277, 1883.

C. Hillebrandi Oliver in Hillebrand, Fl. Hawaiian Is., 331-332, 1888, non *C. Hillebrandii* Vatke (1876) which is *C. waiolani* Wawra (1872); non *C. Hillebrandi* C. B. Clarke (1883) which is *C. Clarkei* Vatke ex Skottsberg, Acta Hort. Gotoburg 10: 168-170, 1936. (Figs. 113-115, 187.)

C. Oliveri Rock, Am. Jour. Bot. 6: 58-59, 1919.

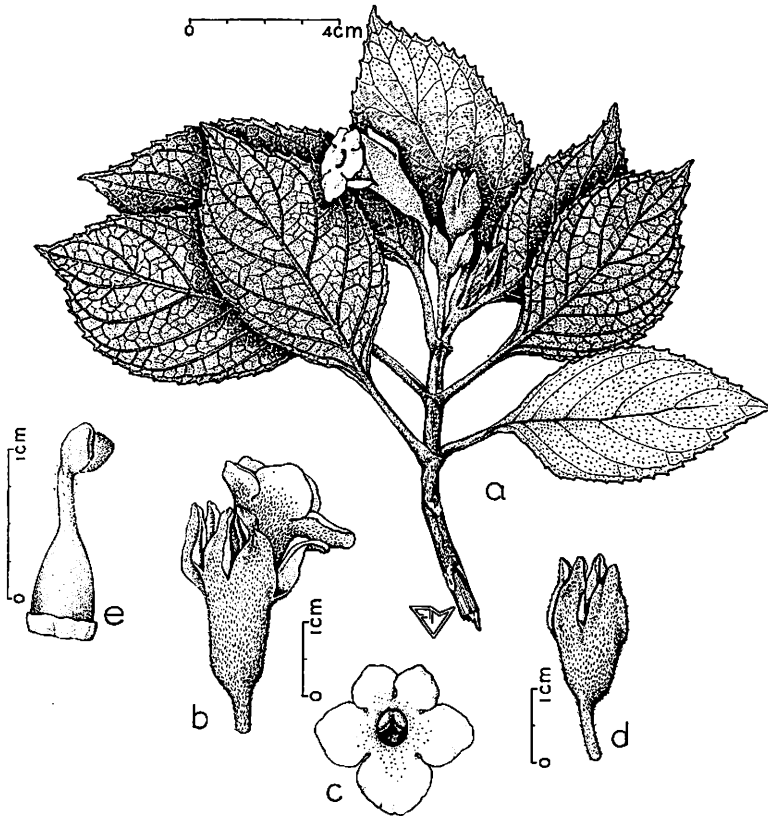


FIGURE 113.—*Cyrtandra scabrella*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Sandwich Is., Hillebrand 324 (Kew).

Description of All Specimens: Shrub; branches brown, when young appressed puberulent, subquadrangular, fleshy, shrinking and longitudinally ridged on drying; young shoots closely appressed puberulous; leaf scars 4-5 mm. high, pale, obdeltoid, bundle scars 5; leafy branchlets up to 4 mm. in diameter, sparsely appressed puberulent throughout; internodes 8-36 mm., averaging 15 mm. in length; *leaves* opposite, divergent, somewhat crowded, borne at the 4-5 upper nodes, those of a pair unequal and one being $\frac{1}{3}$ - $\frac{1}{6}$ larger; petioles 15-27 mm. long, stout and sparsely appressed puberulent; *blades* 7.5-12.5 cm. long, 32-60 mm. wide, thick and when dried subcoriaceous, oval or elliptic, the base cuneate and decurrent, the apex short acuminate, above dark olive green and sparsely hirsutulous, the hairs with large pustulate bases, and thus scabrous, below appressed puberulent throughout, the secondary veins 4-7 on a side, arcuate ascending, and near the margin reticulate incurved and intercon-

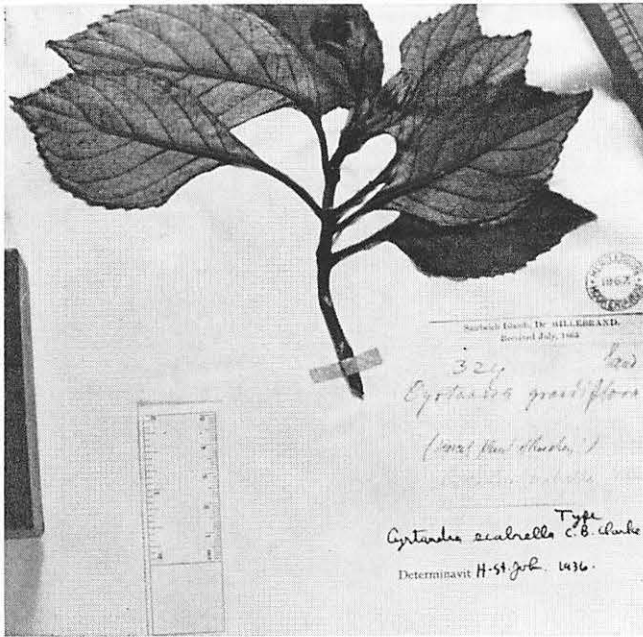


FIGURE 114.—*Cyrtandra scabrella*, isotype (Berlin). Sandwich Is., Hillebrand 324.

nected and salient in the coarse crenate-serrate teeth; *cymes* axillary, 3-5-flowered, appressed puberulent throughout; peduncles 16-20 mm. long; pedicels 10-23 mm. long; bracts 12-20 mm. long, elliptic, subacute; buds elliptic, the calyx lobes ascending; *calyx* in anthesis 22 mm. long when dried (25 mm. when boiled), greenish, within glabrous, without sparsely appressed puberulent, the tube 10 mm. long, narrowly campanulate, within glabrous; the limb 2-lipped, cleft down 12 mm. between lips, 5-lobed; upper lip 3-lobed, ascending, cleft down 11 mm. between the lobes, the lobes 6 mm. wide, narrowly ovate, obtuse, within glabrous; lower lip 2-lobed, cleft 12 mm. between the lobes, the lobes 7 mm. wide; the tube 8 mm. wide at the throat, narrowly campanulate; *corolla* 29 mm. long (when boiled), white, corolla tube 22 mm. long, within glabrous, the lower two-thirds 4 mm. in diameter, straight, without glabrous, the upper third gibbous campanulate, deflexed at 40° to the axis of lower tube, throat 7 mm. in diameter; limb 2-lipped, 5-lobed; 2 upper lobes 7 mm. long, 8 mm. wide, ovate-

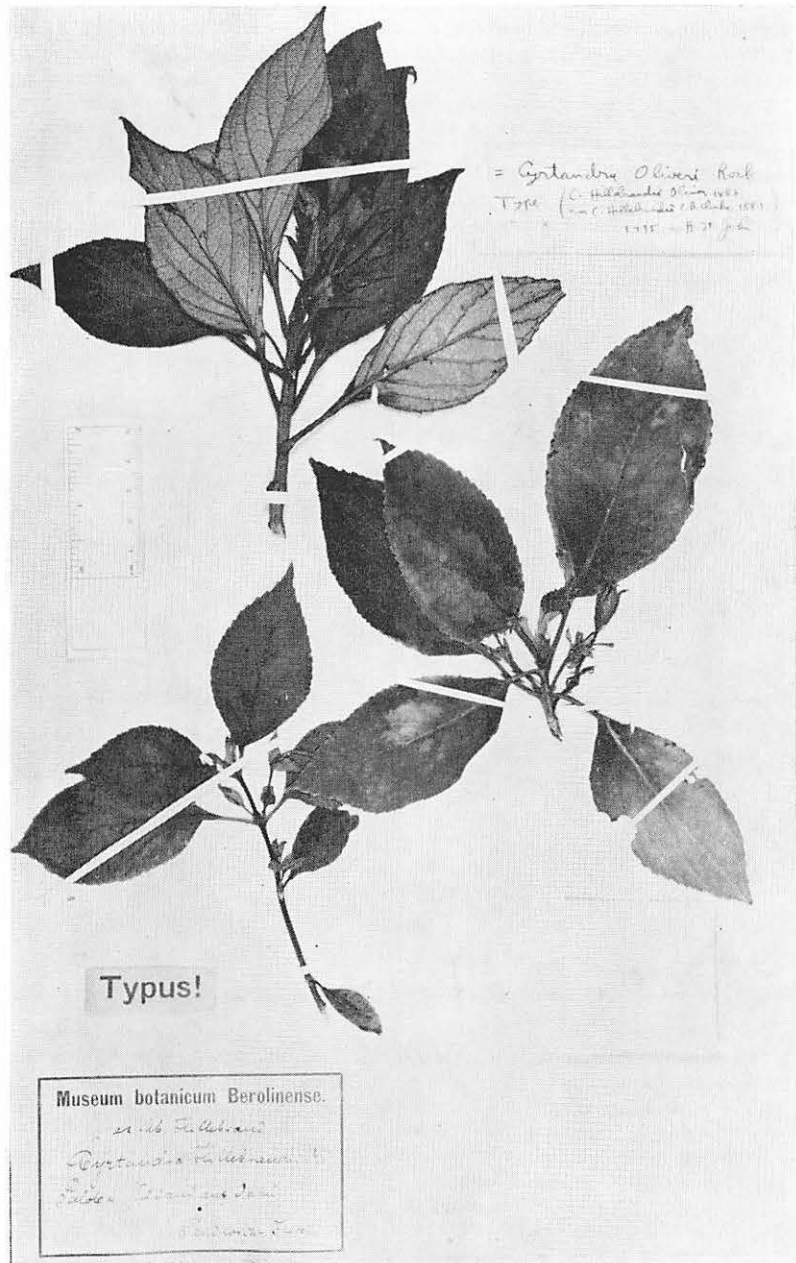


FIGURE 115.—*Cyrtandra Hillebrandi*, holotype (Berlin); this is a synonym of *C. Oliveri* Rock which has the same holotype. Palolo and Nuuanu, Hillebrand, and is now called *C. scabrella*.

suborbicular, without hirsutulous, within glandular puberulous at base; lower lip 3-lobed; lateral lobes 8 mm. long, 9 mm. wide, broadly ovate-suborbicular, pubescent like the upper lobes; lower lobe 8 mm. long, 10 mm. wide, suborbicular, the outer surface hirsutulous throughout, within glandular puberulous towards the base; two lower stamens adnate to the corolla tube to within 8 mm. of the throat, the free portion 3 mm. long, stout subulate, spirally upcurved, the two perfect anthers 3 mm. long, 2.5 mm. wide, very asymmetric oval, like the broad darker connective which is 1.5 mm. wide; the two lateral staminodia with their filament free part 0.7 mm. long, stout, the pale, translucent antheroid tip 0.5 mm. long, subulate; *style* 4 mm. long, stout, and sparsely capitate glandular pilosulous; stigmatic lobes two, 3 mm. long, 2.4 mm. wide, oval, cleft $\frac{3}{4}$ way to base on proximal side; *ovary* 7 mm. long, ovoid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; fruit unknown.

Type: "Ins. Sandwich (Hillebrand, n. 324 in h. Kew)." The more ample isotype (B) was labeled herb Hillebrand, Nuuanu, Oahu. Clastotype (BISHOP MUS.).

Though Hillebrand (1888: 331-332) stated the range as "Oahu! Nuuanu to Palolo," there are no known collections other than his single one from Nuuanu Valley. No subsequent collections have been made since Hillebrand's on the leeward side of the Koolau Range, hence the species is believed to be extinct. The small clastotype (BISHOP MUS.) is labeled "Palolo u[nd] Nuuanu, Oahu, Nuuanu Valley."

C. scabrella is here placed in the section *Crotonocalyces*, because of the structure of its calyx, though Clarke put it in the *Polynesiae* and Rock doubtfully in the *Cylindrocalyces*.

Discussion: *C. scabrella* has had an involved taxonomic and nomenclatorial history. Hillebrand in 1865 sent to the Kew Herbarium a duplicate of his collection No. 324, from the Sandwich Islands and tentatively named *C. grandiflora*. From Kew, Oliver apparently wrote to Hillebrand that it was a new species and that he would call it *C. Hillebrandi* Oliver. As this long remained in manuscript, Hillebrand included it in his "Flora of the Hawaiian Islands" (1888: 331-332) using the name *C. Hillebrandi* and crediting it to Oliver. Whether the description was supplied by Oliver or by Hillebrand is not now known. The type specimen at Kew is a single small, but good, branch 15 cm. long with 7 leaves and one inflorescence showing a bud and a flower. Hillebrand's own duplicate of this, deposited in Berlin, showed three similar flowering branches and detached floral parts. It bore the locality Nuuanu, but as usual, no number, his own herbarium not bearing collectors' numbers. Only the single shipment early sent from Honolulu to Kew had numbers, but these were only serial numbers of that particular shipment and not collectors' or exsiccatae numbers. This isotype is now believed destroyed by bombing in 1943, but it had been examined by the author in Berlin in 1936, and photographed (see Fig. 115). We noted corrections on the description as published by Hillebrand, as follows: leaves: for "pubescent above" read, scabrous appressed hirsutulous; for "or glabrate underneath" read, appressed puberulent; calyx: for "glabrate" read, appressed hirsutulous. Now on finally revising

the group we would also object to the description of the calyx as cleft into "broad lanceolate long acuminate lobes," rather they are narrowly ovate and obtuse. Otherwise Hillebrand's description is accurate for the type at Kew (which is before us at present) and to his more abundant isotype then at Berlin.

Rock (1919: 58-59) realized that *C. Hillebrandi* Oliver was a later homonym, so he renamed it *C. Oliveri* Rock, basing it directly upon the earlier name and description published by Hillebrand. He saw the isotype in Berlin and begged a clastotype of it, now in the Bishop Museum. His description is a direct copy of that by Oliver in Hillebrand except for converting the English measurements into metric ones. Thus *C. Hillebrandi* Oliver in Hillebrand and *C. Oliveri* Rock are exact synonyms. Rock cited a single recent collection of the species, from Kalihi Valley, *Hitchcock 14,105*. This specimen differs in numerous characters of calyx, corolla, pistil, and is now made the type of the new species *C. Skottsbergii* St. John & Storey.

Though unknown to both Hillebrand and Rock, this species was first and legitimately published in 1883 as *C. scabrella* C. B. Clarke. Hillebrand, though living till 1886 and traveling in Europe, never saw Clarke's monograph of *Cyrtandra*. Rock saw it but never studied the type specimen at Kew and did not recognize its identity from its description. In his revision, Rock (1919: 213) listed *C. scabrella* C. B. Clarke in the fourth and last part of his series, placing it in an Addenda to the section *Cylindrocalyces*, quoting Clarke's description. Rock stated that he was unable to give an opinion as to its validity, "It may be related to *C. longifolia*, but the 'callous serrate leaves' would bring it closer to *C. paludosa* than to the former, which has entire leaves." There should be no reflection on Clarke, for his description was ten lines in length, accurate and detailed; rather it illustrates the size and complexity of this genus in the Hawaiian Islands.

There were two earlier homonyms which made Oliver's name, published by Hillebrand, invalid. *C. Hillebrandii* Vatke (1876) was a later synonym of *C. waiolani* Wawra (1872). Also, there is *C. Hillebrandi* C. B. Clarke (1883) which is now called *C. Clarkei* Vatke ex Skottsberg (1936).

81. *Cyrtandra Skottsbergii* St. John and Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 80, 1950. (Figs. 116, 117, 195.)

C. Pickeringii Gray var. *latifolia* Skottsberg, Göteborg Bot. Trädgård, Med. 10: 169-170, 1936, not *C. latifolia* Bentham, in Hooker London Jour. Bot. 2: 228, 1843 which equals *C. cymosa* Forster, Char. Gen., 6, 1776.

Description of All Specimens Examined: Shrub; leafy branchlets somewhat quadrangular, 1.5-4 mm. thick; leaf scars 3-4 mm. high, cordate-shield-shaped; bundle scars 5; leaves opposite, unequal, one of a pair from $\frac{1}{5}$ to 2 times the larger; densely pilosulous, the hairs ferruginous, ascending pilosulous; blades 6.5-21 cm. long, 4.5-11.5 cm.

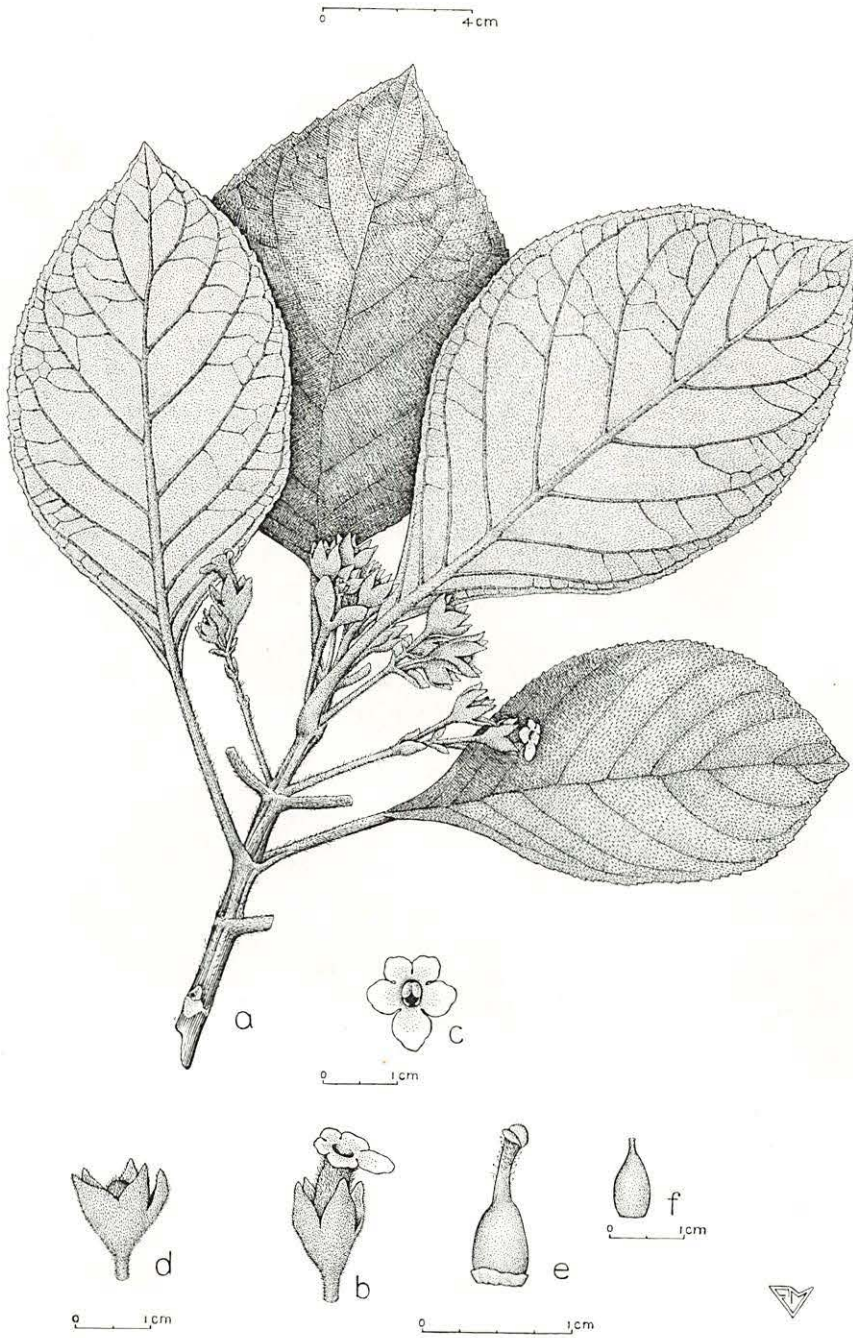


FIGURE 116.—*Cyrtandra Skottsbergii*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Oahu, Forbes in 1908.

wide, oval, the tip acute, the base cuneate and short decurrent, chartaceous, above dark green, sparsely and distantly appressed puberulent, below pale and densely white pilosulous, more noticeably so on the veins and veinlets, the hairs drying whitish; the margins shallowly undulate serrate; cymes 3-5-flowered, borne in the leaf axils, densely ascending pilosulous; peduncles 2-4 cm. long; pedicels 5-14 mm. long; bracts 6-10 mm. long, oblanceolate; buds cupulate, the calyx lobes ascending; calyx 13-16 mm. long,

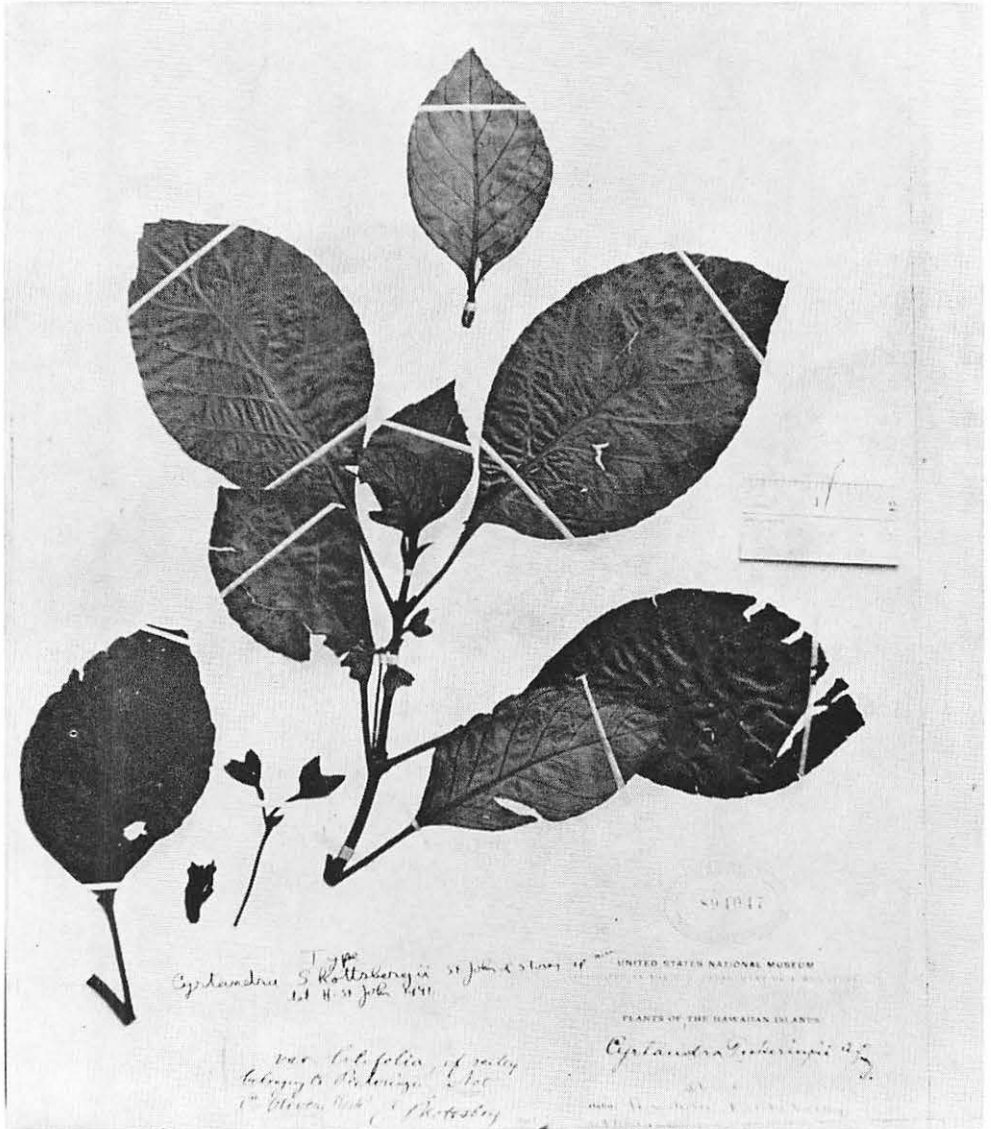


FIGURE 117.—*Cyrtandra Skottsbergii*, holotype (U. S. National Herbarium). Kalihi Valley, Hitchcock 14,105. Also holotype of *C. Pickeringii* var. *latifolia* Skottsberg.

funneliform, lobed $\frac{1}{2}$ to $\frac{2}{3}$ way into slightly unequal broadly ovate or lance-ovate, obtuse lobes without closely subappressed pilosulous, apparently persistent; the upper lobes 6-7 mm. long, the lower lobes 7-9 mm. long; *corolla* 18-25 mm. long, white, the tube 12-19 mm. long, 4-8 mm. in diameter, subcylindric, tapering down slightly from the broader throat, the enclosed base glabrous, the exposed upper part densely white villous, the throat open, the lobes 3-6 mm. long, semiorbicular, entire or somewhat lobed, spreading, the outer side villous, the margin villous ciliate, the inner side sparsely villosulous; filaments fused to the corolla tube to within 4 mm. of the throat, the free portion 2.5 mm. long, curved, subulate; anthers 3 mm. long, elliptic-ovoid; *style* 6 mm. long, stout, sparsely hirsute to glabrous; stigma with 2 lobes 2.5 mm. long, broadly oval to suborbicular, the margin sinuate, connate up one side $\frac{3}{4}$ way and lying in one plane; *ovary* glabrous; fruit unknown.

Distribution: Koolau Mts., leeward side, known definitely only from Kalihi Valley.

Holotype: Oahu: Kalihi Valley, Aug. 2, 1916, *A. S. Hitchcock* 14,105 (US; clastotype, BISHOP MUS.).

Specimens Examined: Oahu, without locality, 1908, *Forbes*.

Discussion: *C. Skottsbergii* is a member of the section *Crotonocalyces*. Its closest relative is *C. honolulensis* Wawra which grew in the same area, the mountain ridges behind Honolulu. The latter differs in being more densely and spreading pilose; the petioles 4-8 cm. long; blades very broadly oval to almost suborbicular, the upper surface more closely pilosulous; calyx densely spreading pilose, the bracts ovate or lance-ovate. In contrast, *C. Skottsbergii* is more sparsely pilosulous, the hairs ascending or subappressed; the petioles 30-47 mm. long; blades oval, the upper surface sparsely and distantly appressed puberulent; calyx closely subappressed pilosulous, the bracts oblanceolate.

Skottsberg described (1936: 169-170) this plant as a variety of *C. Pickeringii* Gray in a detailed discussion of that species and of *C. Clarkei* Vatke ex Skottsberg. As he indicates, *C. Pickeringii*, collected on the Wilkes Expedition, had not been found again, and its interpretation was misunderstood by Clarke, Hillebrand, and Rock. The writer concurs, but can see no specific relationship of the new plant to *C. Pickeringii*, which differs in habit, pubescence, leaf shape, and in shape and lobing of the calyx, as can be seen in our photograph of the type of Gray's species (Fig. 111). On the type sheet in the U. S. National Herbarium Skottsberg wrote "var. *latifolia*, if really belonging to *Pickeringii*."

Figure 117 shows the type sheet in Washington with the Bishop Museum clastotype, a leaf, a flower, and a cyme, placed upon it.

82. *Cyrtandra subcordata* St. John, sp. nov. (Figs. 118, 190).

Diagnosis Holotypi: Frutex 5 m. altus, ramulis 5-6 mm. diametro quadrangularibus griseo-brunneis sublucidis carnosus et in sicco contractis sulcatis, ramulis foliferis 2-5 mm. diametro dense capitato-glanduloso-pilosis, internodis 15-45 mm. plerumque 25 mm. longis, cicatricibus 4-8 mm. altis approximatis late scuteliformis pallidis suberosis, fasciculis 9; novellis dense albo-pilosulis, *foliis* oppositis adscendentibus econgatis in 3-5 nodis

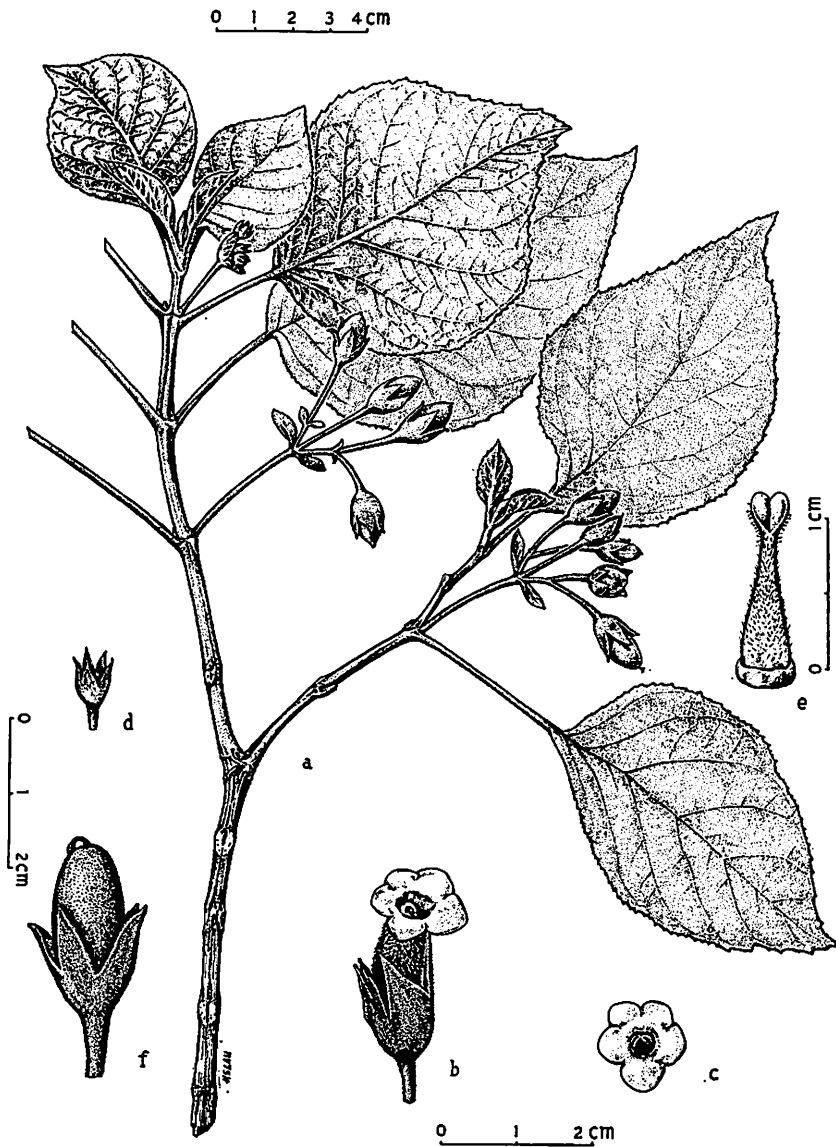


FIGURE 118.—*Cyrtandra subcordata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Moanalua, St. John 20,287, holotype (Bishop Mus.).

superis affixis uno plerumque $\frac{1}{2}$ minore, petiolis 15-90 mm. longis dense albo-pilosulis, *laminis* 7-16.5 cm. longis 32-102 mm. latis crasse molliter chartaceis late ovatis vel late ovalibus in basi asymmetricè subcordatis in apice acuto marginibus duplo dentatis supra obscure viridibus et sparse adpressi-albo-hirsutulis infra albescenti-viridibus et in nervis nervulisque dense pilosis sed in intervallis minus pilosulis, nervis secundariis 7-9 in uno latere adscendentibus et arcuatis apicibus interconnectis et in dentibus salientibus, *cymis* axillaribus 4-(5)-floriferis 5-8 cm. longis dense albo-pilosulis in fructu in ramis nudis, pedunculis 22-35 mm. longis, pedicellis 13-30 mm. longis, bracteis 13-30 mm. longis foliaceis anguste lanceo-ellipticis integris, alabastris late campanulatis, *calycibus* in vivo 13-15 mm. longis (in sicco 10-12 mm.) pallide viridibus exacrescentibus infundibuliformis vel campanulatis extra dense albo-pilosulis intra in tubo glabris inter labias 8-9 mm. partitis, lobis superis tribus 6-7 mm. partitis 3-4.5 mm. latis lanceolatis subacutis conniventibus porrectisque, lobis inferis binis 7-8 mm. longis 5-6 mm. latis late lanceolatis intra albo-pilosulis, *corollis* in vivo 19-21 mm. longis extra dense albo-hirsutis excepta in basi inclusa, tubo 16 mm. longo subcylindrico in basi contracto et 4 mm. diametro tunc supra 6 mm. diametro et in loco $\frac{2}{3}$ ex orifice in 25° sensim decurvato lobis 5 extra hirsutulis excepta partibus in alabastris clausis intra glabris, lobis superis binis 3 mm. longis 5 mm. latis transverse ellipticis in basi auriculatis impensisque, labia infera trilobata, lobis lateralibus 3.5 mm. longis 5.5 mm. latis similibus, loba infera 4.5 mm. longa 5.5 mm. lata semiorbiculari, staminibus binis inferis in tubo 5 mm. ex orifice affixis parte libera 2 mm. longa tortuosa, antheris 3 mm. longis 2.5 mm. latis oblique ovatis sagittatis, connectivo 1.8 mm. lato ovato, staminodeis lateralibus in tubo 7 mm. ex orifice affixis filamenta libera 0.2 mm. longa, apice antheroideo 0.5 mm. longo anguste lanceolato translucenti, *style* 2 mm. longo capitato-glanduloso-piloso, lobis stigmatis 2.8 mm. longis oblongo-ellipticis $\frac{1}{3}$ connatis in dorso glabro, *ovario* 7 mm. longo 3 mm. lato linearilanceoloideo itaque piloso in basi cum disco cupulato 0.9 mm. alto cincto, *baccis* 17-22 mm. longis 8-9 mm. diametro anguste elliptico-ovoideis albis hirsutulis, seminibus 0.23-0.29 mm. longis 0.08-0.10 mm. diametro breve oblique fusiformis obscure mellicoloratis in apicibus brunneis in epidermati grosse oblongo-reticulatis areolis $\frac{1}{4}$ - $\frac{1}{2}$ longis quam seminam.

Description of Holotype: Shrub 5 m. tall; branchlets 5-6 mm. in diameter, quadrangular, gray brown, smooth, somewhat shining, fleshy and on drying shrinking to form longitudinal furrows and ridges; leafy branchlets 2-5 mm. in diameter, quadrangular, greenish, and densely capitate glandular pilose; internodes 15-45 mm., usually about 25 mm. long; leaf scars 4-8 mm. high, almost touching, broad shield-shaped, pale, corky; bundle scars 9; young shoots densely spreading white pilosulous; *leaves* opposite, ascending, not crowded, attached at the 3-5 upper nodes, one of each pair usually about $\frac{1}{2}$ the smaller; petioles 15-90 mm. long, densely spreading white pilosulous; *blades* 7-16.5 cm. long, 32-102 mm. wide, soft thick chartaceous, broadly ovate or broadly oval, the base asymmetric subcordate, the apex acute, the margins doubly dentate, above dark green and sparsely appressed white hirsutulous, below whitish green and densely spreading pilose on the veins and veinlets, more sparsely white pilosulous on the intervals, the secondary veins 7-9 on a side, ascending, then upward arcuate, the tips interconnecting and salient in the teeth; *cymes* axillary, in flower among the leaves, but in fruit often from naked nodes, 4-(5)-flowered, ascending at about 45° , densely spreading white pilosulous, 5-8 cm. long; peduncles 22-35 mm. long; pedicels 13-30 mm. long; bracts 6-12 mm. long, foliaceous, narrowly lance-elliptic, entire; buds broadly campanulate; *calyx* 13-15 mm. long (when fresh), (10-12 mm. when dried), pale green, not accrescent, funnelliform to campanulate, densely spreading white pilosulous without, within the tube glabrous, 2-lipped, cleft 8-9 mm. between the lips, and appearing to be lobed $\frac{1}{2}$ to $\frac{3}{4}$ way; upper lip 3-lobed, cleft 6-7 mm. between the lobes, these lobes 3-4.5 mm. wide, lanceolate, subacute, connivent and porrect; lower lip 2-lobed, the lobes 7-8 mm. long, 5-6 mm. wide, broadly lanceolate; calyx lobes within white pilosulous; *corolla* when fresh 19-21 mm. long, shaggy white hirsute without except near the enclosed base, the tube 16 mm. long, subcylindric, at the very base contracted

and 4 mm. in diameter but immediately above it 6 mm. and so elsewhere, gently deflexed $\frac{3}{5}$ way from the throat at 25° from the axis of the lower tube, within glabrous; limb 2-lipped, 5-lobed, the lobes hirsutulous without, except where covered in vernation, and all glabrous within; upper lobes two, 3 mm. long, 5 mm. wide, spreading at about 70° , transversely elliptic, the base auriculate and overlapping; lower lip 3-lobed; lateral lobes 3.5 mm. long, 5.5 mm. wide, similar to the upper; lower lobe 4.5 mm. long, 5.5 mm. wide, semiorbicular; two lower stamens with filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 2 mm. long, stout, spirally up-curved; the perfect anthers 3 mm. long, 2.5 mm. wide, ovate sagittate, oblique, the dark connective 1.8 mm. wide, ovate; the two lateral staminodia with their filaments adnate to the corolla tube to within 7 mm. of the throat, the free part 0.2 mm. long, bearing a recurving antheroid tip 0.5 mm. long, narrowly lanceolate, pale, translucent; *style* 2 mm. long, pilose and the hairs with minute glandular capitate tips; the two stigmatic lobes 2.8 mm. long, oblong-elliptic, connate $\frac{1}{3}$ way up proximal side, the backs glabrous; *ovary* 7 mm. long, 3 mm. wide, linear lanceoloid, similarly pubescent, base surrounded by a dark cupulate disk 0.9 mm. high; *berry* 17-22 mm. long, 8-9 mm. in diameter, narrowly elliptic-ovoid, white, and hirsutulous throughout; seeds 0.23-0.29 mm. long, 0.08-0.10 mm. in diameter, short oblique spindle-shaped, dark honey-colored with brown ends, the surface with heavy, raised, oblong reticulations $\frac{1}{4}$ - $\frac{1}{2}$ as long as the seed.

Distribution: Koolau Range, leeward side, at 1,400 ft. alt., in Moanalua, in the Koa Zone.

Holotypus: Oahu, Moanalua Valley, East Ridge, $\frac{2}{3}$ way up, moist shaded gulch, 1,400 ft. alt., April 18, 1942, *H. St. John 20,287* (BISHOP MUS.).

Discussion: *C. subcordata* is a member of the section *Crotonocalyces*. A relative is *C. cordifolia* Gaud. var. *cordifolia* which grows on the full length of the leeward side of the Koolau Range, and also occurs at Moanalua. Still closer relatives are *C. villosiflora* St. John and *C. Pearsallii* St. John. These four are adjacent in, and their contrasting characters are given in the key.

The new specific epithet is from the Latin, *sub*, somewhat so; *cordata*, heart-shaped, in allusion to the shape of the blade base.

83. *Cyrtandra Vanioti* Léveillé, Fedde Repert. Sp. Nov. 10: 155, 1911. (Figs. 119, 191.)

C. Vaniotii Léveillé ex Rock, Am. Jour. Bot. 6: 205-206, 1919 (name misspelled).

Description of Isotype: Shrub; branches soon glabrate, smooth, pale brown, with slight longitudinal furrows, naked below, as much as 8 mm. in diameter, terete; leaf scars 2.5-3 mm. high, pale, broad shield-shaped; bundle scars 7; young shoots densely pilosulous; leafy branchlets as much as 3 mm. in diameter, densely pilosulous; internodes 6-48 mm. averaging 8 mm. long; *leaves* opposite, ascending, then diverging, borne at the 3-4 upper nodes, crowded in a terminal plume, those of a pair unequal, one being about $\frac{1}{2}$ larger; petioles 8-23 mm. long, densely pilosulous; *blades* 3.4-6.7 cm. long, 19-41 mm. wide, firm, thick chartaceous, asymmetric oval, the base short cuneate, the apex abruptly acute, above dark green, pilosulous, the hairs separated, below pale greenish, densely pilosulous velvety, the margins serrulate, the secondary veins 5-8 on a side, the vein tips arching forward, indistinct at the margin; *cymes* 3-5-flowered, axillary, densely pilosulous; peduncles 12-19 mm. long, slender; pedicels 5-10 mm. long; bracts 4-7 mm. long, lanceolate or oblanceolate, foliaceous; buds at first fusiform or turbinate, soon campanulate, the calyx lobes erect; *calyx* in anthesis 7-8

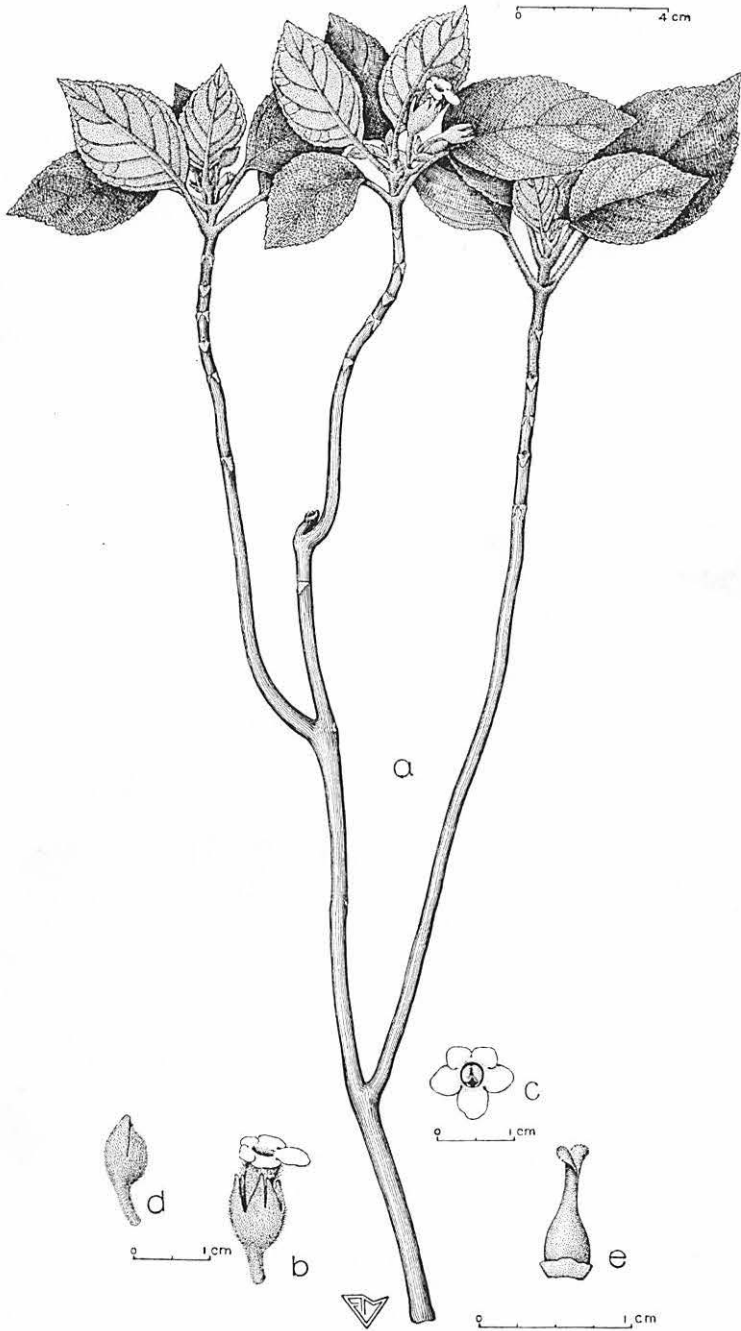


FIGURE 119.—*Cyrtandra Vanioti*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Mt. Kaala, Faurie 1,144, isotype (Bishop Mus.).

mm. long (when boiled), green, pilosulous without and on the margins, within glandular atomiferous, the tube 2.8 mm. long, campanulate; the limb 2-lipped, cleft down 6 mm. between lips, 5-lobed; upper lip 3-lobed, cleft down 5 mm. between lobes; the lobes 2.3-2.5 mm. wide, lanceolate, all the lobes smooth callous and blunt at the apex; lower lip with 2 lobes, cleft 5.3 mm. between the lobes, 2 mm. wide, lanceolate, obtuse; *corolla* 13.5 mm. long (when boiled), white, only very slightly decurved glabrous within, the tube 10.5 mm. long, subcylindric, 3 mm. in diameter, the lower third glabrous without, the rest white pilose; limb 2-lipped, 5-lobed; upper lobes 2, and 2.5 mm. long, 3.5 mm. wide, rhombic-suborbicular, auriculate and much overlapping at base and sides; lower lip 3-lobed; lateral lobes 3-3.5 mm. long, 3 mm. wide, broadly oval, recurved at about 50° from the axis of the upper throat; two lower stamens perfect, the filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 3 mm. long, 1 mm. wide, spirally upcurved, ligulate, the 2 perfect anthers 2.7 mm. long, obliquely broad oval, the apices connate, the connective ovate; the staminodia adnate to the tube to within 5.5-6 mm. of the throat, subulate 0.2-0.3 mm. long; *style* 4 mm. long, glabrous; stigmatic lobes 2, sessile, 3 mm. long, oval, connate $\frac{2}{3}$ way up the proximal side; *ovary* 5-6 mm. long, lance-ovoid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; fruit unknown.

Distribution: Waianae Mts., Mt. Kaala, without further localization.

Type: "Oahu: Kaala, nov. 1909 (*Faurie*, 1144)." Holotype not seen.

The isotype (BISHOP MUS.) is similarly labeled. As Rock has already indicated (1919: 206) this specimen is labeled in L veill 's hand *Cyrtandra Wainotii* L vl. sp. n., an erroneous rendering of *C. Vanioti* but Rock redetermined it as *C. Garnottiana* Gaudichaud, also a misspelling of *C. Garnotiana*.

Discussion: *C. Vanioti* is a member of the section *Crotonocalyces*. Its closest relative seems to be *C. hirsutula* St. John and Storey of the same peak in the Waianae Mts., Mt. Kaala. This species has the blades narrowly oblanceolate, 9-16 mm. wide, glabrous above and sparsely hirsutulous below, nearly entire; calyx 12-15 mm. long; and the corolla 18-23 mm. long, *C. Vanioti* differs in having the blades asymmetric oval, 19-41 mm. wide, serrulate, above and below pilosulous; calyx 7-8 mm. long; and the corolla 13.5 mm. long.

L veill  either did not understand the genus *Cyrtandra* or his studies were too hurried to allow for detailed research and careful evaluation of the results. His descriptions of his new species were usually almost telegraphic in brevity and of his few words, a number have no diagnostic significance. The fact that he described a genuine new species of *Cyrtandra*, but placed it in the *Violaceae* and in the genus *Viola*, is an indication of the carelessness of his studies and of the degree of his knowledge of the Hawaiian flora. Rock in a caustic review of L veill 's novelties (1914: 359), reduced all of his *Cyrtandra* species to synonymy. However, L veill  described several good species in *Cyrtandra*. *Faurie* gathered eight collections of *Cyrtandra*. L veill  sorted these into six species of *Cyrtandra* and one of *Viola*, all of which he described as new. In a large and technical genus with many undescribed species, even a random sampling, with eyes closed, could have chanced on some new species. In our revision two of his species are restored and maintained.

Rock, who had a revision of *Cyrtandra* in preparation, obtained a set of the Faurie-Léveillé Hawaiian plants and wrote a severe criticism of Léveillé's proposed species, reducing most of them to synonymy. He reduced *C. Vanioti* to *C. Garnotiana* Gaudichaud, a species he said was "confined to the western end of Oahu, especially Mount Kaala" (1919: 206). Recent collections and studies show that *C. Garnotiana* is widely distributed in the Waianae Mountains, and is very abundant on the lee side of the Koolau Range from the Poamoho Trail to Nuuanu. *C. Vanioti* Léveillé, though known only from the type collection from Kaala, without further geographic detail, proves to be a clearly distinct species. Its numerous diagnostic characters can easily be noted from the description, key, and illustration.

The source of the specific name was not explained. However, in the same year, 1911, Léveillé described a *Myrsine Vanioti*, and in 1913 recombined the latter specific name as *Suttonia Vanioti*. As these names were surely personal ones, a search was made in vain in the principal botanical bibliographies for a publishing botanist of that name. Eventually there was found in Dorfler (1909: 134) that there was a French botanist, Eugène Vaniot, interested in the Compositae, a resident of Le Mans, Sarthe, France. It appears that Prof. Augustin Abel Hector Léveillé named these species for his contemporary fellow botanist and fellow townsman, E. Vaniot.

84. *Cyrtandra villicalyx* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 80, 1950.

Description: Shrub 2-4 m. tall; *leaves* opposite 4-16 cm. long; *blades* suborbicular, above villous; *cymes* 3-4-flowered; *calyx* 15-30 mm. long, villous; *corolla* 20-22 mm. long, white; *berry* glabrous or puberulent.

This is composed of the two following varieties.

85. *Cyrtandra villicalyx* St. John & Storey var. *villicalyx* (Figs. 120, a-f, 121, 189).

Description of All Specimens Examined: Shrub 2-4 m. tall, 2-5 cm. in diameter at base; stems brown, smooth; leaf scars 4-8 mm. high, pale, broad shield-shaped, separate; bundle scars 9; young shoots densely shaggy viscid villous, the hairs white but drying tawny; leafy branchlets as much as 6 mm. in diameter, quadrangular, villous; internodes 1.7-6 cm., averaging 3 cm. in length; *leaves* opposite, ascending at about 45°, not crowded, borne at the 1-5 upper nodes, those of a pair unequal, one being $\frac{1}{5}$ - $\frac{1}{8}$ larger; petioles 4-16 cm. long, shaggy villous; *blades* 11-24.5 cm. long, 8-22 cm. wide, chartaceous, suborbicular (or small ones rarely ovate and even cuneate) the apex short acuminate, the base unequal but strongly cordate with overlapping lobes, above dark green, catenulate villous, below whitish green, shaggy villous on the veins and softly so on the intervals, the margins denticulate or serrate-denticulate, the veins 7-9 on a side, straight, ascending at 45°, then arcuate, the tips inarching and interconnected and salient in the teeth; *cymes* axillary, numerous, densely pale glandular villous with multicellular hairs about 1 mm. long, 3-flowered or rarely 4-flowered; peduncles 23-50 mm. long, in anthesis ascending, in fruit divergent or even reflexed; pedicels 13-28 mm. long stiffly ascending; bracts 14-27 mm. long, ovate-lanceolate foliaceous, shaggy, glandular villous,

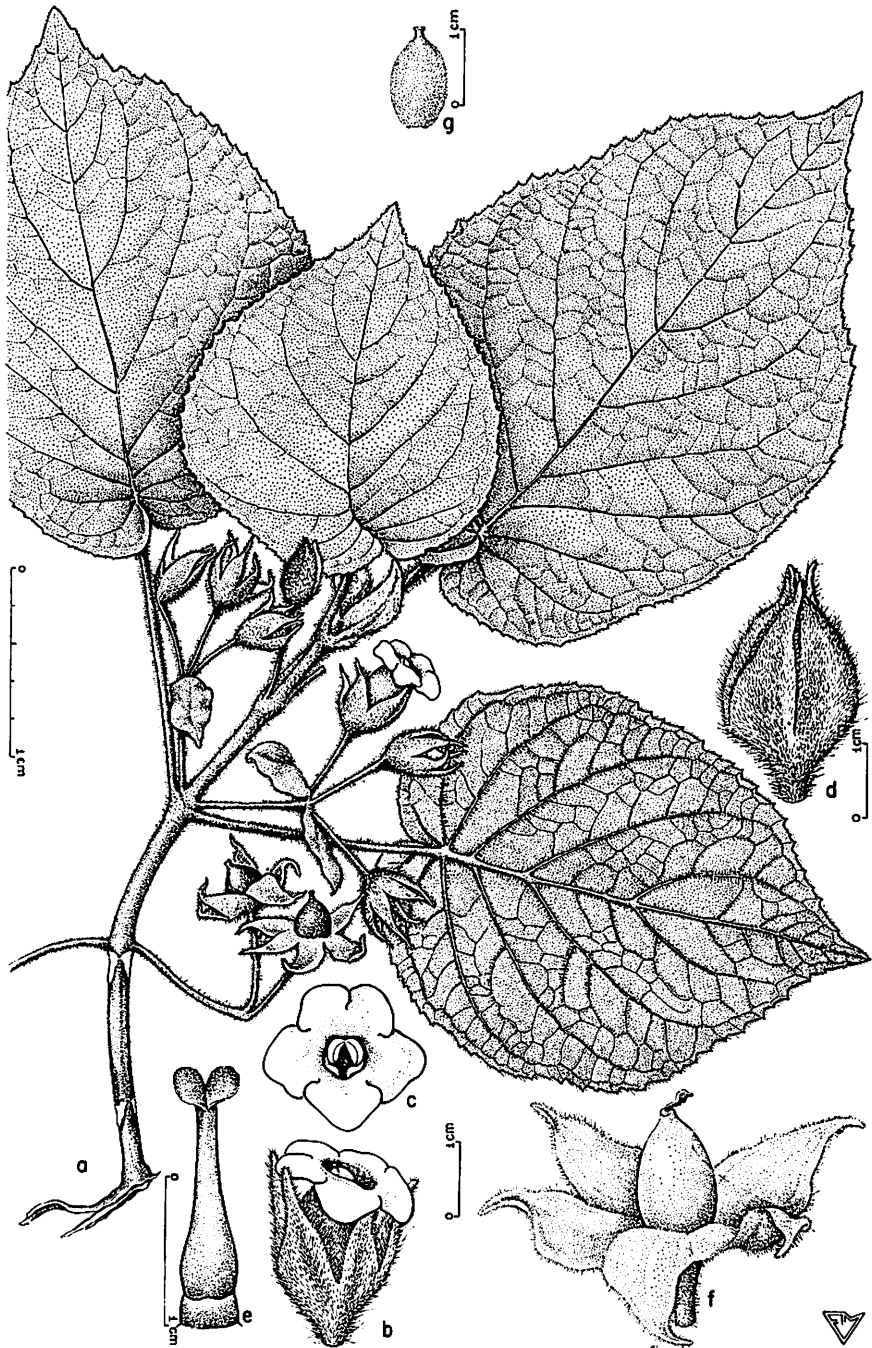


FIGURE 120.—*Cyrtandra villicalyx*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$; g, fruit of var. *piligna*, $\times 1$. Waikane-Schofield, Waikane, St. John and Storey 20,239, holotype (Bishop Mus.).

caducous; buds densely shaggy, glandular villous, at first subglobose, later as the calyx lobes open becoming campanulate; *calyx* 15-30 mm. long, not accrescent, pale green, but in fruit white, outside shaggy, glandular villous, inside with the parts beyond the middle shaggy, glandular villous but below the middle glandular pilose or pilosulous, broadly campanulate, but 2-lipped, the 3 lower lobes 4-5 mm. wide, lanceolate, acuminate, cleft $\frac{4}{5}$ to $\frac{5}{6}$ way to the base, upper lip with 2 lobes 8-10 mm. wide, ovate, abruptly acuminate, cleft $\frac{1}{2}$ to $\frac{1}{3}$ way; *corolla* 22-25 mm. long, white, the tube cylindric, straight or slightly decurved at or beyond the middle, 7-8 mm. in diameter, outside

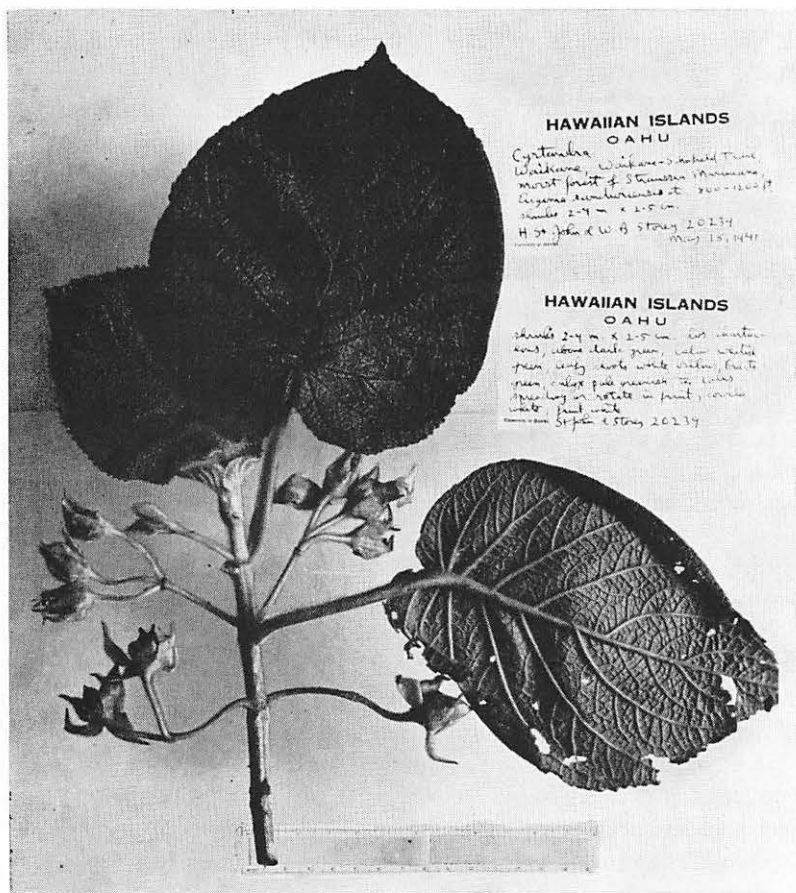


FIGURE 121.—*Cyrtandra villicalyx*, holotype (Bishop Mus.). Waikane, St. John and Storey 20,239.

glandular pilose almost to the base, inside glabrous; the throat open, 5-7 mm. in diameter; limb 2-lipped, 5-lobed, the lobes recurving at about 100° to 110° to the axis of the upper tube; the two upper lobes 4 mm. long, 8 mm. wide, cordate at base, transversely oval; lower lip with two lateral lobes 7 mm. long, 10 mm. wide, broadly deltoid, very obtuse, the lower lobe 6 mm. long, 10 mm. wide, broadly deltoid, the angles and apex very obtuse, the lobes all glabrous inside, outside glabrous near the margin, glandular villous at base and up the center; filaments adnate to the corolla tube

to within 8 mm. of the throat, the free portion 3 mm. long, stout, subulate, spirally up-curved; anthers 4 mm. long, obliquely elliptic, flattened, sagittate at base; style stout, 6 mm. long, the 2 terminal stigmatic lobes 3 mm. long, oval, connate $\frac{1}{3}$ way up the proximal side; ovary 8 mm. long, glabrous, lanceoloid, the base surrounded by a cupulate disk 1.7 mm. high; berry 14-20 mm. long (when dried), 11-13 mm. in diameter, ovoid, apiculate beaked; seeds 0.38-0.46 mm. long, 0.14-0.22 mm. wide, regularly or asymmetrically ellipsoid or fusiform, amber-colored with darker ends, the surface covered with raised cellular narrow oblong reticulations $\frac{1}{4}$ as long as the seed.

Distribution: Koolau Range, windward side, in upper Waikane and upper Kahana Valleys, common in wet forests from 800 to 1,200 feet altitude, in the Ohia Zone.

Holotype: Oahu, Waikane-Schofield Trail, Waikane, Koolau Range, 800-1,200 ft. alt., moist forest of *Straussia Marimiana*, *Eugenia sandwicensis*, etc., May 18, 1941, *H. St. John & W. B. Storey 20,239* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Kahana, 900 ft. alt., moist forest on steep slope, May 18, 1941, *St. John 20,244*; Waikane-Schofield Trail, Waikane, 205 m. alt., wet forest, Oct. 16, 1932, *Fosberg 8,785*; ditto, moist forest of *Perrottetia*, *Eugenia sandwicensis*, and *Gardenia Mannii*, 1,000 ft. alt., June 29, 1947, *St. John 22,692*; ditto, wet forest of *Metrosideros* and *Eugenia sandwicensis*, 800 ft. alt., Dec. 2, 1951, *St. John 24,712*.

Discussion: *C. villicalyx* is a member of the section *Crotonocalyces*. It is similar to, one might even say that it mimics *C. cordifolia* which is a very common species known to almost all botanists who visit the Hawaiian Islands. They meet it on the ridges behind Honolulu, and, for that matter, on any ridge along the whole leeward side of the Koolau Range. *C. villicalyx* is equally common in upper Waikane and Kahana, a region frequently explored along the Waikane-Schofield Trail. Why none of the many earlier botanists to collect on this trail gathered this species is difficult to understand. It is abundant for a mile in the woods and right up to the edge of the trail, the biggest and most conspicuous species of the fifteen species of *Cyrtandra* encountered along that mountain trail. Not everyone would single it out as new, but why no one collected it is inexplicable. Its closest relative is *C. cordifolia*. The two are adjacent in and are contrasted in the key.

The specific name was coined from Latin *villus*, long weak hairs; and Greek, *calyx*, a cup, or the calyx.

86. *Cyrtandra villicalyx* St. John & Storey var. *pubentigyna* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 80, 1950. (Figs. 120, g, 189.)

Description of All Specimens Examined: Differs from the species by having the berry viscid puberulent.

Range: Same as the species.

Holotype: Koolau Mts., Hauula Forest Reserve, Kahana Valley, 1,100 ft., shady moist slope, Dec. 10, 1933, *Frank Kitamura* (BISHOP MUS.).

Specimens Examined: Koolau Range, Windward Side: Waikane-Schofield Trail, near Waikane Ditch House, 850 ft. alt., in rain forest, Dec. 10, 1933, *Yoshioka*.

There is a possibility that this might be a hybrid between *C. villicalyx* and *C. propinqua* Forbes, as the new plant has pubescent fruits, but they are puberulent, not villous. In other details it is a good match for *C. villicalyx* with which it grows. It seems best classified as a variety of that species.

The varietal name was coined from the Latin *pubens*, pubescent; and the Greek *gune*, woman, in allusion to the hairy ovary.

87. *Cyrtandra villosiflora* St. John, sp. nov. (Figs. 122, 186).

Frutex 3 m. altus, ramis 4-8 mm. diametro cortice griseo vel brunneo glabrato in sicco contracto et sulcato, cicatricibus 3-7 mm. altis scutelliformibus corticosis, fasciculis 7; internodiis 8-23 mm. plerumque 15 mm. longis, ramulis foliferis 1.5-3 mm. diametro quadrangularibus crebre albescentibus capitato-glanduloso-pilosis, *foliis* oppositis adscendentibus tunc divergentibus in 3-4 nodis superis affixis inaequalibus uno $\frac{1}{3}$ minore, petiolis 15-50 mm. longis crebre capitato-glanduloso-pilosis, *laminis* 8-12.5 cm. longis 44-80 mm. latis crasse chartaceis ellipticis vel late ovatis et subsymmetricis in basi rotundata vel breve cuneata inaequali in apice acuto supra obscure viridibus et semiadpresso-hirsutulis et ita subscabris infra albescentibus et albo-pilosulis et in nervis ita dense marginibus depresso-serrulatis nervis secundariis 7-8 in uno latere adscendentibus et antice arcuatis et in apicibus interconnectis et in dentibus salientibus, *cymis* axillaribus (3)-5-9-floriferis singulis dense minute capitato-glanduloso-pilosis in fructu subumbellatis, pedunculis 13-28 mm. longis in 45° adscendentibus, pedicellis 8-20 mm. longis, bracteis 9-28 mm. longis 5-17 mm. latis foliaceis lanceo-ovatis eis majoribus petiolatis serrulatisque, alabastris turbinatis infra sinus angulos lobis divergentibus, *calycibus* in vivo 13-14 mm. longis (in sicco 9-11 mm.) subviridibus campanulato-infundibuliformis extra dense albo-capitato-glanduloso-pilosis, tubo 6-7 mm. longo intra albo-puberulento, limbo 5-lobato minime bilabiato intra itaque piloso, labia supera 3-lobata lobis 7-8 mm. longis in juvente conniventibus deinde distinctis late deltoideis subacutis in basi 6-7 mm. latis, labia infera itaque pilosa bilobata 9 mm. partita lobis late ovatis in basi 7-8 mm. latis apice 1.5-2 mm. longo subulato, *corollis* in vivo 18 mm. longis albis extra dense albi-villosis, tubo 14 mm. longo subcylindrico sed parum ellipsoideo intra glabro 7 mm. diametro in media 6 mm. in orifice, limbo bilabiato, lobis superis binis 2 mm. longis 3.5 mm. latis transverse late ellipticis intra glabris, labia infera 3-lobata lobis lateralibus 3 mm. longis 5 mm. latis transverse late ellipticis, loba infera 4 mm. longa 5.5 mm. lata deltoideo-suborbiculari, staminibus binis inferis in tubo 6 mm. ex orifice affixis, filamenta libera 1.5 mm. longa, antheris 2.5 mm. longis, 1.8 mm. latis, staminodeis lateralibus binis in tubo 5 mm. ex orifice affixis parte libera 0.5 mm. longa lanceolata, *stylo* 2 mm. longo capitato-glanduloso-pilosulo, lobis stigmatis binis 2.5 mm. longis anguste ellipticis $\frac{1}{3}$ connatis in dorso sine pilis sed papilloso, *ovario* 8-9 mm. longo lanceoloideo dense capitato-glanduloso-pilosulo, *baccis* 18-19 mm. longis 9 mm. diametro ovato-lanceoloideis albis capitato-glanduloso-puberulentis, seminibus 0.22-0.25 mm. longis 0.12-0.15 mm. diametro late ellipsoideis vel oblique ita mellicoloratis sed apicibus brunneis testis grosse oblongo-reticulatis areolis $\frac{1}{5}$ - $\frac{1}{6}$ longis quam seminam.

Description of All Specimens Examined: Shrub 3-4 m. tall; branches 4-8 mm. in diameter, the bark gray to brown, glabrate, on drying with longitudinal furrows and ridges; leaf scars 3-7 mm. high, shield-shaped, pale, corky; bundle scars 7; internodes 8-50 mm., averaging about 20 mm. long; leafy branchlets 1.5-3.5 mm. in diameter,

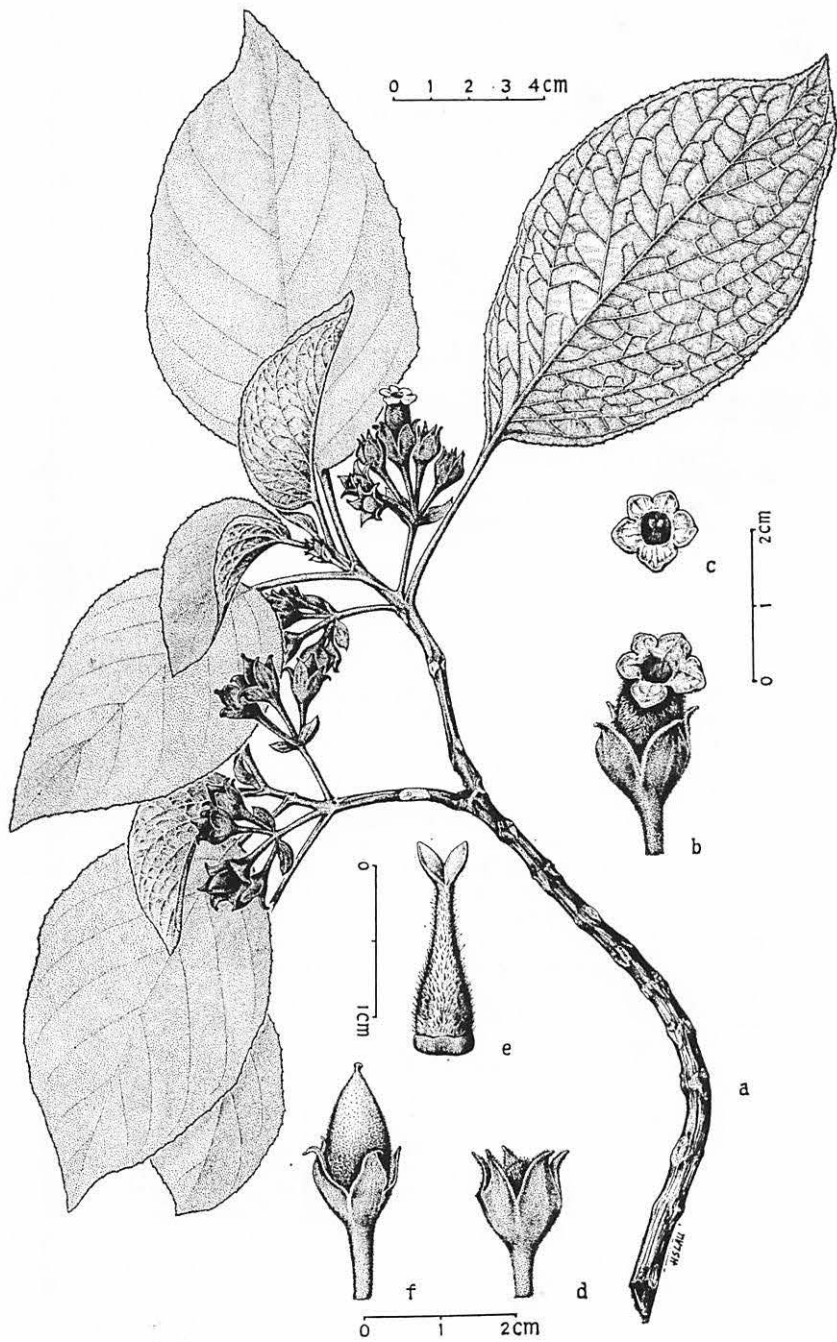


FIGURE 122.—*Cyrtandra villosiflora*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Moanalua, St. John 20,289, holotype (Bishop Mus.).

quadrangular, densely spreading whitish capitate glandular pilose; *leaves* opposite, ascending to diverging, borne at the 3-4 upper nodes, unequal, one of a pair being $\frac{1}{3}$ the smaller; petioles 15-70 mm. long, densely capitate glandular pilose; *blades* 8-19 cm. long, 44-97 mm. wide, thick chartaceous, elliptic to broadly ovate, a little asymmetric, the base rounded or short cuneate, unequal, the apex acute, above dark green, and semiappressed hirsutulous and thus somewhat scabrous, below whitish, and white pilosulous, more shaggily so on the veins, the margin low serrulate, the secondary veins 7-9 on a side, ascending, then upwards arcuate and the tips interconnected and salient in the teeth; *cymes* in the leafy axils, (3)-5-9-flowered, single, densely pilose, the hairs minutely capitate glandular, in fruit appearing umbellate; peduncles 13-41 mm. long, ascending at 45° ; pedicels 8-20 mm. long; bracts foliaceous, 9-28 mm. long, 5-17 mm. wide, lance-ovate, the larger ones petioled and serrulate; buds turbinate, angled below each sinus, the lobe tips spreading; *calyx* 13-14 mm. long when fresh (9-11 mm. when dried), greenish, campanulate-funnelform, without densely white pilose, the hairs minutely capitate glandular, the tube 6-7 mm. long, funnelform, with a salient angle below each sinus, within white puberulent; the limb 5-lobed, the lobes ascending, with arcuate spreading tips, within similarly pilose, perceptibly 2-lipped; upper lip 3-lobed, the lobes 7-8 mm. long, connivent in bud but at length separating, broad deltoid, subacute, 6-7 mm. wide at base; lower lip 2-lobed, similarly pilose, cleft 9 mm. between the lobes, the lobes broadly ovate, 7-8 mm. wide at base, the apex 1.5-2 mm. long, subulate; *corolla* 18 mm. long when fresh (14 mm. when dried), white, shaggy white villous without, tube 14 mm. long, subcylindric but slightly ellipsoid distended, within glabrous, 7 mm. in diameter at the middle, 6 mm. at the throat, the tube almost straight; limb 2-lipped, 5-lobed, the lobes glabrous within; upper lobes two, 2 mm. long, 3.5 mm. wide, transversely broad elliptic; lower lip 3-lobed; lateral lobes 3 mm. long, 5 mm. wide, transversely broad elliptic; lower lobe 4 mm. long, 5.5 mm. wide, deltoid-suborbicular; two lower stamens adnate to the corolla tube to within 5-6 mm. of the throat; free filament tips 1.5 mm. long, subulate, spirally upcurved; perfect anthers 2.5 mm. long, 1.8 mm. wide, oblique ovate, the dark connective 1.2-1.3 mm. wide, the two lateral staminodia adnate to the corolla tube to within 5 mm. of the throat, the free portion 0.5 mm. long, lanceolate; *style* 2 mm. long, capitate glandular pilosulous; the two stigmatic lobes 2.5 mm. long, narrowly elliptic, connate $\frac{1}{3}$ way up proximal side, the back hairless but remotely papillose; *ovary* 8-9 mm. long, lanceoloid, closely capitate glandular pilosulous; *berries* 18-19 mm. long, 9 mm. in diameter, ovate-lanceoloid, white, capitate glandular puberulent; seeds 0.22-0.25 mm. long, 0.12-0.15 mm. in diameter, broadly ellipsoid or slightly obliquely so, honey-colored and with darker brown ends, the surface with heavy oblong reticulations $\frac{1}{5}$ - $\frac{1}{6}$ as long as the seed.

Distribution: Koolau Range, leeward side, at 1,200-1,400 ft. alt., in Moanalua, in the Koa Zone.

Holotypus: Oahu, Moanalua Valley, East ridge, $\frac{2}{3}$ way up, moist shaded gulch, April 18, 1942, *H. St. John 20,289* (BISHOP MUS.).

Specimens Examined: Koolau Range, leeward side, Moanalua Valley, E. ridge, $\frac{2}{3}$ way up, moist shaded gulch, 1,200 ft. alt., April 18, 1942, *St. John 20,286*.

Discussion: *C. villosiflora* is a member of the section *Crotonocalyces*. The species which it most closely resembles is *C. villosa* St. John & Storey, which is known only from Waikane on the windward side of the central part of the Koolau Range. It differs by having the leaf scars high obcordate; bundle scars 5; leafy branchlets rusty brown puberulent; petioles 13-31 mm. long, sparsely rusty brown puberulent; blades broadly asymmetric-oblancheolate or oblanche-

olate, the base decurrent, the apex short acuminate, below minutely pilosulous, especially on the veins; cymes 3-5-flowered, closely brown appressed puberulent; peduncles 8-23 mm. long; bracts 4-7 mm. long; calyx 9-13 mm. long, without appressed puberulent, the tube campanulate; corolla tube closely pilosulous without; and the ovary glabrous. *C. villosiflora* has, in contrast, the leaf scars high shield-shaped; bundle scars 7; leafy branchlets densely spreading whitish capitate glandular pilose; petioles 15-70 mm. long, densely capitate glandular pilose; blades elliptic to broadly ovate, a little asymmetric, the base subcordate, rounded, or short cuneate, the apex acute, below white pilosulous and more shaggily so on the veins; cymes (3)-5-9-flowered, densely capitate glandular pilose; peduncles 13-41 mm. long; bracts 9-28 mm. long; calyx 13-14 mm. long, without densely capitate glandular pilose, the tube funnellform with a salient angle below each sinus; corolla tube shaggy villous without; and the ovary closely capitate glandular pilosulous.

The new specific epithet is from the Latin *villosus*, rough haired; *flora*, flower, in reference to the long shaggy hairs of the corolla.

88. *Cyrtandra viridiflora* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 80, 1950. (Figs. 123, 188.)

Cyrtandra crassifolia (Hillebrand) Rock, Am. Jour. Bot. 5: 265, pl. 18, 1918 as to Punaluu specimen and pl. 18, not as to typonym, not *C. Pickeringii* Gray β var. *crassifolia* Hillebrand, Fl. Hawaiian Is., 327, 1888.

Description of All Specimens Examined: Bush 5-20 dm. tall; stems crooked, the lateral ones divergent, 3-8 mm. in diameter, older parts quadrangular, with yellowish or pale brownish, glabrate, corky bark that exfoliates in flakes; leaf scars 4-5 mm. high, low obcordate shield-shaped, pale, corky; bundle scars 5; internodes 2-9 mm., averaging 4 mm. long; young branches and herbage and inflorescence entirely densely viscid velvety spreading villous, the hairs white when fresh, brown when dried, about 1 mm. long, tapering from a stouter basal cell 0.2 mm. wide to the slender, somewhat viscid tip; leaves opposite, subequal, few; petioles 2-9.5 cm. long, stout, 4-6 mm. in diameter when fresh; blades 3-10.2 cm. long, 3-7.5 cm. wide, cordate to suborbicular, the apex short acuminate, the base strongly and unequally cordate, the whole leaf asymmetric, texture thick and fleshy, pale green, midrib and nerves thickened and raised on lower surface, the margin irregularly callous-denticulate or serrate; inflorescence from leaf axils, umbellate, 1-5-flowered; peduncles 6-33 mm. long, stout; pedicels 12-33 mm. long, stout; bracts 10-15 mm. long, lanceolate, foliaceous, caducous; buds campanulate, the calyx lobes erect; calyx 12-15 mm. long, narrowly funnellform, 2-lipped, densely spreading white viscid villous without, unequally lobed $\frac{1}{2}$ to $\frac{2}{3}$ way to base into lanceolate, acute, or subacuminate lobes, pale green, but the lobes darker green, within glabrous or villous only near the apices, upper lip shortly 2-toothed, lower lip more deeply 3-toothed, persistent; corolla 26-27 mm. long when fresh (17-22 mm. when dry), tubular, slightly curved, about 6-8 mm. in diameter, subcylindric except for the turgid middle 8-9 mm. in diameter from which point the apical half of the corolla tube is declined at about 35°, the exposed parts viscid white villous without, glabrous within, the 5 lobes subequal, rounded, rotate, clear, bright green, the two upper lobes 3 mm. long, 7 mm. wide, broadly ovate-deltoid, auriculate at base, without nearly glabrous, the three lower lobes 4-6 mm. long, 7 mm. wide, broadly ovate, subauriculate

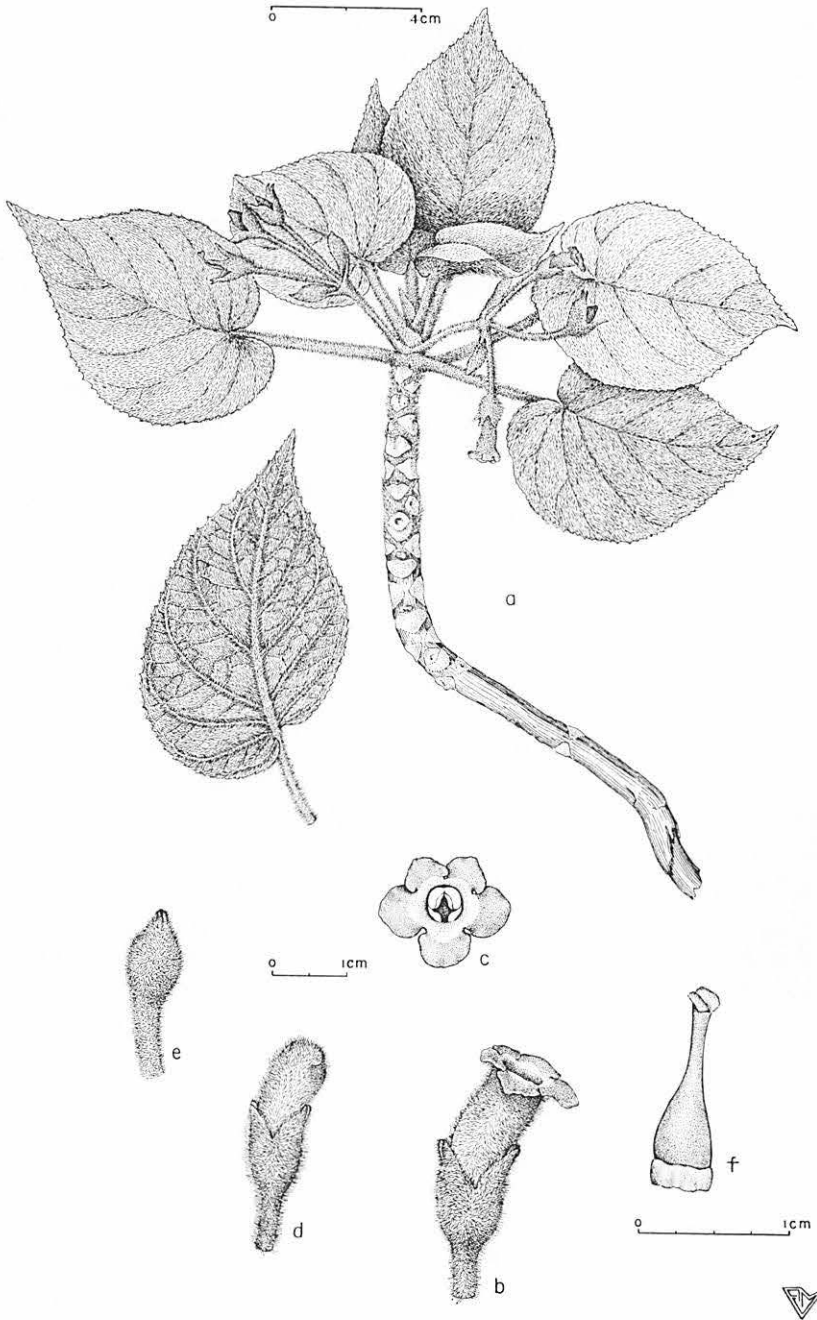


FIGURE 123.—*Cyrtandra viridiflora*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, 1; f, pistil, $\times 2$. Lanihuli, St. John 20,362, holotype (Bishop Mus.).

at base, without sparsely pilose, the margin ciliolate; filaments fused to corolla tube to within 5 mm. of the throat, free portion 3 mm. long; anthers 3 mm. long, sagittate; style 3-4 mm. long, stout, glabrous; stigma 2.5-3 mm. long, flat, flabellate, deeply emarginate; ovary lanceoloid glabrous; berry (according to Rock, 1918:265), ovoid, acute, glabrous, the immature ones seen were 13 mm. long, 7 mm. in diameter, whitish, not exceeding the calyx.

Distribution: Koolau Mts. from Punaluu to Lanihuli, on the very crest in the open windswept, treeless Cloud Zone, 2,500-2,700 feet altitude.

Holotype: Puu Lanihuli, near summit, Kaneohe-Nuuanu, 2,650 ft. alt., rare, only 3 plants in thicket on main divide, Sept. 5, 1943, *H. St. John 20,362* (BISHOP MUS.).

Specimens Examined: Koolau Range. Koolauloa Mts. [Koolau], between Punaluu and Kaipapau [Kaipapau], May 3-8, 1909, *Forbes & Cooke*; Punaluu Mts., summit ridges above, windward side, Dec. 24-29, 1908, *Rock 492* (GH); Punaluu Mts., Aug. 1911, *Rock 8,825*; Waikane-Waipio, 1st peak south of Puu Kaaumakua, 2,500 ft. alt., 5 dm. shrub, only one seen, low moist turf, windswept windward crest among *Lycopodium serratum*, *Rollandia St.-Johnii*, etc., leaves pale green, almost velvety with dense tawny pubescence, May 7, 1939, *St. John 20,031*; Lanihuli trail, Nuuanu on the top, corolla lobes intense green inside, July 19, 1933, *Russ*.

Discussion: Our new species in section *Crotonocalyces*, is in part the *C. crassifolia* (Hillebrand) Rock sensu Rock. It is actually the part of it that Rock knew, and Rock 8,825, from Punaluu, was the sheet illustrated in his revision. His description was largely based on this Punaluu material, and only to a minor degree on Hillebrand's concept. Rock states (1918:266) "No specimen of Hillebrand's *C. Pickeringii* β var. *crassifolia* is in Hillebrand's herbarium, nor in any other herbarium so far as the writer is aware. His type was evidently distributed or was lost." Hence, Rock's interpretation of the typonym was based solely on Hillebrand's three-line description.

The writer in 1935 found the type of *C. Pickeringii* Gray β var. *crassifolia* Hbd. in place in the Berlin herbarium. It is so named, and the data given is Niu, Oahu, Lydgate. We illustrate this critical type specimen (Fig. 105). It is here redetermined and reduced to the synonymy of *C. honolulensis* Wawra.

Rock described and stressed (1918:266) an unusual leaf posture as characteristic of this plant: "the thick fleshy leaves occupy a vertical position on the horizontally arranged petioles, giving the plant a peculiar aspect." At the two other stations, Puu Kaaumakua and Puu Lanihuli, the shrubs had the petioles divergent, but the blades more or less horizontal or somewhat drooping, but not vertical in a lateral plane. The plants grew in the cloud zone, right on the crest of the main divide of the Koolau Range, fully exposed to the whipping of the strong trade winds. The shrubs are small, with a few straggling branches and these assume various positions. Doubtless the plant observed by

Rock did have vertical leaves, but this posture does not seem to be characteristic or constant.

The new *C. viridiflora* is not closely related to any known Hawaiian species. In the key are given numerous diagnostic characters separating it from its neighbor *C. propinqua* Forbes.

The name *C. viridiflora* is derived from the Latin, *viridis*, green; *flora*, flower. The name alludes to the conspicuous characteristic of this species, it being the only known species with green flowers. The corolla tube is white, but the rotate lobes are clear bright green. This green color, when fresh, is more exactly Hay's Green (Ridgway, R., Color Standards and Color Nomenclature, pl. 18, 1912) or Vert. no. 422 (Séguy, E., Code Universel des Couleurs, P. Lechevalier's Encyclopédie Pratique du Naturaliste 30: pl. 29, 1936). Several other species show a tendency towards a green color in the flower. In New Guinea the following species have the corollas greenish white: *C. begonioides* Schlechter, *C. bullata* Schlechter, *C. lithophila* Schlechter, *C. nodulosa* Schlechter, and *C. wariana* Schlechter. White is the flower color of all other Hawaiian species, and it is the commonest color in the genus in all other areas. Other exotic species have flowers colored yellowish white, yellow, scarlet-orange, pink, white with rosy stripes, pale red, wine-color, carmine red, purplish red, or purple.

89. *Cyrtandra waianaensis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 80, 1950. (Figs. 124, 125, 188.)

Description of All Specimens Examined: Shrub 1-5 m. tall or even a tree 6.7 m. tall, 20 cm. in diameter; bark gray; branchlets 3-11 mm. in diameter, finally glabrate, pale gray, quadrangular, somewhat fleshy and on drying shrinking and forming numerous longitudinal furrows and ridges; leaf scars 2.5-4 mm. high, broadly rhombic-shield-shaped, pale, corky; bundle scars 5; young shoots densely brownish hirsute; leafy branchlets 2-3 mm. in diameter, quadrangular, hirsute; internodes 5-35 mm., averaging 7 mm. in length; *leaves* opposite, subequal or unequal with one of the pair $\frac{1}{4}$ - $\frac{1}{2}$ smaller, borne at the 3-5 upper nodes; petioles 10-95 mm. long, slender, and densely hirsute; *blades* 2.4-20.5 cm. long, 15-115 mm. wide, chartaceous, broadly oval, minutely subacuminate, at base rounded or slightly asymmetric subcordate, above dark green and catenulate hirsute, below pale whitish greenish, and generally soft white pilose but on the midrib and laterals shaggy villous; the margins minutely and remotely denticulate or subentire, the lateral veins 5-8 on a side, ascending, the tips arcuate and in-arched interconnecting; *cymes* 3-5-flowered, axillary, densely villous; peduncles 10-45 mm. long; pedicels 10-40 mm. long; bracts 9-60 mm. long, foliaceous, lance-ovate, densely villous; buds ovoid-suborbicular, the calyx lobes ascending; *calyx* at anthesis 14-15 mm. long, when fresh (7-13 mm. when dried), green and foliaceous, villous within and without, broad crateriform and only loosely enclosing the corolla, 2-lipped, 5-lobed, the sinus between the lobes 5-10 mm. deep; upper lip 3-lobed, the lobes 4-9 mm. long, ovate, acute or subacute; lower lip 2-lobed, the lobes 5-10 mm. long, similar to the upper; the calyx persistent, but by fruiting time subaccrescent, as much as 18 mm. long when dried, and fully reflexed; *corolla* when fresh 19-20 mm. long (13-16 mm. when dried), white, broad tubular, the tube 15 mm. long and $\frac{2}{3}$ way from the base gently deflected at 25° from the axis of the lower tube, at base 3 mm. in diameter, at the bend 7 mm., and at the throat 4 mm., without densely white pilose almost to the base, within glabrous; limb 2-lipped, 5-lobed, the sinus between the lobes 4 mm. deep (when dried

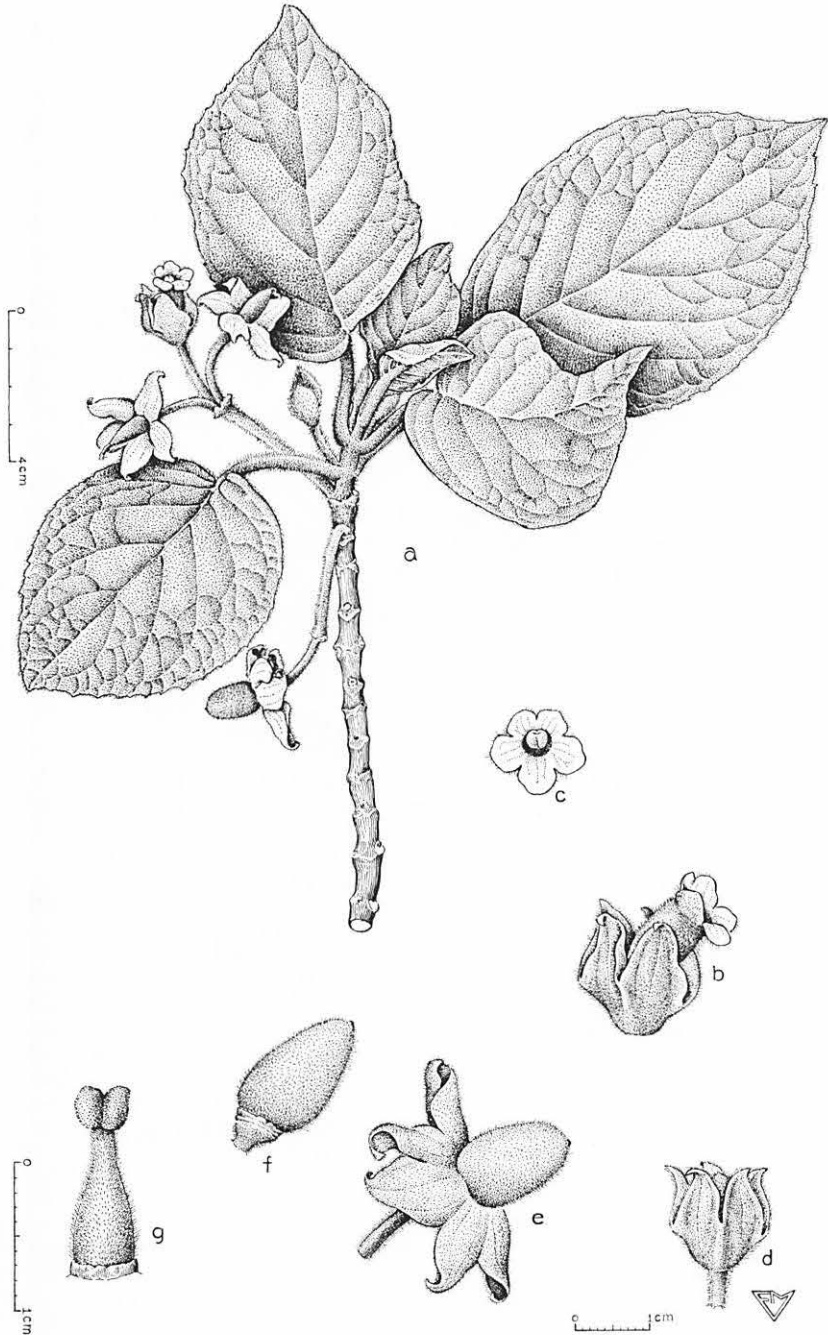


FIGURE 124.—*Cyrtandra waianacensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, f, fruit, $\times 1$; g, pistil, $\times 2$. Puu Kalena, St. John 22,573, holotype (Bishop Mus.).

2-3 mm.); upper lip spreading at about 50° to axis of the throat, the two lobes 2-3 mm. long, 3.5-5 mm. wide, oblate rounded-rhomboid, obtuse, all the lobes glabrous within; lower lip 3-lobed, the two lateral lobes 2-4.5 mm. long, 3.5-5.5 mm. wide, transversely oval, auriculate and overlapping at base; lower lobe, 2.5-5 mm. long, 3.5-6 mm. wide, depressed suborbicular, without densely white villous, the other lobes likewise villous without wholly or partly except for edges that were covered in vernation; the



FIGURE 125.—*Cyrtandra waianaensis*, Mt. Kaala, Storey 235.

two lower stamens perfect, the filaments adnate to the corolla tube to within 4 mm. of the throat, the free portion 3 mm. long, heavy at base, tapering subulate, spirally upcurved; the two perfect anthers connivent, 4 mm. long, 2.5 mm. wide, obliquely oval, the base subsagittate, the apex strongly apiculate, the connective obliquely oval; the staminodia adnate to the corolla tube to within 6 mm. of the throat, the two lateral ones with their free filaments 0.5 mm. long, stout subulate and perpendicular to the tube, the darker antheroid tip 0.1 mm. long, the upper staminodium similar but slightly smaller and appressed; *style* 3 mm. long, terete, densely white pilose; stigmatic lobes two, 3

mm. long, broadly elliptic, connate $\frac{2}{3}$ way up the proximal side; ovary 7 mm. long, lanceoloid, white pilose, the base surrounded by a cupulate disk 0.7 mm. high; berry 15-18 mm. long, 7-10 mm. in diameter, ovoid or broadly so, pilose white; seeds 0.50-0.58 mm. long, 0.22-0.29 mm. in diameter, obliquely ellipsoid, dark honey-colored, with darker brown ends, the body covered with raised cellular, narrow oblong reticulations $\frac{1}{6}$ - $\frac{1}{7}$ as long as the seed.

Holotype: Puu Kalena, Waianaeka, Waianae Mts., in *Metrosideros* forest near summit, 3,400 ft. alt., Feb. 16, 1947, *H. St. John 22,573* (BISHOP MUS.).

Distribution: Waianae Mountains, windward side from Mokuleia to Palikea in moist gulches or forests from 1,600 to 3,600 ft. alt., in the Koa and Ohia Zones; also on the leeward side in Makaha Valley at 1,500-2,000 ft. alt. and on Puu Kaua in rain forest just below the summit, in the Ohia Zone.

Specimens Examined: Waianae Mts.

Windward Side: Mokuleia, 2nd Gulch E. of Puu Kaupakuhale, N.E. slope of Puu Kaala, moist bottom of gulch, 2,000 ft. alt., Oct. 23, 1932, *St. John 12,134*, and *13,177*; N. side of Kaala, moist woods, 3,200 ft. elev., Feb. 11, 1928, *Bergman*; Kaala, S.E. slope, wet forest, *Degener, Salucop & Arlantino 11,573* (NY); Puu Kaala, e. slope, Waianaeka, moist forest, 1,000 m. alt., Jan. 8, 1933, *Fosberg 9,126*; ditto, 2,300 ft. el., Jan. 10, 1932, *Hashimoto*; ditto, 3,400-3,600 ft., Jan. 8, 1933, *Krauss*; ditto, Kaala, ostseite, Feb. 1930, *Meebold 8,465* (M); ditto, small humid valley, 1,600 ft., Jan. 10, 1932, *Storey 165*; ditto, Fire Break Trail, between the stream and the ridge crest, 1,800 ft. elev., May 1, 1932, *Storey 186*; ditto, common in woods on banks above stream in a small open valley at 1,800-2,000 ft., Jan. 8, 1932, *Storey 235*; ditto, wet forest, 3,000 ft. alt., Jan. 12, 1941, *Townsend*; ditto, woods, 3,600 ft., Jan. 10, 1932, *Yamaguchi 1,165*; Puu Kalena, valley s. of e. ridge of, Waianaeka, moist forest, 840 m. alt., March 22, 1936, *Fosberg 12,996*; Puu Kumakalii, $\frac{1}{2}$ mile s.e. of, Waianaeka, in *Metrosideros* forest near crest, 2,400 ft. alt., Feb. 16, 1947, *St. John 22,560*; Puu Hapapa, wooded ridge, 2,500 ft. elev., *Hume 380*; ditto, Popouela Ridge, Honouliuli, moist woods on ridge, 2,600 ft. alt., Jan. 7, 1934, *St. John 13,994*; ditto, in small valley north of main ridge leading to summit, 2,000-2,700 ft. alt., July 1932, *Storey & Dunn*; ditto, ridge, 2,000 ft., Oct. 25, 1931, *Hashimoto (Storey 125)*; Puu Kaua, near top, Honouliuli, wet forest, 960 m. alt., Nov. 6, 1932, *Fosberg 9,039*; ditto, 3,113 ft., Nov. 6, 1932, *Krauss*; ditto, rain forest near summit, 3,050 ft. alt., Dec. 1, 1940, *St. John 20,126*; Palikea, near summit, Honouliuli, wet forest just below main divide, 930 m. alt., June 30, 1935, *Fosberg & Dunn 10,947*; and *Fosberg 10,954*.

Leeward Side: Makaha Valley, Kaala Range, Feb. 12-19, 1909, *Forbes*; Waianae [Mts.], Grat oberhalb, Holt Haus [Makaha, 2 miles up], Nov. 1935, *Meebold 21,043* (M); ditto, woods near head wall of the valley, 1,500-2,000 ft., April 3, 1932, *Storey 184*; Puu Kaua, Waianae, rain forest, just over mountain crest, 3,075 ft. alt., Feb. 26, 1950, *St. John 24,051*.

Oahu (without further data) : Galathea-Expeditionen, 1845-47, *Didrichsen* (C).

Discussion: *C. waianaensis* is a member of the section *Crotonocalyces*. It is now known to be the commonest and, if not the most widely distributed species in the Waianae Mts., is a close second to *C. Garnotiana*. Specimens of this new species have been available for many years, but they have been determined as everything from *C. cordifolia*, *C. Pickeringii*, to *C. Lessoniana*, etc. Though *Didrichsen* collected four sheets of it by 1847, it is surprising that none of the other early explorers and residents collected it, as it is abundant in the Waianae Mountains. The next known collection was by C. N. Forbes in 1909. Actually the species is well marked and not closely similar to any other. Its probable relative is believed to be *C. cordifolia* of the Koolau Range but that species differs by its much larger cordate, sharply denticulate blades, larger flowers, and numerous other technical details. The collection from Puu Hapapa, *Hashimoto* (*Storey 125*) is exceptionally small in all its parts: blades 23-57 mm. long, 13-38 mm. wide; calyx 7-8 mm. long; corolla 13 mm. long (when dried), but in structural details everything is typical. It appears to be an instance of dwarfing or nanism. It is not believed that such a dwarf is worthy of a botanical scientific name. The specific epithet is coined from the name of the mountains, Waianae; and *-ensis*, the Latin place termination, indicating its native region.

II. Subgenus *Cyrtandra*

5. Section *Cylindrocalyces*

90. *Cyrtandra alata* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 81, 1950. (Figs. 126, 189.)

Description of Holotype: Shrub; internodes 5-6 cm. long; leafy branchlets terete, sparsely ferruginous, subappressed pilosulous; young shoots densely velvety, ferruginous, subappressed pilosulous; *leaves* opposite, well spaced, apparently ascending and few; petioles about 4 cm. long, sparsely ferruginous pilosulous; *blades* 13-24 cm. long, 5.3-7 cm. wide, firm chartaceous, elliptic-lanceolate, the apex abruptly subacuminate, the base long decurrent, only slightly asymmetric and curved, plane, above dark green, inconspicuously and remotely ferruginous pilose towards the tip, glabrous towards the base even in youth, below paler green, subappressed ferruginous pilosulous on the veins and veinlets, sparsely so on the intervals, the margin callous serrulate or doubly so; *cymes* from the leaf axils, 7-flowered, densely velvety, subappressed, ferruginous pilosulous; peduncles 25-30 mm. long, ascending; pedicels 8-10 mm. long, divergent; bracts 11-16 mm. long, ovate-lanceolate, foliaceous; *calyx* in anthesis (but dried) 17-18 mm. long (when boiled 23 mm. long) greenish but closely brown pilosulous, within appressed pilosulous only along the midveins, the tube 7-9 mm. long, obovoid; the limb 2-lipped, cleft down 8 mm. between the lips, 5-lobed; upper lip 3-lobed, erect cleft down 5.5-6 mm. between the lobes, the lobes 1.5-2 mm. wide at base, narrowly lanceolate, soon contracted into a long subulate apex; lower lip 2-lobed, cleft 10 mm. between the lobes and finally cleft to the base and then dehiscent from the fruit, the lobes 3 mm. wide at base, narrowly lanceolate, tapering into subulate tips; *corolla* when dried 23-25 mm. long, white, equalling or slightly exceeding the calyx, abruptly deflexed at the middle at 30° and protruding through the deeply cleft proximal cleft in the calyx, corolla tube 13 mm. long, glabrous within, the lower half 4-4.5 mm. in diameter, glabrous without, cylindric, gradually widening above the bend to the throat which is 6 mm. in diameter, open, the limb pilosulous, funnelform, 2-lipped, cleft down 5 mm. between the lips, the upper lip of 2 lobes 4.5 mm. long, 4 mm. wide, oval, the margin and upper third glabrous without, short pilosulous within except for the marginal area, the lower lip of 3 lobes, the two lateral lobes 7 mm. long, 5 mm. wide, suborbicular, the lower lobe 7 mm. long, 4.5 mm. wide, oval, the three pilose without and pilosulous within except near the margin, the throat open, the tube glabrous within; filaments fused to the corolla to within 5 mm. of the throat, the free portion 4 mm. long, subulate, incurved; anthers 4 mm. long, oval-sagittate, flattened, slightly asymmetric with unequal cells, the two anthers connate at tip; *style* 3 mm. long, stout, pilose; stigma with two opposite, separate, thick, fleshy, equal oval lobes 2.5 mm. long; *ovary* lanceoloid, pilose, the base surrounded by a cupulate disk; fruit unknown.



FIGURE 126.—*Cyrtandra alata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, $\times 1$; f, pistil, $\times 2$. Punaluu, Yamaguchi and Storey 167, holotype (Bishop Mus.).

Distribution: Koolau Range, windward side, known only from the type locality, Punaluu, in the Ohia Zone at 1,900 feet altitude.

Holotype: Oahu, Koolau Mts., Punaluu Valley, along Castle Trail, on densely wooded slope at 1,900 ft. elev., Nov. 30, 1929, *M. Yamaguchi & W. B. Storey 167* (BISHOP MUS.).

Discussion: *C. alata* is a member of the section *Cylindrocalyces*, having the typical fusiform, apiculate bud. The corolla is exerted from a deep distal slit in the calyx. Although no fruiting calyx has been collected, it was obvious when the flower was dissected that the calyx would readily split down one side, and is doubtless deciduous. *C. alata* is distinguished by numerous characters and seems not intimately related to any particular species of its section.

The specific name comes from the Latin, *ala*, wing, in allusion to the margined or winged upper portion of the petiole.

91. *Cyrtandra alnea* St. John, sp. nov. (Figs. 127, 128, 187).

C. paludosa Gaudichaud γ var. *alnifolia* Hillebrand, Fl. Hawaiian Is., 336, 1888, not *C. alnifolia* Kränzlin, Philippine Jour. Sci., Bot. 8: 329, 1913.

Description of the Type (as given by Hillebrand): " γ var. *alnifolia* . . . Young shoots and inflor. hirsute with dark ferruginous hairs. Leaves broadly ovate, 4-5' x 2½-3', somewhat obtuse, rounded at the base, the strong ribs and veins pubescent. Peduncle and pedicels 6-7" each. Calyx and corolla faintly pubescent.

"Oahu!"

Description of All Specimens Examined: Shrub; branches 3-5 mm. in diameter, quadrangular, villous; young shoots densely brown villous; leaf scars 3-4 mm. high, pale, connected by a narrow band and thus annular; bundle scars 5; leafy branchlets as much as 4 mm. in diameter, quadrangular, shaggy brownish villous; internodes 8-20 mm., averaging 14 mm. long; *leaves* opposite, well spaced and not crowded, borne at the 3-4 upper nodes, those of a pair slightly unequal, one being $\frac{1}{10}$ larger; petioles 3.5-6.3 cm. long, shaggy brownish villous, narrowly perfoliate at base; *blades* 14-19.5 cm. long, 9-11.5 cm. wide, chartaceous broadly elliptic or broadly ovate, the apex subacuminate, the base rounded, then abruptly short decurrent, above dark green and sparsely catenulate hirsute, below pale greenish, hirsute on main veins and sparsely pilosulous on the intervals, the secondary veins 7-8 on a side ascending, then near the margin arcuate upwards, inarched interconnecting and salient in the teeth, the margin doubly callos denticulate; *cymes* 5-flowered, hirsute; peduncle 20 mm. long; pedicels 7-22 mm. long; bracts fallen; *calyx* in young fruit 12-14 mm. long, hirsute, campanulate, 2-lipped; calyx tube 3-4 mm. long, campanulate; upper lip 3-lobed, the sinus between the lips 10-11 mm. deep, the lobes partly united, lanceolate with a linear-oblong tip 3-4 mm. long, the middle lobe 7-8 mm. long, hirsute within and without; lower lip 2-lobed, lobes 10-11 mm. long, similar to the upper ones; *style* 1 mm. long, hirsute; stigmatic lobes 1.5 ? mm. long; young *fruit* 9 mm. long, ovoid, apiculate, hirsute.

Holotypus: Oahu, *W. Hillebrand* (B). Type Examined.

Specimens Examined: Waianae Mts. Windward side: Puu Kaala, on ledge above spring in dense woods at 3,500 ft. elev., Jan. 10, 1932, *Storey 141*.

Discussion: Though published early by Hillebrand (1888: 336), *C. paludosa* var. *alnifolia* has received little attention, and we think it has been misunderstood. Rock in his revision of the *Cylindrocalyces* (1917: 607) accepted

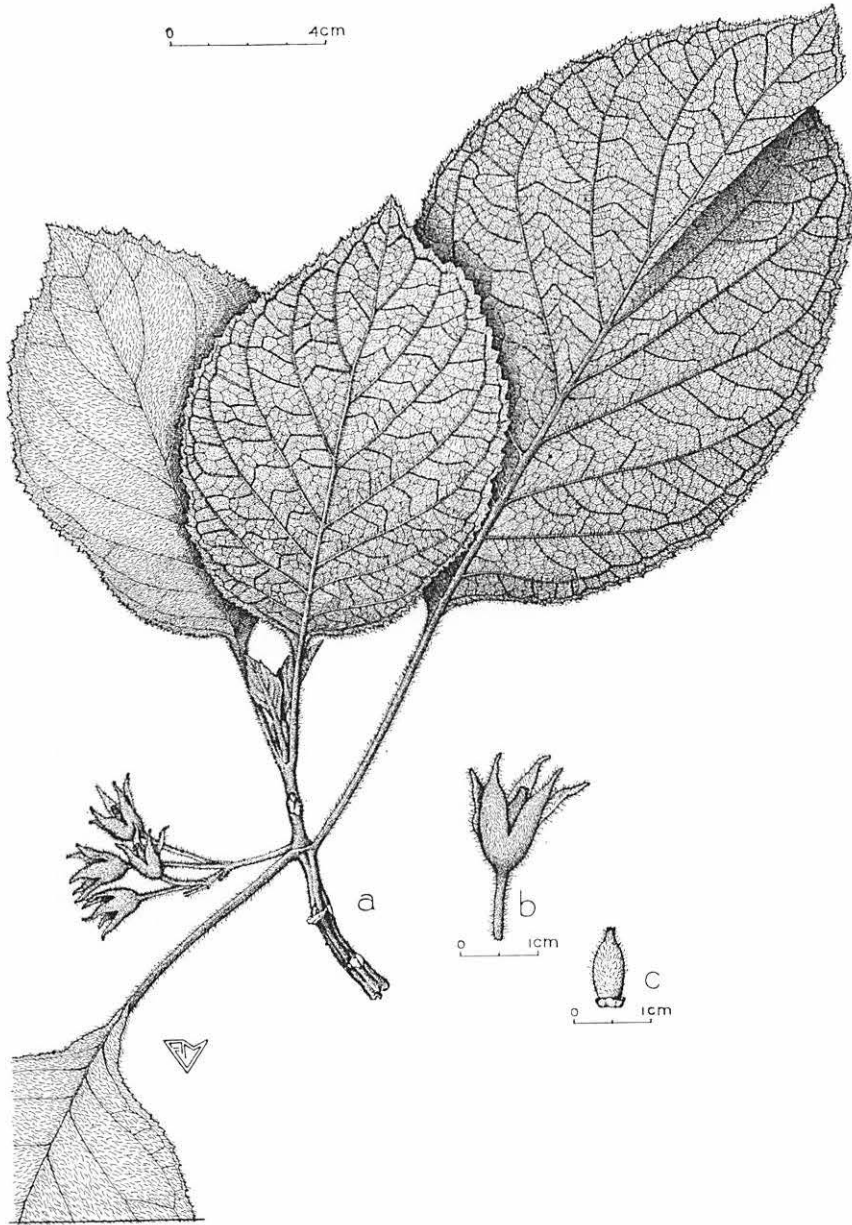


FIGURE 127.—*Cyrtandra alnea*: a, habit, $\times \frac{1}{2}$; b, calyx and fruit, $\times 1$; c, fruit, $\times 1$.
Puu Kaala, Storey 141.

it. For a description he copied Hillebrand's, word for word, except that he changed the English measurements to metric ones. He examined the Hillebrand type specimen in the Berlin herbarium, as shown by his manuscript notes and by his published statement: "This variety can be retained; in its general appearance it is a typical *C. paludosa* but differs from *a typica* only in the longer peduncles and pedicels, and in the young leaves, which are covered with a fulvous tomentum."

The writer also noted the Hillebrand type specimen in Berlin in 1935 and photographed it (Fig. 128). The type was apparently destroyed in 1943 in the bombing of Berlin. It does have a resemblance to *C. paludosa* but not a close one. The caducous calyx places it in the *Cylindrocalyces*, but it differs from *C. paludosa* by having long petioled, broad-oval or ovate blades, long peduncles and pedicels; the herbage with a dense brown pubescence; and the corolla being pubescent. One other botanist, Skottsberg (1936:177), has named a collection *C. paludosa* var. *alnifolia*. It was his own collection no. 86 b, from Tantalus in the Koolau range. He said, "Identical with the type in Herb. Berlin, but hardly worthy of varietal rank." It appears that he compared his collection with Hillebrand's type, but it may not have been a close comparison. He says nothing about the floral details or other characters which make var. *alnifolia* Hillebrand a very marked taxon. The writer did not see *Skottsberg 86 b* in either Honolulu or Stockholm, and it is presumably only in Göteborg. It is likely to be *C. paludosa* var. *paludosa*. In all the mass of collection of *Cyrtandra* assembled during more than two decades of research by the writer and his students, only one recent collection tallies with the type of var. *alnifolia*. It is *Storey 141* from 3,500 ft. alt., on ledge above spring on Kaala in the Waianae Mountains. We can interpolate that this refers to the "spring" or stream above the big cliff on the right-hand ridge trail from the Firebreak Trail, Waianaueka on the east side of the mountain. For 30 years or more, this was the regular route for ascending the mountain, and most parties have stopped at this remote spring for lunch. The specimen, *Storey 141*, consists of two leafy branches, one bearing an inflorescence with four young fruits. In outline and in detail this collection tallies well with the photo of the type. From this recent collection have been supplied the added details given in the expanded description. Unfortunately the lack of corollas prevents a supplying of the finer details of floral morphology. Consequently this species is entered in two places in the key. However, this collection and the photograph of the type establish the identity of var. *alnifolia*, and its specific distinctness from *C. paludosa*.

Since there is an earlier *C. alnifolia* Kränzlin (1913), Hillebrand's varietal name cannot be used for the species. The name *alnea* is taken from the generic name *Alnus*, the alder, thus meaning alderlike.

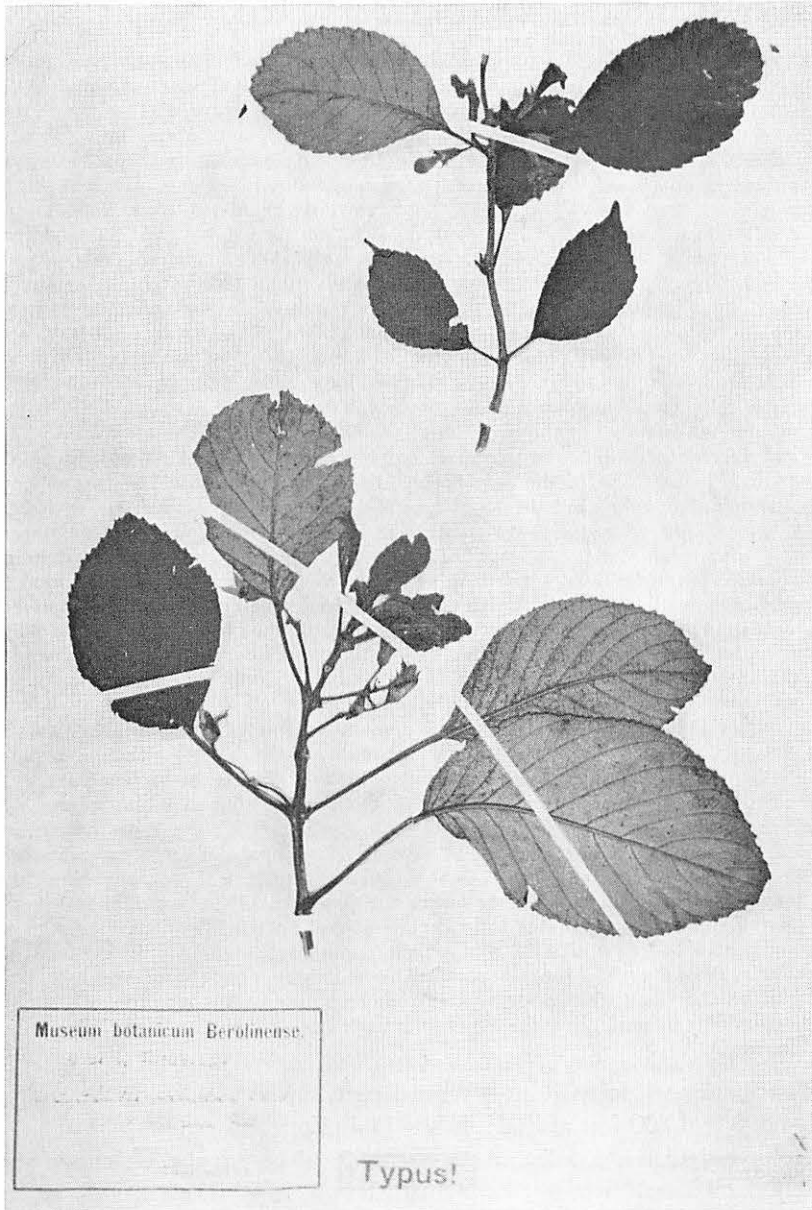


FIGURE 128.—*Cyrtandra paludosa* γ var. *alnifolia*, holotype (Berlin). Oahu, Hillebrand; also holotype of *C. alnea* St. John.

92. *Cyrtandra atomigyna* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 81, 1950. (Figs. 129, 193.)

Description of All Specimens Examined: Shrub; branches smooth, pale yellowish brown, corky, as much as 1 cm. in diameter, naked below; leaf scars of similar coloration, shield-shaped 5-7 mm. high; bundle scars 9; leafy branchlets as much as 4-5 mm. in diameter, subterete, closely brown villous with ascending hairs, somewhat fleshy and shrinking on drying; internodes 1.5-6 cm., averaging 2 cm. long; young shoots densely appressed, brown pilose; *leaves* opposite, ascending, subequal, borne at the few upper (often three upper) nodes, not crowded; petioles 1-2 cm. long, ascending brown villosulous; *blades* 20-38 cm. long, 9.6-17.5 cm. broad, oval, at base contracted and long decurrent to the petiole, the apex abruptly short acute, chartaceous, above dark green, remotely brown hirsutulous, secondary veins 9-12 on a side, ascending, the tips inarching, except at very base, the margins remotely doubly apiculate denticulate or serrulate, below pale green, the salient veins brown pilose; *cymes* axillary, closely castaneous, villous, 3-flowered; peduncles 5-14 mm. long, in anthesis ascending or spreading, in fruit reflexing; pedicels 7-13 mm. long, ascending; bracts 4-8 mm. long, lanceolate, foliaceous but blanketed by castaneous villosity, caducous; buds ellipsoid, the calyx lobes ascending or the tips inflexed and touching; *calyx* in anthesis 15-20 mm. long, not accrescent, the tissue greenish, outside brown villous, inside brown villous almost down to the base of the calyx lobes, the tube glabrous inside, the calyx narrowly campanulate below but the lobes ascending, 2-lipped; the upper lip with 2 lobes cleft $\frac{1}{2}$ way, 2 mm. wide, the lower half linear-lanceolate, the upper half subulate; the lower lip with 3 lobes, cleft $\frac{2}{3}$ way, 3-4 mm. wide, linear-lanceolate, long acuminate; *corolla* 23-25 mm. long, white; the tube narrowly vase-shaped, straight, 17 mm. long, at base 4 mm. in diameter, at the throat 7 mm. in diameter, the exerted outer half stiffly reflexed villous, below the hairs decreasing towards the glabrous base; limb 2-lipped, 5-lobed; upper lobes 2, recurving at about 90° to the axis of the throat, 5 mm. long, 8 mm. wide, depressed suborbicular, with a broadly obtuse apex, overlapping at base, inside nearly glabrous, outside sparsely villous, especially below; lower lobes 3, recurving at about 110° to the axis of the throat, 7 mm. long, 9-10 mm. wide, depressed rhomboid-orbicular, the sides and apex broadly obtuse, overlapping at base, sparsely capitate glandular puberulent towards the throat inside, outside sparsely villous towards the base and lower margins; two lower stamens perfect, the filaments adnate to the corolla tube to within 8 mm. of the throat, the free portion 2 mm. long, stout, spirally upcurved; the 2 perfect anthers 3 mm. long, flattened, oval but attachment asymmetric, connate at apex; staminodia well developed, the lateral pair attached to within 11 mm. of the throat, the filaments 2.8 mm. long, subulate, a short distance above the base sharply reflexed, the anthers 0.4 mm. long, 0.5 mm. wide, depressed globose, yellowish but sterile; fifth stamen or third staminodia attached to within 12 mm. of the throat, represented only by a flat strap 1 mm. long, the upper half fimbriate and dissected; *style* none; stigmatic lobes 2, sessile 0.6 mm. long, semiorbicular, connate $\frac{1}{3}$ way up proximal side; *ovary* 2.8 mm. long, ovoid, glandular atomiferous, the base surrounded by a cupulate disk 1.5 mm. high; fruit unknown.

Distribution: Koolau Range, central part, on both sides of the range, at from 1,500 to 1,800 feet altitude, in the Ohia Zone.

Holotype: Oahu, Koolau Mts., North Fork of Kipapa Gulch, in damp, densely shaded small ravine off the main stream, 1,500 ft. elev., Feb. 10, 1935, *W. B. Storey 258* (BISHOP MUS.).

Specimens Examined: Koolau Range. Windward Side: Kahana Valley, along Waikane-Schofield Trail, 1,800 ft. alt., in company with *C. gracilis* on wooded moist slopes below the trail, Oct. 16, 1932. *Storey 203*.



FIGURE 129.—*Cyrtandra atomigyna*: a, habit, $\times \frac{1}{2}$; b, inflorescence, $\times \frac{1}{2}$; c, d, flower, $\times 1$; e, bud, $\times 1$; f, pistil, $\times 5$; g, staminodium and stamen, $\times 2$. Kipapa Gulch, Storey 258, holotype (Bishop Mus.).

Discussion: *C. atomigyna* is a member of the section *Cylindrocalyces*. The closest relative is *C. carinata* St. John & Storey. The several marked differences between the two are brought out in the key.

The new name, coined in allusion to the glandular atomiferous ovary is taken from the modern word *atom*, derived from the Greek *a*, not, and *temno*, I cut; and *gune*, a woman, female.

93. *Cyrtandra brevicalyx* (Hillebrand) St. John, comb. nov. (Figs. 130, 131, 151, 195).

C. paludosa Gaudichaud β var. *brevicalyx* Hillebrand, Fl. Hawaiian Is., 336, 1888.

C. paludosa Gaudichaud var. *brevicalyx* Hillebrand forma *linearis* Rock, Am. Jour. Bot. 6: 210, 1919.

C. paludosa Gaudichaud var. *filipes* Hillebrand ex Rock, Am. Jour. Bot. 6: 210, 1919 (a manuscript herbarium name, published by Rock in the synonymy of his forma *linearis*, hence an invalid name).

Description of All Specimens Examined: Shrub, 1-3 m. tall; branchlets 3-8 mm. in diameter, gray, smooth, glabrous, fleshy and on drying shrinking and forming longitudinal furrows and ridges; leaf scars 2.5-4 mm. high, depressed semicircular-shield-shaped, pale, corky; bundle scars 5; young shoots appressed brown pilose but hairs caducous; leafy branchlets 1.5-5 mm. in diameter, slightly quadrangular, early glabrate; internodes 2-70 mm., averaging 10 mm. in length; main branches frequently producing numerous axillary short shoots with numerous small leaves equalling or shorter than the petioles of principal leaves; *leaves* opposite, mostly unequal, numerous and somewhat crowded, one of the pair being $\frac{1}{8}$ - $\frac{1}{2}$ smaller, borne at the 5-13 upper nodes; petioles slender, 4-70 mm. long, glabrous; *blades* 3-18 cm. long, 12-68 mm. wide, thick or fleshy, firm chartaceous, commonly oblanceolate but varying to linear-oblanceolate, narrowly elliptic, lanceolate, or oval, the apex acuminate, the base cuneate and decurrent, above glabrous, olive green, below whitish green, glabrous or glabrate, the margin with the outer half or three-quarters coarsely crenate, the lateral veins 11-14 on a side, ascending, arching, the tips inarched interconnecting and salient in teeth; *cymes* 1-3-flowered, axillary; peduncles 1-3 mm. long; pedicels 8-35 mm. long, glabrous; bracts 3-4 mm. long, sparsely pilose near the margins, lanceolate, caducous; buds almost symmetric, the body obovoid, the calyx lobes 1-1.5 mm. long, free, erect or arching outwards; *calyx* at anthesis 7-14 mm. long, glabrous, 2-lipped, 5-lobed, but the lobes subequal, the sinus between the lobes 7 mm. deep; upper lip 3-lobed, the lobes 2-5 mm. long, linear from a narrowly deltoid base; lower lip 2-lobed, the lobes 2-5 mm. long, the lower half deltoid, the upper linear; at length the calyx splitting between the two lower lobes and caducous from the flower or partly grown fruit; *corolla* when fresh 29 mm. long (when dried 16-26 mm.), white, glabrous without, the tube glabrous within, 19 mm. long (13-19 mm. when dried), narrowly funnelform, but $\frac{2}{3}$ way from the base deflected at 30°, at base 3 mm. in diameter, at the bend 7 mm., at the throat 10 mm.; limb 2-lipped, 5-lobed; upper lip spreading at about 90° to the axis of the throat, the two lobes 8 mm. long, 7.5 mm. wide (when dried 3-5.5 mm. long, 3-5 mm. wide), ovate-suborbicular, these and the other lobes capitate glandular puberulent from middle to the base; lower lip 3-lobed; two lateral lobes 10.5 mm. long and wide (when dried 5-6.5 mm. long, 3-6 mm. wide), obliquely suborbicular; lower lobe 10 mm. long, 9.5 mm. wide (when dried 5-9 mm. long, 4-6 mm. wide), elliptic-suborbicular; the two lower stamens perfect, the filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion stout, terete, 3 mm. long, spirally upcurved; the two perfect anthers connivent,

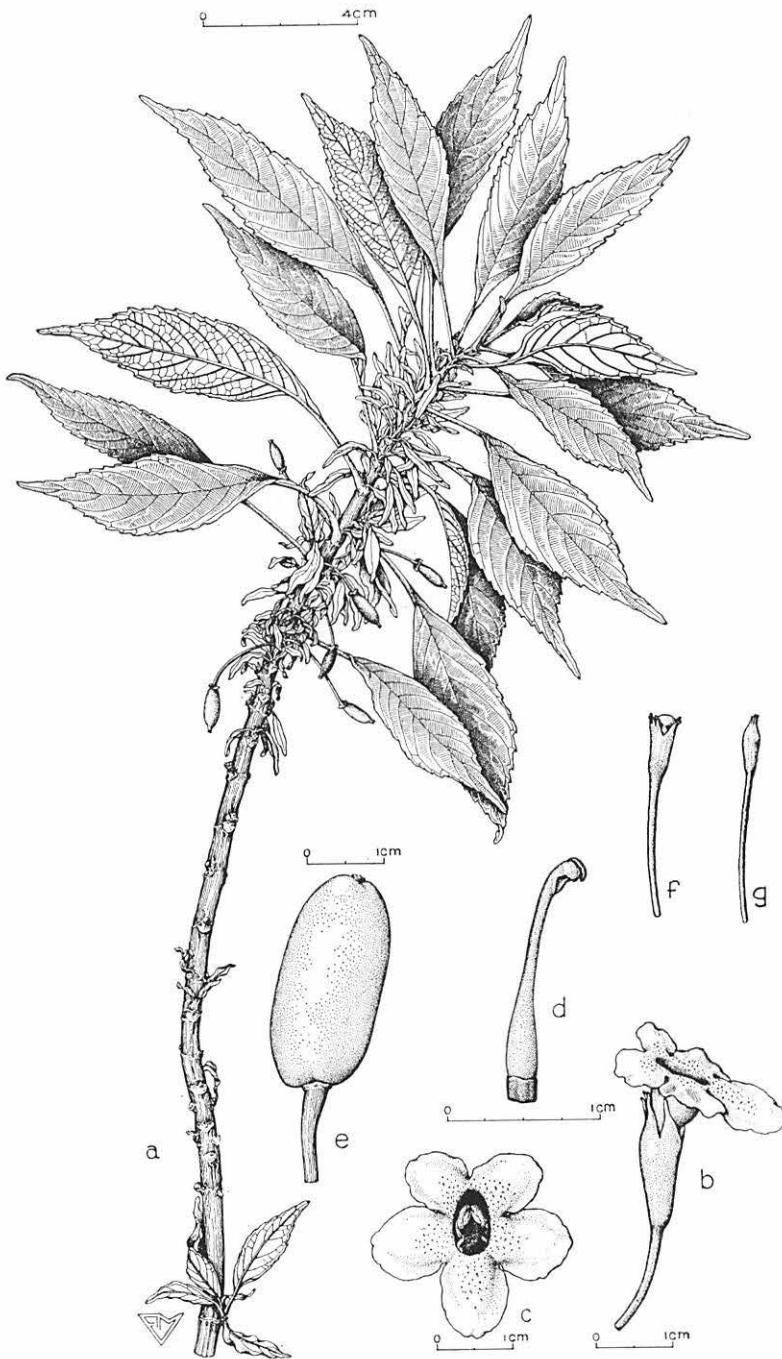


FIGURE 130.—*Cyrtandra brevicalyx*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, pistil, $\times 2$; e, fruit, $\times 1$; f, g, buds, $\times 1$. Poamoho Trail, Paalaa-Wahiawa, St. John 17,658.

3 mm. long, 2 mm. wide, nearly symmetric broad ovate, the connective heavy cordate, ovate; the two lateral staminodia adnate to the corolla to within 12 mm. of throat, their filaments 0.9 mm. long, subulate, the translucent sterile tip 0.5 mm. long; the upper staminodium similar but adnate to the corolla tube to within 11 mm. of the throat; *style* 10 mm. long, glabrous, stout filiform; stigmatic lobes two, 3 mm. long, oval, connate $\frac{3}{4}$ way up proximal side; *ovary* 6 mm. long, linear-lanceoloid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; *berry* 2-3 cm. long, 12-18 mm. in diameter (when dry 17-24 mm. long, 11-14 mm. in diameter), white, broadly ellipsoid; seeds 0.44-0.54 mm. long, 0.21-0.29 mm. in diameter, broadly ellipsoid or ovoid, honey-colored, with a dark brown point at either end, the body covered with raised, cellular polygonal reticulations $\frac{1}{7}$ - $\frac{1}{6}$ as long as the seed.

Distribution: Koolau Range, abundant on windward side from Malaekahana to Waiahole in rain forests from 1,300 to 2,700 ft. alt., and on the summit or lee side from Kaunala to Waipio in moist gulches or rain forests at from 1,000 to 2,600 ft. alt., rare in the Koa Zone, common in the Ohia Zone and the Cloud Zone. In the Waianae Mts., only on Mt. Kaala.

Holotype: "Oahu! Kaala range." The holotype specimen in the Berlin Herbarium bore the additional data: "July 1870, *W. Hillebrand*." Type examined in 1935 (see Fig. 131). Isotypes: (BM, GH).

Specimens Examined: Koolau Range.

Windward Side: Malaekahana, Pupukea summit trail, 1,800 ft. alt., montane rain forest of *Metrosideros polymorpha*, *Dicranopteris*, etc., Sept. 19, 1950, *Hatheway & Degener 380*; above head of Malaekahana Stream, crest of divide, Koolau Range, in low brush, 2,000 ft. alt., June 15, 1958, *St. John 26,293*; Laie Ridge, Feb. 14, 1932, *Suehiro*; Laie-Waimea, Koolau divide, moist woods, 2,200 ft. alt., April 15, 1933, *St. John 13,076*; Kaluanui Valley, ridge northwest of Hauula, Feb. 27, 1938, *Degener 17,398* (NY); Hauula, Maakua-Papali ridge, 1,300 ft. alt., wooded slope, Oct. 15, 1933, *St. John 13,356*; Koolauloa [= Koolau] Mts., between Punaluu and Kaipapau [= Kaipapau], Nov. 14-21, 1908, *Forbes*; ditto, May 3-8, 1909, *Forbes & Cooke*; ditto, May 8-13, 1909, *Forbes & Thompson*; Punaluu-Kaluanui Trail, in vicinity of gap between Punaluu and Kaluanui, 2,700 ft. elev., Dec. 21, 1931, *Yamaguchi (Storey 156)*; Punaluu, maio 1910, *Faurie 614*; ditto, wet slope, 700 m. elev., Jan. 11, 1931, *Hume 70*; Punaluu Mts., Nov. 14-21, 1908, *Rock 291*, and *905* (BISH, GH); ditto, Dec. 3-14, 1908, *Rock 670*, *671*, and *672* (doubtless duplicates); Punaluu, Castle Trail, steep open mountain ridge, 2,000 ft. alt., Nov. 3, 1940, *St. John 20,117*; Kahana, Waikane-Schofield Trail, wet forest, 700 m. alt., Oct. 16, 1932, *Fosberg & Duker 8,807*; ditto, moist woods, 800 ft. alt., Oct. 16, 1932, *Storey 193*; ditto, woods, 2,000 ft. elev., Oct. 16, 1932, *Storey 199*; Kaaawa Valley, north ridge, in shade of trees on wooded ridge, 1,600 ft. elev., April 12, 1931, *Storey 131*; Waikane Mts., Jan. 23, 1909, *Rock 1,135*; Waikane, Jan. 23, 1909, *Rock 1,251*; Waiahole ditch trail, June 1932, *Meebold*; ditto, Dec. 10, 1933, *Yoshioka*.

Leeward Side: Kaunala Gulch, Kaunala, 1,000 ft. alt., moist shaded gulch, only one sterile plant, Feb. 9, 1941, *St. John & Hosaka 20,159*; Paumalu,

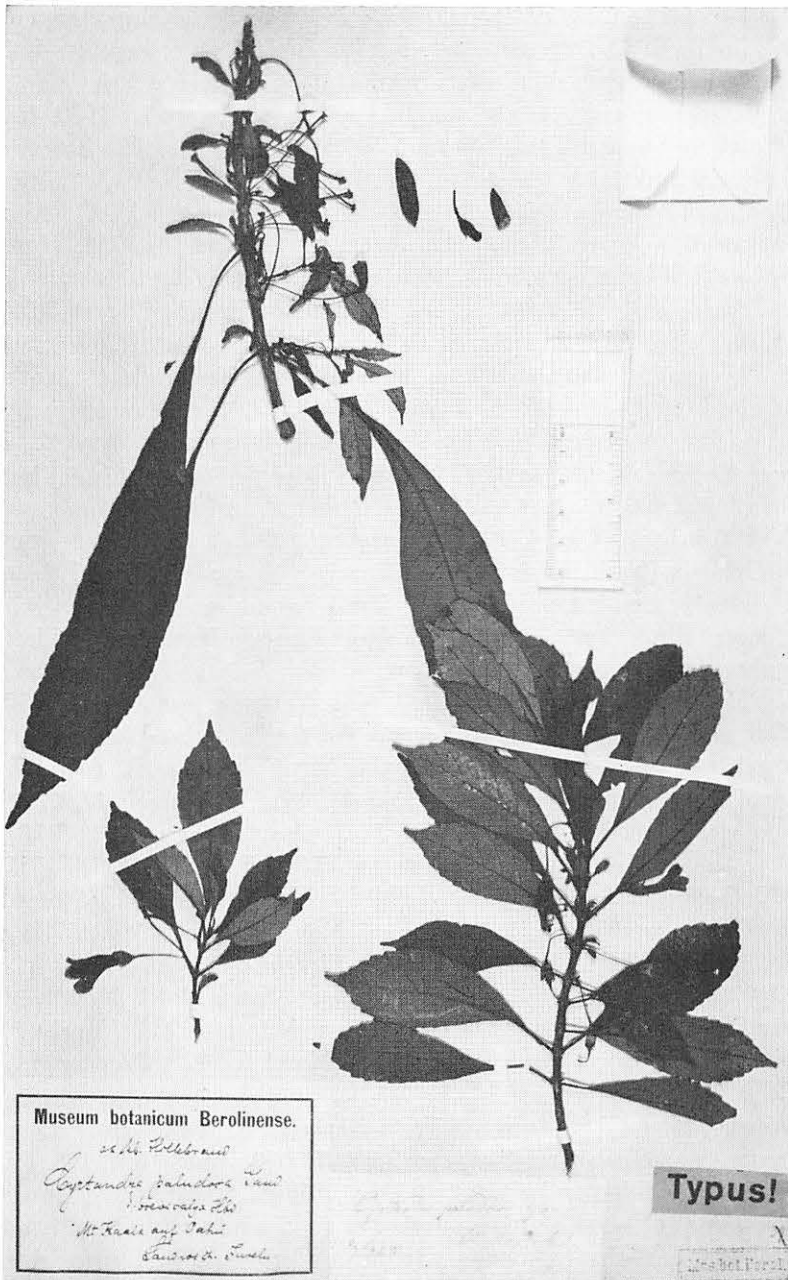


FIGURE 131.—*Cyrtandra paludosa* β var. *brevicalyx*, holotype, Hillebrand. Mt. Kaala (Berlin); basionym of *C. brevicalyx* (Hillebrand) St. John.

1,300 ft., woods, Jan. 12, 1930, *St. John 10,144*; Pupukea-Kahuku region, wet forest, May 28, 1932, *Degener, Park & Nitta 7,499* (NY); Pupukea-Kahuku trail, near summit, open rain forest, April 1, 1929, *Degener 7,554* (NY); Pupukea, Paumalu Forest Reserve, woods, 1,500 ft. elev., Jan. 12, 1930, *Hosaka 120*; Pupukea-Kahuku Trail, woods, 1,500 ft., March 6, 1932, *Storey 162*; ditto, stream banks, wooded region, 1,800 ft., March 11, 1934, *Storey 249*; ridge north of Waimea Valley, Feb. 10-13, 1915, *Forbes 2,059.O*; Anahulu Trail, Kawailoa, lower forest, open vegetation, March 10, 1935, *Hartung*; ditto, S. Fork of Waiola Valley, 1,240 ft. alt., open woods in gulch under kukui trees, Oct. 21, 1945, *St. John 21,365*; Anahulu Trail, lower forest, 1,600 ft., March 10, 1935, *Storey 262*; Kawailoa, rain forest, 1,700 ft. alt., Oct. 2, 1934, *Bryan 799*; head of Kawainui Gulch, main divide of Koolau Mts., wet forest, 840 m. alt., May 30-31, 1937, *Fosberg & Hosaka 13,961*; Kawaiiiki ditch trail, Aug. 15, 1922, *Skottsberg 195*; Peahinaia Trail, dark woods, April 28, 1940, *Degener, Ordonez & Kepaa 12,771* (NY); ridge to Puu Peahinaia, head of small valley, 1,600 ft. alt., Oct. 4, 1931, *Hume 225*; Puu Peahinaia, woods, 1,600-1,800 ft. elev., Oct. 4, 1931, *Yamaguchi (Storey 153)*; ridge south of South Opaepala Gulch, Paalaa, moist densely vegetated, 1,675 ft., Sept. 25, 1932, *Fukuda*; South Opaepala Ridge Trail (a student's collection without other data); ditto, Sept. 25, 1932, *Suehiro*; Opaepala-Kawailoa Divide, Paalaa, moist wooded region, 1,800 ft., Nov. 4, 1931, *Storey 127*; Poamoho trail, Nov. 1935, *Meebold (M)*; Poamoho Trail, Wahiawa, wet forests, 1,900 ft. alt., Oct. 20, 1946, *Shinohara 24*; Poamoho trail, Paalaa-Wahiawa, ridge, moist gulch in moist woods, 1,700 ft. alt., Nov. 22, 1936, *St. John 17,658*; Schofield Barracks, eastern range, July 11, 1916, *Hitchcock 14,027*, holotype and clastotype of *C. paludosa* var. *brevicalyx* f. *linearis* (US, BISHOP MUS.); Kipapa Gulch, Waipio, by stream, 2,000 ft. alt., Sept. 18, 1932, *St. John 12,076*; ditto, slopes in woods, 1,500 ft. elev., Feb. 10, 1935, *Storey 256*; Kipapa Gulch, south ridge, 1,500 ft. elev., Nov. 10, 1929, *Hosaka 26*; ditto, wooded ridge, 1,500 ft. elev., July 4, 1932, *Hosaka 643*; ditto, 1,600 ft. elev., Sept. 18, 1932, *Hosaka 748*; 2nd. North Fork of Kipapa Gulch, Nov. 13, 1932, *Hosaka 850*; ditto, moist gully, 1,200 ft. elev., May 14, 1933, *Hosaka 1,028*; Waipio-Waiawa Ridge, wooded moist slope, March 5, 1928, *Degener & Shear 7,571*.

Waianae Mountains: (see type from Kaala).

Sandwich or Hawaiian Islands: ex herb. *W. Hillebrand* (BM, US); U. S. Exploring Expedition under Capt. *Wilkes*, 1838-42 (GH).

Discussion: *C. brevicalyx* is a member of the *Cylindrocalyces* and is related to *C. paludosa*. Both are common, frequently collected, and represented in herbaria by a mass of material. Since Hillebrand in 1888 described the var. *brevicalyx*, it is probable that all active students of the Hawaiian flora have

been very familiar with both it and *C. paludosa*. Though the two are much alike in foliage and habit, the writer now raises the variety to specific rank as *C. brevicalyx*. The numerous differences between them are listed below, but the structure of the calyx in bud is so different that *C. brevicalyx* is anomalous in the section *Cylindrocalyces*, and might well be removed to another section, were it not for the fact that the calyx is caducous. *C. paludosa* is characterized by having the blades commonly oblanceolate but varying from broadly oblanceolate or oval to narrowly lanceolate; axillary spurs none; cymes 1-7-flowered; peduncles 3-14 mm. long; pedicels 6-21 mm. long, pilose, finally glabrate; bracts 3-8 mm. long, broadly lanceolate, at first obscured by the dense pilosity; calyx in bud appressed brown pilosulous, long fusiform, the fused lobes forming an elongate asymmetric beak 6-9 mm. long; at anthesis the calyx asymmetric, the five lobes separating and 2-10 mm. long, the tube early splitting and the whole caducous from the very young fruit; and there are slight differences in the corolla. In contrast, *C. brevicalyx* has the blades commonly oblanceolate, but varying from oval to linear-oblanceolate; the main branches commonly with numerous axillary short spurs bearing clusters of tiny leaves; cymes 1-3-flowered; peduncles 1-3 mm. long; pedicels 8-35 mm. long, glabrous; bracts 3-4 mm. long, lanceolate, sparsely pilose near the margins; calyx in bud subsymmetric, the body obovoid, the calyx lobes 1-1.5 mm. long, free, erect or arching outward; at anthesis the calyx slightly asymmetric, 7-14 mm. long, glabrous, the subequal lobes 5-7 mm. long, the tube more tardily splitting on the distal side and caducous from the partly grown fruit. The ranges of the two species meet but do not overlap. *C. paludosa* grows from Kipapa Gulch southward along the Koolau Range; while *C. brevicalyx* grows from Kipapa Gulch northward to the end of the Koolau Range.

The only collection of any of these in the Waianae Mountains is the holotype collection of *C. brevicalyx* made by Hillebrand in 1870 in the "Kaala range." As shown by our photograph of the holotype (Fig. 131) it consisted of three branches, one of which has long-petioled, linear-oblanceolate blades, long slender pedicels, and axillary, leafy short spurs. Very similar to, and, it is believed, identical with this is the collection from "Eastern range Schofield Barracks" [= Koolau Range], Hitchcock 14,027, the holotype of *C. paludosa* Gaudichaud var. *brevicalyx* Hillebrand f. *linearis* Rock (Fig. 151). Rock described this from the holotype, Hitchcock 14,027 in the U. S. National Herbarium, and the paratype, Kaala Mts., W. Hillebrand, in the Gray Herbarium. This Hillebrand specimen, labeled *Cyrtandra paludosa* var. *filipes*, is before us. It is a stem 14 cm. long, with numerous oblanceolate leaves, one flower, and two young fruits. It matches perfectly the larger branch in the lower right hand corner of the holotypic sheet, once in Berlin, of *C. paludosa* var. *brevicalyx* Hillebrand. It came from the Kaala Mts. as that one did. The label has a printed heading, Flora Hawaiensis, Coll. Dr. W. Hillebrand, 18- -. This is not the label printed and used for the Hillebrand herbarium when it was

inserted in the Berlin Museum. The data on the label is in Hillebrand's handwriting. It would appear that in some previous year Hillebrand selected a set of duplicates and sent them to Dr. Asa Gray who had befriended and assisted him. At this time he had this *Cyrtandra* under the manuscript name var. *filipes*, but later he published this plant under the name var. *brevicalyx*, probably because he himself used the name *C. filipes* for a species with whorled leaves from Maui. This specimen in the Gray Herbarium, labeled var. *filipes*, seems to be a genuine isotype of *C. paludosa* Gaudichaud var. *brevicalyx* Hillebrand. The type specimen of forma *linearis* does have a distinct aspect. However, Rock had but little material of var. *brevicalyx*. He had only one collection, doubtfully referred to it, besides the type which he had seen in Berlin. The writer considers that two other collections which Rock determined as *C. paludosa*, that is Punaluu Mts., *Rock 291*, and Waikane Mts., *Rock 1,251*, also belong with var. *brevicalyx*. Even so, Rock had available very few specimens. With only those few, the separation of his forma *linearis* was logical. At present there are available many collections from a greater range, and the collections made by the writer and his students usually are represented by many duplicates gathered from a single bush. A study of all these shows a complete gradation in leaf shape from linear-lanceolate to oval, from short to long pedicels, and with or without axillary spurs bearing tiny leaves. These spurs, if present, are usually on the larger, main branches, but lateral, weaker branches of the same bush usually lack them. Finding no line of separation, all these are grouped together, and the forma *linearis* of Rock is reduced to synonymy.

There still may be a mystery about the type locality of var. *brevicalyx* Hbd. on Kaala in the Waianae Mountains. This plant is one of the commonest species in the north half of the Koolau Range where it occurs generally in wet woods. Its occurrence there is almost wholly in the perfectly preserved rain forests. Similar rain forests clothe the upper half and top of Mt. Kaala and they were still well preserved until 1941, after which war time activities altered a part of the summit forest. Since 1900, botanists have climbed Kaala, collected and studied its flora so many times that one could well question if the published type locality for var. *brevicalyx* Hillebrand was correct. In appearance the type specimens exactly match the numerous recent collections from the north half of the Koolau Range. Many other montane species occur in both these mountain ranges, but the species of *Cyrtandra* are largely narrow endemics and but few of them have crossed the low Leilehua gap between the mountains. Hillebrand was a precise and accurate man, and, for his time, kept detailed and excellent data for his collections. There are some errors that the author has observed in Hillebrand's herbarium at Berlin, but all of these were on the new labels on which a young assistant (identity now unknown) copied the data. Hillebrand's handwriting was good, but the Hawaiian place names were exotic, and the assistant at times copied them incorrectly. This can be proven if the original pencil (or ink) label written by Hillebrand was pre-

served, as it was on a small percentage of the sheets. For the others, the original label was discarded. This holotypic sheet of var. *brevicalyx* Hillebrand bore the new label, and the original pencil label in Hillebrand's hand, reading Mt. Kaala, Oahu, July 1870. The data are original, and appear to be correct. If the locality is correct, it is mysterious that no subsequent collector has found the species anywhere on that mountain range.

The scientific name was obviously coined by Hillebrand from the Latin, *brevis*, short; and Greek, *kalux*, cup, or calyx.

94. *Cyrtandra carinata* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 81, 1950. (Figs. 132, 189.)

C. Lessoniana Gaudichaud ♂ var. *pachyphylla* Hillebrand, Fl. Hawaiian Is., 331, 1888, as to plant from Niu with elliptic leaves, not *C. pachyphylla* Kränzlin, Philippine Jour. Sci., Bot. 8: 316, 1913.

Description of All Specimens: Shrub; branches terete, bark brown, glabrous, leaf scars cuneiform or shield-shaped, pale, corky, raised; internodes 10-23 mm. long; leafy branchlets 3-5 mm. in diameter, densely spreading, brownish, glandular pilose; leaf scars not seen; young shoots densely spreading, brownish, glandular pilose; leaves opposite, slightly curved and unequal, divergent, not crowded; petioles 22-32 mm. long, sturdy, densely coated with spreading, brownish, glandular pilosity; blades 9-11.7 cm. long, 33-52 mm. wide, thick and coriaceous, elliptic or ovate-elliptic, apex subacuminate, base short decurrent, then abruptly auriculate, above closely subappressed glandular pilose, below densely spreading, glandular, brownish pilose, the hairs longer and more shaggy on the veins, the margin shallowly flattened serrulate almost to the base; cymes from the leaf axils, 1-flowered, densely spreading glandular, brownish pilose throughout; peduncles 20-25 mm. long; pedicels 18-25 mm. long; bracts paired at apex of peduncle, 9-15 mm. long, foliaceous, elliptic; buds fusiform, the calyx lobes connate; calyx 14-16 mm. long, noticeably sigmoid, greenish, shaggy, densely spreading, glandular, brownish pilose, fusiform even in flower, 3-5-lobed, the upper sinuses running $\frac{1}{2}$ way to base, lower sinus through which the flower is exerted running at anthesis $\frac{3}{4}$ way to base, later splitting to the base and the calyx deciduous, lobes narrowly lance-deltoid, the upper ones 4-5 mm. long, within the tips fleshy carinate and glabrous above but below the middle sparsely glandular puberulous, the tube glandular pilose within, more sparsely so towards the base; corolla 19-21 mm. long, 3.5-6 mm. in diameter, apparently white, the tube 17 mm. long, decurved and arcuate, broadest near the bent middle, without densely white glandular pilose except at base, within glabrous, the lobes spreading apparently at 40° to 50° from the axis of throat and upper tube; upper lobes 6 mm. long, 4 mm. wide, broadly ovate, pilose without, sparsely atomiferous within; lateral lobes 5.5 mm. long, 5 mm. wide, obliquely broad elliptic and wide rhombic; lower lobes 5 mm. long, suborbicular, pilose without, sparsely atomiferous within; filaments fused to corolla tube to within 7 mm. of the throat, the free portion 2 mm. long, incurved, broadly subulate; anthers 3.5-4 mm. long, asymmetric, narrowly elliptic-ovate, the two connivent at the tip; style 2.5 mm. long, stout, atomiferous; stigma with two thick, broadly oval to suborbicular, equal, distinct stigmatic lobes 1.2 mm. long; ovary ovoid, glandular atomiferous, the base surrounded by a cupulate disk; half ripe fruit ellipsoid, glandular atomiferous.

Distribution: Koolau Range, leeward side, at Niu.

Holotype: "Flora Hawaiiensis, Oahu, H. Mann & W. T. Brigham" (CU).

Specimens Examined: Koolau Range, Leeward Side: see holotype listed above; Niu, Dec. 1870, *Lydgate* (Herb. Hillebrand), the two lower specimens,

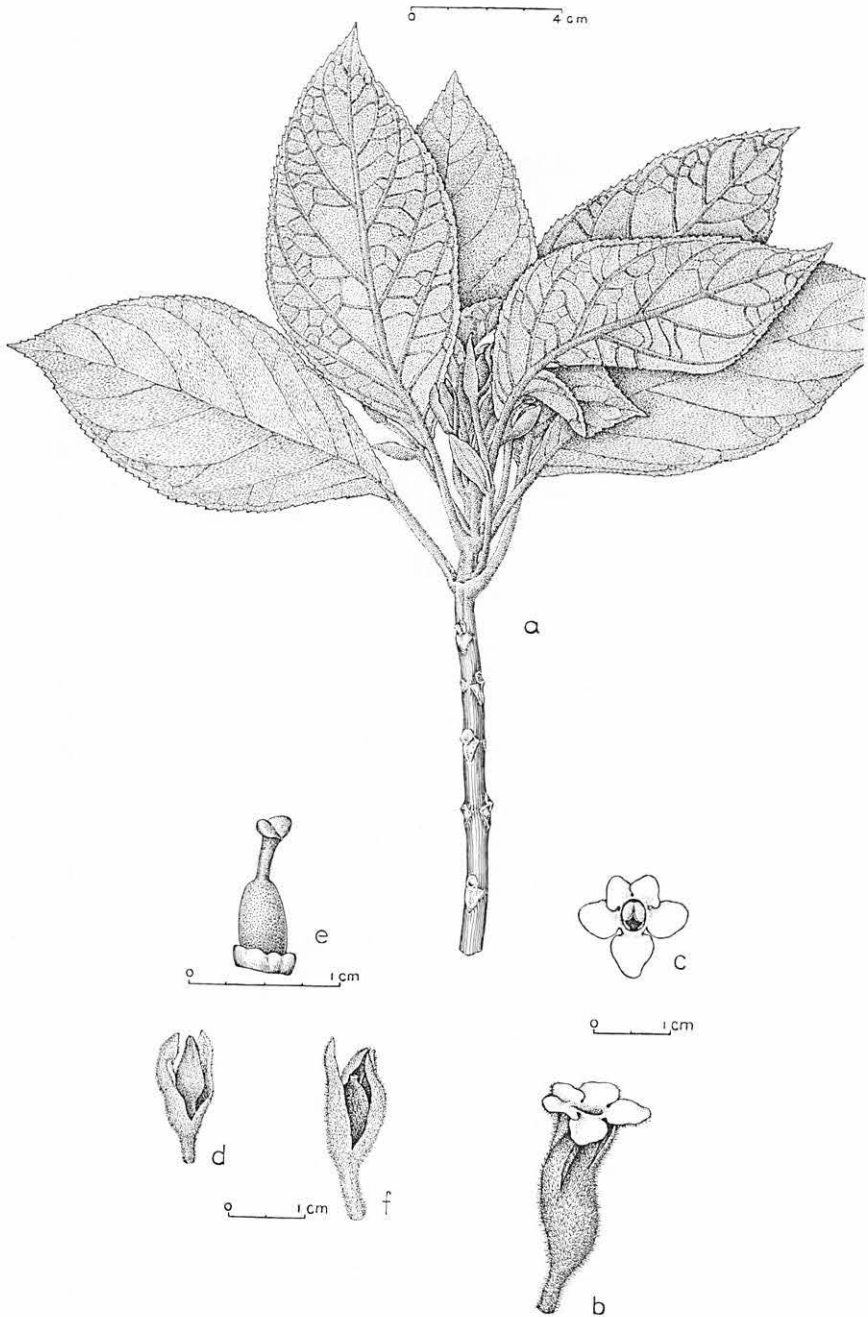


FIGURE 132.—*Cyrtandra carinata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Oahu, Mann and Brigham, holotype (Cornell Herbarium).

lectotype of *C. Lessoniana* Gaud. var. *pachyphylla* Hbd. (B); Niu, Hillebrand and Lydgate (ex Herb. Lydgate), mounted specimen, and loose shoot and two leaves in pocket (excluding loose bud and fruit in pocket), doubtless an isotype of the preceding (BISH).

Discussion: *C. carinata* is a member of the section *Cylindrocalyces*. Its closest relative is *C. oulophylla* St. John & Storey. Diagnostic differences are given in the key and hence will not be repeated here.

The new *C. carinata* formed a part of Hillebrand's concept of his *C. Lessoniana* var. *pachyphylla*. That was an aggregation of three different plants. Hillebrand's concept of species and varieties was excellent, and when he had sufficient personal knowledge, his classification was usually final. Plants known to him by meager or incomplete collections, made by others, he was loath to accord specific rank. If he had several such collections he often lumped them together as a variety of some well-known species. This was a temporary solution, and one not illogical or unsound. Here, it is believed, is the solution of another of these aggregates of Hillebrand's. The writer noted in Berlin in 1935 that there were two sheets corresponding to the Waianae Range and the Niu localities. The Waianae specimen had the leaves "broad oblong," obviously a different plant. It is not now available, but it is probably the same as the plant here described as *C. Wilderi*. The Niu specimen collected by Lydgate is also a mixture. The sheet in Berlin from the Hillebrand collection bore an upper specimen which is here described as *C. carinata*, and two lower specimens with "obovate leaves" which are designated as the lectotype of *C. Lessoniana* Gaud. δ var. *pachyphylla* Hillebrand. These two were the principal element in and agree best with the description of var. *pachyphylla*. The duplicate in the Bishop Museum has mounted a branch with oval leaves like the lower specimen on the Berlin sheet (*C. oulophylla*) and in the pocket three similar leaves and one young tip. There were also, but we have now removed, two loose flowers of *C. Lessoniana* var. *Lessoniana*.

C. carinata is one of the lost species. It was collected by Mann and Brigham in 1864-65. The specimen was in Mann's personal herbarium, and is now at Cornell University, Ithaca, New York. It lacks any date or precise locality. Mann labeled it in ink *Cyrtandra*, then in pencil *Lessoniana* ? forma. It is obvious that to him this was an unsatisfactory and a temporary placement. Had Mann's studies not been cut off by his premature sickness and death, he might have given this collection another placement. The Rev. J. M. Lydgate collected this same species, Dec. 1870, in Niu valley, and gave the specimens to Dr. Hillebrand, who later, from Europe, returned a specimen of it to Lydgate. Subsequently no one has rediscovered this species. It may well be exterminated, as the lower slopes, up to about 1,200 feet have been deforested and denuded, largely due to overgrazing by cattle. Neither Mann nor Lydgate gave any habitat. If the species occurred in the lower forests, it is doubtless extinct. If it occurred in the middle or upper forests, it may still exist. Niu was a favor-

ite collecting area in Hillebrand's time, and many noteworthy species came from there. During the year 1940 the writer made two trips up the central ridge of Niu Valley and reached the main divide, but failed to rediscover this species or the companion one, *C. oulophylla*, found there by Lydgate. It should be noted that on the original penciled label, written by Lydgate, the locality is given as "main ridge at the head of Niu valley." Whether this applied to only one or to both of the plants on the sheet is not known now. They may well still occur there. The upper forks of the valley and ridges are numerous. Without trails it is an arduous task to explore even a portion of the dense rain forests, but there is still the possibility that the species still exist in the upper reaches of the valley.

The specific name is taken from the Latin, *carinatus*, keeled, in allusion to the keeled tips of the calyx lobes.

95. *Cyrtandra grandiflora* Gaudichaud, Voy. Uranie Bot. 447 (1826) = [1829]; Atlas, pl. 55, 1826-30.

Description: The same as for *C. grandiflora* forma *grandiflora*, except as to leaves which are opposite or verticillate.

This is composed of the two following forms.

96. *Cyrtandra grandiflora* Gaudichaud forma *grandiflora* (Figs. 133-136, 191).

C. grandiflora Gaudichaud, Voy. Uranie Bot. 447 (1826) = [1829]; Atlas, pl. 55, 1826-1830.

C. Ruckiana Meyen, Reise Schiffe Prinzess Louise 2: 125, 1834.

C. Endlicheriana Nees ex Walpers, K. Leopold-Carol. Akad. Naturforscher, Verh. 19, Suppl. 1: 359-360, t. x, 1843 (see our Fig. 136).

Description of All Specimens Examined: Shrub, 1-2 m. tall, up to 15 mm. in diameter at base glabrous, grayish fawn-colored, somewhat fleshy and on drying shrinking and forming close longitudinal furrows and ridges; leaf scars 2.5-5 mm. high, shield-shaped, separate, pale, corky; bundle scars 5; young shoots olive brown appressed pilosulous; leafy branchlets as much as 4 mm. in diameter, appressed pilosulous, quadrangular; internodes 0.7-10.5 cm., averaging 2 cm. in length; *leaves* opposite, ascending, then divergent, not crowded, borne at the 3-8 upper nodes; those of a pair mostly unequal, one of the pair being from $\frac{1}{2}$ - $\frac{5}{6}$ smaller; petioles 12-35 mm. long, appressed brown pilosulous; *blades* 6-17 cm. long, 22-76 mm. wide, soft chartaceous, lance-ovate varying to broadly ovate or lanceolate or oblanceolate, the base long cuneate and decurrent, the apex acuminate or merely acute, above bright green, somewhat shiny, appressed pilosulous on the midrib and less so on the secondaries, the surface with a few remote hairs of a pilosulous kind, below whitish green or whitish, the midrib and secondaries closely brown pilosulous, the intervals minutely puberulous, the margins entire or rarely only subentire and perceptibly serrulate near the apex, the secondary veins 8-11 on a side, almost straight, then upward arcuate, the tips inarching and interconnected; *cymes* axillary or cauliflorous to within 30 cm. of the ground, 1-5(-7)-flowered but often flowering one at a time in succession, appressed brown pilosulous; peduncles 15-90 mm. long, slender; pedicels 4-13 mm. long; bracts 2 at apex of peduncle, 16-66 mm. long, 8-21 mm. wide, foliaceous, green, lance-ovate to lanceolate, subpetiolulate, tardily deciduous after anthesis; buds ellipsoid fusiform, terminating in an abrupt

beak 3-4 mm. long formed of the connate calyx lobes; *calyx* in anthesis when fresh 23-27 mm. long (when dried 18-27 mm. long), 8-10 mm. in diameter, pale green, sparsely pilosulous at base, at the tip glabrate or glabrous, within glabrous, the tube 16-19 mm. long, ellipsoid; the limb 2-lipped, cleft down 7-9 mm. between the lips, 5-lobed; upper lip 3-lobed or often two of the lobes remaining more or less completely connate, 5 mm. long, linear-lanceolate, the obtuse, firm, linear tips slightly recurving; lower lip with 2 lobes cleft 8-10 mm. between the lobes which are 4.5 mm. wide, deltoid; *corolla* 30-35 mm. long (when dried 24-32 mm.) white, glabrous without, the tube 20-23 mm. long, subcylindric, but tapering downwards, at base 3 mm. in diameter, at

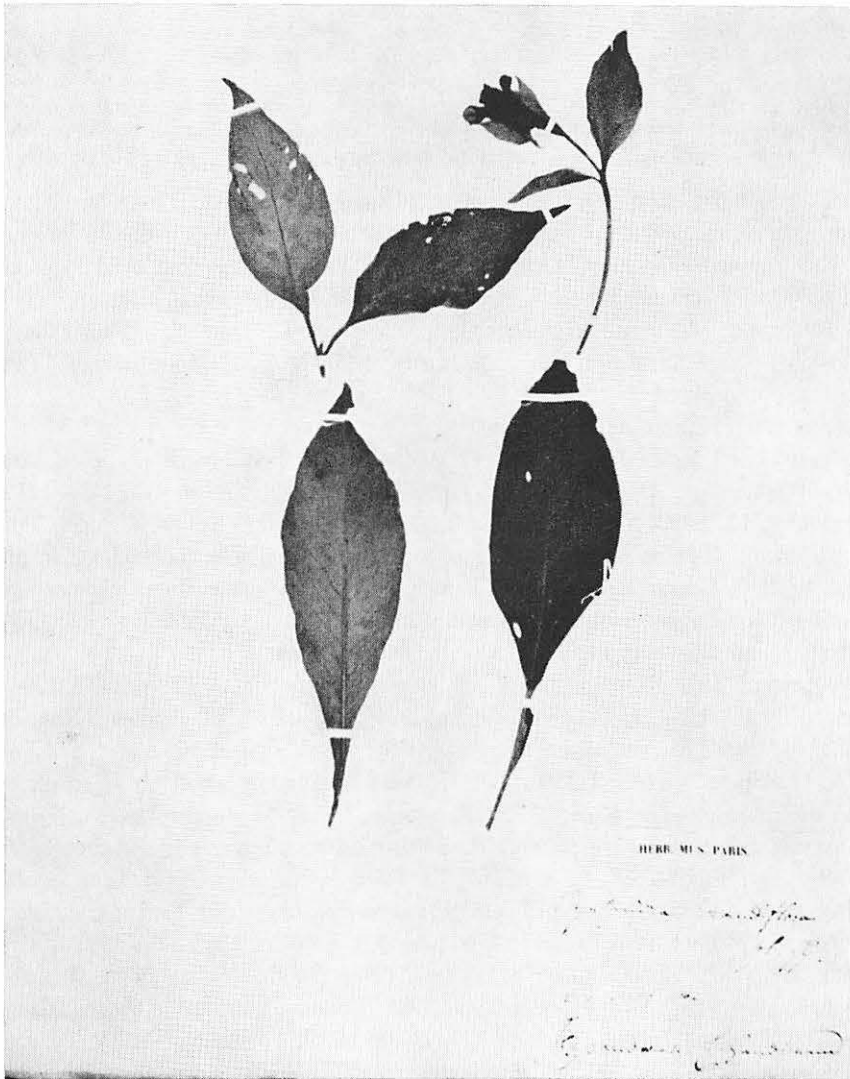


FIGURE 133.—*Cyrtandra grandiflora*, Îles Sandwich, holotype (Paris).

the bend 6 mm. in diameter, at the throat 7 mm. in diameter, deflexed at the middle at 40° from the axis of the lower tube; limb 2-lipped, 5-lobed, the throat and all the lobes in their middle and base capitate glandular puberulous; upper lobes 2, recurving at 60° to the axis of the throat, 7 mm. long, 8-9 mm. wide, broadly oval, overlapping at base; lower lip 3-lobed; lateral lobes 9-10 mm. long, 10-11 mm. wide, obliquely broad oval; lower lobe 12 mm. long, 10-11 mm. wide, broad oval; two lower stamens with filaments adnate to the corolla to within 10 mm. of the throat, the free portion 7 mm. long, spirally upcurved; 2 perfect anthers 3.5-4 mm. long, 2.5 mm. wide, obliquely oval, auriculate at base, the connective obliquely ovate; the staminodia adnate to the corolla tube to within 11 mm. of the throat, the free portion 2-2.3 mm. long, subulate, without any antheroid remnant, the two lateral ones larger; style 7 mm. long, glabrous; stigmatic lobes 2, sessile, 5 mm. long, oval, tapering below, connate $\frac{1}{4}$ way up proximal side; ovary 8 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 2 mm. high; berry white, 20-24 mm. long, 11-14 mm. in diameter, broadly ellipsoid, apiculate; seeds 0.30-0.37 mm. long, 0.16-0.30 mm. wide, oval in outline or nearly so, lemon yellow with brown tips, the body covered with raised, cellular, broad or even isodiametric polygonal or hexagonal reticulations $\frac{1}{7}$ to $\frac{1}{6}$ as long as the seed.

Distribution: Koolau Mountains, windward side, only at Heeia and Kona-huanui in humid woods from 500 to 1,237 feet alt. in the Ohia Zone; common on the leeward side from Kipapa Gulch to Wailupe in moist shady gulches from 600 to 1,700 feet altitude in the Koa Zone and the Ohia Zone.

Holotype: "In insulis Sandwicensibus (Alt. 100-300 hex.)." The holotype is labeled, "iles Sandwich, pl. 55, Uranie, 1817-1820, C. Gaudichaud" (P). Holotype examined.

Specimens Examined: Koolau Range.

Windward Side: Haiku Valley, Heeia, head of valley in shade of large trees, 800 ft. elev., Dec. 11, 1932, *Storey* 228; ditto, humid woods, 500-900 ft. elev., Dec. 11, 1932, *Storey* 230; Kailua, Fourth Branch South of South Fork of Kahanaiki Stream, in brush of staghorn, guava, and *Clermontia*, 900 ft. alt., Dec. 4, 1955, *Pearsall* 22; Kailua, Puu Konahuanui, lower slopes above Nuuanu Pali Road, steep wooded draw, 370 m. alt., Jan. 5, 1935, *Fosberg* 10,734; ditto, 375 m. alt., *Fosberg* 10,735.

Leeward Side: Kipapa Gulch, N. ridge, Waipio, in moist gully, 1,200 ft. elev., July 10, 1932, *Hosaka* 672; ditto, 2nd N. Fork, 1,500 ft. elev., Nov. 13, 1932, *Hosaka* 848; ditto, wet gorge, 1,000 ft. elev., Nov. 10, 1929, *St. John* 10,014; Kipapa Gulch, 1,250 ft. elev., dense shade, in small valley draining into the main stream, Nov. 13, 1932, *Storey* 217A; Waimalu Valley, N. side of middle ridge, moist gulch with *Psidium Guajava*, lower edge of forest, 600 ft. alt., July 13, 1947, *R. P. & M. M. St. John* 3; Kalauao Ridge Trail, woods below trail, 1,200 ft. elev., April 30, 1933, *Storey* 241; upper Moanalua Valley, March 1, 1925, ex herb Degener, *Topping* 3,051 (NY, UC); Kalihi, May 20, 1895, *Heller* 2,336 (GH, US); ridge W. of Kalihi Valley, Oct. 3, 1908, *Forbes*; [Nuuanu] Hillebrand's Glen, 1908, *Forbes*; mountains behind Honolulu, U. S. Expl. Exped. under *Capt. Wilkes* (US); Pauoa Valley, Nov. 4, 1908, *Rock* 703, 704, 705, all duplicates (BISH, GH); ditto, Oct. 29, 1908, *Rock* 10,346; ditto, east side, shady ravines along trail to Tantalus flats,

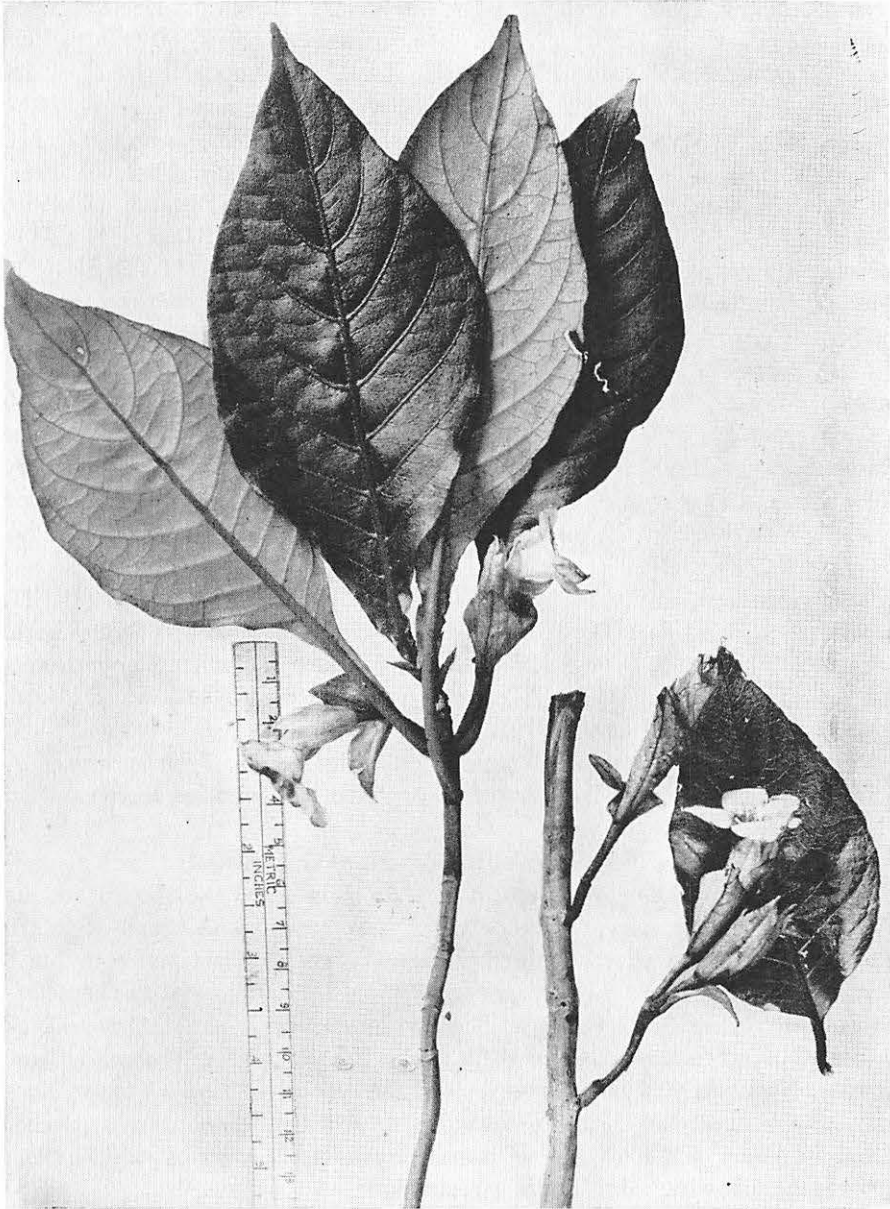


FIGURE 134.—*Cyrtandra grandiflora* forma *grandiflora*. Pauoa Valley, Storey 226.

1,200-1,500 ft., March 20, 1932, *Storey* 182; ditto, Dec. 15, 1932, *Storey* 226; Pauoa-Nuuau Trail, March 14, 1920, *Garber* 331; Tantalus, Dec. 28, 1929, *Nitta* (*Degener's* no. 7,570) (NY); ditto, im Regenwald, 2,500 ft. alt., Feb. 1930, *Meebold* 8,402 (M); ditto, Castle Trail, wet woods, Feb. 20, 1928, *Degener & Shear* 7,577 (NY); ditto, moist wooded east slope, June 11, 1923, *Degener* 7,665 (NY); Tantalus-Pauoa Trail, June 13, 1920, *Garber* 417; Mt. Tantalus, trail on N.E. side, moist shady gulch, 1,700 ft. alt., Sept. 20, 1941, *St. John & Storey* 20,254; Castle Trail to Konahuanui, March 17, 1919, *Forbes* 2545.O; Konahuanui, *Mann & Brigham* 758 (40) (BISH, CU, GH); Manoa, Manoa pali, 410 m. alt., Aug. 27, 1922, *Skottsberg* 354 (BISH, S); Manoa, Manoa Falls, moist gulch under *Aleurites* and *Eugenia malaccensis*, 800 ft. alt., April 5, 1942, *St. John* 20,284; Palolo Valley, right fork, Aug. 1, 1920, *Garber* 512; ditto, Waiomao Stream, 1,000 ft. alt., moist thickets by stream, May 17, 1942, *St. John* 20,297; Wailupe Valley, right fork, Jan. 12, 1920, *Garber & Forbes* 164; ditto, dense shade and small valley leading up to the main range, 1,500 ft., June 25, 1933, *Storey* 244; West Wailupe, valley floor, shaded moist stream bank, 1,700 ft. alt., June 21, 1951, *Kondo*; Wailupe Valley, West Fork, moist forest near stream, 1,300 ft. alt., March 16, 1952, *St. John* 24,795.

Oahu without locality, *Hillebrand* (US, Z); *Mann & Brigham* 40 (BISH, G, GH, US); and 76 (G); *Mann & Brigham* 377; Wahoo [= Oahu] herb. *Nuttall* (BM); 1913, *Wilder*; Sandwich or Hawaiian Islands; without locality, 18-, *Hillebrand* (GH); *Hillebrand & Lydgate*; 1838-42, U. S. Expl. Exped. under *Capt. Wilkes* (GH).

Discussion: *C. grandiflora* is a member of the section *Cylindrocalyces*. A somewhat similar species is *C. calpidicarpa*, but it has whorled leaves and an elongate linear fruit.

C. Endlicheriana Nees ex Walp. was described and illustrated from a specimen collected on Oahu by Meyen. The plate shows well the species and its details are accurate, except that the calyx is represented as equally 5-lobed. The only significant character in the diagnosis was "calycis pubescentibus," this differing from the "calycibus glabris" stated by Gaudichaud as characteristic of his earlier *C. grandiflora*. The two appear very much alike, and, as indicated in our treatment, *C. grandiflora* also has the calyx pubescent, at least at base. Here included is a photograph of the type of *C. Endlicheriana* Nees ex Walpers (Fig. 136). This was kindly furnished by the Naturhistorisches Museum, Wien, and Kurt Fitz of that institute, in his letter of July 7, 1952, reports the following result of his examination:

"*Cyrtandra grandiflora* is only represented in our herbarium by 4 sheets of Wawra no. 1746 from Oahu and by 1 sheet with a label running 'Hb. Endlicher/Cyrtandra n.sp./Oahu/Meyen' which must be the type specimen of *C. Endlicheriana* Walp. This last sheet presents a short branch showing 4 fully



FIGURE 135.—*Cyrtandra grandiflora* forma *grandiflora*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Tantalus, St. John and Storey 20,254.

developed leaves and 1 flower only, the one bract existing being broader and more obtuse compared with the bracts of Wawra's specimens. The calyx appears under the hand lens in the upper two thirds \pm glabrous; to make this sure I boiled the flower up and then the articulated hairs coating the peduncle and pedicel up to the base of calyx with a dense ferrugineous tomentum could be seen under the microscope spreading over the whole calyx on and between the veins up to the extremities of the laciniae, gradually becoming more sparing upwards. But this is \pm the case with Wawra's specimens also, which are on

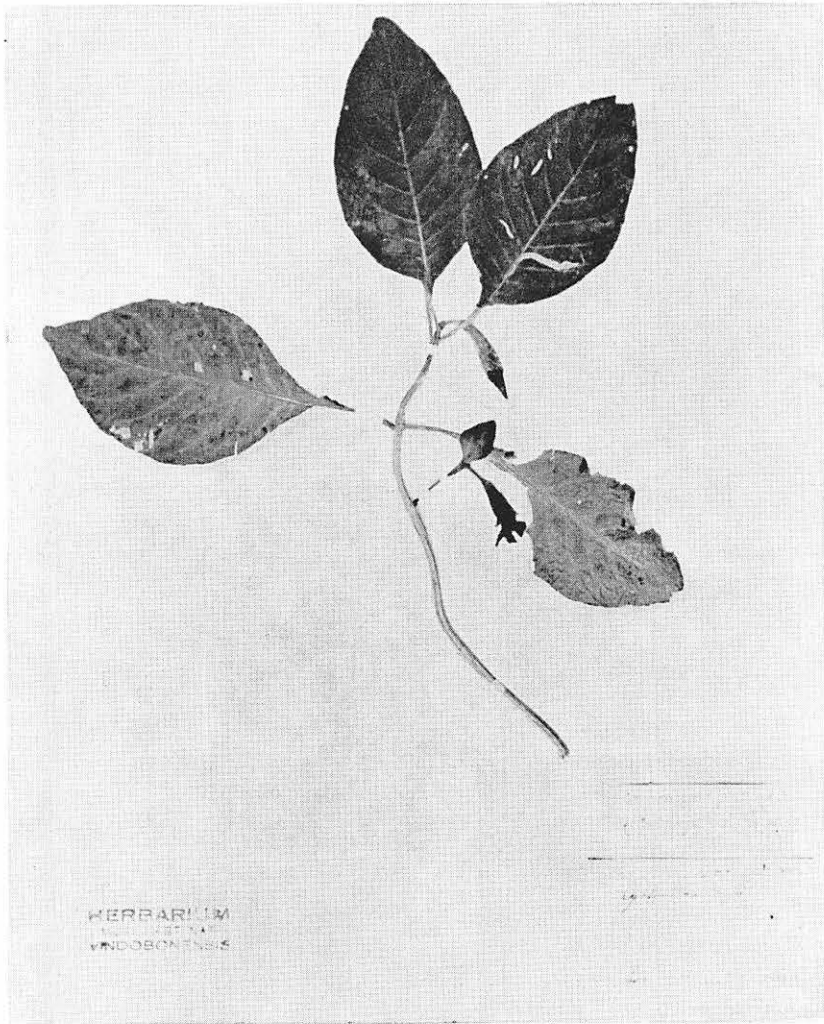


FIGURE 136.—*Cyrtandra Endlicheriana*, Oahu, Meyen, holotype (Vienna); synonym of *C. grandiflora* Gaudichaud forma *grandiflora*.

the whole slightly more glabrous and have more tapering bracts; they are surely not specifically different. *C. Ruckiana* is not represented in our herbarium."

It appears that no specimen of *C. grandiflora* was present in the Wien herbarium when the Meyen collections were being determined between 1832 and 1843. It is apparent that Nees ab Esenbeck, from the one word of description indicating that *C. grandiflora* had the calyx glabrous, decided that the Meyen specimen with a pubescent calyx was significantly different. It is obvious that he did not examine Gaudichaud's holotype in Paris. *C. Endlicheriana* is here confidently reduced to synonymy, agreeing with the previous reductions by C. B. Clarke (1883: 274) and Rock (1917: 621-622).

C. Ruckiana Meyen was described from the same collections made on the voyage of the "Prinzess Louise," but this one was by Meyen himself. It was briefly published in a footnote to a general account of the vegetation. Its description is adequate, containing fifteen significant descriptive words. The description agrees nicely with that of *C. grandiflora* Gaudichaud except that the leaves were said to be puberulent above, but as already indicated in our description, so are those of true *C. grandiflora*. Also the peduncles were said to be 1-flowered and bractless. To be sure, Gaudichaud described *C. grandiflora* as 2-flowered, but that difference in this group is not significant, and we now know that the inflorescence of *C. grandiflora* is from 1-7-flowered. The large bracts of the inflorescence are a feature of *C. grandiflora*, but *C. Ruckiana* was stated by Meyen to be bractless, yet in the very next phrase he added that the bracts were broadly ovate and obtuse. One or the other of his statements was incorrect, but we cannot elucidate it further. Curiously there is no specimen of *C. Ruckiana* Meyen in the herbarium at Wien, and this has been again confirmed after a second thorough search by Kurt Fitz, who so reported in his letter of Oct. 15, 1952. However, two sheets of it, doubtless the type, were previously located in the herbarium at Berlin. These were formally reduced to the synonymy of *C. grandiflora* by both Clarke (1883: 274) and by Rock (1917: 621-622). The writer concurs with that disposition of Meyen's species. The specimens in Berlin cannot now be re-examined as they are believed to have been destroyed in 1943 in the bombing of Berlin.

There has never been any real confusion as to the identity of *C. grandiflora*, as it is a common species in the gorges in the mountains back of Honolulu, and the diagnosis by Gaudichaud was four lines long, and accurate except for the statement "calycibus glabris." It is common to find inaccuracies in the description of a sparse or minute pubescence in accounts written a century or more ago. This was probably due to the poorer lenses and microscopes of that time, and even more so to the concept that details as minute as that lacked significance. The present writer's version would be: calyx in anthesis sparsely pilosulous at base, at the top glabrate or glabrous.

Another feature of *C. grandiflora* is that its blades are entire or subentire. Gaudichaud described it as "foliis . . . obsolete denticulatis." Many branches have the blades entire; others bear leaves that are minutely but perceptibly serrulate near the apex. When drawing such minute details it is easy to magnify them out of their true proportion in the attempt to make them visible. On examining Gaudichaud's illustration (pl. 55) one is struck by the bold coarse serrations shown on the blades from the tip almost to the base. Compare this with our photo of his type in the Paris herbarium (Fig. 133). If studied under magnification this photo shows a hint of several slight serrulations near the tip of two of the blades, but on the remaining three blades none are detectable. No isotypes were found in any of the principal herbaria of Europe or America, so this appears to have been the holotype. Any more ample material, if it existed, has vanished. It appears that the illustrator, A. Poiret, Jr., reconstructed the stem, nodes, and additional leaves from the few loose ones of the holotype. The flower parts used for illustrating the floral dissections were discarded or have been lost subsequently. The reconstruction was good and lifelike, except for the much exaggerated toothing of the blades. Also the illustration by the same artist of *C. cordifolia* is obviously inaccurate; see the present discussion under that species.

The specific name was coined from the Latin, *grandis*, large; *flora*, a flower, in allusion to the good-sized flowers of this species.

97. *Cyrtandra grandiflora* Gaudichaud forma *verticillata* St. John, forma nova (Fig. 187).

Diagnosis Holotypi: Foliis tribus verticillatis.
Leaves in whorls of three.

Holotypus: Oahu, Koolau Range, Kipapa Gulch, in dense shade in small valley draining into the main stream, 1,250 ft. elev., Nov. 13, 1932, *W. B. Storey 217* (BISHOP MUS.).

This is the only collection known of a verticillate shoot in this species. Though it is sterile, it was collected beside a flowering typical specimen with opposite leaves. Its characters are marked enough to justify describing it as a form. Its locality is on the leeward side of the Koolau Range.

The name comes from the Latin, *verticillus*, a whirl, in allusion to the whorled leaves.

98. *Cyrtandra Hosakae* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 82, 1950. (Figs. 137, 187.)

Description of All Specimens Examined: Shrub 1-2 m. tall, branching, erect; branches smooth, pale, straw-colored, somewhat fleshy and on drying shrinking and showing longitudinal furrows, naked below; leaf scars rounded shield-shaped, 2.5-3 mm. high, pale; bundle scars 7; young shoots sparsely appressed brown pilose; leafy branchlets as much as 5 mm. in diameter, subquadrangular, the younger parts sparsely brown pilose; internodes 8-23 mm. long, averaging 10 mm. long; *leaves* opposite, divergent or



FIGURE 137.—*Cyrtandra Hosakae*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, fruit, $\times 1$; f, pistil, $\times 2$. Kipapa Gulch, Storey 225, holotype (Bishop Mus.).

slightly ascending, numerous, borne at the upper 7-13 nodes, not crowded; petioles 8-40 mm. long, at first sparsely brown pilose, later glabrate; *blades* 9-18 cm. long, 26-46 mm. wide, unequal, one of the pair being about $\frac{1}{3}$ larger, firm chartaceous narrowly elliptic, the apex acuminate, the base cuneate or short decurrent, the margins crenate except at base, above dark green and shining, glabrous except for the appressed pilose midrib which is later glabrate, below pale green, and appressed brownish pilosulous, permanently so on the veins, secondary veins 8-13 on a side, ascending, arcuate, the tips inarching; *cymes* sparsely appressed brown pilosulous, axillary, from the upper axils, 1-flowered, peduncles 6-7 mm. long, ascending at 45°; pedicels 1-2 cm. long; bracts 5-8 mm. long, narrowly lance-elliptic, deciduous before the setting of fruit; buds at first fusiform; *calyx* 20 mm. long, white, sparsely brown appressed ascending pilosulous without, within glabrous, funnelform, lobed $\frac{1}{2}$ way into subequal lobes, sparsely pilose within, the tube narrowly funnelform, campanulate, the 2 upper lobes 9 mm. long, 4 mm. wide, the body elliptic, narrowing to a subacuminate, obtuse tip, the 3 lower lobes 10-11 mm. long, 5 mm. wide, deltoid-elliptic obtuse, caducous from the young fruit; *corolla* when fresh 22 mm. long (when dried 18 mm. long), white, the tube 17 mm. long, 4 mm. in diameter, cylindric, just below the middle gently recurved at 20°, glabrous within and without on the enclosed lower two-thirds, shaggy villous on the exerted upper third; the limb 2-lipped, 5-lobed, the 2 upper lobes spreading at 40° from the axis of the upper tube and throat, 5 mm. long, 6 mm. wide, asymmetrically elliptic ovate; of the lower lip the 2 lateral lobes 5-6 mm. long, 6 mm. wide broadly oval, emarginate, the lower lobe 4.5-5 mm. long, 5-5.5 mm. wide, oblong-oval, broadly obtuse, deflexed at 45° from the axis of the throat and upper tube; corolla lobes villous at base and hairy up the middle but the hairs decreasing in length and abundance, within towards the throat minutely capitate glandular puberulous; filaments fused to the tube to within 6 mm. of the throat, the free portion 3.5 mm. long, spirally upcurved; anthers 2.2 mm. long, 1.6 mm. wide, connivent at apex, asymmetrically and obliquely elliptic-ovate; *style* 4 mm. long, stout, glabrous; the 2 terminal stigmatic lobes 1 mm. long, equal, semiorbicular, cleft equally on each side, so that the symmetrical lobes face each other instead of opening outwards on one side; *ovary* broadly lanceoloid, glabrous; basal cupulate disk 1 mm. high, prominent; mature fruit not seen.

Distribution: Koolau Range, leeward side, Kipapa Gulch, in the Ohia Zone.

Holotype: Oahu, Kipapa Gulch, S. Ridge Trail, Koolau Mts., in woods just below the old trail about $\frac{1}{4}$ mile below the old ranger's cabin, 1,500 ft. elev., July 4, 1932, *W. B. Storey* 225 (BISHOP MUS.).

Specimens Examined: Koolau Range, Leeward Side: Kipapa Gulch, south ridge, Waipio, 1,500 ft. alt., moist stream bed, July 4, 1932, *Hosaka* 618 (BISH).

Discussion: *C. Hosakae* is of the section *Cylindrocalyces*. Its calyx is deciduous promptly after flowering, so that the fruit is naked. The young bud is fusiform, but the large calyx lobes soon open and in large, opened bud the shape approaches the campanulate.

The most similar species is *C. pupukeaensis* St. John & Storey, but this differs in numerous characters, including the following: blades oval, subacuminate; cymes 3-7-flowered; calyx lobes green, 2.8-4 mm. long, narrowly deltoid. In contrast, *C. Hosakae* has the blades narrowly elliptic, acuminate; cymes 1-flowered; calyx lobes white, 14-17 mm. long, ovate-deltoid. This is notable in having the calyx white.

The species is dedicated to the late collector, Edward Y. Hosaka, of the Agricultural Extension Service, University of Hawaii, active student of the Hawaiian flora and author of a detailed study of the flora and the vegetation of Kipapa Gulch, now the best known region botanically on Oahu.

99. *Cyrtandra infundibuliformis* St. John, sp. nov. (Figs. 138, 190).

Diagnosis Holotypi: Frutex 2.5 m. alta 5 cm. diametro late pluri-ramosa, cortice ramorum pallida fusca glabrata, cicatricibus 2-3.5 mm. altis pallidis suberosis lunatis sed interconjunctis et annulatis, fasciculis 5 vel 7, ramulis foliosis 4-5.5 mm. diametro subquadrangularibus carnosus viridibus ab initio olivaceo-brunneis adpressi-catenulato-pilosulis, internodis 0.3-5 cm. (plerumque 1.5 cm.) longis, novellis clausis dense adpresse olivaceo-brunneis pilosis, *foliis* oppositis, adscendentibus modice densis in 4-10 nodis superis affixis subaequalibus vel uno $\frac{1}{3}$ minore, petiolis 10-25 mm. longis validis carnosis dense adpresse brunneo-pilosulis, *laminis* 10.5-27 cm. longis 18-73 mm. latis chartaceis ellipticis vel elliptico-oblancoelatis in basi cuneatis et anguste oblongo-decurrentibus in apice subacuminatis supra obscure viridibus glabris vel in midnervo paene pilosulis, infra pallide viridibus et in nervis sparse adpresse brunneo-pilosulis in intervallis glabris vel subglabris, marginibus crenatis, nervis secundariis 15-18 in uno latere adscendentibus subarcuatis apicibus interconnectis et in dentibus salientibus, *cymis* axillaribus 3- vel 5-floriferis dense adpresse olivaceo-brunneo-pilosis, pedunculis 4-5 mm. longis, pedicellis 2-11 mm. longis, bracteis 20-35 mm. longis, foliaceis viridibus lanceo-ovatis sparse adpresse brunneo-pilosis $\frac{1}{2}$ connatis apicibus adscendentibus, alabastris lanceo-fusiformibus lobis calycis in rostro curvato conjunctis, *calycibus* in vivo 33-35 mm. longis 8 mm. diametro elliptico-lanceoloideis adpresse adscendente brunneo-pilosulosis in flore 15-17 mm. fissis in 2 labiis, labia supera ex 3 lobis connatis constructa, labia infera ex 2 lobis constructa sed tarde lobis in 10 mm. partitis linearibus basi lanceolati, calycibus intra adpresse pilosulis, *corollis* 33 mm. longis tubo 25 mm. longo in media et infra 5 mm. diametro in orifice 8 mm. diametro, parte tertia superiore in 40° deflexa, extra hirsuto et extra lobis in media hirsutis sed omnibus partibus alteris glabris, corollis albis bilabiatis, labia supera bilobata sinu 4 mm. profundo, lobis 6 mm. longis 7 mm. latis suborbiculari-cordatis impensis, labia infera 3-lobata in 40° divergenti, lobis lateralibus binis 8 mm. longis latisque oblique elliptico-suborbicularibus, loba infera 9 mm. longa 8.5 mm. lata late ovali subacuta intra capitato-glanduloso-puberula et lobis alteris itaque puberulis ex medio ad basim, staminibus inferis perfectis in tubo corollae 7 mm. ex orifice affixis, parte libera 4 mm. longa subulata curvato-adscendenti, antheris 4 mm. longis 3-3.5 mm. latis conniventibus oblique ovatis, connectivo obscuro 2 mm. lato late obliquo-ovato, staminodiis laterilibus binis in tubo 9 mm. ex orifice affixis filamentis 1.3 mm. longis apicibus antheroideis albis 0.9 mm. longis lanceolatis, staminodio supero in tubo 8 mm. ex orifice affixo filamentis libero 0.5 mm. longo apice antheroideo 0.2 mm. longo ovato, *stylum* 11 mm. longo tereto sparse capitato-glanduloso-hirsuto et minute capitato-glanduloso-puberulo, lobis stigmatis binis 4 mm. longis late ovalibus $\frac{1}{2}$ connatis, *ovario* 6-8 mm. longo anguste lanceoloideo glabro in basi disco-cupulato 1.5-2 mm. alto obscuro cincto, fructu ignoto.

Description of Holotype: Shrub 2.5 m. tall, 5 cm. in diameter, freely wide branching; branches with bark pale, tawny, glabrate, smooth; leaf scars 2-3.5 mm. high, pale, corky, lunate but interconnected and annular; bundle scars 5 or 7; leafy branchlets 4-5.5 mm. in diameter, subquadrangular, fleshy, green, and at first olive brown closely appressed catenulate pilosulous; internodes 0.3-5 cm. averaging 1.5 cm. long; young shoots obscured by the dense appressed olive brown pilosity; *leaves* opposite, ascending, moderately crowded, borne at the 4-10 upper nodes; either subequal or unequal with one as much as $\frac{1}{3}$ the smaller; petioles 10-25 mm. long, stout and fleshy, and closely appressed brown pilosulous; *blades* 10.5-27 cm. long, 18-73 mm. wide, chartaceous, elliptic or elliptic-oblancoelate, at base cuneate, then narrowly oblong-decurrent, the apex subacuminate, above dark green and glabrous or merely slightly pilose on part of the

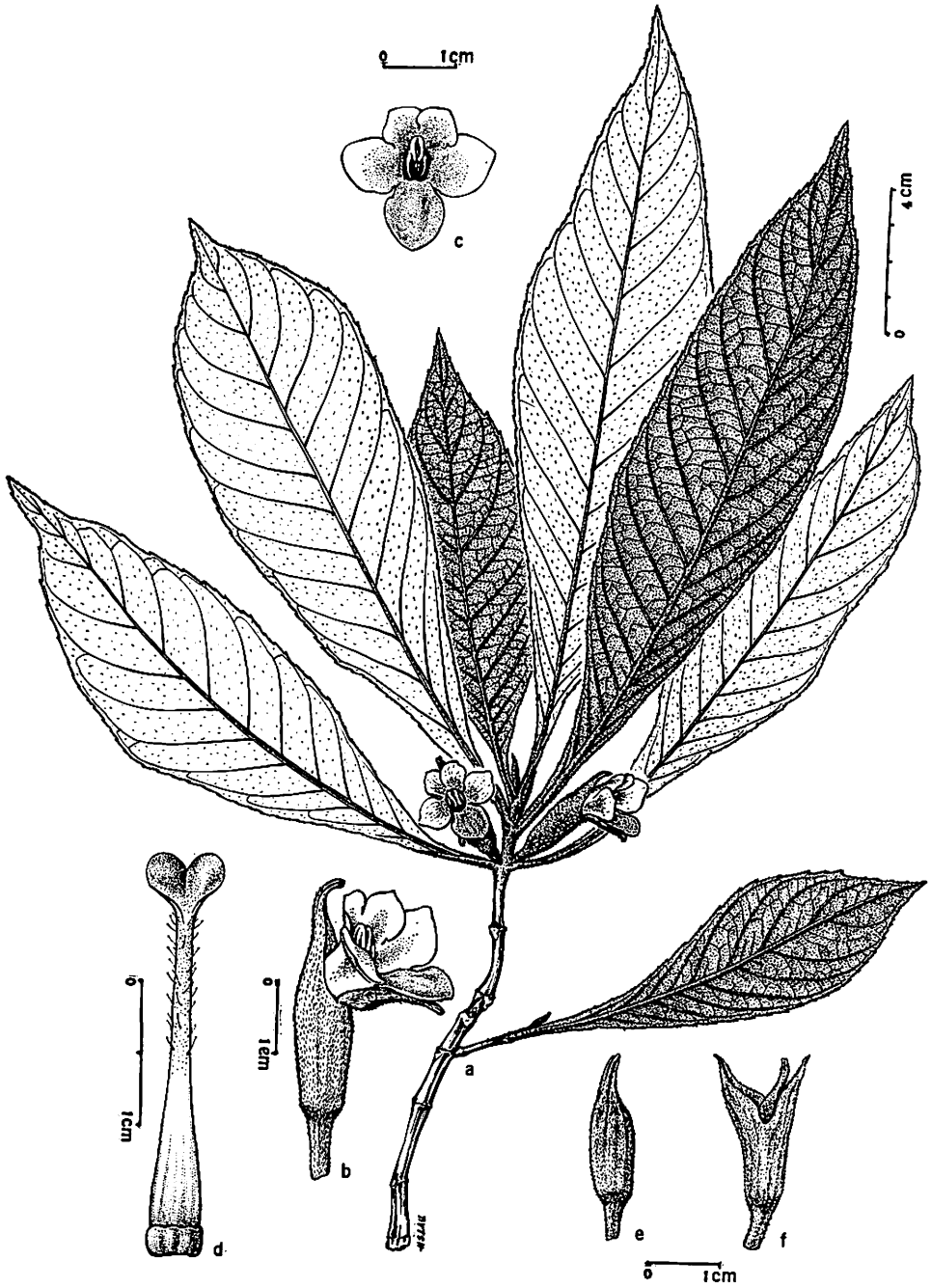


FIGURE 138.—*Cyrtandra infundibuliformis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, pistil, $\times 2$; e, bud, $\times 1$; f, calyx, $\times 1$. Waiahole, St. John 25,967, holotype (Bishop Mus.).

midrib, below pale green, sparsely brown appressed pilosulous on the veins, not or scarcely so on the intervals, the margins crenate, the secondary veins 15-18 on a side, ascending, slightly arcuate, tips inarched interconnecting and salient in the teeth; *cymes* axillary, 3- or 5-flowered, densely appressed olive brown pilose; peduncles 4-5 mm. long; pedicels 2-11 mm. long; bracts 20-35 mm. long, foliaceous, green, lanceovate, sparsely appressed brown pilose, united for half their length, the free tips ascending; buds lance-fusiform, the calyx lobes fused into a curved beak; *calyx* in anthesis 33-35 mm. long (when fresh), 8 mm. in diameter, green, elliptic-lanceoloid, appressed ascending brown pilosulous, at anthesis cleft down 15-17 mm. into 2 lips, the upper of 3 fused lobes, the lower of 2 fused lobes which in age divide into 2 lobes 10 mm. long, the base lanceolate, the rest linear, the calyx within appressed pilosulous; *corolla* 33 mm. long, the tube 25 mm. long, 5 mm. in diameter from middle down, widening to 8 mm. at the throat, deflexed at $\frac{3}{4}$ from the base at 40° from the axis of the lower tube, on the outside a hirsute band running down the middle of the lobes and down the tube to its bend, elsewhere glabrous, within glabrous; the throat open, glabrous; corolla white, 2-lipped, the upper lip of 2 lobes parted for 4 mm., the lobes 6 mm. long, 7 mm. wide, suborbicular-cordate, overlapping at base; lower lip 3-lobed, spreading at about 40° , the two lateral lobes 8 mm. long and wide, obliquely-elliptic suborbicular, the lower lobe 9 mm. long, 8.5 mm. wide, broad oval, subacute, within capitate glandular puberulous all over, while all the other lobes are similarly hairy from the middle to the base; the two lower stamens perfect, the filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 4 mm. long, subulate, gently spirally upcurved; the 2 perfect anthers 4 mm. long, 3-3.5 mm. wide, connivent, obliquely ovate, the heavy, dark connective 2 mm. wide, broad oblique ovate; the two lateral staminodia adnate to the corolla tube to within 9 mm. of the throat, their filaments 1.3 mm. long, their whitish, thin antheroid tips 0.9 mm. long, lanceolate; the upper staminodium adnate to within 8 mm., free filament 0.5 mm. long, the antheroid tip 0.2 mm. long, ovate; *style* 11 mm. long, terete, sparsely hirsute, the hairs at first with capitate glandular tips, and the style also closely minutely capitate glandular puberulous; stigmatic lobes two, 4 mm. long, broadly oval, connate $\frac{1}{2}$ way up proximal side; *ovary* 6-8 mm. long, narrowly lanceoloid, glabrous, the base surrounded by a dark cupulate disk 1.5-2 mm. high; fruit unknown.

Distribution: Koolau Range, windward side, known only from the type locality, at 700 ft. alt. in the Ohia Zone.

Holotypus: Oahu, Waiahole Ditch Trail, Waiahole, 1st gulch N. of tunnel, moist gulch, 700 ft. alt., April 29, 1956, *H. St. John 25,967* (BISHOP MUS.).

Discussion: *C. infundibuliformis* is a member of the section *Cylindrocalyces*. Because of its fused floral bracts it appears in the key next to *C. calpidicarpa* and *C. cornuta*, but they are not very similar, and can easily be separated by having their leaves in whorls. The closest relative is deemed to be *C. Rockii* which has its blades oval-oblancheolate, 7-9 cm. wide; the inflorescence and calyx densely brown villous; calyx 36 mm. long, lobed $\frac{3}{4}$ way into 5 lanceolate lobes; corolla fine white lanate without; and the pistil glabrous. In contrast, *C. infundibuliformis* has the blades elliptic or elliptic-oblancheolate, 10.5-27 cm. long; the inflorescence and calyx densely appressed olive brown pilose or pilosulous; calyx 33-35 mm. long, lobed $\frac{1}{2}$ way into 2 lips, and only the lower splitting into 2 lobes that are linear above the lanceolate base; corolla with 5

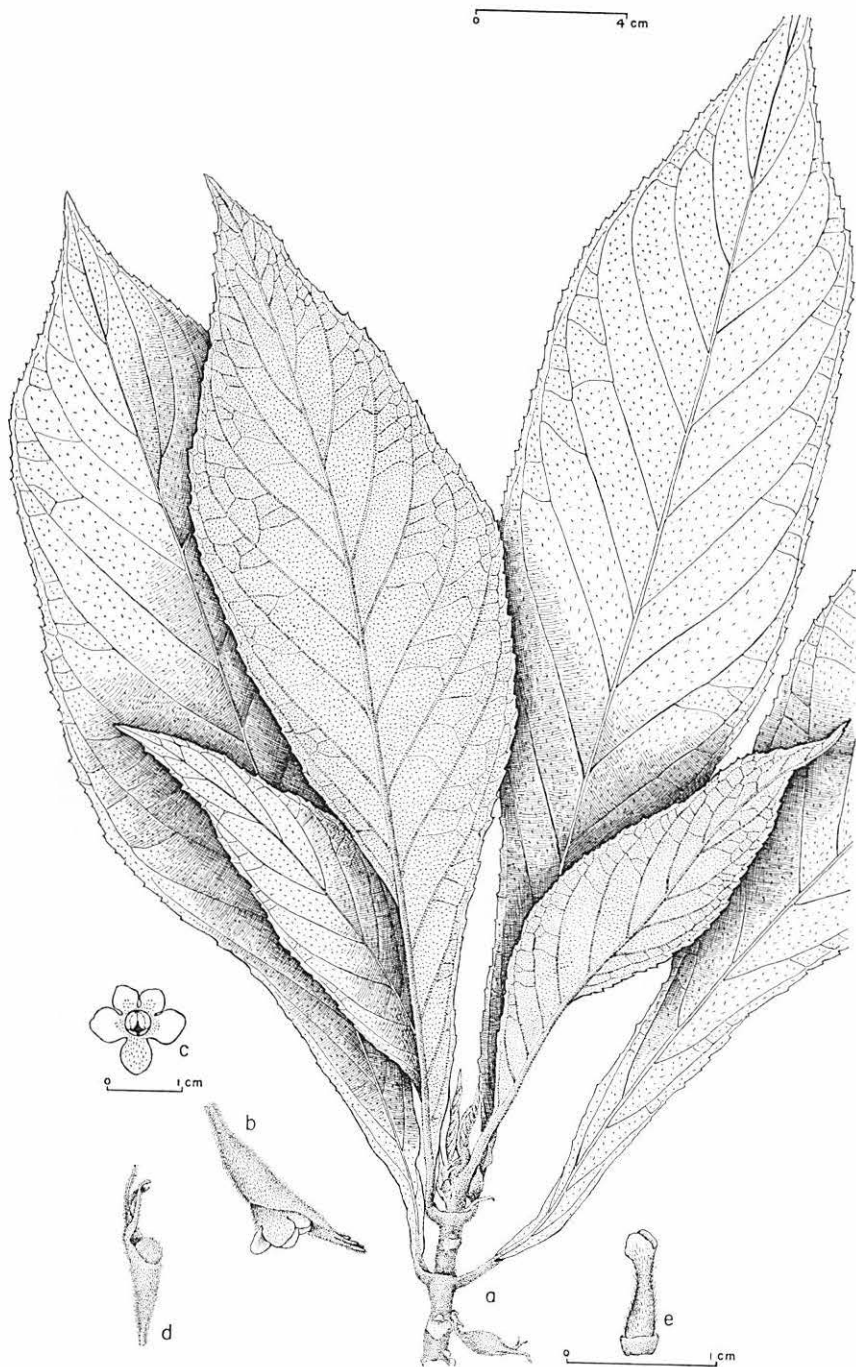


FIGURE 139.—*Cyrtandra intravillosa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Kipapa, Storey, holotype (Bishop Mus.).

hirsute bands on the outside; and the style hirsute and capitate glandular puberulous.

The new specific epithet is from the Latin, *infundibulum*, a funnel, and *formis*, shape, in allusion to the widened, funnellform corolla tube.

100. *Cyrtandra intravillosa* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 82, 1950. (Figs. 139, 191.)

Description of Holotype: Shrub; branches buff-colored, smooth and glabrous, the leaf scars 4 mm. high, broadly cordate shield-shaped, pale and corky; bundle scars 7; internodes 5-15 mm., usually about 10 mm. long; leafy branchlets somewhat quadrangular, densely dark brown pilose; young shoots covered with a dense, subappressed, dark brown pilosity; *leaves* opposite, distinctly unequal, one of a pair as much as $\frac{1}{6}$ the larger, the several pairs approximate, ascending in a terminal tuft; petioles about 1 cm. long, densely dark brown pilose; *blades* 29-36 cm. long, 6-9.5 cm. wide, chartaceous, linear-oblongate, abruptly subacuminate, the base gradually narrowed and long tapering and decurrent winged, nearly straight and symmetric, plane, above dark green, remotely hirsute, below pale green, brown pilose on the veins and sparsely so on the intervals, the margin doubly denticulate; *cymes* from the leaf axils, 1-3-flowered, shaggy, dark brown pilose; peduncles 1-3 mm. long; pedicels 5-10 mm. long; bracts 5-6 mm. long, lanceolate; buds slender fusiform, beaked; *calyx* 17-19 mm. long, densely brown villous, outside and inside, lobed $\frac{1}{2}$ way to base, early caducous, the three lobes 8 mm. long, narrowly linear-lanceolate; *corolla* in bud 15 mm. long, the tube 11 mm. long, 3.5 mm. in diameter, subcylindric and only slightly widened above, villous without except near the base, 2-lipped, 5-lobed, the upper lobes 3 mm. long, ovate-semiorbicular and glabrous within, villosulous without, the lower lobes 4 mm. long, the lateral pair semiorbicular, densely capitate villous without near the throat, the lower lobe oval, capitate glandular puberulent nearly throughout the upper surface; two lower filaments fused to the corolla to within 4 mm. of the throat, the free portion 2.5 mm. long, stout, terete, incurved; anthers 2 mm. long, oval-suborbicular, flattened, the anther sacs subequal; three staminodia fused to the corolla tube to within 4.5 mm. of the throat, 0.8-1.2 mm. long, subulate, bearing at the end a tiny ovoid, curved, empty and sterile anther; immature *style* 2.5 mm. long, villous; stigma with two compressed, broadly ovate, opposite, distinct, glabrous stigmatic lobes 1.5 mm. long; *ovary* lanceoloid, the upper half villous, the base surrounded by a cupulate disk: fruit unknown.

Distribution: Koolau Range, leeward side, known only from Kipapa Gulch where it grows in the Ohia Zone at 1,500 feet altitude.

Holotype: Oahu, Koolau Mts., Kipapa Gulch, in ravine below the Kipapa Trail to the summit of the range, elev. 1,500 ft., *W. B. Storey* (BISHOP MUS.).

Discussion: The new *C. intravillosa* is most likely to be confused with *C. crenata* St. John & Storey, which it resembles. However, *C. crenata* is a member of the section *Verticillatae* and has the leaves in whorls of 3 and the calyx fusiform in bud; the petioles 1-4 cm. long; and the style capitate glandular puberulent. In contrast, *C. intravillosa* has the leaves opposite and the calyx campanulate in bud; petioles about 1 cm. long; and the style villous.

101. *Cyrtandra kahukuensis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 82, 1950. (Figs. 140, 141, 191.)

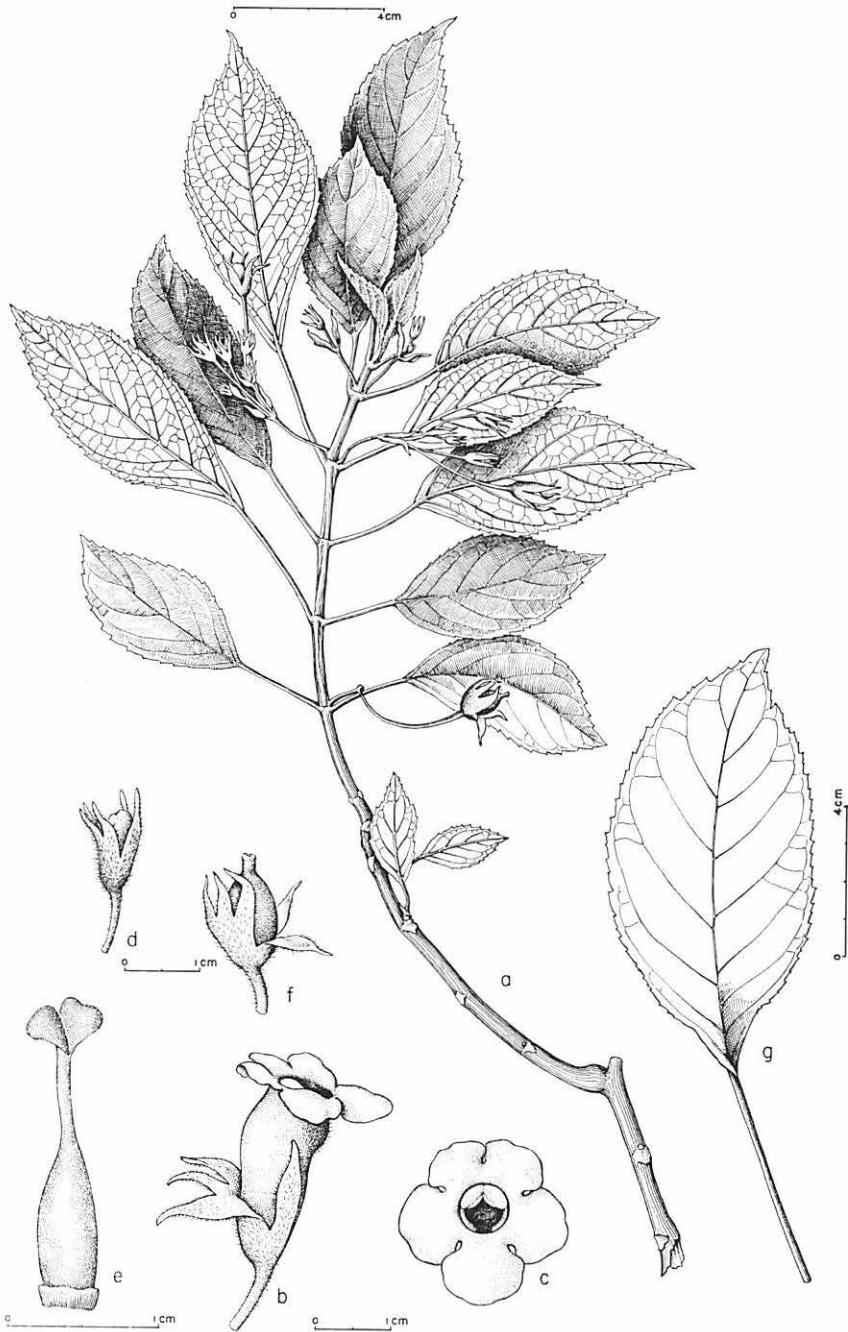


FIGURE 140.—*Cyrtandra kahukuensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$; g, leaf, $\times \frac{1}{2}$. Pupukea-Kahuku Trail, Ohia Ai Gulch, St. John 20,221, holotype (Bishop Mus.).

Description of Holotype: Shrub 2 m. tall; branches pale yellowish brown, as much as 5 mm. in diameter, quadrangular, fleshy, on drying forming longitudinal ridges and furrows; leaf scars 2-4 mm. high, pale, rounded shield-shaped; bundle scars 5; young shoots brownish pilosulous; leafy branchlets as much as 5 mm. in diameter, quadrangular, sparsely brown pilosulous, soon glabrate; internodes 1-6 cm., averaging 2 cm. in length; *leaves* opposite, divergent, not crowded, borne at the 5-8 upper nodes; those of a pair subequal or unequal and one about $\frac{1}{2}$ larger; petioles 1-6 cm. long, slender, and sparsely pilosulous; *blades* 4-13 cm. long, 10-54 mm. wide, somewhat fleshy chartaceous, oval or elliptic, the base cuneate and short decurrent, the apex acuminate or subacuminate, above dark green and glabrous or hirsutulous with a few remote hairs, below pale green,



FIGURE 141.—*Cyrtandra kahukuensis*, holotype. Kahuku, St. John 20,221.

and pilosulous on the veins, the margins serrate, the secondary veins 6-9 on a side, almost straight, but near the margin arcuate, then salient in the teeth; *cymes* axillary, 2-7-flowered, sparsely brown pilosulous; peduncles 5-16 mm. long, filiform; pedicels 10-39 mm. long, filiform; bracts 7-15 mm. long, lanceolate, foliaceous; buds slender fusiform, but the calyx lobe tips early separating; *calyx* in anthesis 17-18 mm. long when fresh (but when dried only 10-11 mm. long), pale greenish but becoming whitish, pilose without, the tube 4-5 mm. long narrow campanulate; the limb 2-lipped, cleft down 13-15 mm. between the lips, 5-lobed; upper lip 3-lobed, sharply reflexed, cleft 8.5-9 mm. between the lobes, the lobes 2.5-3 mm. wide, linear-lanceolate, within capitate glandular pilosulous near the tips and below glandular atomiferous; lower lip with 2 lobes, cleft 13-14 mm. between the lobes, the lobes 3-4 mm. wide, linear lanceolate; *corolla* 28 mm. long, white, glabrous without and within, tube 19 mm. long subcylindric, but slightly enlarged at bend, at base 5 mm. in diameter, at the bend 9 mm. in diameter, at the throat 7 mm. in diameter, deflexed 13 mm. from the base at 20° from the axis of the lower tube; limb 2-lipped, 5-lobed; upper lobes 2, recurving at about 90° to the axis of the throat, 4-5 mm. long, 9 mm. wide, transversely oval, auriculate and overlapping at base; lower lip 3-lobed; lateral lobes 7 mm. long, 10 mm. wide, rhombic-subglobose, obtuse; lower lobe 7 mm. long, 11 mm. wide, transversely oval; two lower stamens with filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 4 mm. long, spirally upcurved; the 2 perfect anthers 2.3 mm. long, 2.7 mm. wide, obliquely reniform, the connective cordate; the 2 lateral staminodia adnate to corolla tube to within 8 mm. of the throat, subulate, 1.5-1.8 mm. long; the upper staminodium adnate to within 9 mm., and 0.8 mm. long, subulate; *style* 5-6 mm. long, glabrous; stigmatic lobes 2, sessile, 3 mm. long, oblong oval, connate $\frac{2}{3}$ way up proximal side; *ovary* 15-18 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; *berry* white, when dried 13 mm. long, 7 mm. in diameter, ellipsoid, short-beaked, naked by the fall of the deciduous calyx; seeds 0.38-0.51 mm. long, 0.18-0.24 mm. in diameter, oval to elliptic, lemon-yellow in color, the body covered with raised cellular, narrow oblong reticulations $\frac{1}{6}$ as long as the seed.

Distribution: Koolau Range, at the extreme north end, on the windward side, at 1,300 ft. alt., in the Ohia Zone.

Holotype: Oahu, Kahuku, Pupukea-Kahuku Trail, Ohia Ai Gulch, 1,300 ft. alt., moist wooded gulch, April 6, 1941, *H. St. John 20,221* (BISHOP MUS.).

Discussion: *C. kahukuensis* is a member of the section *Cylindrocalyces*. The closest relative is *C. kaalae* St. John & Storey, but this species of Mt. Kaala, the highest peak of the Waianae Mountains, differs in having the petiole bases perfoliate; calyx only slightly 2-lipped; corolla 20 mm. long, villous without; and the anthers obliquely oblong ovate. On the other hand *C. kahukuensis* has the petiole bases separate; calyx strongly 2-lipped; corolla 28 mm. long, glabrous; and the anthers obliquely reniform.

The specific name is formed from that of the local geographic name Kahuku, plus the Latin adjectival place suffix *-ensis*.

102. *Cyrtandra kaulantha* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 82, 1950. (Figs. 142, 143, 185.)

Description of All Specimens Examined: Shrub 1-3.5 m. tall, erect, simple, or little branched; trunk 1-5 cm. in diameter at base; upper stem fleshy, subquadrangular; lower stem woody, terete; branches 1-5 cm. in diameter, smooth, glabrous, greenish, finally buff-colored; the leaf scars, 7-9 mm. high, broad shield-shaped, finally con-

nected by a ring and annular, pale, corky, sunken on fresh material; bundle scars 9, V-shaped; internodes 1-10 cm., usually about 2 cm. long; leafy branchlets slightly quadrangular, 8-15 mm. in diameter, where not obscured by crowded leaf bases, sparsely brown appressed pilosulous; young shoots somewhat brown appressed pilosulous; *leaves* opposite, sessile, equal, numerous, crowded in an ascending terminal tuft; *blades* 30-60 cm. long, 11-22 cm. wide, thick chartaceous, oblanceolate, abruptly acuminate, oblong toward the auriculate base, above dark green and somewhat shiny, remotely pilose to early glabrate, below whitish green, sparsely appressed white puberulous, the veins appressed brown pilosulous, the margins apiculate crenate; *cymes* cauliflorous, basal or subbasal often on subterranean caudex or even on the root, 7-25-flowered, 2-6 cm. long, densely clustered; peduncles 5 mm. long, appressed castaneous villous, jointed; pedicels 3-5 mm. long, appressed brown pilose, bracts 5-18 mm. long, lanceolate, foliaceous, villous, caducous; buds appressed castaneous villous, short fusiform, the calyx lobes firmly connivent; *calyx* in anthesis when fresh 20-23 mm. long (when dried 15-21 mm.), oblique but almost campanulate when opened, greenish, at base appressed brown pilose, on the body glabrous without, villous within, lobed $\frac{1}{3}$ to $\frac{1}{2}$ way to base, 2-lipped, and cleft down 9-11 mm. between the lips; calyx tube 5-10 mm. in diameter, sparsely appressed villous, glabrate, upper lip 3-lobed, the center lobe free for 4-6 mm., lanceolate with a firm subulate tip; lower lip 2-lobed, the lobes 9-11 mm. long, separated by a cleft 9-10 mm. deep, the lobes 4 mm. wide, broadly lanceolate, with a subulate tip 2.5-3 mm. long; *corolla* tube 17-23 mm. long, the enclosed portion 4-5 mm. in diameter, cylindrical, straight, glabrous without, slightly longer than the exerted portion which is declined at 35° from the lower tube and is ventricose campanulate, 5-7.5 mm. in diameter, remotely capitate glandular puberulous, without and within; the corolla clearly 2-lipped, the 5 lobes unequal, wide spreading, the upper rotate, the lower at length all reflexed, without minutely capitate glandular puberulous, within capitate glandular puberulent; the upper lobes 4-5 mm. long, 5-6 mm. wide, broadly deltoid semiorbicular, within capitate glandular puberulous; lateral lobes 6-8 mm. long, 8 mm. wide, obliquely broad oval, capitate glandular puberulous up the middle within, lower lobe 9 mm. long, 8 mm. wide, broadly oblong oval, within capitate glandular puberulous except near the broad margin; filaments fused to lower side of corolla tube to within 4 mm. of the throat, the free portion 3 mm. long, twisted and arcuate, the 2 anthers 3 mm. long, connate at tip, obliquely ovate, with cordate base; the 3 staminodia 2 mm. long, subulate; *style* 16 mm. long, stout, enlarging to the narrowly lanceoloid base, sparsely capitate glandular puberulous; *stigma* 4 mm. long, obcordate, the sinus 1.2 mm. deep, the lobes oval, partly infolded; *ovary* subcylindric, glabrous; *berries* 14-18 mm. long, 9-11 mm. in diameter broadly ellipsoid or oblong-ellipsoid, microscopically capitate glandular puberulous, the tip with a stout apiculation 1-1.5 mm. long; seeds 0.38-0.45 mm. long, 0.20-0.22 mm. wide, broadly ellipsoid, pale stramineous, each end with a low brownish boss, the body surface shiny and wavy transverse sinuate, covered with raised cellular, rectangular oblong reticulations $\frac{1}{11}$ - $\frac{1}{15}$ as long as the seed.

Distribution: Koolau Range, windward side, in Waikane Valley, found in steep moist gulches from 700 ft. to 1,200 ft. altitude in the lower forest, Ohia Zone.

Holotype: Oahu: Waikane, Waiahole Ditch Trail, Intake 24, moist wooded gulch, under ohia ai trees, 700 ft. alt., May 18, 1941, *H. St. John & W. B. Storey 20,238* (BISHOP MUS.).

Specimens Examined: Oahu, windward side.

Koolau Range: Waikane, by tunnel 24, Waikane-Waiahole Ditch Trail, in ravines above the trail, humid and densely shaded, 900 ft. elev., March 3, 1932, *Hume 450*; ditto, N. Fork Uwau Stream, March 23, 1947, *St. John 22,581*;

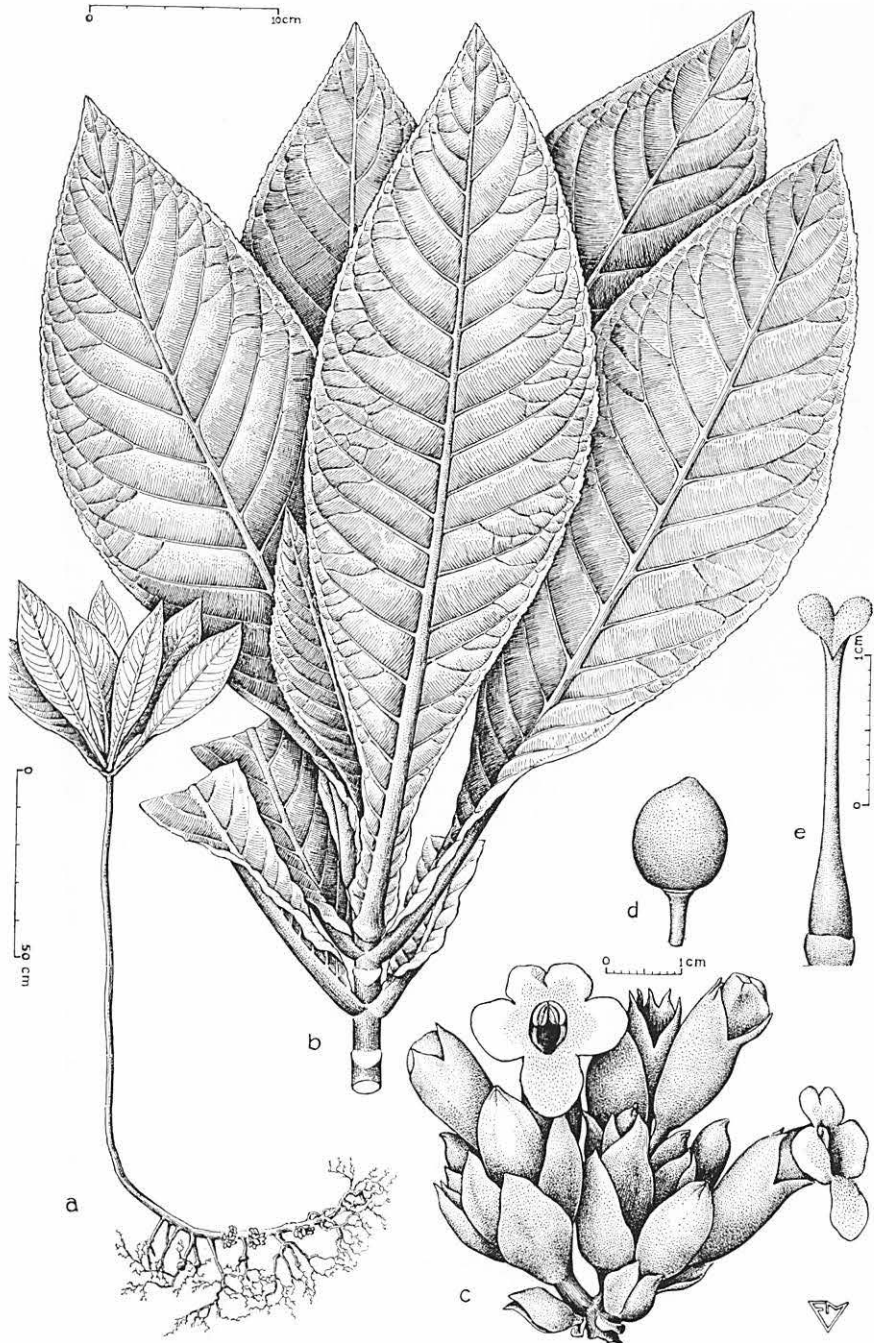


FIGURE 142.—*Cyrtandra kaulantha*: a, habit, $\times \frac{1}{20}$; b, foliage habit, $\times \frac{1}{4}$; c, inflorescence, $\times 1$; d, fruit, $\times 1$; e, pistil, $\times 2$. Waiahole, St. John 22,581.

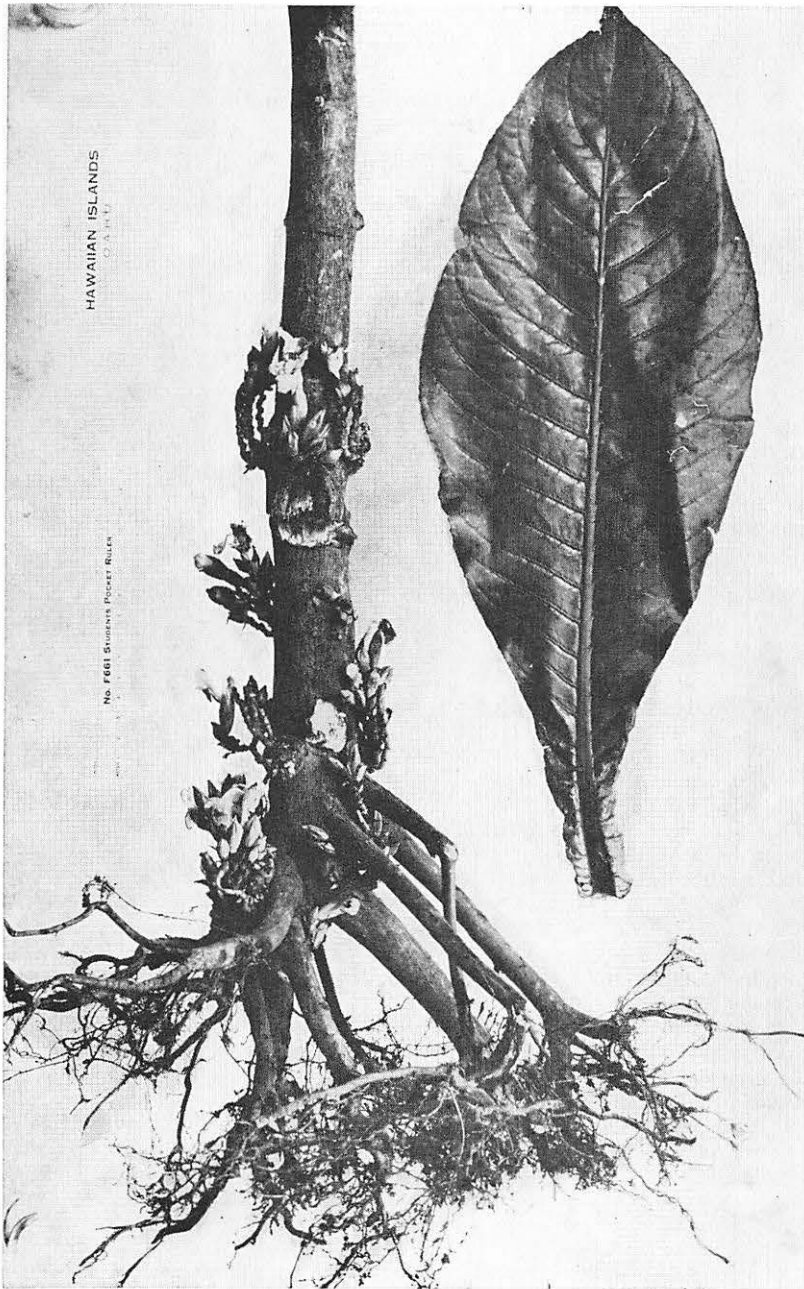


FIGURE 143.—*Cyrtandra kaulantha*, topotype. Waikane Valley, Storey 175.

Waikane Valley, at Intake 24, Waikane Ditch Trail, in dense shade in small damp ravine, 800-1,200 ft. elev., April 17, 1932, *Storey 175*; Waikane Valley, Waikane Ditch Trail, 800 ft. elev., in dense shade, ravines above the trail, Aug. 21, 1932, *Storey 205*; Kailua, third branch south of south fork of Kaha-naiki Stream, 790 to 825 ft. elev., east side of wet ravine, in open brush of kukui, *Dioscorea*, guava, *Musa*, and *Touchardia*, March 16, 1956, *Pearsall 93*.

Discussion: Our new species, in the section *Cylindrocalyces*, is striking in aspect, the tall stems ending in a plume of large leaves, somewhat resembling various species of *Rollandia* with which it grows. It is noteworthy in its cauliflorous habit, the many flowered cymes being clustered at the very base of the stout woody stem, either close to the ground, or partly subterranean. The caudex often produces a subhorizontal main root, and this is frequently aerial, borne up by stiltlike secondary roots. This apparent elevation of the main root may be due to sheet erosion of the surface soil. In any case, fertile cymes of flowers are often produced on the roots.

The closest relative of *C. kaulantha* is *C. waianuensis* Rock which also is known only from a small secondary gulch of Waikane Valley. *C. waianuensis* has its cymes in the axils of the active leaves, instead of at the base. Other differences are brought out in the key.

The new specific name was coined from the Greek roots, *kaulos*, stem; and *anthos*, flower, in allusion to the basal cauliflorous habit.

103. *Cyrtandra laevis* St. John, sp. nov. (Figs. 144, 191).

Diagnosis Holotypi: Frutex, ramis subquadrangularibus glabris pallide luteo-brunneis, cicatricibus 5 mm. altis obovato-scutelliformibus pallidis prominentibus; fasciculis 7, internodis 1.5-3.5 cm. longis, ramulis foliferis 2-4 mm. diametro itaque novellis dense ferruginosi-adscendenti-pilosulosis, *foliis* oppositis subaequalibus minime asymmetricibus, petiolis 20-35 cm. longis adscendenti-pilosulosis, *laminis* 8.5-10 cm. longis 4.4-5.2 cm. latis firme chartaceis asymmetricice ellipticis vel ovalibus ad apicem abrupte acutis ad basim gradatim cuneatis supra sparse adpressi-hirsutulis infra copiose molliter subadpressi-pilosis marginibus grosse serratis, *cymis* axillaribus 3-5-floriferis crebre adscendenti-pilosulosis pilis in sicco ferrugineis, pedunculis 12-20 mm. longis, pedicellis 8-9 mm. longis, bracteis 7-9 mm. longis ovato-lanceolatis foliaceis, alabastris obovoideo-fusiforibus lobis calycis conniventibus, *calycibus* 14 mm. longis (12 mm. longis in sicco) campanulatis modice adscendenti-pilosulis $\frac{1}{2}$ - $\frac{2}{3}$ -lobatis bilabiatis tubo 6 mm. longo calycibus intra ad basim glabris ad orificem pilosulosis, lobis anguste lanceolatis intra pilosulosis, lobis tribus superioribus 7 mm. longis, lobis binis inferioribus 8 mm. longis, *corollis* 18-22 mm. longis, tubo 16-18 mm. longo 4-5 mm. diametro tubuloso subrecto extra albo villosulo sed ad basim glabro intra glabro ore pilosulosis, lobis corollarum superioribus 2 mm. longis suborbicularibus extra albo-villosis intra glabris, lobis inferioribus 4 mm. longis similaribus ad 50° divergentibus, staminibus ignotis, *stylis* 2.5 mm. longo valido et capitato-glanduloso-villosulo, lobis stigmatibus binis 4 mm. longis ovalibus $\frac{1}{3}$ -connatis, *ovario* 5 mm. longo lanceoloideo glabro in basi disco 2 mm. alto cupulato sustento, frutu ignoto.

Description of Holotype: Shrub; branches somewhat quadrangular, glabrous, smooth, pale yellowish brown, the leaf scars 5 mm. high, obovate-shield-shaped, pale, corky, raised, bundle scars 7; internodes 1.5-3.5 cm. long; leafy branchlets 2-4 mm. in diameter, densely ascending ferruginous pilosulous; young shoots densely, ascending fer-

rugineous pilosulous; *leaves* opposite, slightly unequal, slightly asymmetric, the pairs ascending; petioles 20-35 mm. long, ascending pilosulous; *blades* 8.5-10 cm. long, 4.4-5.2 cm. wide, firm chartaceous, asymmetrically elliptic to oval, abruptly acute at apex and gradually cuneate at base, above sparsely appressed hirsutulous, below abundantly subappressed soft pilose, the margin coarsely serrate; *cymes* from the leaf axils, 3-5-flowered, densely ascending pilosulous, ferrugineous when dry; peduncles 12-20 mm. long; pedicels 8-9 mm. long; bracts 7-9 mm. long, ovate-lanceolate, foliaceous; buds obovoid fusiform, the calyx lobes connivent; *calyx* 14 mm. long (12 mm. when dried), green, moderately pilosulous with ascending hairs, ferrugineous when dry, campanu-

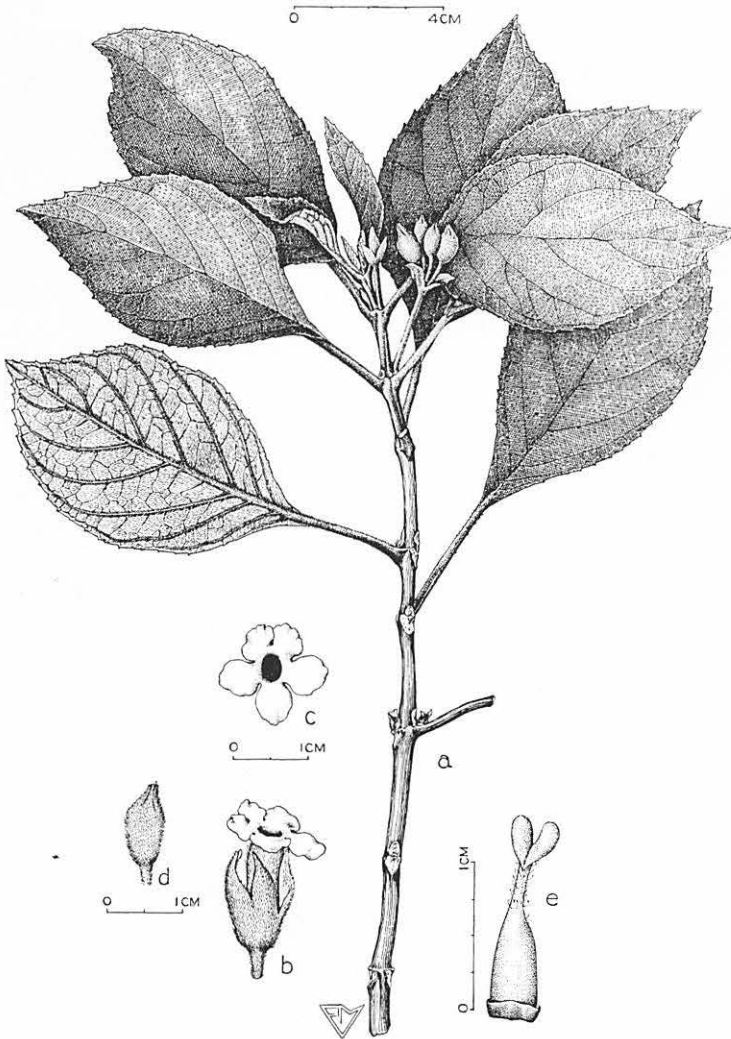


FIGURE 144.—*Cyrtandra laevis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Moanalua Valley, Forbes 1,273, holotype (Bishop Mus.).

late, lobed $\frac{1}{2}$ to $\frac{2}{3}$ way to base, 2-lipped, the lobes narrowly lanceolate, within the lobes pilosulous, the tube within glabrous towards the base but pilosulous above, the tube 6 mm. long, the three upper lobes 7 mm. long, the 2 lower lobes 8 mm. long; *corolla* 18-22 mm. long, the tube 16-18 mm. long, 4-5 mm. in diameter, tubular, almost straight, without the exposed part white villous but glabrous towards the base, within glabrous, the throat open, but pilosulous; *corolla* lobes unequal, the upper lobes 2 mm. long, suborbicular, white villous without, glabrous within, the lower 4 mm. long, similar, the lobes apparently spreading at about 50° from the axis of the tube; filaments and anthers not seen; *style* 2.5 mm. long, stout, and capitate glandular villous; stigma with two flattened oval stigmatic lobes 4 mm. long, connate on the proximal side for $\frac{1}{3}$ their length; *ovary* 5 mm. long, lanceoloid, glabrous, surrounded at base by a cupulate disk 2 mm. high; fruit unknown.

Distribution: Known only from the type collection, on the leeward side of the Koolau Range, but the zonal location is unknown.

Holotypus: Moanalua Valley, April 6, 1909, *C. N. Forbes 1,273* (BISHOP MUS.).

Discussion: This species is placed in the section *Cylindrocalyces* because of the fusiform-obovoid buds, the connivent calyx lobes, and the ease with which they can be parted on dissection. Though the fruits are unknown it is evident that the calyx is deciduous from the fruit. Hence it is confidently placed in the *Cylindrocalyces*. The closest relative is *C. alata*. Differences between it and the new species are stated in the key.

If a more precise locality can be inferred for the holotype, by the species collected by Forbes on the same trip and recorded under adjacent numbers in his field number book, *C. laevis* probably grew far up in Moanalua Valley, not far from the windward "pali" or precipice.

The new specific epithet is the Latin adjective, *laevis*, smooth, in allusion to the smooth and glabrous style.

104. *Cyrtandra longicalyx* St. John, sp. nov. (Figs. 145, 186).

Frutex 2 m. altus, ramulis glabris subquadrangularibus ad 6-9 mm. diametro, internodiis 8-32 mm. plerumque 20 mm. longis, cicatricibus 4-6 mm. altis semiorbicularibus distinctis pallidis elevatis suberosis, fasciculis 7, ramulis foliosis 5-8 mm. diametro subquadrangularibus supra obscure adpresse brunneo-pilosulis infra sparse itaque, novellis obscuratis cum pilis brunneis adpressis, *foliis* oppositis adscendentibus deinde divergentibus vegetis subcongregatis inaequalibus uno $\frac{1}{4}$ - $\frac{1}{2}$ minore, petiolis 2-5 cm. longis validis ab initio sparse adpresse brunneo-pilosulis deinde glabris, *laminis* 12-24 cm. longis 53-97 mm. latis crasse carnosio-chartaceis oblique ellipticis vel late ellipticis in apice acutis in basi cuneatis tunc decurrentibus supra adpresse pilosulis in midnervo aliter glabris infra sparse minutiore adpresse puberulis et in midnervo et nervis secundariis adpresse brunneo-pilosulis marginibus depresso crenulatis nervis secundariis 12-17 in uno latere adscendentibus arcuatis et interconnectis, *cymis* axillaribus 7-floriferis adpresse brunneo-pilosulis, pedunculis 13-17 mm. longis adscendentibus pedicellis 10-14 mm. longis, bracteis 7-11 mm. longis lanceolatis foliaceis $\frac{1}{4}$ connatis, alabastris fusiformibus sed apice compresso et adscendenti; *calycibus* 22-25 mm. longis in vivo viridibus deciduis sparse adpresse brunneo-pilosulis extra etiam plus intra basi cuneata tubo cylindrico et subdecurvato 4-5 mm. diametro limbo bilabiato et inter labias 6-7 mm. partito, labia supera trilobata lobis 6-7 mm. longis 4 mm. partitis in basi late lanceolatis in apice late lineari et obtuso, labia infera bilobata lobis 5 mm. longis

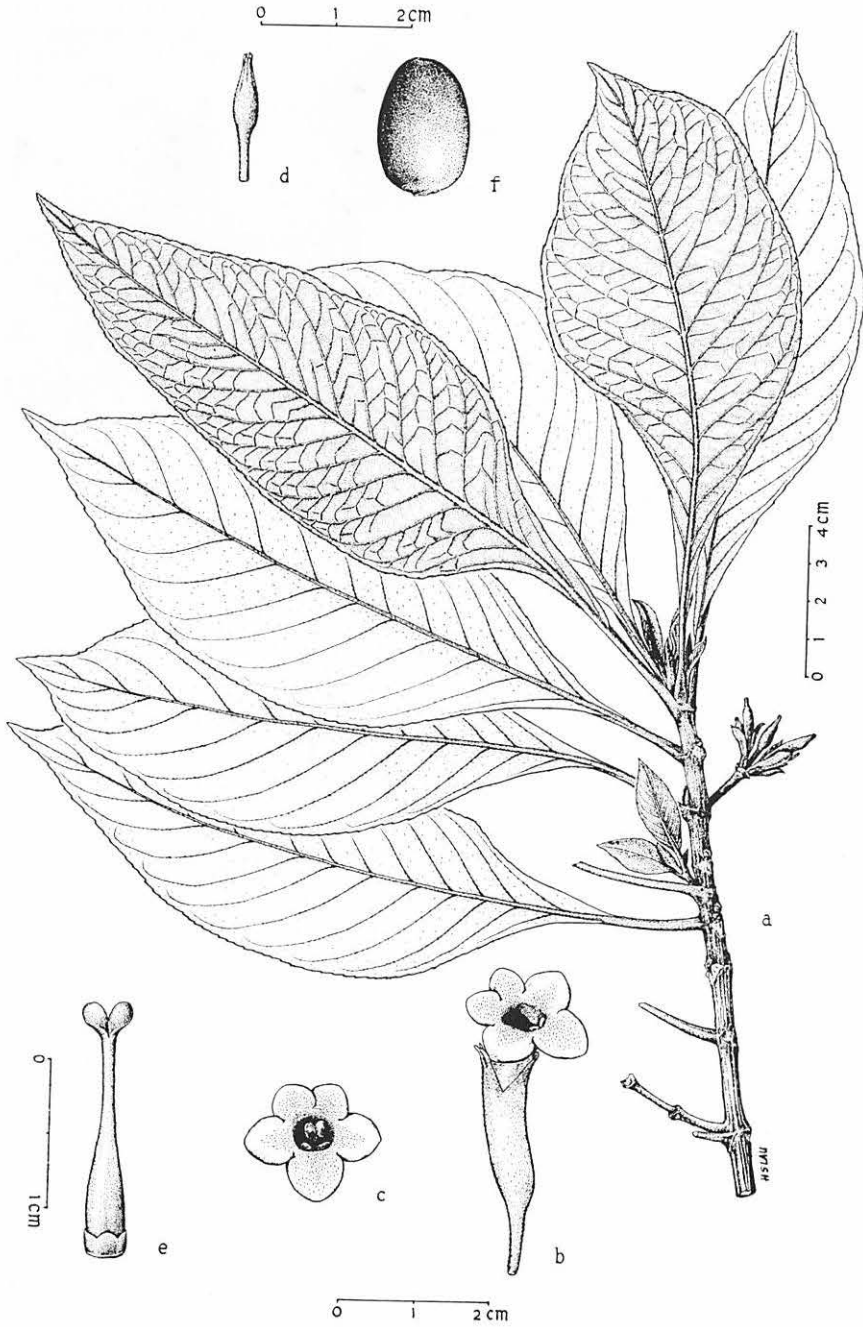


FIGURE 145.—*Cyrtandra longicalyx*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Kailua, St. John 25,587, holotype (Bishop Mus.).

distinctis parte $\frac{3}{5}$ infera lanceolata apice late lineari obtuso intra infra apicem sparse adpresse brunneo-pilosulo, *corollis* 26 mm. longis in vivo albis extra glabris anguste infundibuliformibus tubo 20 mm. longo subcylindrico ad basim diminuendo in basi 3 mm. diametro in media 4 mm. in orifice 7 mm. pauce supra mediam in 25° deflexo, limbo bilabiato inter labias 5 mm. partito 5-lobato extra glabro, labia supra bilobata lobis 4 mm.. longis 5.5 mm. latis transverse late ellipticis in basi auriculatis et impensis intra minute capitato-glanduloso-puberulis excepta in margine, labia infera trilobata lobis lateralibus binis 6 mm. longis 7 mm. latis oblique late rotundato-ovatis in basi auriculatis et impensis intra ex basi ad mediam minute capitato-glanduloso-puberulis, loba infera 6 mm. longa 7.5 mm. lata late transverse elliptica intra minute capitato-glanduloso-puberula excepta in margine, staminibus binis inferis perfectis filamentis in tubo 5 mm. ex orifice affixis parte libera 2.5 mm. longa tereti valida contorte adscendenti, antheris 2.5-2.9 mm. longis 1.5-1.9 mm. latis valde oblique ellipticis connectivo 1.5-1.8 mm. lato oblique late ovato, staminodeis lateralibus in tubo 7 mm. ex orifice affixis filamenta libera 0.5 mm. longa late subulata pallida antheridiis nullis; *stylo* 7 mm. longo gracile tereti glabro, stigmatibus 2.3 mm. longis late ellipticis $\frac{1}{2}$ connatis, *ovario* 7 mm. longo lineari-lanceoloideo apparente glabro (sed sub $60\times$ lupe in dimidia supra minutissime capitato-glanduloso-puberulo) in basi cum disco cupulato 1.3 mm. alto cincto, *baccis* 16 mm longis 12 mm. in diametro late ellipsoideis glabris, seminibus 0.22-0.23 mm. longis 0.11-0.13 mm. diametro late ellipsoideis stramineis in apicibus obscuris in epidermi valde elevato-reticulatis areolis isodiametricis hexagonalibus $\frac{1}{7-1/8}$ longis quam seminam.

Description of Holotype: Shrub 2 m. tall; branchlets glabrate, 6-9 mm. in diameter, subquadrangular; internodes 8-32 mm., averaging 20 mm. long; leaf scars 4-6 mm. high, semiorbicular, pale, corky, raised, separate; bundle scars 7; leafy branchlets 5-8 mm. in diameter, subquadrangular, above dark brown appressed pilosulous, below sparsely so; young shoots obscured by the similar pilosity; *leaves* opposite, ascending, then spreading lush and somewhat crowded, unequal, one being $\frac{1}{4}$ - $\frac{1}{2}$ the smaller; petioles 2-5 cm. long, stout, at first sparsely appressed brown pilosulous, later glabrate; *blades* 12-24 cm. long, 53-97 mm. broad, thick, fleshy chartaceous, obliquely elliptic or broadly so, the apex acute, the base cuneate, then decurrent, above appressed pilosulous on the midrib, elsewhere glabrous, below sparsely and very minutely appressed puberulous and on the midrib and secondaries appressed brown pilosulous, the margins low crenulate; lateral veins 12-17 on a side, ascending, gently then sharply arcuate, inarched and interconnected; *cymes* axillary 7-flowered, appressed brown pilosulous; peduncles 13-17 mm. long, ascending; pedicels 10-14 mm. long; bracts 7-11 mm. long, lanceolate, foliaceous, connate for the lower $\frac{1}{4}$; buds fusiform but the apex laterally compressed and upturned; *calyx* 22-25 mm. long when fresh green, deciduous, sparsely appressed brown pilosulous without, and within more densely so, the base cuneate, the tube cylindric but slightly decurved, 4-5 mm. in diameter, the limb bilabiate and the cleft between the lips 6-7 mm. deep; upper lip 3-lobed, the lobes 6-7 mm. long and parted for 4 mm., the base broad lanceolate, the tips broad linear, obtuse; lower lip 2-lobed, the lobes free, 5 mm. long, the lower $\frac{3}{5}$ ovate lanceolate, the tip broad linear, obtuse, within sparsely appressed brown pilosulous below the tip; *corolla* 26 mm. long when fresh, glabrous without, white, narrowly funnellform, the tube 20 mm. long, subcylindric but tapering downward, at base 3 mm. in diameter, at the middle 4 mm., at the throat 7 mm., just above the middle gradually deflexed at 25° from the axis of the lower tube; the limb 2-lipped, cleft 5 mm. between the lips, 5-lobed, glabrous without; upper lip 2-lobed, the lobes 4 mm. long, 5.5 mm. wide, transversely broad elliptic, at base auriculate and overlapping, within minutely capitate glandular puberulous except near the margin; lower lip 3-lobed, two lateral lobes 6 mm. long, 7 mm. wide, obliquely broad rounded ovate, at base auriculate and overlapping, within minutely capitate glandular puberulous on lower part and up the middle; lower lobe 6 mm. long, 7.5 mm. wide, broad transverse elliptic, within minutely capitate glandular puberulous except at the margin; two lower stamens perfect, their filaments adnate to the corolla tube to within 5

mm. of the throat, the free portion 2.5 mm. long, terete, stout, spirally ascending, the two perfect anthers 2.5-2.9 mm. long, 1.5-1.9 mm. wide, very obliquely broad elliptic, the sacs unequal, the dark connective 1.5-1.8 mm. wide, obliquely broad ovate; the lateral staminodia adnate to the tube to within 7 mm. of the throat, the free part 0.5 mm. long, of filament only, broad subulate, pale; upper staminodium similar but 0.8 mm. long, and attached a little higher in the tube; *style* 7 mm. long, slender, terete, glabrous; stigmas 2.3 mm. long, broad elliptic, connate $\frac{1}{2}$ way up proximal side; *ovary* 7 mm. long, linear lanceoloid, appearing glabrous (though under a 60-power binocular microscope the upper half shows sparse, very minute capitate glandular puberulous), the base surrounded by a dark cupulate disk 1.3 mm. high; *berry* 16 mm. long, 12 mm. in diameter, broad ellipsoid, glabrous; seeds 0.22-0.23 mm. long, 0.11-0.13 mm. in diameter, broad ellipsoid, stramineous with dark brown ends, the surface prominently raised reticulate, the areolae isodiametric hexagonal and about $\frac{1}{7}$ - $\frac{1}{8}$ as long as the seed.

Distribution: Koolau Range, windward side, on the slope of the highest peak, Puu Konahuanui, in a moist gulch, shaded every afternoon, at 1,000 ft. alt., in the lower part of the Ohia Zone.

Holotypus: Kailua, 1st Fork North of Main South Fork of Kahanaiiki Stream, steep gulch with *Boehmeria*, under *Psidium Guajava*, 1,000 ft. alt., Sept. 25, 1955, *H. St. John 25,587* (BISHOP MUS.).

Discussion: *C. longicalyx* is a member of the section *Cylindrocalyces*. Though not really a close relative, the most similar species is *C. infundibuliformis* St. John which also occurs on the windward base of the Koolau Range, but only at Waiahole, eight miles to the northwestward. This species is marked by having the leaf scars 2-3.5 mm. high, annular; leaves in whorls of 3 on the main branches; petioles 10-25 mm. long, appressed brown pilosulous; blades 18-73 mm. wide, elliptic or elliptic-oblanceolate and the apex subacuminate; cymes 3-5-flowered; peduncles 4-5 mm. long; pedicels 2-10 mm. long; bracts 20-35 mm. long, lance-ovate, united for half their length; calyx 33-35 mm. long, the upper lip of three fused lobes, the lower lip of two lobes 10 mm. long; corolla 33 mm. long, the outside with hirsute bands, the tube deflected at 40°, the upper lobes 6 mm. long, the lower lobe 9 mm. long; anthers 4 mm. long; style sparsely glandular hirsute; and the ovary glabrous. In contrast, *C. longicalyx* has the leaf scars 4-6 mm. high, separate; leaves opposite; petioles 20-50 mm. long, glabrate; blades 53-97 mm. wide, obliquely elliptic or broadly so, the apex acute; cymes 7-flowered; peduncles 13-17 mm. long; pedicels 10-14 mm. long; bracts 7-11 mm. long, united for $\frac{1}{4}$ their length; calyx 22-25 mm. long, the upper lip of three lobes 6-7 mm. long, the lower lip of two lobes 5 mm. long; corolla 26 mm. long, the outside glabrous, the tube deflexed at 25°, the upper lobes 4 mm. long, the lower lobe 6 mm. long; anthers 2.5-2.9 mm. long; style glabrous; and the ovary microscopically capitate glandular puberulous.

The specific epithet is compounded from the Latin, *longus*, long; the Greek, *calyx*, cup, which in neo-Latin is *calyx*, the calyx of a flower, in reference to the lengthy calyx of this species.

105. *Cyrtandra olivacea* St. John, sp. nov. (Figs. 146, 192).

Diagnosis Holotypi: Frutex 1 m. alta, ramis laevibus pallide fuscis vel griseis ad 6 mm. diametro carnosus in sicco contractis et longitudinaliter sulcatis, cicatricibus 1.5-2.5 mm. altis pallidis depresso obdeltoideo-scutelliformibus late interconnectis et annulatis, novellis adpresse olivaceo-brunneo-pilosis, ramulis foliosis ad 2-3 mm. diametro subteretibus dense adpresse olivaceo-brunneo-pilosis, internodis 3-18 sed plerumque 5 mm. separatis, *foliis* oppositis adscendentibus in 3-4 nodis superis affixis non aggregatis uno in nodo $\frac{1}{2}$ grandiori, petiolis 1-2 cm. longis gracilibus dense adpresse olivaceo-brunneo-pilosis in basi interconnectis et circulum incrassatum perfoliatum formantibus, *laminis* 4.5-13 cm. longis 13-36 mm. latis firme chartaceis anguste ellipticis apice acuto basi longe cuneata et decurrenta supra obscure olivaceo-viridibus mox glabratis vel glabris infra pallide luteo-viridibus et sparse adpresse olivaceo-pilosulis plerumque in nervis, nervis secundariis 9-11 in uno latere arcuatis interconnectis et in serris excurrentibus marginibus serrulatis, *cymis* axillaribus 1-3-floriferis reflexis dense adpresse olivaceo-brunneo-pilosis, pedunculis 1-5 mm. longis, pedicellis 5-12 mm. longis, bracteis 1-3 mm. longis caducis, alabastris fusiformibus lobis calycis exapertis, *calycibus* in flore (quando bullitis) 17 mm. longis subviridibus extra adpresse brunneo-pilosis tubo campanulato intra glabro limbo bilabiato 11 mm. partito, labia supra 10 mm. bilobata lobis linearilanceolatis intra glabris in basi latissimis 2.5 mm. latis subsigmoideis in apice deflexis, labia infera 3-lobata 8 mm. partita lobis rectis angustiore deltoideis in basi 2.7 mm. latis intra glabris, *corollis* 24 mm. longis (quando bullitis) albis tubo 17 mm. longo intra ad basim glabro et 3 mm. diametro in media 4 mm. diametro in orifice 7 mm. diametro et glanduloso-puberulis in media valde in 45° deflexis extra ad basim glabris sed partibus evidentis dense albo-hirsutis, limbo bilabiato 5-lobato, lobis binis superis in 50° recurvatis 5 mm. longis 6 mm. latis suborbicularibus ad basim impensis intra in loco triangulari centrali capitato-glanduloso-puberulis extra hirsutis excepta proxime marginibus, labia infera trilobata in eodem modo puberulis in 80° recurvatis, lobis lateralibus 5 mm. longis 6 mm. latis depresso-orbicularibus, loba infera 7 mm. longa 8 mm. lata depresso-orbicularibus, staminibus binis inferis perfectis in tubo 6 mm. ex orifice affixis parte libera 3 mm. longa valide tereti contorto-adscendente, antheris 2.3-2.5 mm. longis oblique ovalibus connectivo elliptico, staminodeis erectis parte libera 1 mm. longa apice antheroideo 0.3 mm. longo pallidi curvato, *stylo* 4 mm. longo validi tereti glabro, lobis stigmatis binis 2 mm. longis sessilibus ovalibus $\frac{1}{3}$ connatis in latere proximo, *ovario* 3.5 mm. longo lanceoloideo glabro, *fructibus* albis.

Description of Holotype: Shrub, 1 m. tall; branches smooth, pale brown to gray, as much as 6 mm. in diameter, fleshy, on drying shrinking and becoming longitudinally ridged and furrowed; leaf scars 1.5-2.5 mm. high, pale, low obdeltoid-shield-shaped, connected by a broad band, hence annular; bundle scars 3; young shoots appressed olive brown pilose; leafy branchlets as much as 2-3 mm. in diameter, subterete, densely olive-brown, appressed pilose; internodes 3-18 mm., commonly 5 mm. long; *leaves* opposite, distinctly unequal, one of a pair as much as $\frac{1}{2}$ the larger, ascending, borne at 3-4 upper nodes, not crowded; petioles 1-2 cm. long, slender, densely appressed olive-brown pilose, the bases interconnected by a raised perfoliate ring causing a joint annular leaf scar; *blades* 4.5-13 cm. long, 13-36 mm. wide, firm chartaceous, narrowly elliptic, the apex acute, the base long cuneate and decurrent, above dark olive green, early glabrate or glabrous, below pale yellowish greenish, and sparsely olive-brown appressed pilosulous mostly on the veins, secondary veins 9-11 on a side, arcuate, more strongly so beyond the middle, interconnected but the main tip excurrent on marginal teeth, margin serrulate; *cymes* axillary, 1-3-flowered, reflexed, and densely olive brown appressed pilose; peduncles 1-5 mm. long; pedicels 5-12 mm. long; floral bracts 1-3 mm. long, caducous; buds fusiform, the calyx lobes at first closed; *calyx* in anthesis (when boiled) 17 mm. long, tissue greenish, outside appressed brown pilose, the tube campanulate, inside glabrous, the calyx 2-lipped, the clefts between the lips 11 mm. deep; upper lip with 2 lobes, the cleft between them 10 mm. deep, the lobes linear-

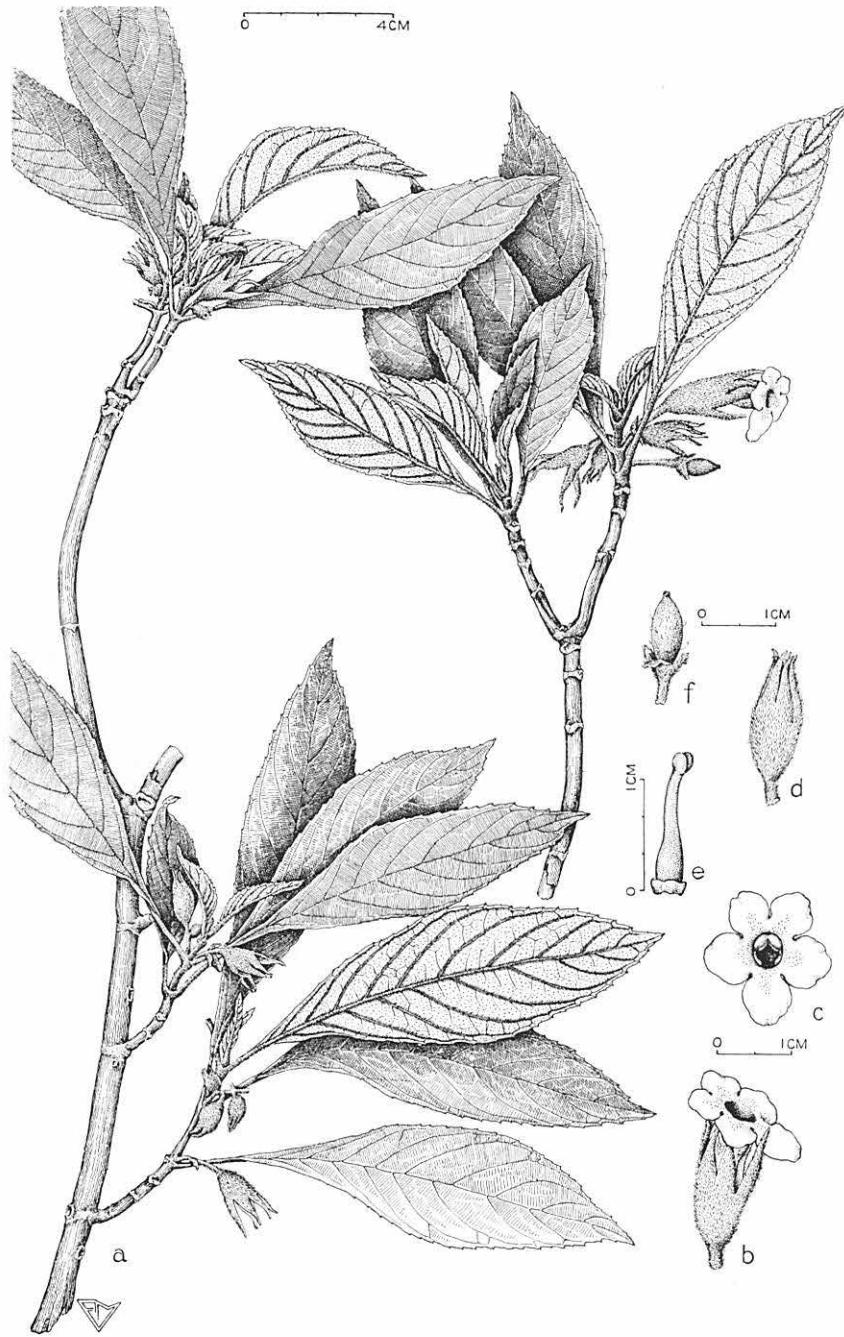


FIGURE 146.—*Cyrtandra olivacea*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Poamoho Stream, St. John 23,699, holotype (Bishop Mus.).

lanceolate, glabrous within, broadest at base, 2.5 mm. wide, gently sigmoid, the tip deflexed; lower lip 3-lobed, the clefts between them 8 mm. deep, the lobes straight, very narrowly deltoid, 2.7 mm. wide at base, glabrous within; *corolla* 24 mm. long (when boiled), white, the tube 17 mm. long, glabrous below, but capitate glandular puberulous in the throat, at base 3 mm. in diameter, at the middle 4 mm., at the throat 7 mm., sharply deflexed at the middle at 45°, glabrous below, but the exposed parts shaggy white hirsute; limb 2-lipped, 5-lobed; upper lobes 2, recurving at about 50° to the axis of the upper throat, 5 mm. long, 6 mm. wide, overlapping at base, suborbicular, inside capitate glandular puberulous along a triangular strip starting on the center line well back from the margin and broadening towards the throat, without hirsute except near margins; lower lip 3-lobed, similarly puberulous, recurving at about 80° the lateral lobes 5 mm. long, 6 mm. wide, depressed orbicular; lower lip 7 mm. long, 8 mm. wide, depressed suborbicular; the 2 lower stamens perfect, the filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 3 mm. long, stout, terete, spirally upcurved; the 2 perfect anthers 2.3-2.5 mm. long, obliquely oval, connate at apex, the connective elliptic; staminodia erect, the filament 1 mm. long, firm, the anther remnant 0.3 mm. long, curved, pale; *style* 4 mm. long, stout, terete, glabrous; two stigmatic lobes, sessile, 2 mm. long, oval, connate $\frac{1}{3}$ way up the proximal side; *ovary* 3.5 mm. long, lanceoloid, glabrous; *fruit* white.

Distribution: Koolau Range, central part, leeward side at Poamoho, 2,000 ft. alt., on a stream bank in the Ohia Zone.

Holotypus: Oahu, Poamoho Stream, Wahiawa, steep rocky banks of stream in Ohia Zone, 2,000 ft. alt., Feb. 20, 1949, *H. St. John 23,699* (BISHOP MUS.).

Discussion: *C. olivacea* is a member of the section *Cylindrocalyces*. Its most nearly related species is *C. turbiniformis* St. John & Storey of Heeia Valley on the windward side of the Koolau Range. Between them there are numerous distinguishing characters which are stated in the key. *C. olivacea* is noteworthy in having perfoliate petiole bases and consequent connected annular leaf scars.

The specific name is from the Latin, *oliva*, an olive, hence like an olive, in allusion to the olive-brown hairy coating of the young shoots and foliage.

106. *Cyrtandra oulophylla* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 83, 1950. (Figs. 147, 148, 189.)

C. Lessoniana Gaudichaud δ var. *pachyphylla* Hillebrand, Fl. Hawaiian Is., 331, 1888, in part, as to plant from Niu with obovate leaves, not *C. pachyphylla* Kränzlin, Philippine Jour. Sci., Bot. 8: 316, 1913.

Description of All Specimens: Shrub; branches terete, glabrous, the bark smooth, brown, leaf scars 3.5-5 mm. high, shield-shaped, pale, corky, raised; bundle scars not seen; internodes 20-30 mm. long; leafy branchlets 3-5 mm. in diameter, densely spreading, glandular, brown pilose; young shoots densely brown, glandular pilose; *leaves* opposite, almost equal and symmetric, somewhat divergent but approximate; petioles 24-35 mm. long, stout, densely spreading, brown, glandular pilose; *blades* 6-10 cm. long, 36-56 mm. wide, thick and coriaceous, broadly oval or broadly obovate, the apex abruptly acute, the base cuneate, above abundantly subappressed, glandular pilose, below densely shaggy brown, spreading glandular pilose, the margin prominently and saliently crenate-serrate; *cymes* from the leaf axils, 1-2-flowered, densely spreading brown, glandular pilose throughout; peduncles 20-23 mm. long, divergent; pedicels 18-27 mm. long, bracts paired at the summit of the peduncle, 14-18 mm. long, lance-elliptic, foliaceous; buds

not seen; *calyx* 15-16 mm. long, thick and firm, green but obscured by the dense coat of spreading brown, glandular pilosity, fusiform, then narrowly cylindric-campanulate, lobed about $\frac{2}{3}$ way to base into 3-5 lobes, the lobes narrowly oblong, obtuse, finally splitting to the base and deciduous, within the tips glabrous, below pilose; corolla not seen; *style* glabrous, 3 mm. long, the stigmatic lobes 2 mm. long, spatulate; *ovary* lanceoloid, glandular atomiferous; fruit unknown.

Distribution: Koolau Range, leeward side, Niu Valley, but exact locality and vegetational zone unknown.

Holotype: "Oahu, Niu, Dec. 1870, *J. Lydgate* (Herb. W. Hillebrand)," (B), lectotype, the two lower plants with broadly oval, broader leaves.

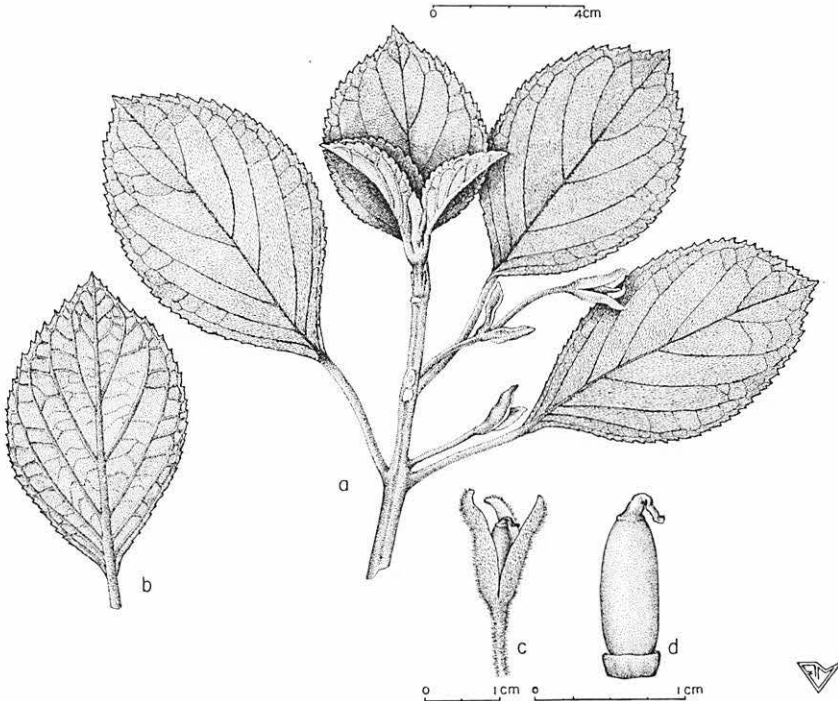


FIGURE 147.—*Cyrtandra oulophylla*: a, habit, $\times \frac{1}{2}$; b, leaf, $\times \frac{1}{2}$; c, d, young fruit, $\times 1$. Niu, Hillebrand and Lydgate (Bishop Mus.).

Specimens Examined: see type; also an isotype (US); and Niu, *Hillebrand & Lydgate* (BISH), except the two loose flowers of *C. Lessoniana* which we removed from the pocket.

Discussion: *C. oulophylla* is a member of the section *Cylindrocalyces*, though Hillebrand and Rock considered that Lydgate and Hillebrand's plants belonged in the section *Schizocalyces*. Hillebrand (1888: 331) united several collections under his new *C. Lessoniana* Gaudichaud δ var. *pachyphylla*. A full

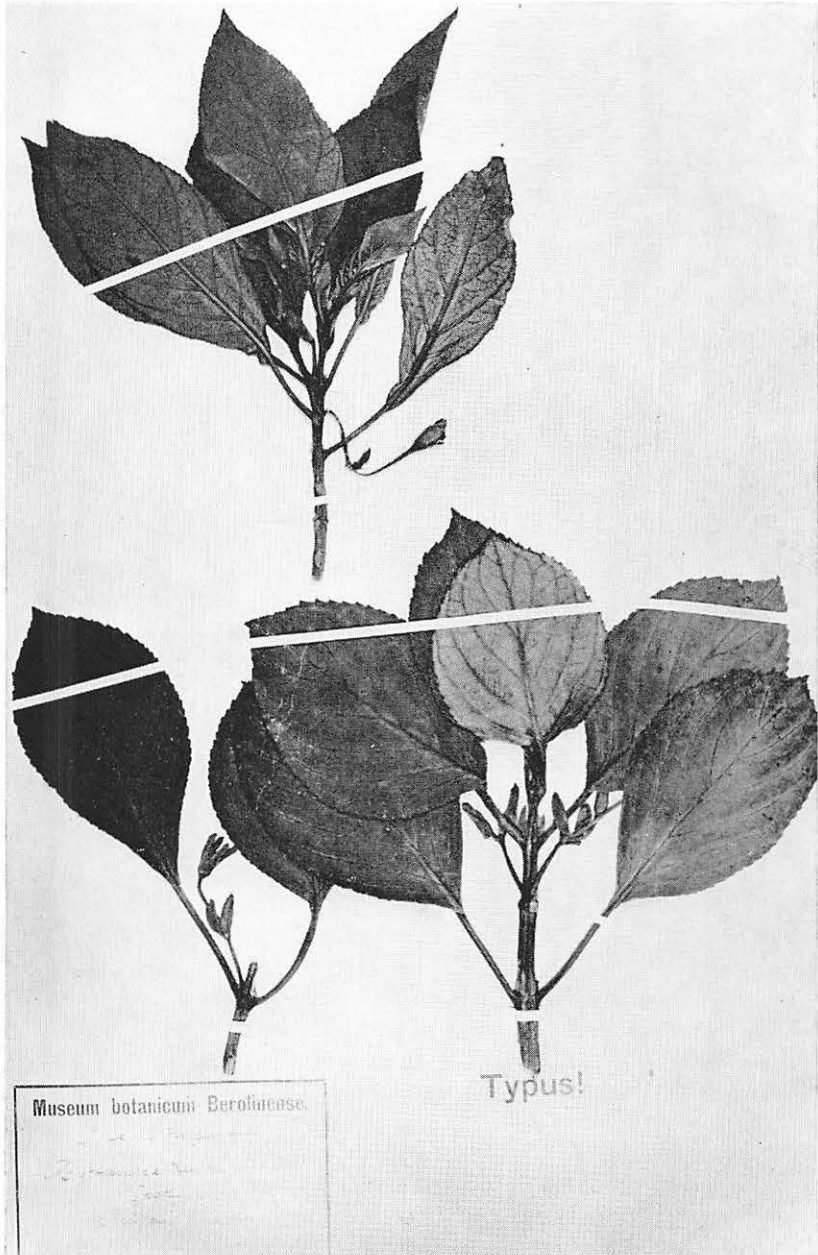


FIGURE 148.—*Cyrtandra Lessoniana* δ var. *pachyphylla*. Niu, Hillebrand, holotype (Berlin) ; two lower specimens are now the holotype of *C. oulophylla* St. John and Storey.

discussion of these will be found under *C. carinata*. Here, it can be stated more briefly. Hillebrand's specimen with oblong leaves was the one from the Waianae Range. This is probably *C. Wilderi*. Hillebrand's other sheet, from Niu, contained an upper plant with elliptic leaves which is here referred to *C. carinata*. The two lower specimens from Niu with broadly oval blades are made the lectotype of *C. Lessoniana* Gaudichaud var. *pachyphylla* Hillebrand, which equals *C. oulophylla*. *C. oulophylla* is a lost species, not collected since 1870 when Lydgate got it for Hillebrand, and it may well be extinct.

The new *C. oulophylla* is most closely related to *C. carinata*, also of Niu Valley. The diagnostic differences are brought out in the key.

This new plant has abundant differences in its leaf and flower, and, hence, is accorded specific rank. It cannot be called *C. pachyphylla* since that name was preoccupied in 1913 by *C. pachyphylla* Kränzlin.

Heller referred (1897: 889) his no. 2,351 from Konahuanui to Hillebrand's var. *pachyphylla*. This specimen in the Gray Herbarium was studied by Rock and referred to *C. Lessoniana*.

The newly coined name is from the Greek, *oulos*, woolly; and *phullon*, leaf.

107. *Cyrtandra paludosa* Gaudichaud var. *paludosa* (Figs. 149, 150, 195).

C. paludosa Gaudichaud, Voy. Uranie, Bot., 447 (1826) = [1829].

C. paludosa Gaudichaud, var. δ *typica* Wawra, Flora 55: 558, 1872, and in reprint p. 14.

C. paludosa Gaud. var. *a typica* C. B. Clarke ex Rock, Am. Jour. Bot. 4: 605, 1917.

Vernacular Name: "Moa," "Hahala" (fafara of Gaudichaud and he applied it to all six of his species).

Description of All Specimens Examined: Shrub, 1-5 m. tall, as much as 5 cm. in diameter at base; branchlets pale brown, glabrous, on drying shrinking slightly and forming longitudinal ridges; leaf scars 2-4 mm. high, broad shield-shaped, pale, corky; bundle scars 5; young shoots appressed brown pilose; leafy branchlets 2-5 mm. in diameter, quadrangular, towards the tip appressed brown pilose, towards the lowest leaves subglabrate; internodes 4-72 mm., averaging 10 mm. in length; *leaves* opposite, not crowded, ascending, then diverging, slightly unequal, one of a pair being $\frac{1}{8}$ - $\frac{1}{6}$, smaller, borne at the upper 5-12 nodes; petioles slender, 7-50 mm. long, appressed brown pilose, later subglabrate; *blades* 3.2-22 cm. long, 9-63 mm. wide chartaceous, oblanceolate or broadly so, or lanceolate, or narrowly so, elliptic, or oval, apex acuminate or subacuminate, the base cuneate and decurrent, above glabrous or remotely pilose and glabrate, dark green, below whitish, and pilosulous on midrib and laterals, the outer half or two-thirds coarsely crenate, the lateral veins 8-12 on a side, gently arching upwards, the tips inarching and salient in the teeth; *cymes* 1-7-flowered, axillary, appressed brownish pilose; peduncles 3-14 mm. long, ascending in flower; pedicels 6-21 mm. long, pilose in anthesis but finally glabrate; bracts 3-8 mm. long, broadly lanceolate, at first chartaceous and obscured by the dense brown appressed pilosity, then after the fall of much of the pubescence visible and dry scarious and caducous; buds appressed brown pilose, chartaceous, fusiform with a body ellipsoid to obovoid tapering at base, and the tip ending in a slender beak 6-9 mm. long; *calyx* at anthesis 14-20 mm. long, sparsely pilose to glabrate, but within glabrous, splitting unevenly and

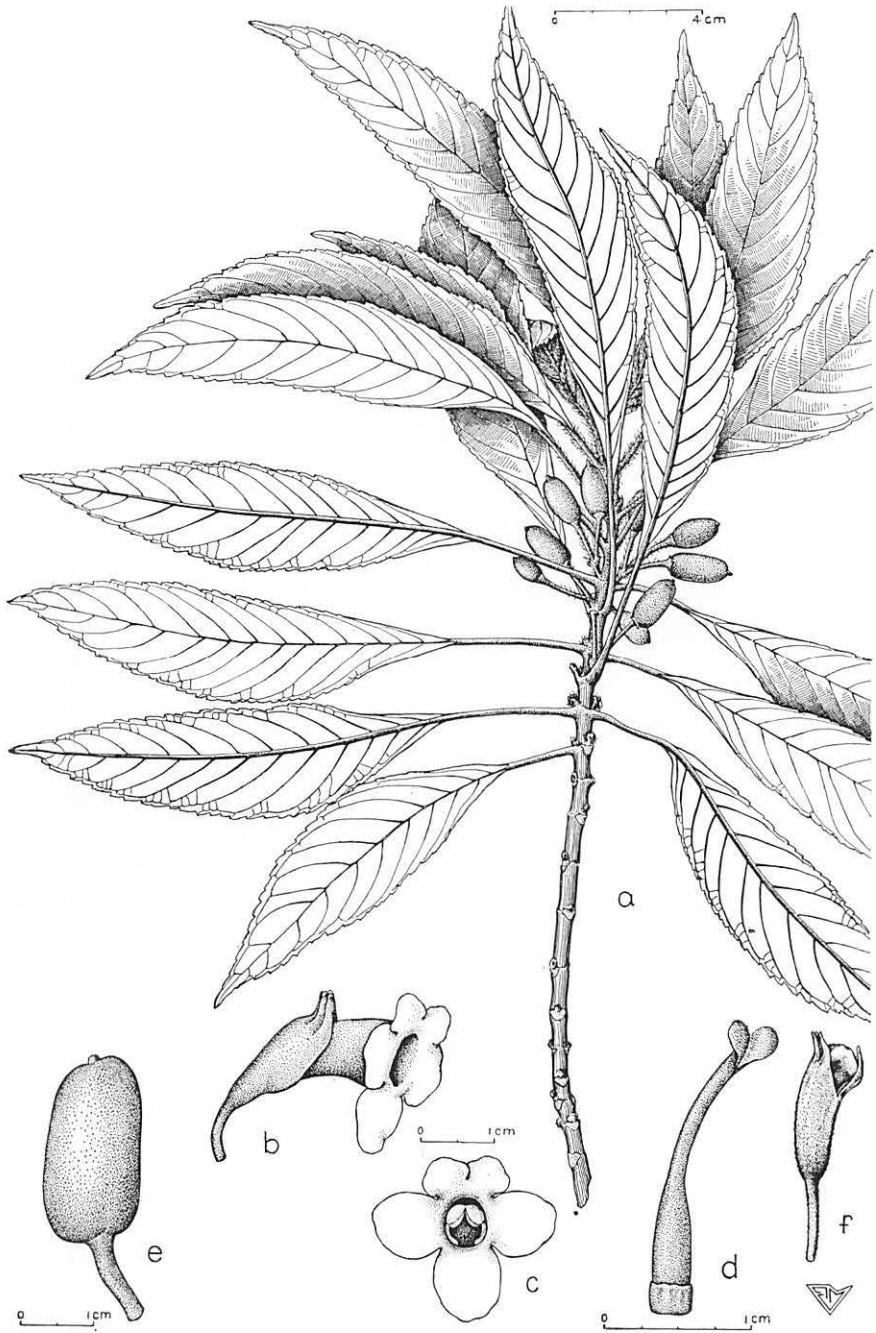


FIGURE 149.—*Cyrtandra paludosa* var. *paludosa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, pistil, $\times 2$; e, fruit, $\times 1$; f, bud, $\times 1$. Hahaione, St. John 20,179.

asymmetric but 2-lipped and 5-lobed; upper lip 3-lobed, the lobes 2-6 mm. long, linear-lanceolate, ascending, approximate; lower lip 2-lobed, the lobes 6-10 mm. long, obliquely linear-lanceolate, at length parted by a slit to the base and the calyx then deciduous from the very young fruit; *corolla* 23-30 mm. long when fresh (when dried 18-26 mm. long), white, glabrous without, the tube 16-20 mm. long, glabrous within, subcylindric, but $\frac{2}{3}$ way from the base deflected at 30° to 35° , at base 3 mm. in diameter, at the bend 4-6 mm. in diameter, at the throat 7-8 mm. in diameter; limb 2-lipped, 5-lobed; upper lip spreading at about 90° to the axis of the throat, the two lobes 4.5-7 mm. long (3-6 mm. when dried), 6-7 mm. wide (3-5 mm. when dried); ovate-suborbicular, auriculate

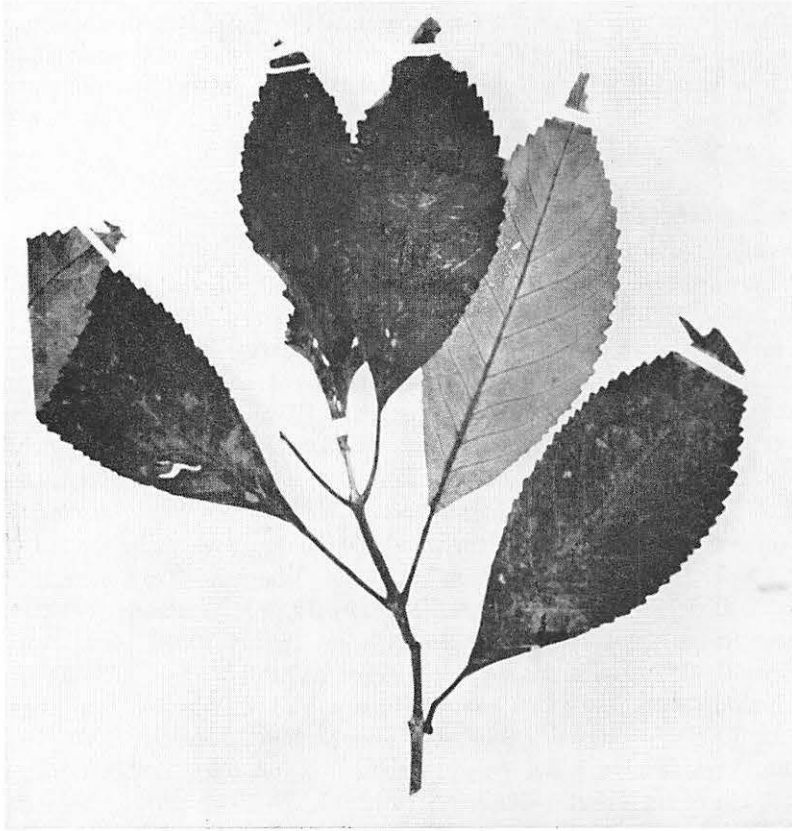


FIGURE 150.—*Cyrtandra paludosa*, holotype (Paris). Insulis Sandwicensibus, Gaudichaud.

and overlapping; lower lip 3-lobed; the two lateral lobes 8-9 mm. long (4-7 mm. when dried), 8-9 mm. wide (4.5-6 mm. when dried), obliquely broad oval, lower lobe 7-9.5 mm. long (5-8.5 mm. when dried), 8-9 mm. wide (4.5-5 mm. when dried), broad oval, all the lobes within capitate glandular puberulous towards the throat and the lower lobe more widely so; the two lower stamens perfect, the filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion stout, 3 mm. long, spirally upcurved; the two perfect anthers 2 mm. long, connivent, subcircular, the two sacs almost equal and symmetric, the connective circular; the two lateral staminodia adnate to the

corolla to within 7 mm. of the throat, their filaments 0.5 mm. long, ligulate, bearing antheroid tips 0.5 mm. long, subulate, translucent; the upper staminodium similar but adnate to the corolla tube to within 8 mm. of the throat; *style* 6-8 mm. long, terete, glabrous; stigmatic lobes two, 3 mm. long, oval, connate $\frac{3}{4}$ way up proximal side; *ovary* 7-8 mm. long, linear-lanceoloid, glabrous, the base surrounded by a cupulate disk 2 mm. high; *berry* 16-30 mm. long, 10-14 mm. in diameter, broadly ellipsoid, white; seeds 0.40-0.53 mm. long, 0.16-0.23 mm. in diameter, broadly ellipsoid, pale greenish yellow, but the ends brownish, the body covered with raised cellular hexagonal or broad polygonal reticulations $\frac{1}{8}$ - $\frac{1}{6}$ as long as the seed.

Distribution: Koolau Range, windward side, rare, from Heeia to Waimanalo, in moist woods at cliff bases from 500 to 1,200 ft. alt., and just over the crest at 2,500 ft. alt., and leeward side, common from Kipapa Gulch to Hahaione, in moist forests from 700 to 2,000 ft. alt., in the Koa Zone and the Ohia Zone.

Type: "In insulis Sandwicensibus (Alt. 100-300 hex.)." Collected and described by C. Gaudichaud on the voyage of the Uranie in 1819. Type specimen (P) examined. (See Fig. 150.)

Specimens Examined: Koolau Range.

Windward Side: Haiku Valley, Heeia, in humid, wooded habitat near head of the valley, 500-900 ft. elev., Dec. 11, 1932, *Storey 299*; Maunawili [Kailua], in woods near base of pali back of Kaimi Farm, 1,200 ft. elev., Jan. 23, 1935, *Storey 254*; Kailua, third branch south of south fork of Kahanaiki Stream, 825 ft. elev., open brush, March 16, 1956, *Pearsall 89*; Waimanalo, crest of opposite head of Waialae Nui, 2,500 ft. alt., wind-swept gulch near summit, March 21, 1954, *St. John 25,290*; Waimanalo, crest of Koolau Range north of Niu, dwarfed scrub, 2,500 ft. alt., Oct. 19, 1941, *St. John 20,267*.

Leeward Side: Kipapa Gulch, wooded hillside above main stream, 1,500 ft. alt., Nov. 13, 1932, *Storey 218*; Waimano, Waimano Trail, rare in moist woods, 1,400 ft. alt., March 23, 1941, *St. John 20,202*; Waimano, 1944, *Wong*; Kalauao Ridge Trail, on wooded slopes below trail, 1,500 ft. elev., April 30, 1933, *Storey 239*; Kalihi Valley, right ridge, at head of, Jan. 1, 1920, *Garber 114*; Kalihi, Sept. 9, 1902, *Pahau*; Nuuanu Valley, W. side near the Pali, July 25, 1908, *Forbes*; Waiolani, W. side Nuuanu, June 28, 1908, *Forbes*; Nuuanu, Upsidedown Falls, grassy, weedy slope on ridge, 1,400 ft. alt., Aug. 4, 1955, *Pearsall*; Nuuanu-Lanihuli Trail, Feb. 29, 1920, *Garber 272*; Pauoa-Pacific Heights ridge, March 21, 1920, *Garber 354*; Pauoa-Konahuanui ridge, July 11, 1920, *Garber 495*; Konahuanui Ridge, July 28, 1909, *Forbes*; Konahuanui, Jan. 6, 1909, *Forbes 1,012*; lower slopes of Konahuanui, above Manoa, May 13, 1895, *Heller 2,268* (CU, BISH, GH, UC, US); Konahuanui, rain forest, in shade, 600 m. alt., Nov. 1, 1926, *MacDaniels 107*; trail to Konahuanui, Jan. 7, 1909, *Rock 1,073*, and *1,079* (duplicates); Manoa Cliff Trail, Sept. 19, 1925, *Topping 3,243* (NY, UC); Manoa Valley rim, Jan. 3, 1929, *Degener 7,544* (NY); Manoa Valley, east ridge of, Feb. 3, 1929, *Degener and Krauss 7,543* (NY); ditto, July 3, 1923, *Degener 7,667* (NY); ditto,

Oct. 1935, *Meebold* 20,431 (M); between Konahuanui and Olympus, March 17, 1919, *Forbes* 2,538.O; ridge leading to Mt. Olympus, rain forest, wet, vegetation heavy, Feb. 12, 1927, *Degener* 7,656 (NY); Manoa Valley, E. ridge to Olympus, wooded ridge, 1,600 ft. elev., Dec. 10, 1931, *Hume* 415; Manoa-Palolo Ridge, rather dry wooded ridge, 500 m. alt., March 19, 1933, *Fosberg* 9,280; ditto, 1,600-1,800 ft., Jan. 10, 1933, *Krauss*; ditto, 1,600 ft. elev., June 1932, *Meebold*; Palolo Valley, in forest of west branch, March 20,

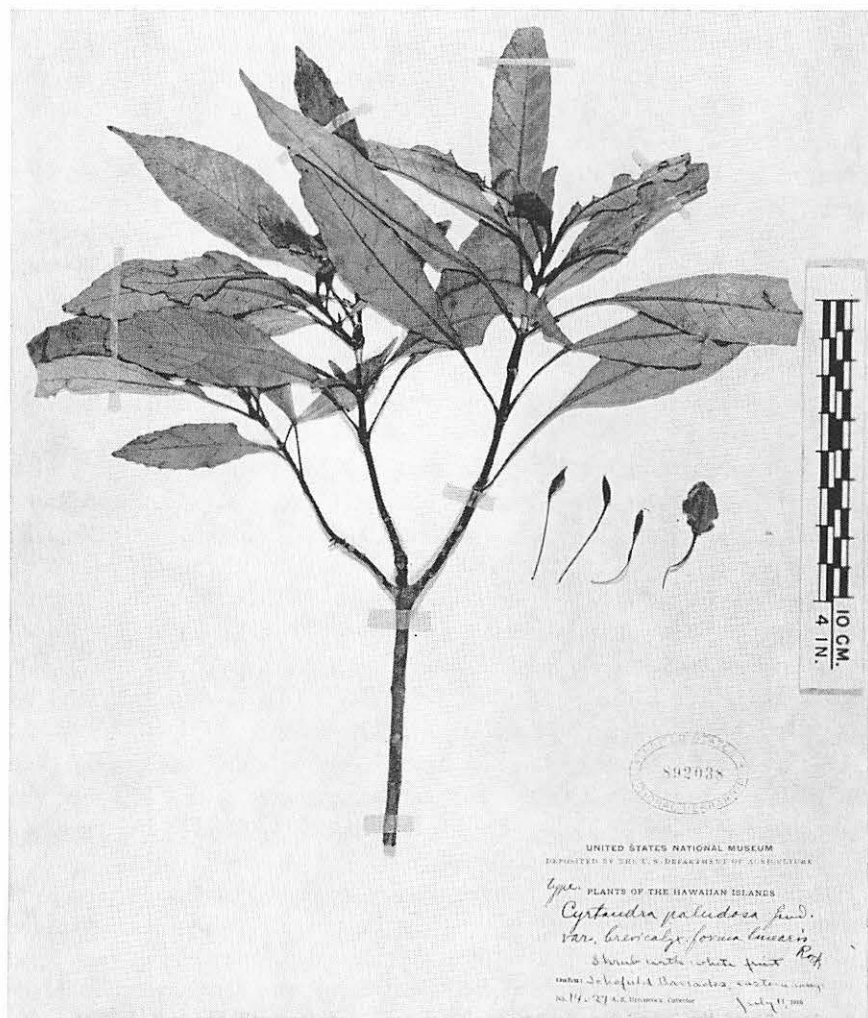


FIGURE 151.—*Cyrtandra paludosa* var. *brevicalyx* forma *linearis*, lectotype (U. S. National Herbarium). Schofield Barracks, Hitchcock 14,027. This is a synonym of *C. brevicalyx* (Hillebrand) St. John.

1932, *Degener et al.* 7,496 (NY); Palolo Valley ridges, Nov. 7, 1908, *Forbes & Rock*; Palolo Valley, Oct. 22, 1914, *Forbes* 1,962.O; ditto, *Forbes* 1,963.O; Palolo Ridges (Palolo-Waiialae), March 23, 1910, *Forbes* 1,488; Palolo Valley, Nov. 7, 1908, *Rock* 96 (BISH, GH); ditto, 1910, *Rock* 13,089; ditto, Nov. 30, 1912, *Rock* (GH); ditto, Nov. 30, 1912, *Rock & Ballou* (GH); ditto, Oct. 23, 1922, *Skottsberg* 886; Palolo, Kaau Crater, south rim, moist mixed forest, 1,650 ft. alt., May 17, 1942, *St. John* 20,295; Palolo Valley, right fork, Aug. 1, 1920, *Garber* 510; Palolo, Waiomao Stream, with ferns in moist Aleurites forest, 700 ft. alt., March 4, 1945, *St. John* 20,950; Palolo-Waiialae Ridge, wet forest, 550 m. alt., *V. O. Fosberg* 23; 24; ditto, Jan. 27, 1927, *MacDaniels* 511; Wiliwilinui Ridge, Waiialae Iki-Wailupe, moist forest on steep slope, 1,400 ft. alt., May 11, 1947, *St. John* 22,685; Wailupe Valley, on side hill woods above main stream, 1,000 ft., June 25, 1933, *Storey* 243; Niu, *Hillebrand* (Z); Niu, April 1930, *Russ*; Niu, Kulepamoa Ridge, thicket on moist ridge, 1,500 ft., Nov. 10, 1940, *St. John* 20,122; Niu Ridge, Sept. 7, 1924, *Topping* 2B49 (NY, UC); Puu-O-Kona, March 14, 1911, *Forbes* 1,672.O; Kuliouou, forest, 450-600 m. el., Feb. 5, 1931, *Christophersen, Wilder & Hume* 1,506; 1,510; ditto, rain-forest near summit, June 23, 1935, *Degener* 10,524; ridge east of Kouliououiki [= Kuliouou], Nov. 17, 1914, *Forbes* 2,012.O; valley between Hahaione and Kuliouou, Feb. 5, 1931, *Christophersen, Wilder & Hume* 1,533; n.w. head of Hahaione Valley, upper edge of ohia forest, 2,000 ft. alt., *St. John* 20,179.

Oahu (without further data): Woahu, soil loam, mountains, July 1837, *Barclay* (BM); Oahu, 1837, *Barclay* (BM); Oahu, Galathea Expeditionen 1845-1847, *Didrichsen* 237 (M); Woahoo, maio 1825, *Macrae* (BM, G); Oahu, *Mann and Brigham* 76 (BISH, CU, GH, US); Wahoo, "moa of the Islanders," *Nuttall* (BM); Oahu, *Wawra* 1,665 (BISH, W).

Sandwich or Hawaiian Islands: *Gaudichaud* (FI); *Gaudichaud* 154 (voyage of La Bonite, and not the type collection as stated by Rock (1917:606) (B, BISH, GH); 1839, *Gaudichaud* (G); 1830 (!), *Gaudichaud*, and two duplicates labeled *C. Lessoniana*, t. 54, *Gaudichaud* 154 (G); *Hillebrand* 323 (GH); ex herb. *Hillebrand* (S); ex herb. Lydgate, collected by *Hillebrand & Lydgate* (only as to lower half of sheet, being mixed with *C. brevicalyx*); *Mann and Brigham* 446; Wilkes Expedition, 1838-1842 (GH); *Degener* 7,694 (NY); 1863, *Seemann* 2,276 (G).

Discussion: *C. paludosa* var. *paludosa* was described by Gaudichaud in his botanical account of the voyage of the "Uranie" as one of his six new species, the first ones of the genus recorded from the Hawaiian Islands. For each of the other five he gave a large and detailed illustration, and a somewhat fuller description. For all of them he gave the single statement of occurrence on the Sandwich Islands at from 100 to 300 fathoms altitude. *C. triflora* has been collected subsequently only once, near Honolulu. The other four species are still

common in the Koolau Range back of Honolulu. *C. paludosa* was not illustrated by Gaudichaud and his description of it was the briefest, comprising only 12 words, of which only eight were descriptive. It read as follows, "C. foliis oblongis, acuminatis, basi angustatis, grossè serratis, glabris, subtùs pallidioribus, pedunculis unifloris." No isotypes of this were found in any of the principal herbaria, but the holotype is in the museum in Paris (Fig. 150). This consists of a stem tip and five leaves but without sign of inflorescence, though Gaudichaud stated it to be 1-flowered. All the other descriptive details that he gave applied only to the leaves. Subsequent botanists have accepted this species and have interpreted it, as we also do, as the common species of the *Cylindrocalyces* widespread in the southern Koolau Range, Oahu, and common in the uplands near Honolulu. The photograph of his type is well matched by numerous recent collections. We would describe his blades as elliptic, rather than oblong, and can demonstrate with a lens that the veins below have a persistent pilosity. Nevertheless we are in full accord with previous interpretations, and accept this sixth species of Gaudichaud's as one also characteristic of the mountains behind Honolulu.

C. paludosa is the only widespread species, and the only Oahu species which is said to be found on the other islands of the Hawaiian group.

Several of the collections with more numerous flowers (3-7) were marked by Forbes with a manuscript varietal name, which was not published. The writer sees no sound basis for separating these several collections with a slightly larger number of flowers at some of their nodes. There appears to be a complete intergradation from the 1-flowered to the 7-flowered inflorescences.

The specimen collected on Wahoo [Oahu Island] by T. Nuttall lacks flowers or fruit. We determine it as var. *paludosa*, though it cannot be definitely proven not to be *C. brevicalyx*. Nuttall collected in several parts of Oahu, so he may well have been in the northern Koolau Range. The interesting fact is his record: "Moa of the Islanders." Besides the record of Gaudichaud that all his six species were called "fafara" [= "hahala"] this is the only other early record of a vernacular name on Oahu for a species of *Cyrtandra*. The commonest meaning of "moa" is fowl or chicken, but another plant, *Psilotum nudum*, is also called "moa."

Cyrtandra paludosa has been recorded either as what is now called var. *paludosa* or as other varieties, on Kauai, Maui, and Hawaii. At least some of these described varieties are closely related to *C. paludosa*, but until all have been dissected and carefully compared, it would be premature to accept them as within the specific limits of *C. paludosa*. Of the varieties described from Oahu, the var. *brevicalyx* Hillebrand is here made a new species, *C. brevicalyx*; the var. *alnifolia* Hillebrand is made *C. alnea*. No composite description is given here for *C. paludosa* and the remaining varieties, as it is not certain how many of them will remain under *C. paludosa* when they have been given monographic study.

There is in the Bishop Museum a sheet from the herbarium of the Rev. J. M. Lydgate, collected by Hillebrand and Lydgate. The lower half of the sheet bears one good specimen of *C. paludosa* var. *paludosa*; but the upper half bears two specimens of *C. brevicalyx*. There is also an original ticket with, in ink, *Cyrtandra paludosa* Gaudichaud, in Hillebrand's own hand. Like so many others of this Hillebrand and Lydgate set, the collection is a mixture. Hillebrand after returning to Europe sent Lydgate as good a set of his species as possible, but he often combined parts of several collections under a single label and included, without any indication, several varieties or species. This sheet is another example of these confusions.

C. paludosa var. *paludosa* is probably the commonest species on Oahu, and occurs more generally in the rain forest than any of the others. It is not, like so many of the others, restricted to wet gulches or humid, shady stream gorges.

The specific name was obviously the Latin adjective, *paludosa*, marshy or boggy.

108. *Cyrtandra pupukeaensis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 83, 1950. (Figs. 152, 189.)

Description of All Specimens Examined: Shrub, 2-3 m. tall, divaricately branched; branches 4-8 mm. in diameter, quadrangular, glabrate, brown, the leaf scars prominent, shield-shaped, pale, corky; internodes 1.5-5.5, usually about 2 cm. long; leaf scars 4-7 mm. high, shield-shaped; bundle scars 5; leafy branches on drying strongly quadrangular, 3-6 mm. in diameter at the lowest node, remotely spreading pilose or later glabrate; strong ascending shoots with 7-8 pairs of leaves, well-spaced; lateral shoots with 3-7 pairs of leaves; young shoots with the stems sparsely pilose and the folded leaves densely ascending brownish pilose; *leaves* opposite, unequal, one of the pair being $\frac{1}{4}$ - $\frac{1}{3}$ larger, ascending, later spreading or even descending; petioles 2.5-9.5 cm. long, subterete, sparsely spreading brown pilose but later more or less glabrate; *blades* 5.5-18 cm. long, 2.2-9.5 cm. wide, oval to elliptic but the well developed ones curved and asymmetric, usually broadest slightly above the middle, the apex abruptly short sub- acuminate or acuminate, the base unequally short cuneate, texture firm chartaceous, above dark green, early glabrate or sparsely pilose near the margins towards the tip, below whitish, the pubescence a brownish pilosity on the midrib and secondary veins or even on a few tertiary ones, the margin coarsely serrate or rounded serrate with the veins terminating at the apices of the teeth frequently as callous apiculations, the teeth diminishing towards the base, and the lower fifth subentire; principal lateral veins 7-11 on a side, opposite or alternate, arcuate ascending and the tips inarched and joining; *cymes* from the leaf axils, 3-7-flowered, brownish pilose, sparsely so below, densely so towards the tip; peduncles 11-23 mm. long, at first ascending, later more or less reflexed, pedicels 10-30 mm. long, filiform, pilose; bracts 5-8 mm. long, lanceolate, foliaceous, pilose; bud narrowly campanulate, open, the calycine lobes ascending; *calyx* in anthesis 11-13 mm. long (9-11 when dried), without brownish pilose, sparsely so below, densely so towards the tip and on the lobes, within the tube glabrous, campanulate, lobed $\frac{1}{3}$ to $\frac{2}{3}$ way to the base; the tube 6-8 mm. long; upper lip of 3 lobes cleft $\frac{1}{3}$ way, the lobes narrowly deltoid, 2.8-3 mm. long, pilose without and also within near the margins; lower lip of 2 lobes cleft $\frac{1}{3}$ to $\frac{2}{3}$ way, the lobes similar, 4 mm. long; *corolla* 20-28 mm. long, white, the tube (when dried) 18 mm. long, 6 mm. in diameter at the throat, 5 mm. at the middle, and 4 mm. at the base, subcylindric and gently decurved, the axis of the throat at 38° with that of the base of the tube, inside the corolla glabrous, outside the tube glabrous below, but the exposed part capitate

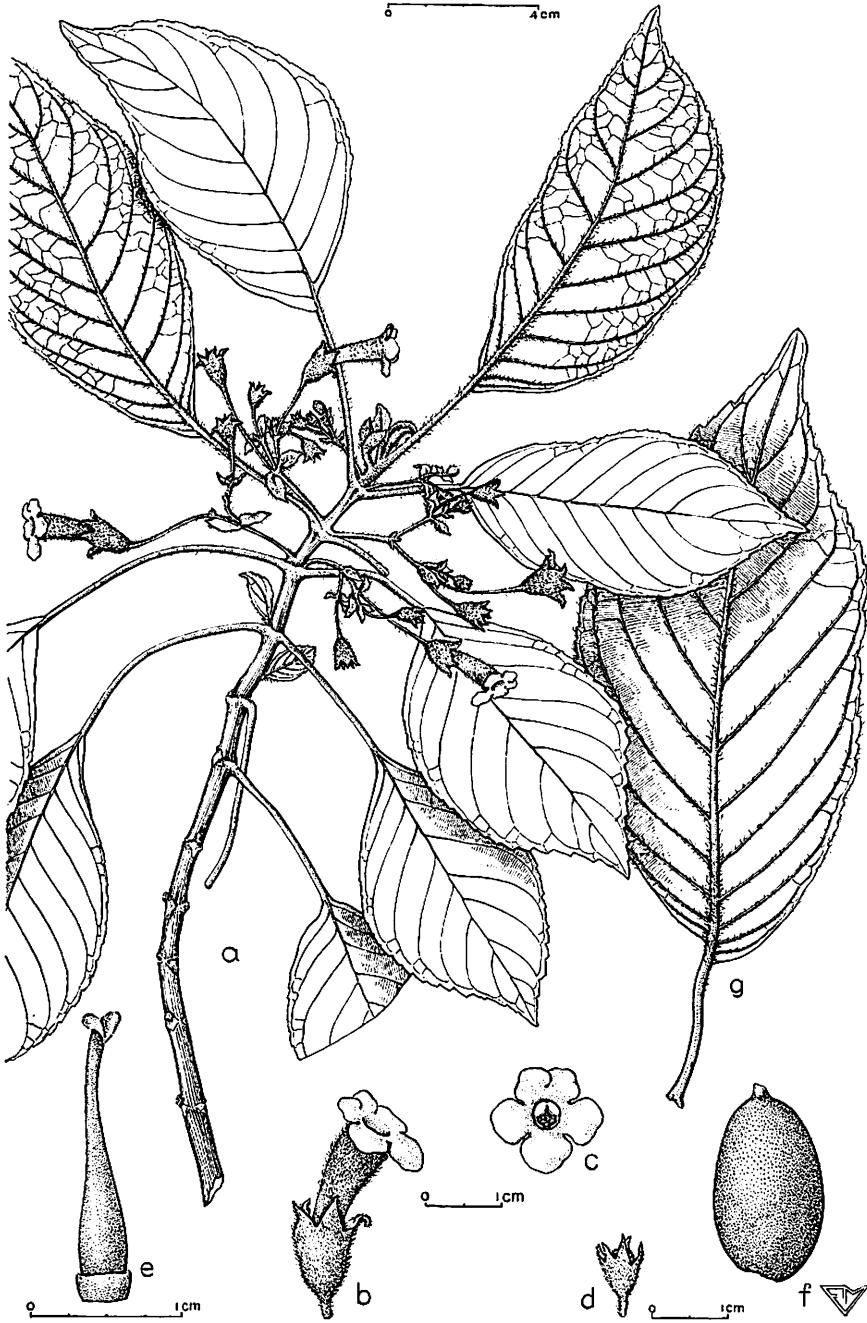


FIGURE 152.—*Cyrtandra pupukeensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$; g, leaf, lower side, $\times 1$. Pupukea-Kahuku Trail, Storey 169, holotype (Bishop Mus.).

glandular crinkly pilose, less so below but densely so at the throat; limb rotate, 2-lipped, 5-lobed; upper lip with 2 lobes 3.5 mm. long, 5 mm. wide, low depressed cordate with a broad obtuse apex, within glabrous, without glabrous towards the tip, pilose from back to base; lower lip with 3 lobes, within glabrous, the 2 lateral lobes 5 mm. long, 5-5.5 mm. wide, transversely oval, broadly obtuse, without pilose from base to middle; lowest lobe 5 mm. long, 7 mm. wide, transversely broad oval, without pilose except near the margins; 2 lower stamens perfect, the filaments adnate to the corolla to within 4.5 mm. of the throat, the free portion 4 mm. long, subulate, spirally upcurved; the 2 perfect anthers 2.7-3 mm. long slightly obliquely oval; 2 lateral staminodia 1 mm. long, arcuate, bearing sterile anthers $\frac{1}{3}$ as long; *style* 6 mm. long, glabrous; 2 stigmatic lobes 1.7-1.9 mm. long, oval, proximal side connate $\frac{2}{3}$ way; *ovary* 7-8 mm. long, linear-lanceoloid, glabrous, the base surrounded by a cupulate disk 1-1.2 mm. high; *berry* ovoid, 2.5 cm. long, 1.5 cm. in diameter, the apex with a broad apiculation; seeds 0.21-0.27 mm. long ovoid or dumbbell-shaped, light brown, shining, smooth.

Distribution: Koolau Range, at the extreme north end of the mountains at Pupukea and three miles away on the windward side at Malaekahana, from 1,500 to 1,750 ft. alt., in the Ohia Zone.

Holotype: Pupukea-Kahuku Trail, Koolau Range, common in woods along trail at 1,500 ft. in company with *Cyrtandra propinqua* Forbes, March 6, 1932, *W. B. Storey 169* (BISHOP MUS.).

Specimens Examined: Koolau Range.

North End: Pupukea-Kahuku Trail, along stream at about 1,500 ft., March 6, 1932, *Storey 170*; Pupukea-Kahuku Trail, Kaunala, 450 meters alt., wet forest, shrub 2-3 m. tall, Feb. 19, 1933, *Fosberg & Duker 9,203*.

Windward Side: Laie-Malaekahana Ridge, 1,750 ft., moist, wooded locations along trail, Feb. 14, 1932, *Storey 144*.

Discussion: The specimen *Storey 170* is normal in appearance, but the flowers are teratological. The two fertile stamens are not connate but separate and beyond the anther sacs the connective is prolonged into a broadly obovate, petaloid expansion 2 mm. long, 3 mm. broad, the 2 lateral staminodia have a free filament 2.5 mm. long, lacking any sign of an anther, but bearing a similar petaloid expansion 3 mm. long, 2 mm. wide; the upper staminodium lacks any stalk, being 4 mm. long, 1 mm. wide and oblanceolate. The two branches seem normal and typical in other regards.

C. pupukeensis is a member of the section *Cylindrocalyces*. The closest relative is *C. Hosakae* with which it is contrasted in the key.

The name of the new species is coined from the geographic locality, Pupukea, with the Latin adjectival place ending, *ensis*.

109. *Cyrtandra turbiniformis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 84, 1950. (Figs. 153, 195.)

Description of Holotype: Shrub; branches smooth, terete, dark mahogany colored, as much as 5 mm. in diameter, naked below; leaf scars 2-3.5 mm. high, triangular-shield-shaped, pale, corky; bundle scars 7; young shoots closely appressed brown pilose; leafy branchlets as much as 3 mm. in diameter, slightly quadrangular, sparsely sub-appressed brown pilosulous; internodes 7-48 mm., averaging 12 mm. long; *leaves* op-



FIGURE 153.—*Cyrtandra turbiniformis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Haiku Valley, Heeia, Storey 232, holotype (Bishop Mus.).

posite, ascending to spreading, borne at the 3-6 upper nodes, the leaves of a pair equal or perceptibly unequal in size, not crowded; petioles 10-35 mm. long, slender, sparsely subappressed brown pilosulous; *blades* 6-17 cm. long, 20-45 mm. wide, chartaceous, narrowly elliptic or oblanceolate, subacuminate, the base cuneate and decurrent, above dark green, remotely pilose, below whitish green, pilosulous especially on the veins, the margins serrulate except at base, secondary veins 8-13 on a side, ascending at 45° and upward arching; *cymes* axillary, 3-5-flowered, appressed brown pilosulous; peduncles 10-19 mm. long; pedicels 2-9 mm. long; floral bracts 5-13 mm. long, ovate or elliptic, foliaceous, green; buds top-shaped, beaked by the connivent calyx lobes; *calyx* in anthesis 16 mm. long (when boiled), green, campanulate, pilose; the tube 9 mm. long; the limb 2-lipped, cleft down 9 mm. between the lips, 5- (or 4-) lobed; upper lip 3-lobed, slightly divergent, cleft down 5.5 mm. between the lobes, the lobes 2 mm. wide at base, linear-lanceolate, long tapering to a slender, obtuse apex; lower lip 2-lobed, the lobes cleft down 5-6 mm., 1.5 mm. wide, linear lanceolate, attenuate, or the two lobes united to the apex; *corolla* (when boiled), 24 mm. long, the tube 18 mm. long, 3 mm. in diameter at base, 5 mm. at the middle, 6 mm. at the throat, within glabrous, without glabrous below the middle, white villous on distal and lateral sides from the middle to the throat, sharply deflexed at the middle at 35° from the axis of the lower tube; limb 2-lipped, 5-lobed, cleft 6 mm. between the lips; upper lobes 4.5 mm. long, 5 mm. wide, broad oval; lateral lobes 6 mm. long, 6 mm. wide, suborbicular; lower lobe 6 mm. long, 5 mm. wide, oval, all the lobes villous up the back, within towards the throat glandular pilosulous; two lower stamens perfect, with the filaments attached to the corolla tube to within 4.5 mm. of the throat, the free portion 2.5 mm. long, subulate, spirally up-curved; the two perfect anthers connate at apex, asymmetric oval, 2.5 mm. long, the connective oval, nearly as large as the anther; the staminodia 0.5-0.9 mm. long, subulate, with a hint of an anther, adnate to within 6 mm. of the throat; *style* 3 mm. long, terete, stout, glabrous; stigmatic lobes 2, sessile 4 mm. long, broadly oval connate $\frac{1}{2}$ way up proximal side; *ovary* 6 mm. long, narrowly lanceoloid, glabrous, the base surrounded by a cupulate disk 1.5 mm. high; *berry* 16 mm. long, 5 mm. wide, linear oblanceoloid (when dried), white; seeds 0.35-0.37 mm. long, 0.16-0.18 mm. in diameter ellipsoid, straw-colored, the ends brown, the body covered with raised cellular oblong reticulations $\frac{1}{4}$ to $\frac{1}{2}$ as long as the seed.

Distribution: Koolau Range, windward side, Heeia, at 600 ft. alt., in the lower part of the Ohia Zone.

Holotype: Oahu, Koolau Mts., Heeia, Haiku valley, near foot of pali in woods at about 600 ft., Dec. 11, 1932, *W. B. Storey 232* (BISHOP MUS.).

Discussion: *C. turbiniiformis* is a member of the section *Cylindrocalyces*. Its closest relative is *C. alata* St. John & Storey which occurs only at Punaluu in the windward Koolau Range and has the blades 13-24 cm. long, 53-70 mm. wide, the base long decurrent, above glabrous towards the base; peduncles 25-30 mm. long; pedicels 8-10 mm. long; exposed corolla tube pilosulous, the throat glabrous; and the style pilose. The contrasting characters for *C. turbiniiformis* are: blades 6-17 cm. long, 20-45 mm. wide, the base short decurrent, above remotely pilose; peduncles 10-19 mm. long; pedicels 2-9 mm. long; exposed corolla tube villous; the throat glandular pilosulous; and the style glabrous.

The specific name is coined from the Latin, *turbineus*, shaped like a top; *forma*, shape, in allusion to the top-shaped flower buds.

110. *Cyrtandra waianuensis* Rock (as *Waianuensis*), Am. Jour. Bot. 4: 618-620, Fig. 5, 1917. (Figs. 154, 155, 188.)

Description of Holotype: Shrub, single stemmed, unbranched, 1.5-2 m. tall, early glabrate, fawn-colored, somewhat fleshy towards the apex and on drying shrinking to form longitudinal furrows and ridges, 8-10 mm. in diameter near the terminal crown of leaves, towards the base thick, woody, and brittle; leaf scars 5-10 mm. high, cordate, finally annular interconnected, bundle scar 1, broad U-shaped, nearly as wide as the leaf scar; young shoots densely appressed brown pilose; young leafy stems quadrangular, brown pilose; internodes 12-50 mm., averaging 20 mm. in length; leaves opposite, ascending, subequal or one as much as $\frac{1}{2}$ the larger; petioles almost none; blades 30-45 cm. long, 10-20 cm. wide, membranous to chartaceous, elliptic to oval, apex acute, the base rounded or short cuneate and decurrent winged to the base, above dark green and at first brown pilose on the midrib and secondaries, later glabrate, below pale green and densely brown pilosulous on the veins, sparsely so on the intervals, the margins subentire or rarely minutely apiculate serrulate, the secondary veins 14-16 on a side, ascending, the tips arcuate, inarched interconnecting and salient; cymes 7-15-flowered, 3-5 cm. long; axillary, appressed brown pilose; peduncle 2-10 mm. long, stout; pedicels 5-19 mm. long; bracts 11-16 mm. long, 4-5 mm. wide, foliaceous, lanceolate; buds obovate-fusiform, beaked, the calyx lobes connate; calyx in anthesis 15-19 mm. long, subcylindric, greenish, without generally pilosulous or in part subglabrate, within densely brown pilose; the tube 11-12 mm. long, 5-7 mm. in diameter; the limb 2-lipped, cleft down 7-9 mm. between the lips, 5-lobed, the lobes persistent pilosulous; upper lip 3-lobed, ascending, cleft down 3-5 mm. between the lobes, the lobes 3.5 mm. wide, lanceolate, apiculate; lower lip with 2 lobes cleft down 8-10 mm. between the lobes, lobes 4 mm. wide, lanceolate; corolla when dried 25-30 mm. long, white, without glabrous, the tube 18-20 mm. long, at base 3 mm. in diameter, at the bend 4-5 mm. in diameter, at the throat 6 mm. in diameter, at 6 mm. from the throat decurved at 20° to 30° from the axis of the lower tube; limb 2-lipped, the 5 lobes glandular puberulent within; upper lobes 2, recurving at about 60° from the axis of the throat, 6 mm. long, 5 mm. wide, broadly oval; lower lip 3-lobed; lateral lobes 8 mm. long, 7 mm. wide, obliquely broad oval; lower lobe 7.5 mm. long, 7 mm. wide, broadly ovate; two lower stamens with filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 3 mm. long, subulate, spirally upcurved; the 2 perfect anthers 3 mm. long, 1.9 mm. wide, obliquely ovate, the connective ovate; the staminodia adnate to the corolla tube to within 4-5 mm. of the throat, subulate 1-1.3 mm. long; style 9 mm. long, terete, glabrous; stigmatic lobes 2, sessile, 3 mm. long, oval, connate $\frac{2}{3}$ way up proximal side; ovary 7 mm. long, lanceoloid, glabrous, base surrounded by a cupulate disk 2 mm. high; immature berry 14 mm. long, 5 mm. in diameter, glabrous, lanceoloid.

Distribution: Known only from the type collection, probably at about 1,000 feet altitude, in the wet, lower forest of the Ohia Zone.

Holotype: "Oahu: Waianu Valley, windward side of the Koolau Range, near the head of the valley, along stream-bed, flowering, Jan. 22, 1909. Rock, type no. 1167" (BISHOP MUS.). Fourteen sheets in (BISHOP MUS.); one (GH).

Discussion: *C. waianuensis* is a member of the section *Cylindrocalyces*. It and its close relative, *C. kaulantha*, are unique in being tall, single-stemmed plants with a terminal plume of very large leaves. Distinctive characters for the two are given in the key.

The species has never been collected again. The small valley, heading into a shallow amphitheater at the base of the windward precipices of the Koolau

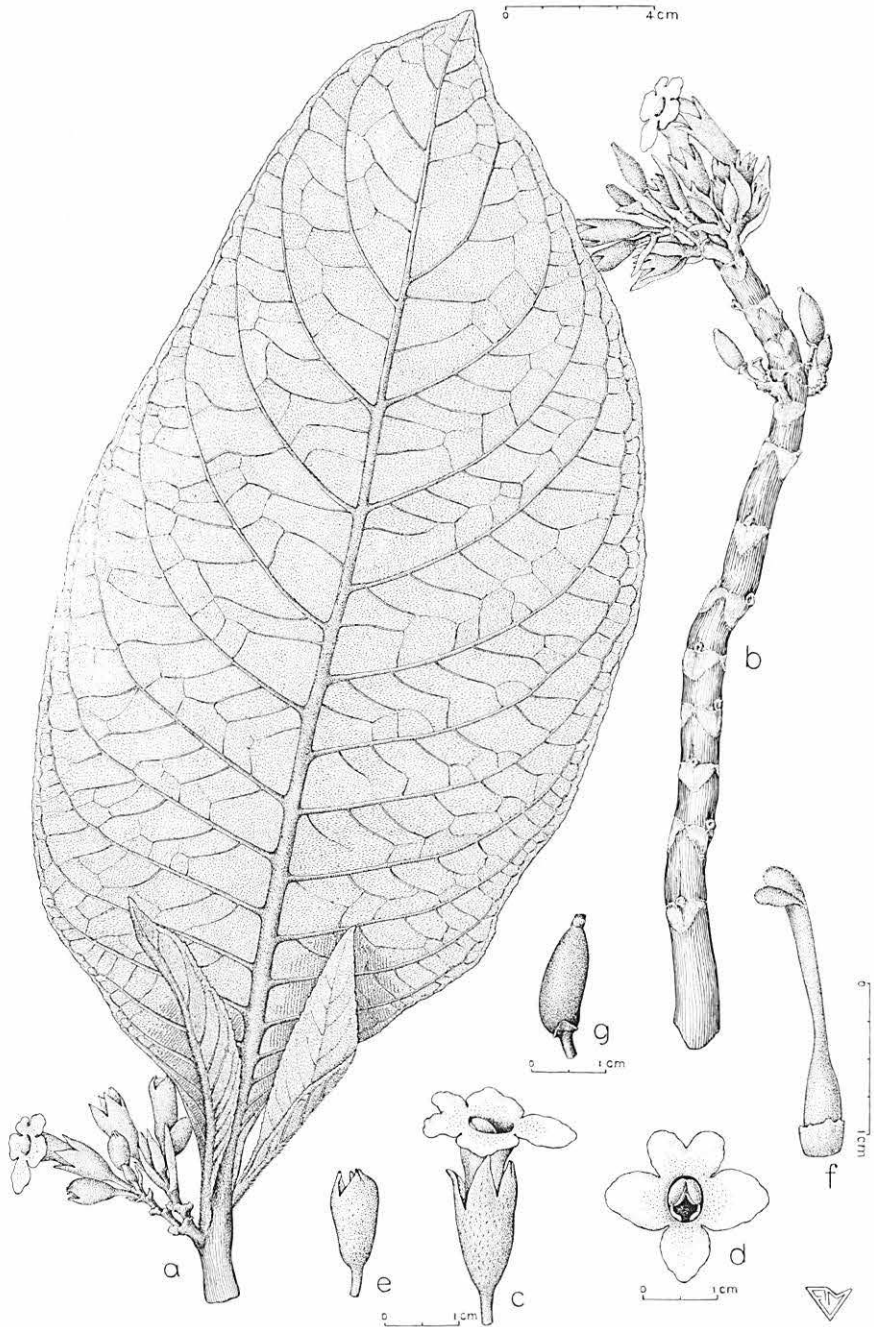


FIGURE 154.—*Cyrtandra waiamuensis*: a, habit, $\times \frac{1}{2}$; b, inflorescence, $\times \frac{1}{2}$; c, d, flower, $\times 1$; e, bud, $\times 1$; f, pistil, $\times 2$; g, fruit, $\times 1$. Holotype, Waianu, Rock 1,167 (Bishop Mus.); inflorescence only, Rock 1,198.

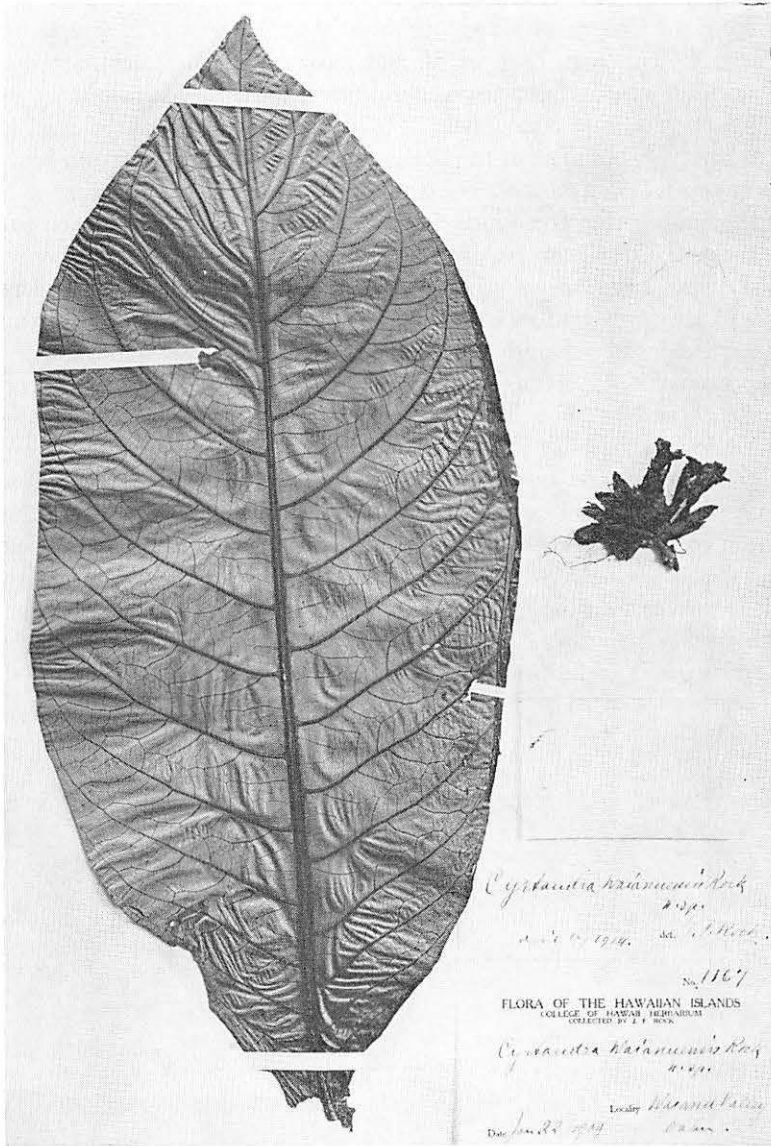


FIGURE 155.—*Cylindrocalyx waianuensis*, holotype (Bishop Mus.). Waianu Valley, Rock 1,167. (Photograph after Rock.)

Range, is now in the Water Reserve, closed to the public. It has been searched for in vain in the next valley head, half a mile away to the north.

Rock collected abundant material, and much of it is still in Honolulu, transferred from the College of Hawaii to the Bishop Museum. As the plants were very large, he cut them into pieces, and most of his sheets contain detached leaves and inflorescences; a few contain small stem tips with one or two attached leaves, and a few have naked stems and loose leaves. He cited his no. 1,167 as the type, but most of the sheets now in the Bishop Museum bear numbers between 1,139 and 1,200. These numbers were given, according to Rock's custom, by numbering consecutively with a numbering machine each pressing sheet, thus each duplicate received a different number. Often they were distributed under these individual numbers. Later he selected 1,167, and renumbered with this preferred number some of the sheets. Some bear this and the original number. In our understanding, these are all exact duplicates.

One unmounted sheet is troublesome. On the folder it has the original stamp 1,170, and within a label typed after Rock's departure giving the data and no. 1,167, which was a justified version. It has a stem tip 25 mm. long, with one large leaf and several juvenile leaves, and a detached naked stem 12 cm. long. This is the only stem showing leaf scars in whorls of three. This may have been collected from the same species or it may be different and extraneous. As this is the only twig with a whorled arrangement, it will be excluded until it is proven that the species has both opposite and whorled leaves.

The specific name was coined from the locality name, Waianu; plus the Latin suffix, *ensis*, indicating place origin.

6. Section *Verticillatae*

111. *Cyrtandra brevicornuta* St. John, sp. nov. (Figs. 156, 188).

Diagnosis Holotypi: Frutex, ramis ad 10 mm. diametro laevibus lucidis griseis in sicco contractis et sulcatis, cicatricibus 4-6 mm. altis deltoideo-scutelliformibus interconnectis et annulatis pallidis suberosis, fasciculis 7, ramulis foliferis 5-7 mm. diametro subquadrangularibus vel teretibus sparse pilosulis, novellis clausis et dense semiadpresse brunneo-pilosis, internodis 3-43 mm. plerumque 16 mm. longis, *foliis* ternatis in ramis principalibus sed in ramulis lateralibus exiguis oppositis subaequalibus in 3-5 nodis superis affixis adscendentibus congregatis, petiolis 0-15 mm. longis brunneo-pilosis, *laminis* 20-37 cm. longis 50-126 mm. latis subtiliter chartaceis oblanceolatis in basi longe cuneatis et decurrentibus in apice acutis supra obscure viridibus in pagina ab initio remote brunneo-pilosis sed in maturitate subglabris midnervo dense adpresse brunneo-piloso infra albescenti-viridibus et sparse adpresse brunneo-pilosulis sed in midnervo et nervis principalibus adpresse brunneo-pilosulis marginibus sime serratis nervis secundariis 12-17 in uno latere apicibus arcuatis interconnectis et in dentibus excurrentibus, *cymis* axillaribus 1-3-floriferis adpresse brunneo-pilosis, pedunculis 3-8 mm. longis adscendentibus, bracteis binis 15-21 mm. longis foliaceis connatis et infundibuliformis bilobatis lobis 8-10 mm. longis late lanceolatis integris divergentibus adpresse brunneo-pilosis, pedicellis 5-15 mm. longis semiadpresse brunneo-pilosis, alabastris ovoideo-fusiformibus semiadpresse brunneo-pilosis, *calycibus* in flore et vivo 25-30 mm. longis (20-25 mm. in sicco) fusiformibus subviridibus et extra sparse adpresse brunneo-pilosis et intra dense itaque in tubo in latere distali 8.5 mm. partitis bilabiatis et inter labias in 6 mm. partitis, labia supera 7 mm. longa tripartita intra ad basim pilosis, lobis inaequalibus loba centrali 6 mm. longa, lobis lateralibus 3-5 mm. longis omnibus in basi subiter late ovatis sed parte supera lanceo-linearis crassis et subteretibus, labia infera bipartita lobis 8 mm. longis apice brevi subulato parte principali late ovata intra in basi adpresse pilosis, *corollis* in vivo 32-37 mm. longis albis tubo 27 mm. longo subcylindrico sed sursum dilatato 5 mm. diametro in basi et media sed 9 mm. in orifice paene supra media in 35° ad 65° deflexo intra glabro extra in dimidia supera adscendente brunneo-piloso, labia supera bilobata lobis 4.5-5 mm. longis 6 mm. latis suborbicularibus in basi subcordatis et impensis extra in linea mediali ex basi ad mediam brunneo-pilosis intra dimidia infera minute capitato-glanduloso-puberula, lobis lateralibus 8-9 mm. longis 7-9 mm. latis suborbicularibus, loba infera 9-10 mm. longa 7-9 mm. lata late elliptica, staminibus binis inferis perfectis filamentis in tubo 8 mm. ex orifice affixis parte libera 4 mm. longa crasse ligulata contorte adscendentibus, antheris 3 mm. longis 2 mm. latis oblongo-ellipticis connectivo 1.5 mm. lato obovato, staminodeis binis lateralibus in tubo 10 mm. ex orifice affixis filamentis parte libera 0.5 mm. longa terete apice antheroideo 1.1 mm. longo anguste lanceolato translucenti, *stylo* 7 mm. longo tereti validi glabro excepta pilis paucis in apice, lobis stigmatis 4 mm. longis obovatis ½ connatis, *ovario* 8 mm. longo lanceoloideo glabro in basi cum disco subnigro cupulato 1.3 mm. alto cincto, *fructu* immaturo 27-31 mm. longo 4-6 mm. diametro anguste subcylindrico in apicibus diminuendo.

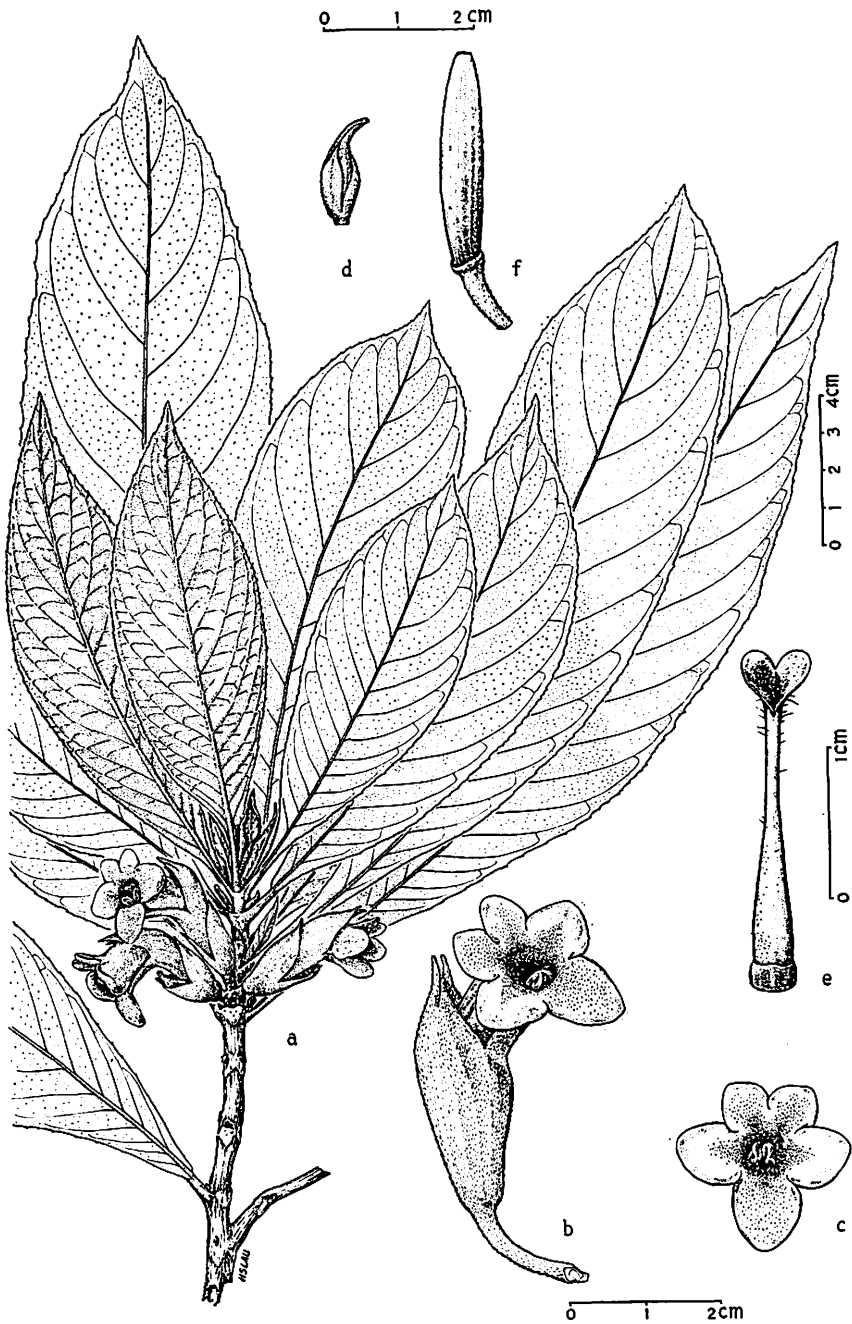


FIGURE 156.—*Cyrtandra brevicornuta*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Kailua, Pearsall 91, holotype (Bishop Mus.).

Description of Holotype: Shrub; branches as much as 10 mm. in diameter, smooth, shining, light gray, on drying shrinking to form longitudinal furrows and ridges; leaf scars 4-6 mm. high, triangular-shield-shaped, interconnected and annular, pale, corky; bundle scars 7; leafy branchlets 5-7 mm. in diameter, subquadrangular to terete, sparsely pilosulous; young shoots covered with a dense semiappressed brown pilosity; internodes 3-43 mm., averaging 16 mm. long; *leaves* ternate on the main stems, opposite on weaker laterals, subequal, borne at the 3-5 upper nodes, ascending, crowded; petioles 0-15 mm. long, brown pilose; *blades* 20-37 cm. long, 50-126 mm. wide, thin chartaceous, oblanceolate, the base long cuneate and decurrent to or almost to the base, the apex acute, above dark green, the surface at first remotely brown pilose but in age subglabrous, midrib densely appressed brown pilose, below whitish green and the midrib and principal veins appressed brown soft pilosulous, and sparsely so on the intervals, the margins low flattened serrate, the secondary veins 12-17 on a side, the tips arcuate ascending interconnected and excurrent in the teeth; *cymes* axillary, 1-3-flowered, appressed brown pilose; peduncles 3-8 mm. long, ascending; bearing at their summit two foliaceous bracts 15-21 mm. long, connate into a broad funnel ending in two lateral lobes 8-10 mm. long, broadly lanceolate, entire, diverging, the tissue foliaceous, greenish, appressed brown pilose, enclosing the buds and persisting and subtending the flowers in anthesis; pedicels 5-15 mm. long, brown semiappressed pilose; buds ovoid fusiform, semiappressed brown pilose; *calyx* in anthesis when fresh 25-30 mm. long (20-25 mm. when dried), fusiform, greenish, sparsely appressed brown pilose without and densely so within the tube, parted 8.5 mm. on the distal side to allow the protrusion of the corolla, two-lipped, cleft 6 mm. between the lips; upper lip of 3 lobes, 7 mm. long, within appressed pilose near the base, glabrous above, unequal, the central one 6 mm. long, the lateral ones 3-5 mm. long, all abruptly widened and broadly ovate at base but above that lance-linear, thick and subterete; lower lip of two lobes 8 mm. long, the short tip subulate, the main part broad ovate, within appressed pilose only near the base; *corolla* when fresh 32-37 mm. long, white, the tube 27 mm. long, subcylindric but expanding upward, 5 mm. in diameter at base and middle, 9 mm. at the throat, just above the middle deflexed at 35° to 65° to the axis of the lower tube, the tube glabrous within, and without glabrous from the bend downwards, but above it on the distal side ascending brown pilose from the bend to the throat and on the midnerve running to the upper lobes, ascending brown pilose in a broad band from a little above the bend up to the throat; the limb 2-lipped, 5-lobed, the upper lip of two lobes 4.5-5 mm. long, 6 mm. wide, suborbicular, at base subcordate and overlapping, without on a medial band ascending brown pilose from base to well above the middle, within minutely capitate glandular puberulous from the throat almost to the middle; lower lip 3-lobed, the lobes spreading at 50° to 80°, the two lateral lobes 8-9 mm. long, 7-9 mm. wide, suborbicular, overlapping at base, within capitate glandular puberulous up to the middle; lower lobe 9-10 mm. long, 7-9 mm. wide, broadly elliptic, it and the lateral ones pilose without on a median strip up to the middle and within capitate glandular puberulous except on the upper quarter; two lower stamens perfect, the filaments adnate to the corolla tube to within 8 mm. of the throat, the free portion 4 mm. long, thick ligulate, spirally upcurved; the perfect anthers 3 mm. long, 2 mm. wide, oblong elliptic, nearly symmetrical, the dark connective 1.5 mm. wide, obovate; the two lateral staminodia adnate to the corolla tube to within 10 mm. of the throat, their free filaments 0.5 mm. long, terete, firm, the antheroid tip 1.1 mm. long, narrowly lanceolate, translucent; *style* 7 mm. long, stout, terete, glabrous except for several hairs of the hirsute type at the apex; stigmatic lobes two, 4 mm. long, obovate connate $\frac{1}{2}$ way up proximal side; *ovary* 8 mm. long, lanceoloid, glabrous, the base subtended by a dark cupulate disk 1.3 mm. high; immature *fruit* 27-31 mm. long, 4-6 mm. in diameter, narrowly subcylindric, tapering to either end.

Range: Koolau Range, windward side, in moist shady gulches in the Koa Zone.

Holotypus: Kailua, Third Branch South of South Fork of Kahanaiki Stream, open brush of kukui, *Dioscorea*, guava, *Musa*, and *Touchardia*, growing near head of ravine, wet, only a few hours of sunlight each day, 790 ft. alt., March 16, 1956, G. Pearsall 91 (BISHOP MUS.).

Discussion: *C. brevicornuta* is a member of the section *Verticillatae*. It makes the fourth species in a group notable for having the two bracts at the summit of the peduncle fused to form a funnel-like structure surrounding the buds and flowers. Of these species the most similar is *C. calpidicarpa* (Rock) St. John & Storey which occurs in the Koolau Range on the windward side from Laie to Kahaluu and on the leeward side at Kipapa Gulch. This species is characterized by having the bundle scars 5; leaves 3-4 at a node; petioles 10-62 mm. long; blades 6-23 × 1.3-6.3 cm., the secondary veins 10-13 on a side; floral bracts mostly deciduous by anthesis; buds with an apical beak 10-16 mm. long; calyx remotely pilose to subglabrate, splitting ½ way for protrusion of corolla, the upper lobes 13 mm. long, the lower lobes 12 mm. long, broadly lanceolate; corolla with the tube on the outside with a sparse hirsute distal patch below the throat, the lobes glabrous without; and the style 13-15 mm. long. *C. brevicornuta*, on the other hand, has the bundle scars 7; leaves on main branches 3 at a node but on weaker laterals opposite; petioles 0-15 mm. long; blades 20-37 × 5-12.6 cm., the secondary veins 12-17 on a side; floral bracts persisting in anthesis; buds with a beak 3 mm. long; calyx sparsely brown appressed pilose, splitting ¼ way for protrusion of corolla, the upper lobes 7 mm. long, the lower lobes 8 mm. long with a short subulate tip and the main part broad ovate; corolla with the tube having five pilose bands from the bend to the throat, the lobes having on the outside a pilose median strip from the base to the middle; and the style 7 mm. long.

The new specific epithet is taken from the Latin, *brevis*, short; *cornutus*, horned, in allusion to the short apical beak of the calyx.

112. *Cyrtandra calpidicarpa* (Rock) St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 81, 1950. (Figs. 157-159, 192.)

C. longifolia Hillebrand ex. C. B. Clarke var. *calpidicarpa* Rock, Am. Jour. Bot. 4: 618, Fig. 4, 1917.

Description of All Specimens Examined: Shrub 1-4 m. tall, upright or tortuously branched, stem up to 5 cm. in diameter; branches glabrous, smooth, brown, fleshy and on drying forming longitudinal ridges and furrows; leaf scars 2-6 mm. high, depressed cordate and interconnected laterally into a ring, corky, whitish; bundle scars 3 (or 5 if the common marginal ones are counted); leafy branchlets 2-4 mm. in diameter, sparsely brown pilose, the young shoots closely and densely so; internodes 0.5-13 cm., averaging 1.5 cm. in length; leaves whorled, 3-4 at a node on the principal branches (rarely opposite on weak laterals), subequal or one of a set as much as ¼ smaller, borne at the 3-8 upper nodes, approximate but not crowded; petioles 10-62 mm. long, slender, and brown pilose; blades 6-23 cm. long, 13-63 mm. wide, chartaceous or thick chartaceous, oblanceolate or rarely lanceolate, base decurrent, apex acuminate or shortly so, above dark green, the midrib pilose especially towards the base, elsewhere remotely pilose,

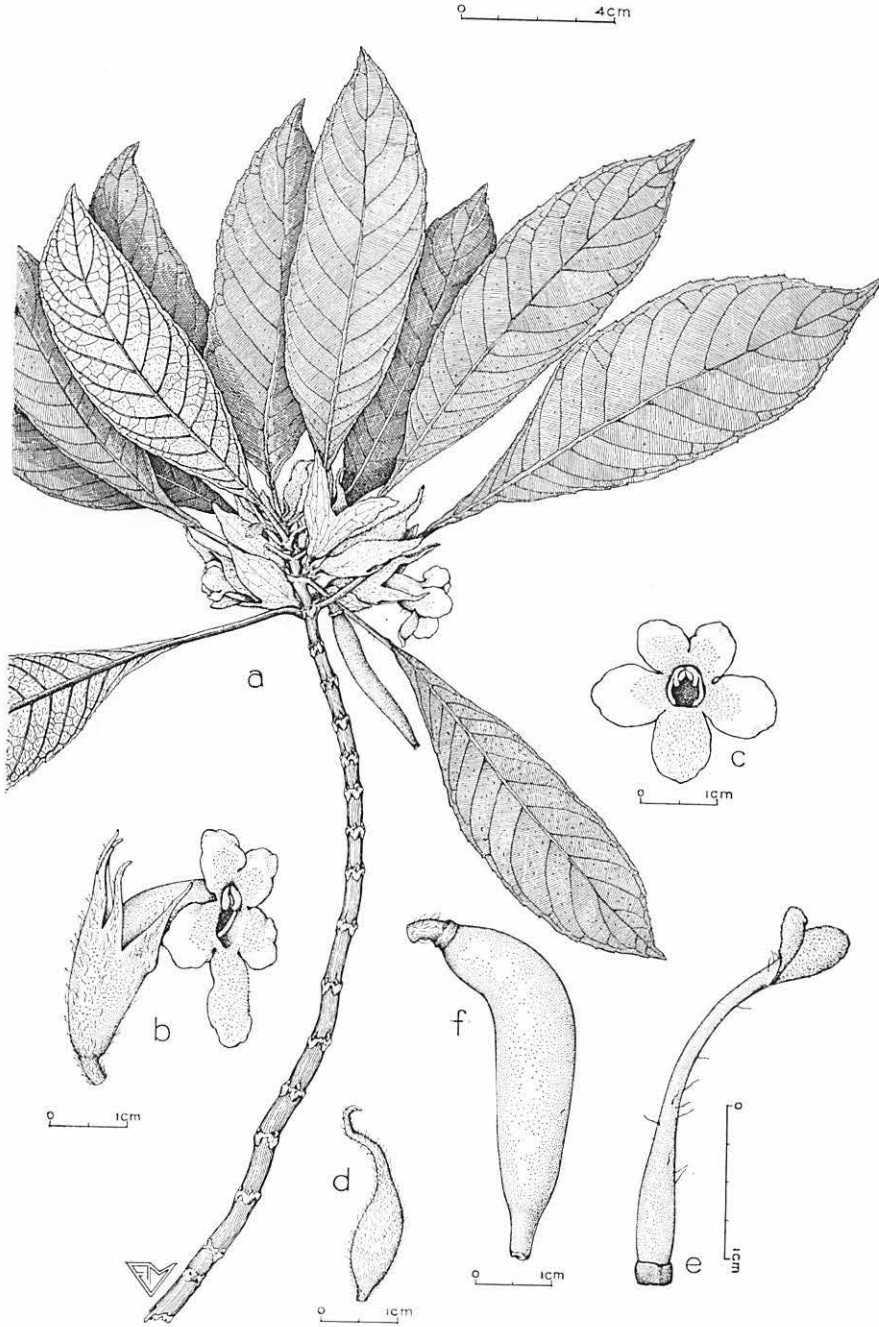


FIGURE 157.—*Cyrtandra calpidicarpa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Punaluu, St. John 20,114.

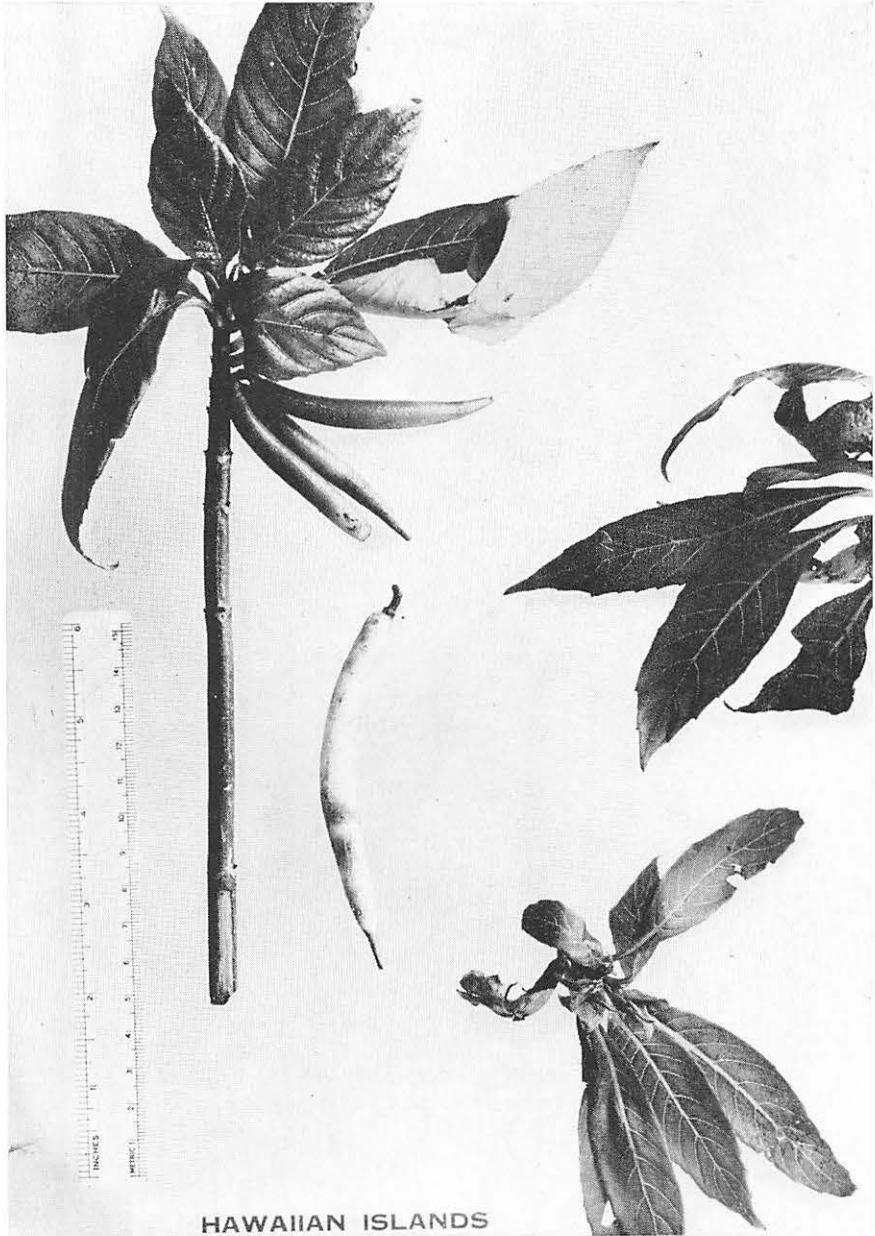


FIGURE 158.—*Cyrtandra calpidicarpa*, Waikane, Storey.

below whitish green, and pilose on midrib and secondaries and almost imperceptibly so or glabrate on the intervals, the margins remotely low serrulate-denticulate except at base, the secondary veins 10-13 on a side, forward arching, the tip inarching interconnected and excurrent in the teeth; *cymes* axillary, 1-3-flowered, sparsely brown pilose; peduncles 1-3 (-7-9) mm. long, bearing at their summit two foliaceous, 18-33 mm. long bracts connate into a broad funnel ending in two distal deltoid lobes 9-16 mm. long, the tissue membranous, greenish, remotely brown pilose within and without, the margins entire or serrulate, enclosing the buds but mostly deciduous at anthesis; pedicels 3-7 mm. long, pilose; buds slender fusiform, the calyx teeth connate into a beak 10-16 mm. long; *calyx* in anthesis 23-37 mm. long, remotely pilose to subglabrate, splitting at least $\frac{1}{2}$ way down the distal side to allow the protrusion of corolla, the tube ellipsoid, within densely brown pilose, the caudate tip splitting all or part way down into the 5 lance-linear, acuminate teeth that in age recurve or coil; *corolla* (when fresh) 30-35 mm. long (27-35 mm. when dried) white, the tube 20-24 mm. long, from the middle gradually decurved at 45° to 55° to the axis of the lower tube, at base 4 mm. in diameter, at the middle 5 mm., at the throat 6-8 mm., within glabrous, without glabrous except for a sparse hirsute patch below the throat on the distal side; limb 2-lipped, 5-lobed; upper lobes 2, recurving at about 90° from the axis of the throat, 6.5-8 mm. long, 5.5-6 mm. wide, broadly oval, glabrous without, but within capitate glandular puberulent except near the margin; lower lip 3-lobed; lateral lobes 8-11 mm. long, 7-8 mm. wide, broadly oval, similarly pubescent; lower lobe 9-10.5 mm. long, 6-8 mm. wide, oval, similarly pubescent; two lower stamens with filaments adnate to the corolla tube to within 3 mm. of the throat, the free portion 4 mm. long, spirally upcurved; the 2 perfect anthers 2.5 mm. long, obliquely ovate, cordate, the connective ovate; the staminodia adnate to the corolla tube to within 8 mm. of the throat, the free portion 0.8 mm. long, subulate; *style* 13-15 mm. long, filiform, very remotely hirsute; stigmatic lobes 2, sessile, 4.5 mm. long, elliptic, connate $\frac{3}{5}$ way up proximal side; *ovary* 11 mm. long, linear-lanceoloid, straight or curved, glabrous, the base surrounded by a cupulate disk 1.3 mm. high; *berry* white 3-10 cm. long, 6-12 mm. in diameter, naked subcylindric, tapering to both ends, white, granular on the surface, the form and color suggestive of a white radish; seeds 0.27-0.32 mm. long, 0.18-0.24 mm. in diameter, broadly ellipsoid, lemon yellow, with dark ends, the body covered with raised cellular, broad oblong reticulations $\frac{1}{5}$ as long as the seed.

Distribution: Koolau Range, on the windward side, at from 800 to 1,900 ft. alt., common in lower wet forest to the wet Ohia Zone from Laie to Kaha-luu; on the leeward side, known only from Kipapa Gulch from 1,200-1,300 ft. alt. in the bottom of the gulch in the Koa Zone.

Holotype: "Oahu: Windward side, Waiahole Valley, a rocky wall, near waterfall at the head of the valley; flowering and fruiting, Jan. 17, 1909, Rock, type no. 1093 in herb. College of Hawaii." Type now in BISHOP MUS. and also an isotype. Isotype (GH).

Specimens Examined: Koolau Range.

Windward Side: Laie Trail, Kahawainui Gulch, wet *Metrosideros* forest near stream, 1,200 ft. alt., March 25, 1956, *St. John 25,959*; Hauula Valley, dark forest, July 4, 1940, *Degener 12,991* (NY); ditto, rich dark forest, July 4, 1940, *Degener 17,202* (NY); Waipilopilo, Hauula, June 11, 1940, *Degener 17,720* (NY); Punaluu, Castle Trail, steep wet slope, 600 m. alt., March 1, 1936, *Fosberg 12,960*; Punaluu, Sept. 27, 1938, Hawaiian Bog Survey, *Selling 3,673*; ditto, open forest, 1,000 ft. alt., Nov. 3, 1940, *St. John 20,114*; ditto,

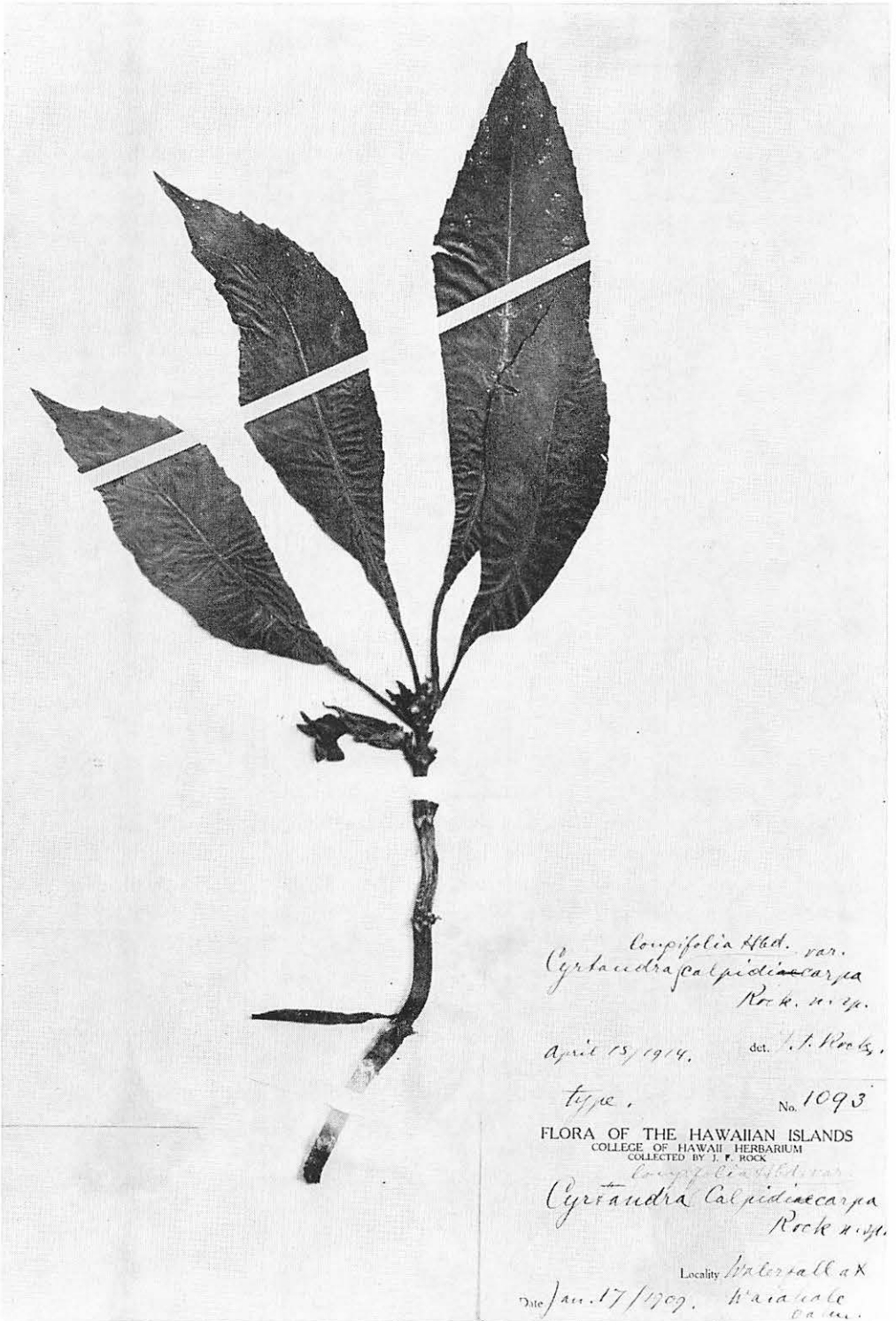


FIGURE 159.—*Cyrtandra longifolia* var. *calpidicarpa*, Waialeale, Rock 1,093, holotype (Bishop Mus.); basionym of *C. calpidicarpa* (Rock) St. John and Storey.

edge of trail, 1,200 ft. alt., Jan. 11, 1931, *Storey 124*; ditto, dense woods, 1,800 ft. alt., July 4, 1931, *Storey 137*; ditto, woods, 1,000 ft. alt., May 8, 1932, *Storey 187*; ditto, small ravine, 900 ft. alt., April 29, 1934, *Storey 250*; Waikane-Schofield Trail, Oct. 16, 1932, *Suchiro*; Waikane-Schofield Trail, Kahana, moist *Metrosideros* forest, Dec. 2, 1951, *Haramoto*; ditto, rocky wet ridge, 1,600 ft. alt., May 18, 1941, *Wong*; Waikane Ditch Trail, trail to intake no. 20, 750-900 ft. alt., *Storey 275*; Waianu, Waiahole, small gulch in lower forest, Aug. 10, 1937, *Degener et al. 12,179* (NY); Waiahole Valley, on wall of mountain, beside waterfall, Jan. 17, 1909, *Rock 1,096*; Waiahole Valley, Dec. 1919, *Rock*; Waihee Valley, south ridge, moist forest, head of gulch, 1,000 ft. alt., May 11, 1941, *St. John & Storey 20,235*; Waihee, N. W. gulch, head of, moist wooded gulch, 900 ft. alt., June 1, 1941, *St. John 20,249*; Kahaluu, n. ridge, steep slope, fairly moist place, 1,000 ft. alt., July 4, 1935, *Hosaka 1,283*; Kahaluu Valley, small gulch on north slope, moist forest, bottom of small side gulch, 275 m. alt., July 4, 1935, *Fosberg 12,196*; Kailua, third branch south of south fork of Kahanaiki stream, near head of wet ravine, with only a few hours of sunlight each day, open brush of kukui, *Dioscorea*, guava, *Musa*, and *Touchardia*, 790 ft. elev., Mar. 16, 1956, *Pearsall 91*.

Leeward Side: Kipapa Gulch, 425 m. cl., Feb. 15, 1931, *Hume 100*; Kipapa Gulch, in dark gully off main stream, 1,200 ft. alt., Nov. 13, 1932, *Storey 216*.

Discussion: *C. calpidicarpa* is a member of the section *Verticillatae*. It and three other species are well set off from the other species by having two large floral bracts fused into a funnel enclosing the buds, and in having a slender elongate berry 3-12 cm. long. No other Hawaiian species has such an elongate fruit.

It is of interest that Rock, in his preliminary study, considered this a new species, and so labeled his type specimen in both 1909 and 1914. When finishing his revision he changed his mind, altered the label, and published the plant as a variety of *C. longifolia* Hillebrand. He indicated the unique, elongated fruit, but did not note the fused foliar bracts. He placed his variety under a Kauai species with campanulate calyces, subsessile, opposite leaves, etc. The author sees no similarity between the two, other than the fact that both have somewhat lanceolate leaves. We disagreed with Rock's placement and have raised the Oahu plant to specific rank, and placed it in a different section.

The name was coined by Rock from the generic name, *Calpidia*; and the Greek, *karpos*, fruit, suggesting that the long cylindrical fruit resembled that of the trees in the genus *Calpidia*.

113. *Cyrtandra calycoschiza* (St. John & Storey) St. John, comb. nov. (Figs. 160, 192).

C. degenerans (Wawra) Heller var. *calycoschiza* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 81-82, 1950.



FIGURE 160.—*Cyrtandra calycoschiza*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$, Waimano, Forbes and Lake 1,984.O, holotype (Bishop Mus.); f, fruit, $\times 1$, Rock and Horner 3,029, Kaukonahua Gulch.

Description of All Specimens Examined: Shrub, 1-2.6 m. tall; branches 3-10 mm. in diameter, pale yellowish, corky; leaf scars 1.5-2 mm. high, triangular shield-shaped, stramineous, raised, prominent, contiguous; bundle scars 3; internodes 8-60 mm. long; leafy branchlets 2-5 mm. in diameter, glabrate, smooth, stramineous, much wrinkled on drying, axillary buds brown lanate; young shoots densely brown villous; *leaves* all in a terminal plume, 4-6 at a node; petioles 8-17 mm. long, slender, brown pilose; *blades* 8-22 cm. long, 13-52 mm. wide, subequal, narrowly elliptic, tapering and acute at both ends, the base long cuneate decurrent, serrulate except at base, above dark green, glabrous, below sparsely brown pilosulous and densely so on midrib and laterals, lateral veins 14-17 on a side, ascending, the tips arcuate, inarching and salient in the teeth; *cymes* 1-3-flowered, subsessile; peduncles minute; bracts 4-7 mm. long, linear-lanceolate, densely brown villous; pedicels 1-3 mm. long; buds obliquely fusiform, covered with a dense brown villosity, usually throughout, though a few are less hairy at apex and show visible minute rudiments of calyx lobes; calyx 21-32 mm. long, densely castaneous villous without and within, obliquely fusiform, the apex long acuminate, upcurved beak, all covered with a shaggy brown villosity, the body opening by a distal slit through which the corolla is deflexed but also splitting from the apex of the beak into 3 lance-linear lobes 9-15 mm. long; *corolla* 28-37 mm. long, white, the tube 22-27 mm. long, 5.5 mm. in diameter, glabrous without and within, or sparsely pilose without below the throat, the lower part 14 mm. long, straight, included in the calyx tube, the upper part slightly enlarged upwards, deflected at about 45° from the axis of the lower part and protruding through a slit in the calyx; the limb 2-lipped, 5-lobed, the upper lobes spreading at about 60° from the axis of the upper tube, the lower lobes at about 110°, all sparsely capitate glandular puberulent within, the upper two lobes 7-8 mm. long, 4.5 mm. wide, oblong-oval, the lateral lobes 10-11 mm. long, 9 mm. wide, oval; lower lobe 12 mm. long, 6 mm. wide, elliptic; filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 5 mm. long, subulate, spirally upcurved; anthers 3 mm. long, 1.5 mm. wide, obliquely ovate, flattened, connate at apex; *style* about 12 mm. long, glabrous, stout; stigmatic lobes 4 mm. long, oblong-oval, the margin entire, connate $\frac{1}{3}$ way up proximal side, *ovary* 7 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1 mm. high; *berry* 2 cm. long, 14 mm. in diameter, white, broadly oval in outline, terete, umbonate at apex; seeds 0.30-0.42 mm. long, 0.14-0.17 mm. wide, straw-colored, the umbonate ends darker, the body broadly oval, covered with a raised cellular reticulation, the areolae oblong polygonal $\frac{1}{4}$ - $\frac{1}{2}$ the length of the seed.

Distribution: Koolau Range, windward side at Hauula at 1,600 feet; and leeward side from Wahiawa to Waimano at from 1,650 to the summit at 2,150 or 2,200 feet, in the Ohia and the Cloud Zones.

Holotype: Waimano Ridge, along the stream sides of a deep gully in dense shade, Oct. 27-30, 1914, *C. N. Forbes & D. Lake 1,984.O* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Hauula, Maakua-Papali ridge, Kaipapau For. Res., moist wooded gulch, 1,600 ft. alt., Oct. 15, 1933, *St. John 13,355*.

Leeward Side: Wahiawa, North Fork of Kaukonahua Gulch, May 15, 1909, *Rock & Hosmer 3,029* (apparently of this species); Waikane-Schofield Trail, Oct. 16, 1932, *Suehiro*; Waipio, Kipapa Gulch, 550 m. alt., wet forest, bush 1.5 m. tall, Aug. 7, 1933, *Fosberg 9,768*; ditto, Kipapa Gulch, South Ridge, el. 1,700 ft., near stream bed, Sept. 18, 1932, *Hosaka 746*; Waimano, Waimano Trail, at summit pass, 2,150 ft. alt., moist thicket, decumbent shrub

2 m. long, May 3, 1942, *St. John & Conger 20,291*; Koolau Mts., Oct. 31, 1914, *Rock*.

Discussion: *C. calyoschiza* is a member of the section *Verticillatae* and in that section is its closest relative, *C. latebrosa*. The two are adjacent in and are contrasted in the key. Only one collection, that from Hauula, is definitely from the windward side of the Koolau Range. The species occurs near the summit of the range from Wahiawa south to Waimano, most of the stations being definitely on the ridge or its leeward slopes. There is a collection from the Waikane-Schofield Trail by Suehiro but the brief data do not include the valley or "ahupuaa." It is quite possible that they were found on the windward side, in Kahana, but there is no definite record, so it is uncertain.

The collection from Kipapa Gulch, *Hosaka 746*, shows four branches and numerous flowers, all typical, except for one flower which has an unlobed calyx, thus resembling the flowers of *C. degenerans*. It seems that this was an instance of delayed fission and that it does not fully invalidate the specific status of this plant. The calyx length and shaggy villosity separate it satisfactorily from the other species.

The plants of *C. calyoschiza* are similar to *C. degenerans* in appearance and like it have the fusiform calyx permanently shaggy brown villous. They differ in having the shorter calyx splitting into three lance-linear lobes; and the leaves less tapering at base and shorter and narrower. The corresponding measurements are given in the descriptions. The geographic ranges of the two nowhere overlap, but they closely approach each other in Kahana Valley. Here *C. degenerans* occurs from the valley floor at 800 ft. up to 1,500 ft., while *C. calyoschiza* is not encountered except at 2,200 ft. at the summit.

The new name was coined from the Greek, *kalix*, cup or calyx; and *skizo*, to split, indicating the split or divided calyx.

114. *Cyrtandra caudatisepala* St. John, sp. nov. (Figs. 161, 194).

Diagnosis Holotypi: Frutex 1.8 m. alta, caule 4 cm. diametro pauce ramosi, cortice pallide brunnea sublaeve; ramulis 6-10 mm. diametro viridibus carnosius subquadrangularibus glabris, cicatricibus 3-5 mm. altis lunatis ad depresso deltoideis pallidis suberosis proximis sed exannulatis, fasciculis 7; ramulis foliosis 5-8 mm. diametro quadrangularibus viridibus carnosius supra olivaceo-brunneo-hirsutis infra subglabris, novellis modice subadpresse olivaceo-brunneo-hirsutis, foliis in ramis principalibus et floriferis ternatis sed in ramulis tenuibus et lateralibus oppositis, adscendentibus congestis inaequalibus, in nodo quisque folia una $\frac{1}{4}$ - $\frac{1}{3}$ minore, petiolis 2.5-7.3 cm. longis viridibus validibus carnosius modice olivaceo-brunneo-hirsutis, laminis 8-19 cm. longis 41-110 mm. latis molliter chartaceis late ellipticis apice subacuminato basi inaequilaterali cuneato vel breve decurrenti supra viridibus et ab initio modice subbrunneo-hirsutulis deinde subglabris infra semialbis et in nervis hirsutulis sed in intervallis minus hirsutulis pilis albis ultimo brunneis marginibus grosse duplo serratis vel irregulariter serratis, nervis lateralibus 9-11 in uno latere adscendentibus et apicibus arcuatis et interconnectentibus, cymis axillaribus 3- vel 5-floriferis olivaceo-brunneo-hirsutis, pedunculis 15-20 mm. longis, pedicellis 5-13 mm. longis, bracteis foliaceis subviridibus infimis 20-25 mm. longis 15-18 mm. latis oblique ovatis distinctis vel subconnatis superi-

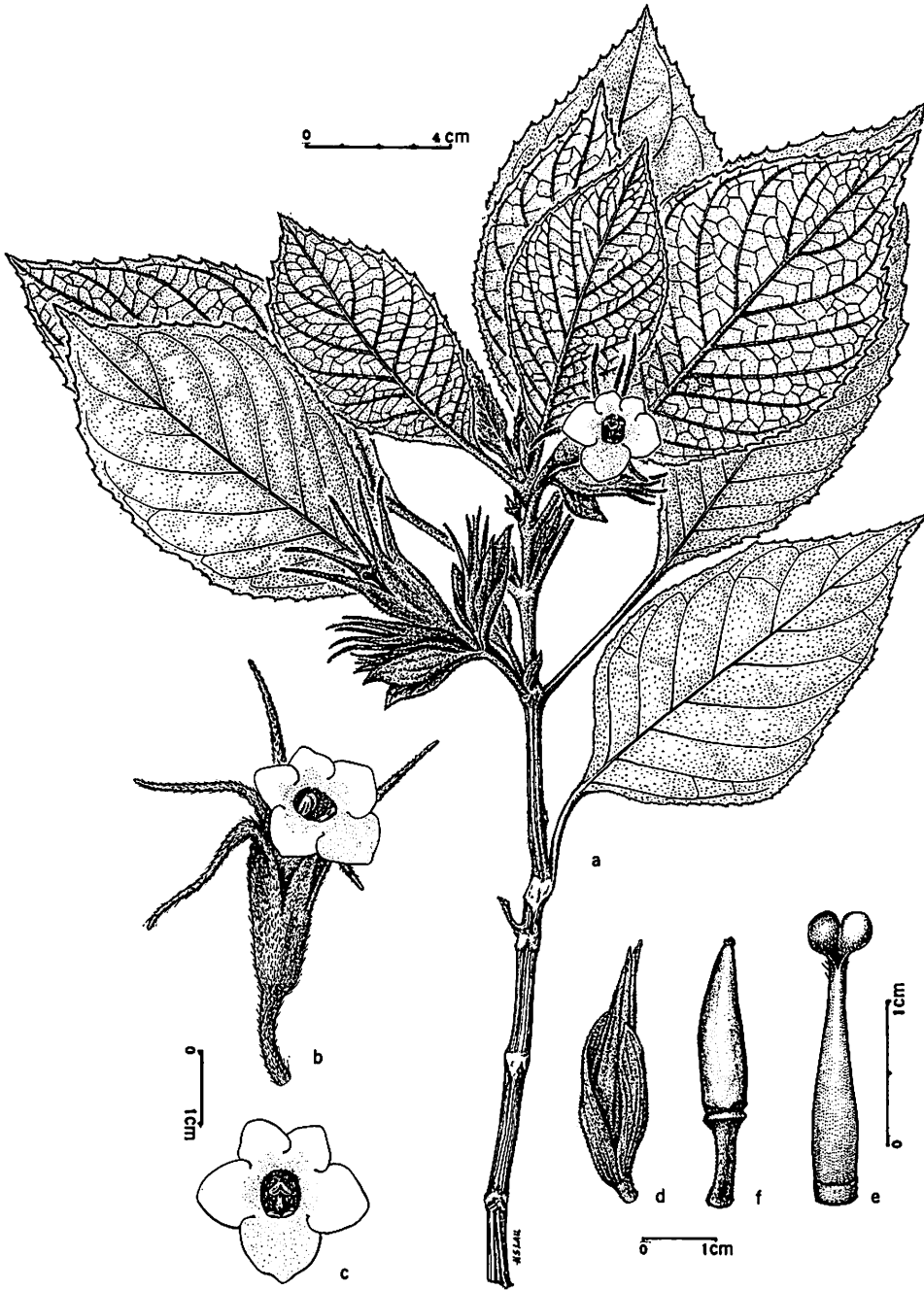


FIGURE 161.—*Cyrtandra caudatisepala*: a, habit, $\times 1$; b, c, flower, $\times 1$; d, bud, $\times 2$; e, pistil, $\times 2$; f, fruit, $\times 2$. Laie, St. John 25,964, holotype (Bishop Mus.).

oribus distinctis 25-27 mm. longis 8-10 mm. latis lanceolatis, alabastris lanceoloideo-campanulatis, *calycibus* in flore 42-45 mm. longis subviridi-albis sed in fructu subviridibus lobis ex medio reflexis dense viscide adscendente brunneo-pilosis pilis 0.7-1 mm. longis, tubo 7-10 mm. longo anguste campanulato intra adscendente brunneo-piloso, limba bilabiata adscendente viscide brunneo-pilosa, labia supra 3-lobata, lobis laterali-bus 3.1 cm. longis 5-6 mm. latis tertia infera lanceo-elliptica, parte supra caudata attenuata, loba media breviori 2.1 cm. longa 3 mm. lata, labia infera bilobata inter lobas in 25 mm. fissa lobis 6 mm. latis lineari-lanceolatis caudatis, *corollis* in vivo 30 mm. longis albis extra in tertia infera glabris, in parte altera et ad orificem adscendente albo-pilosula, tubo 20 mm. longo in basi et media 6 mm. diametro in orifice 9 mm. diamet-ro in media in 25° deflexo, limba bilabiata 5-lobata, lobis superis binis 5 mm. longis 7 mm. latis semiorbicularibus in basi cordatis et impensis ad orificem extra et intra et lobis inferis pilosulis, labia infera 3-lobata, lobis laterali-bus 8 mm. longis et latis ovato-suborbicularibus, loba infera 8.5 mm. longa 10 mm. lata depresso suborbicularibus cordatis intra minute pilosulis, staminibus inferis binis perfectis filamentis 5 mm. ex orifice affixis, parte libera 3 mm. longa incurvatis staminibus in parte distali dispositi, antheris 3.5 mm. longis 2.5 mm. latis asymmetricis ovatis, connectivo ovato, *stylo* 3 mm. longo subglabro, *ovario* 13 mm. longo anguste lanceoloideo glabro in basi ex disco cupulato 1.3 mm. alto cincto, lobis stigmatis binis 4-5 mm. longis late obovatis in latere proximo glabro $\frac{2}{3}$ connatis, *baccis* (immaturis) 24 mm. longis 5 mm. diametro anguste lanceoloideo glabro.

Description of Holotype: Shrub 1.8 m. tall; stem 4 cm. in diameter, few branched above; bark pale brown, rather smooth; branchlets 6-10 mm. in diameter, green, fleshy, glabrate, subquadrangular; leaf scars 3-5 mm. high, lunate to depressed deltoid, pale, corky, almost touching but not truly annular; bundle scars 7; leafy branchlets 5-8 mm. in diameter, quadrangular, green, fleshy, above moderately olive brown hirsute, below subglabrate; young shoots moderately subappressed olive brown hirsute; *leaves* ternate on main and flowering shoots, opposite on weaker, leafy laterals, ascending, crowded, unequal, one of those at the node being $\frac{1}{4}$ to $\frac{1}{3}$ the smaller; petioles 2.5-7.3 cm. long, green, stout, fleshy, moderately olive brown hirsute; *blades* 8-19 cm. long, 41-110 mm. wide, soft, chartaceous, broadly elliptic, the apex subacuminate, the base inaequilateral, cuneate or short decurrent, above clear green and moderately brownish hirsutulous at first, later more or less glabrate, below whitish and hirsutulous on the veins, less so on the intervals, the hairs white, becoming brownish; the margins coarsely doubly serrate or irregularly serrate, the lateral veins 9-11 on a side, ascending, then arcuate curving, interconnected; *cymes* axillary 3- or 5-flowered, olive brown hirsute; peduncles 15-20 mm. long; pedicels 5-13 mm. long; the bracts foliaceous, pale greenish, the lowest ones 20-25 mm. long, 15-18 mm. broad, obliquely ovate, slightly united or separate, the upper ones separate, 25-27 mm. long, 8-10 mm. wide, lanceolate; buds lanceoloid-campanulate; *calyx* in anthesis 42-45 mm. long, greenish white, but in fruit greenish, the lobes fully reflexed at the middle, densely brown ascending viscid pilose, the hairs 0.7-1 mm. long, the tube 7-10 mm. long, narrowly campanulate, within ascending brown pilosulous; the limb 2-lipped, brown ascending viscid pilose; upper lip 3-lobed, the lateral lobes 3.1 cm. long, 5-6 mm. wide, the lower third lance-elliptic, the upper part caudate attenuate, the middle lobe shorter, 2.1 cm. long, 3 mm. wide; lower lip 2-lobed, cleft 25 mm. between the lobes, the lobes 6 mm. wide, linear lanceolate, caudate; *corolla* when fresh 30 mm. long, white, without glabrous on lower third, ascending white pilosulous on middle third and extending beyond the throat, the tube 20 mm. long, 6 mm. in diameter at base and middle, 9 mm. at the throat, at the middle deflexed at 25° from the axis of the lower tube; limb 2-lipped, 5-lobed; 2 upper lobes 5 mm. long, 7 mm. wide, semiorbicular, the base cordate and overlapping, near the throat pilosulous within and without, as are the lower lobes; lower lip 3-lobed, the lateral lobes 8 mm. long and wide, ovate-sub-orbicular; the lower lobe 8.5 mm. long, 10 mm. wide, depressed suborbicular, cordate, within minutely pilosulous; two lower stamens perfect, with filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 3 mm. long, spirally curved

bringing together the connivent anthers which lie against the lower side of the throat (though in all other species examined they lie against its upper side), the two perfect anthers 3.5 mm. long, 2.5 mm. wide, asymmetric ovate, the heavy dark connective ovate; lateral staminodia adnate to the corolla tube to within 8 mm. of the throat, the free portion 0.8 mm. long, heavy thick subulate, the apical pale antheroid tip oblong, 0.5 mm. long; the upper staminodium 1 mm. long, similar; *style* 3 mm. long, glabrous except for two or three apical hairs; *ovary* 13 mm. long, narrowly lanceoloid, glabrous, the base surrounded by a cupulate disk 1.3 mm. high; stigmatic lobes two, 4-5 mm. long, broadly obovate, connate $\frac{2}{3}$ way up proximal glabrous side; *berry* (immature) 24 mm. long, 5 mm. in diameter, narrowly lanceoloid, glabrous.

Range: Koolau Range, windward side, known only from the type locality, at 1,250 ft., in the Ohia Zone.

Holotypus: Oahu, Laie Trail, Koolau Range, moist *Metrosideros* forest, 1,250 ft. alt., April 22, 1956, *H. St. John 25,964* (BISHOP MUS.).

Discussion: *C. caudatisepala* is a member of the section *Verticillatae*. Certainly its closest relative is *C. plurifolia* but this species has the blades 40-62 mm. wide, oblanceolate, the margins callous apiculate serrate; cymes 2-flowered; calyx in anthesis 26 mm. long, the surface soft pilose, the lobes narrowly lanceolate, attenuate; corolla 35 mm. long, the upper tube deflected at 50°; and the style capitate glandular pilose. *C. caudatisepala* differs in having the blades 41-110 mm. wide, broadly elliptic, the margins coarsely doubly serrate; cymes 3- or 5-flowered; calyx in anthesis 42-45 mm. long, the surface densely brown ascending viscid pilose, the lobes with their lower third lance-elliptic, the upper part caudate attenuate; corolla 30 mm. long, the upper tube deflected at 25°; and the style glabrous except for two or three apical hairs.

The specific epithet is coined from the Latin words, *caudatus*, tailed, and *sepalum*, a covering, or a sepal, in allusion to the long-tailed calyx lobes.

115. *Cyrtandra cornuta* St. John, sp. nov. (Figs. 162, 193).

Diagnosis Holotypi: Frutex 2 m. alta, ramis pallide brunneis subcarnosis et in sicco sulcatis, cicatricibus 1.5-3 mm. altis pallidis suberosis cordatis sed connatis, novellis adpresse olivaceo-pilosis, ramulis ad 3 mm. diametro subquadrangularibus sparse pilosulis, internodiis 5-60 mm. plerumque 12 mm. longis, nodis 4-foliferis (rare in ramulis debilibus 2-foliferis), *foliis* in 3-6 nodis superis affixis subaequalibus econgrogatis deinde divergentibus, petiolis 15-32 mm. longis gracilibus et brunneo-pilosulis, *laminis* 5.5-15 cm. longis 13-42 mm. latis crasse chartaceis elliptico-oblanceolatis in basi cuneata et longe decurrenta in apice subacuminato supra obscure viridibus in juvente remote pilosis sed mox glabratis infra albescentibus vel fulvis in juvente in nervis puberulis sed plerumque cito glabratis marginibus remote crenato-serratis excepta in basi nervis secundariis 12-15 in uno latere rectis tum subarcuatis et interconnectis apicibus in serris excurrentibus; *cymis* axillaribus 1-floriferis subsessilibus in duo bracteis foliaceis viridibus connatis infundibuliformibus 2-4 cm. longis inclusis sparse adpressi-brunneo-pilosulis vel subglabratis lobis binis terminalibus 10-22 mm. longis lanceo-deltaideis integris post florescentens deciduis, pedicellis 3-8 mm. longis brunneo-pilosis, alabastris fusiformibus in apice 20-24 mm. longo curvato caudato connato terminati, *calycibus* in flore 4-6.2 cm. longis dense fusco-pilosis intra et extra in latere distali medio fisso sed apice caudato integro persistenti deinde post flore calycibus deciduis; *corollis* recentibus 40 mm. longis albis extra glabris tubo intra glabro infundibulariformi media infera cylindrica 4 mm. diametro orifice 9-10 mm. diametro tubo supra media

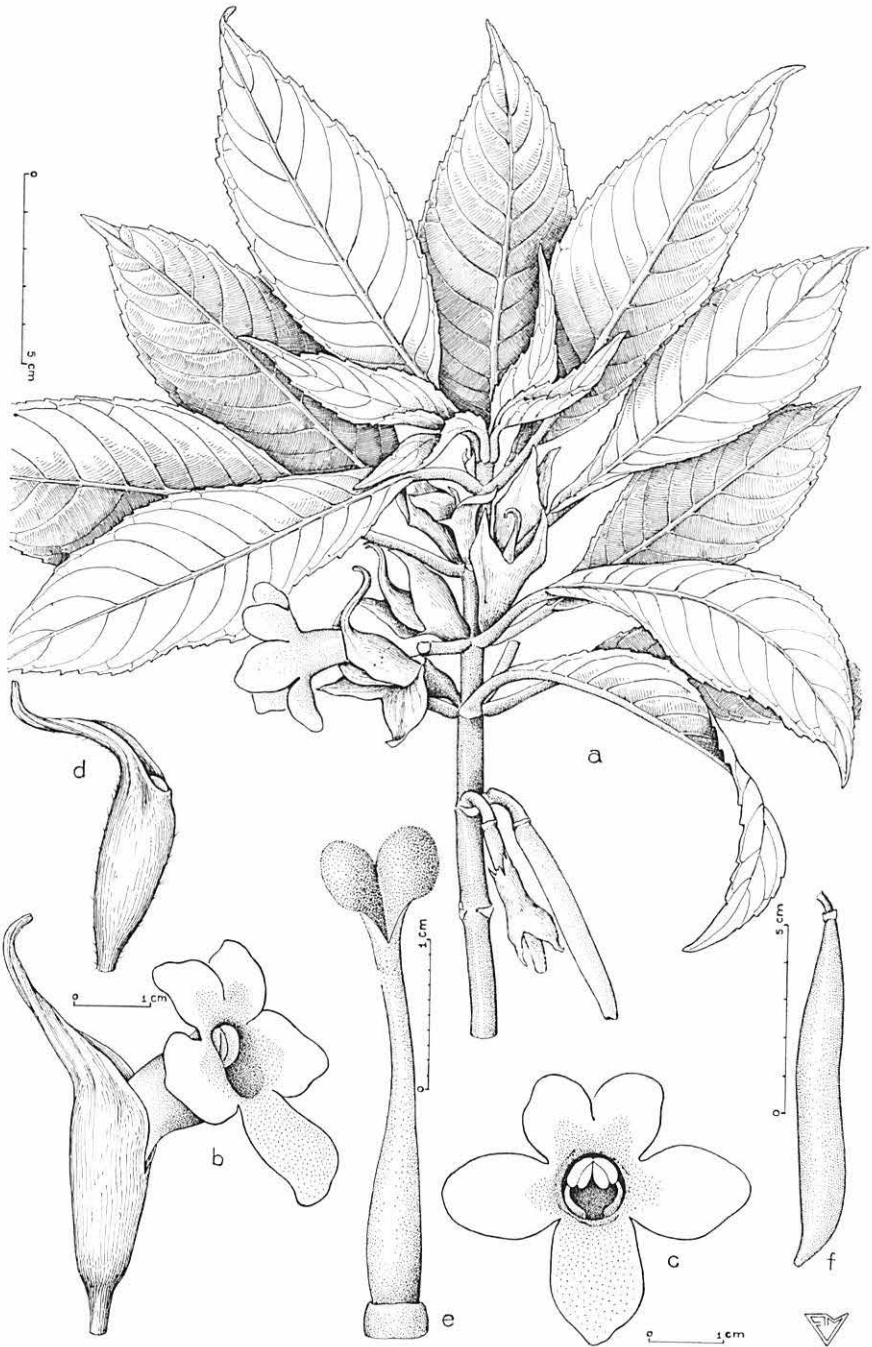


FIGURE 162.—*Cyrtandra cornuta*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times \frac{1}{2}$. Punaluu, St. John 22,694, holotype (Bishop Mus.).

in 60° ad 70° deflexis, limbis bilabiatis 5-lobatis, lobis superis binis in 80° recurvatis 9-10 mm. longis 7-9 mm. latis late ovalibus intra ad basim capitato-glanduloso-puberulis, labia infera 3-lobata, lobis lateralibus 13-16 mm. longis 10-12 mm. latis ovalibus eodem modo pubescentibus, loba infera 14-17 mm. longa 10-13 mm. lata oblongo-ovali eodem modo pubescenti, staminibus binis inferis in tubo 7 mm. ex orifice affixis parte libera 6 mm. longa subulata, antheris 4.5 mm. longis 2.5 mm. latis oblique ovalibus connectivo ovato, staminodiis in tubo 9 mm. ex orifice affixis subulatis 1 mm. longis sine antheroideis, *stylo* 12 mm. longo filiforme, lobis stigmaticis binis 7 mm. longis sessilibus anguste oblongo-ovalibus in latere proxime $\frac{3}{4}$ connatis, *ovario* 13 mm. longo lineari-lanceoloideo glabro in basi disco cupulato 2 mm. alto cincto, *fructu* immaturo ad 3.5 cm. longo lineari-cylindrico glabro, seminibus incognitis.

Description of All Specimens Examined: Shrub, 2 m. tall; branches pale brown, somewhat fleshy and on drying shrinking to form longitudinal ridges and furrows; leaf scars 1.5-3 mm. high, pale, corky, cordate, but interconnected and thus annular; bundle scars 3; young shoots appressed olivaceous pilose; leafy branchlets as much as 3 mm. in diameter, somewhat quadrangular, sparsely pilosulous; internodes 5-110 mm., averaging 12 mm. long; *leaves* in whorls of 4 (rarely in 2's on weak branches), borne at the 3-6 upper nodes, not crowded, at length diverging, those of a whorl subequal; petioles 15-32 mm. long, slender and brownish pilosulous; *blades* 5.5-21.5 cm. long, 13-48 mm. wide, thick chartaceous, elliptic-oblanceolate, base cuneate and long decurrent, the apex subacuminate, above dark green, in youth remotely pilose but early glabrate, below whitish or tawny, in youth puberulous along the veins but usually early glabrate, the margins remotely crenate-serrate except at base, the secondary veins 12-19 on a side, straight, then gently arcuate upwards, the tips interconnecting and excurrent at the teeth; *cymes* axillary, 1-flowered, subsessile, surrounded by two green foliaceous bracts connate into a funnel 2-4.1 cm. long, sparsely appressed brown pilosulous to subglabrate, the two terminal lobes 10-22 mm. long lance-deltoid, entire, deciduous soon after anthesis; pedicels 3-8 mm. long, brown pilose; buds fusiform ending in a curved caudate tip 20-24 mm. long, with the calyx lobe tips connate; *calyx* in anthesis 4-6.2 cm. long, densely brown pilose without and within, splitting longitudinally on distal side for protrusion of the corolla, the caudate tip remaining as a single curved, hornlike beak, the calyx deciduous after anthesis; *corolla* (when fresh) 40 mm. long, white, glabrous without, the tube funnelform, glabrous within, the lower half cylindrical, 4 mm. in diameter, 8 mm. just above the middle and 9-10 mm. at the throat, deflexed just above the middle at 60° to 70° to the axis of the lower tube; limb 2-lipped, 5-lobed; upper lobes 2, recurving at about 80° to the axis of the throat, 9-10 mm. long, 7-9 mm. wide broadly oval, within capitate glandular puberulous towards the base; lower lip 3-lobed; lateral lobes 13-16 mm. long, 10-12 mm. wide, oval, similarly puberulous; lower lip 14-17 mm. long, 10-13 mm. wide, oblong-oval, similarly puberulous; two lower stamens with filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 6 mm. long, subulate, spirally upcurved; the 2 perfect anthers 4.5 mm. long, 2.5 mm. wide, obliquely oval, the connective ovate; the staminodia adnate to the corolla tube to within 9 mm. of the throat, subulate, 1 mm. long, without anther remnant; *style* 12 mm. long, filiform, stigmatic lobes 2, sessile, 7 mm. long, narrowly oblong-oval, connate $\frac{3}{4}$ way up proximal disk; *ovary* 13 mm. long, linear-lanceoloid, glabrous, surrounded at base by a cupulate disk 2 mm. high; immature *fruit* to 3.5 cm. long, linear-cylindric, glabrous; seeds not seen.

Distribution: Koolau Range, windward side, Hauula to Waiahole, from 800 to 2,000 ft. alt., in the Ohia Zone.

Holotypus: Oahu, Punaluu, Castle Trail, shaded gulch, 1,500 ft. alt., July 27, 1947, *H. St. John* 22,694 (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Hauula, Maakua-Papali ridge, head of Papali Gulch, 1,900 ft. alt., rain forest, Oct. 26, 1952, *St. John 24,847*; Punaluu, Castle Trail, 2,000 ft. alt., steep slope, Nov. 3, 1940, *St. John 20,116*; Punaluu Valley, Castle Trail, in dense shade, 1,800 ft. alt., July 4, 1931, *Storey 133*; Waikane Valley, dense shade along ditch trail, 800-1,000 ft., Oct. 16, 1932, *Storey 195A*; Wai-ahole Valley, Dec. 1919, *Rock*.

Discussion: *C. cornuta* is a member of the section *Verticillatae*. Its close relative is *C. calpidicarpa*, and these and two others are unique in the elongate cylindrical fruit. They also have the two floral bracts fused into a large funnel enclosing the buds. The two may be separated by the characters detailed in the key.

The name is from the Latin, *cornutus*, horned, in allusion to the attenuate, hornlike apex of the calyx.

116. *Cyrtandra crenata* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 81, 1950. (Figs. 163, 186.)

Description of All Specimens: Shrub, 1-2 m. tall; branches of medium size, somewhat fleshy and shrinking on drying, the bark smooth, glabrous, pale buff or brownish; leaf scars 3-4 mm. high, rounded shield-shaped, corky, pale, scarcely raised, interconnected and annular; bundle scars 7; internodes 0.7-9 cm., usually about 2 cm. long; leafy branchlets 4-7 mm. in diameter, somewhat quadrangular, densely brown villous; young shoots densely subappressed, brown villous; *leaves* in whorls of 3, borne at the 4-7 upper nodes, slightly unequal and curved or asymmetric, approximate, ascending, forming a terminal tuft on each branch; petioles 1-4 cm. long, appressed brown villous, connate perfoliate around the node; *blades* 12-25 cm. long, 4-8 cm. wide, thick chartaceous, elliptic to oblanceolate, acute or subacuminate, the base long decurrent, and tapering into the petiole, plane, above green, impressed nerved, very remotely villous, below pale or whitish green, appressed villous on the veins and sparsely so on the intervals, the margins crenate or denticulate except at base; *cymes* from the leaf axils, 3-7-flowered, appressed brown villous throughout; peduncles 3-5 mm. long; pedicels 5-16 mm. long; bracts 6-15 mm. long, lanceolate, foliaceous; buds fusiform, the calyx lobes fused into a long beak; *calyx* 20-27 mm. long, green, densely appressed brown villous without and within to base, subcylindric except for the short cuneate base, 2-lipped, lobed about $\frac{3}{5}$ way to base, finally splitting down one side and deciduous or subsistent, tube 6-7 mm. long, cylindric above the cuneate base; upper lip 3-lobed, lobes 18 mm. long, 4 mm. wide at base, linear except for the lance-linear base, curving upwards, without softly appressed pilose, within glabrous; lower lip 2-lobed, the lobes similar, 16 mm. long; *corolla* 25-32 mm. long when fresh, white, exerted through the deep distal sinus of the calyx, sharply deflexed at the middle at from 40° to 80° to the axis of the base, the exposed parts glandular pilosulous, the tube 23-26 mm. long, 4 mm. in diameter below, but 7 mm. at the throat, glabrous within, the lobes glandular puberulent within and without, unequal, the upper 3-6 mm. long, suborbicular, when fresh 7-8 mm. long, 9 mm. wide, the lateral lobes 8 mm. long and wide, suborbicular, the lower lobe 5-9 mm. long, 5-8 mm. wide, oval, apparently spreading at about 50° to the axis of the throat; filaments fused to the corolla to within 5 mm. of the throat, the free portion 6-7 mm. long, subulate, incurved, exerted; anthers 2.5 mm. long, obliquely ovoid, flattened, the cells unequal; staminodia with their filaments adnate to the corolla tube to within 8 mm. of the throat, the free part 0.7 mm. long, the subulate darker antheroid tip 0.7 mm. long; *style* 8-11 mm. long, stout, profusely capitate glandular puberulent; stigma with two flat spatulate-obovate lobes 4-6 mm. long, connate on one edge nearly



FIGURE 163.—*Cyrtandra crenata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Waikane-Schofield Trail, Kahana, St. John and Storey, 20,242, holotype (Bishop Mus.).

to the tip; *ovary* narrowly lanceoloid, capitate glandular puberulent near the tip, glabrous below, the base surrounded by a smooth cupulate disk 2 mm. high; *berry* 15-17 mm. long, 6-7 mm. thick, ellipsoid, white, glabrous except for the glandular puberulent tip; seeds 0.45-0.47 mm. long, 0.22 mm. wide, ellipsoid, stramineous, the two apiculate ends brown, the body covered with raised cellular, oblong reticulations $\frac{1}{7}$ to $\frac{1}{8}$ as long as the seed.

Distribution: Koolau Range, windward side, in the central area in Kahana and Waikane, in the Ohia Zone, at from 800 to 1,600 ft. altitude.

Holotype: Oahu, Kahana, Waikane-Schofield Trail, moist wooded gulch on steep slope, 1,600 ft. alt., May 18, 1941, *H. St. John & W. B. Storey 20,242* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: see type; Kahana Valley, Koolau Mts., along Waikane-Schofield Trail, $\frac{1}{4}$ mile above lower turn-off trail into Kahana, moist woods, elev. 1,600 ft., June 5, 1934, *Storey 269*; Kahana, Waikane-Schofield Trail, first pass to main divide, alt. 1,250-2,400 ft., Oct. 16, 1932, *Suehiro*; Waikane Valley, in wooded ravine below the Waikane-Schofield Trail, elev. 800 ft., Oct. 16, 1932, *Storey 200*.

Discussion: *C. crenata* is a member of the section *Verticillatae*. It is unique among the Hawaiian species in its capitate glandular puberulent style and tip of ovary. No close relatives are known, so it is not here contrasted with any other species. It is also unusual in that the calyx on some fruits is subpersistent.

There is one good, flowering specimen of *C. crenata* bearing the data Puu Kaua, 2,400 ft., Nov. 6, 1932, *Amy Suehiro*. This locality is in the southern Waianae Mts., and is dry and largely denuded. There is a mossy, damp forest of the Cloud Zone near the very summit and down for 100 or 200 feet on the 3,113 foot peak. Below that the forest is open and dry.

One other member of the section *Verticillatae*, *C. fusiformis*, is found only in the Waianae Mountains, but its habitat is at 3,470 feet altitude, on Puu Kalena, in a moist thicket with *Gunnera* and *Touchardia*. This mountain is a part of the Mt. Kaala massif, and due to its northwestward position, receives a good rainfall. The record of *C. crenata* from Puu Kaua is considered doubtful.

The new specific name is from the Latin, *crenatus*, with rounded teeth.

117. *Cyrtandra degenerans* (Wawra) Heller, *Minn. Bot. Stud.* 1: 887, 1897. (Figs. 164-166, 190.)

C. paludosa Gaudichaud var. γ *degenerans* Wawra, *Flora* 55: 558-559, 1872.

C. longifolia Hillebrand var. (?) δ *degenerans* (Wawra) C. B. Clarke, in De Candolle, *Monogr. Phanerog.* 5 (1): 277, 1883; sensu Rock, excluding synonym, *Am. Jour. Bot.* 4: 613, 615, Fig. 3, 1917.

C. latebrosa Hillebrand, *Fl. Hawaiian Is.*, 337, 1888, in part, as to var. *degenerans* Wawra.

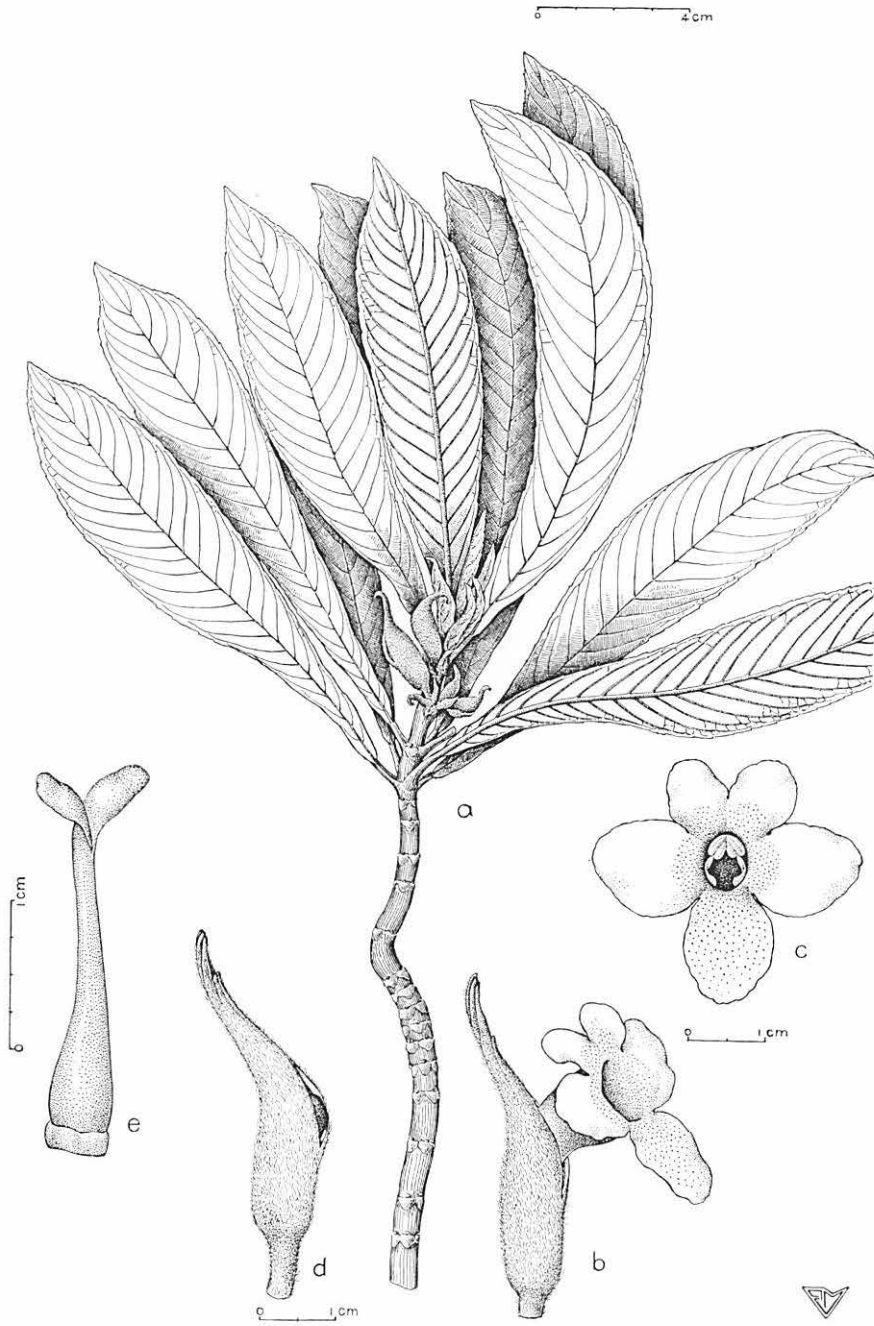


FIGURE 164.—*Cyrtandra degenerans*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Puu Konahuanui, St. John 20,964.



FIGURE 165.—*Cyrtandra paludosa* var. γ *degenerans*, holotype (Vienna). Oahu, Wawra 1,781.

C. punaluensis St. John and Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 83, 1950.

Illustrations: in Rock, Am. Jour. Bot. 4: 614, Fig. 3, 1917, as *C. latebrosa*.

Description of All Specimens Examined: Shrub 1-3 m. tall, the branches as much as 3 cm. in diameter, erect, little-branched, naked below, gray corky, the leaf scars 2.5-4 mm. high, broad shield-shaped, stramineous, raised, prominent, confluent; bundle scars 5; leafy branchlets stout, 5-14 mm. in diameter, castaneous villous to glabrate, fleshy, the gray corky surface much wrinkled on drying; young shoots densely shaggy castaneous villous, terete or slightly quadrangular; internodes 1-5, averaging 2 cm. long; *leaves* all in a terminal plume, 3 to 6, but commonly 4, in a whorl, equal or unequal and 1 to 2 as much as $\frac{1}{3}$ smaller than the others; leaves sessile or with a petiole as much as 2 cm. in length; *blades* 10-34 cm. long, 22-54 mm. wide, narrowly linear-oblanccolate, long tapering to the cuneate base, apex acute or, on larger leaves, short acuminate, thick chartaceous, above dark green, glabrous, below silky castaneous appressed villous on the principal veins, sparsely so on intervals, prominently pinnately many-nerved; the base entire, beyond the middle minutely crenulate; *cymes* axillary, densely shaggy castaneous villous, 1-5-flowered; peduncles 1-4 mm. long; pedicels 2-8 mm. long, becoming reflexed; bracts 10-20 mm. long, lance-linear, covered with a shaggy villosity; buds densely castaneous shaggy villous, fusiform or obliquely so, the apex a long-acuminate, upcurved beak, the whole completely connate; bud fusiform, villous, the base ellipsoid, elongate beak arched ascending; *calyx* 29-48 mm. long, permanently shaggy castaneous villous without, so densely so as to conceal the surface, within sparsely appressed, castaneous villous, obliquely fusiform with the apical beak ascending or arched, at anthesis opening only by a distal longitudinal slit near the end of the body of the calyx through which the curved corolla pushes down and protrudes, the 5 calyx teeth tips minute and less than 1 mm. long, but evident towards the apex of the subulate, entire beak; *corolla* 35-38 mm. long when fresh, glabrous without, white, funnelform, the tube with a lower part 12 mm. long, 4 mm. in diameter, cylindrical, glabrous, with an upper expanded part abruptly deflexed at about 45° fully within the calyx, this upper part 4 mm. in diameter at base, 12 mm. at apex, the lower side nearly straight, the upper side concave, the limb 2-lipped, 5-lobed, the lobes spreading at about 80° from the axis of the upper tube and throat, the two upper lobes 10 mm. long, 12-13 mm. wide, oval, the three lower lobes 11-12 mm. long, 8-9 mm. wide, oblong-oval, the outside villous except near the margin, the inside capitate glandular puberulent down into the throat, but below the tube glabrous within; filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 5 mm. long, subulate, spirally upcurved; anthers 3 mm. long, obliquely ovate, compressed; two lateral staminodia with filaments adnate to the corolla tube to within 8 mm. of the throat, the free portion 1 mm. long, filiform, bearing an antheroid tip 0.3 mm. long, subulate, inflexed; *style* glabrous, stout, about 1 cm. long; the 2 terminal stigmatic lobes 5 mm. long, oval, the margin entire or erose, connate $\frac{1}{2}$ way up the proximal side; *ovary* 12 mm. long, glabrous, lanceoloid, base surrounded by a cupulate disk 2.5-3 mm. high; *berry* (fide Rock p. 613) "olive shaped, 26 mm. long."

Distribution: Koolau Range, windward side from Kaipapau to Waikane, and leeward side from Kalihi to Manoa, in deep moist, shady gulches, from 800 to 2,200 feet altitude, in the Ohia Zone.

Type: "Oahu, finstere Schluchten in Gebirgswaldern; [*H. Wawra*] 1781" (W, and clastotype in BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Hauula Valley, along stream, July 4, 1940, *Degener* 12,992 (NY); Kaluanui, elev. 2,000 ft., May 1932, *Meebold*; Kaluanui, Castle



FIGURE 166.—*Cyrtandra punaluensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, pistil, $\times 2$. Punaluu, Forbes 11/14-21/08. Synonym of *C. degenerans*.

Trail, moist wooded hillside, 1,900 ft. alt., Nov. 3, 1940, *St. John 20,115*; ditto, along stream above the 2nd waterfall, elev. 2,000 ft., in densely shaded situations, July 4, 1931, *Storey 135*; ditto, common, low rain forest on valley slope, 2,000 ft. alt., Oct. 21, 1945, *St. John 21,366*; Koolauloa Mts. between Punaluu and Kaipapau, Nov. 14-21, 1908, *Forbes*; ditto, Nov. 14-21, 1908; ditto, Jan. 7, 1927, *MacDaniels 398*; Punaluu, Pig God Trail, rain forest, May 31, 1931, *Degener, Park, Topping, & Bush 7,513* (NY); Punaluu, forest, *Degener & Park 7,519* (NY); Punaluu, 1929, *Nitta (Degener 7,539)*, (NY); Maio 1910, *Faurie 619* (BISH, Z); ditto, August 1908, *Rock 9*; ditto, Sept. 27, 1938, *Selling 3,633*; ditto, 1929, *Nitta (Degener 7,539)*, (NY); ditto, Punaluu Mt., in forest, 2,400 ft., Nov. 14-21, 1908, *Rock 934*, type of *C. punaluuensis*; ditto, *Rock 933*; ditto, Dec. 3-14, 1908, *Rock 157* (GH); ditto, Dec. 24-29, 1908, *Rock 407*; Punaluu Mts., near mt. stream, Nov. 14-21, 1908, *Rock 933*; Punaluu, upper ridge, 2,200 ft. alt., Nov. 30, 1929, *St. John 10,087*; ditto, Castle Trail, Nov. 30, 1929, *Yamaguchi*, distributed as *Storey 148*; Punaluu-Kaluanui Trail, approaching the gap [= Punaluu], in shaded, moist situations, elev. 2,200 ft., Dec. 31, 1931, *Yamaguchi*, distributed as *Storey 157*; Kahana Valley, Ditch Trail, alt. 260 m., wet forest, bottom of gully, Nov. 26, 1933, *Fosberg 10,411*; ditto, Waiahole Ditch Trail, Valley No. 10, 800 ft. alt., moist gorge, Dec. 10, 1933, *St. John 13,419*; Waikane-Schofield Trail, in moist situations in shade near summit of the ridge, 2,200 ft. elev., Oct. 16, 1932, *Storey 195*; Waikane, Waikane-Schofield Trail, 1,500 ft., moist forest, May 18, 1941, *St. John 20,245*; ditto, 800 to 1,000 ft., in dense shade in ravines, April 17, 1932, *Storey 177*.

Leeward Side: Kipapa Gulch, Waipio, wet forest, 550 m. alt., Aug. 7, 1933, *Fosberg 9,768*; Kalihi, Ex Museo botanico Berolinensi [*Hillebrand*]; Kalihi, Ex Herbarium Rev. J. M. Lydgate, collected by *Hillebrand & Lydgate*; Konahuanui-Olympus Trail, Feb. 15, 1920, *Garber 246*; [Manoa], gulch below Konahuanui, Kona[huanui]-Olympus trail, growing along stream at 2,000 ft. elev., July 11, 1920, *Garber 491*; Manoa, Puu Konahuanui, North Fork of Waihi Stream, 2,200 ft. alt., moist shaded bank below waterfall, above Castle Trail, May 27, 1945, *St. John 20,964*.

Oahu, without locality: *Plantae Hawaiienses*, ex herb. *Hillebrand* (E); Koolau Mts., Oct. 31, 1914, *Rock*.

Hawaiian Islands, without locality: *Cyrtandra latebrosa* Hbd. in *Hillebrand's* handwriting, then printed data: Ex. Herb. Lydgate, collected by *Dr. William Hillebrand and J. M. Lydgate*, in part, as to plant at lower right with villous entire calyx, not as to plant at left which was later named *C. longifolia* Hbd. var. *degenerans* (Wawra) C. B. Clarke f. *subglabra* Rock (BISH).

Discussion: This specimen of *Hillebrand's* is from the set presented to the Rev. Lydgate by *Hillebrand*. The set contains many authentic collections and isotypes, but they had been badly mixed when sold to the Bishop Museum,

and it is common to find two or three species combined on a single sheet which bears only generalized data. The left-hand specimen we redetermine as *C. degenerans*, but the one at the right is *C. latebrosa*. It will be recalled that Hillebrand merged *C. paludosa* var. *degenerans* Wawra in his own new species *C. latebrosa*, which he recorded from "Kalihi and Manoa, Oahu! Mopulehu, Molokai!" Rock studied the Hillebrand material in Berlin and concurred with Hillebrand in merging var. *degenerans* Wawra with *C. latebrosa* Hillebrand, but adopted the name *C. longifolia* Hillebrand var. *degenerans* (Wawra) C. B. Clarke. Rock saw the Wawra type in Vienna and the Hillebrand specimens, "in deep and dark ravines of Kalihi and Manoa, Hillebrand, without date or number in herb. Berlin and herb. College of Hawaii (Kalihi spec.)." The writer also examined the type sheet of *C. latebrosa* in Berlin and photographed it (Fig. 173). It bore Rock's annotation and when first placed in the herbarium had been given a new label, Sandwich Inseln, Kalihi auf Oahu, ex hb. Hillebrand. It also bears the original loose ticket with: "Kalihi, in a deep gulch, Jan. 1870."

Hillebrand's lengthy discussion (1888: 337) deserves quoting; "In deep and dark ravines of *Kalihi* and *Manoa*, Oahu! *Mopulehu*, Molokai!—The singular form of the calyx, attributed by Wawra to a morbid degeneration, is simply the normal bud-state in the present group, which here remains permanent probably for want of elasticity, owing to its thick unyielding substance and to the exclusion of direct sunlight. By the narrow slit at the apex water with organic material is apt to find an entrance, perhaps also insects, which soon cause decay of the hairy lining and with it of the corolla, so that flowers or fruit are seldom seen in this form; but when the flower develops [*sic*] it forces itself through the lateral slit indicated. The fruit remains a long time surrounded by the closed calyx, which however at last breaks away from its base, as is the case in *C. paludosa*. The forms with closed calyx occur at the bottom of the ravines, while those with open calyces are found on the more exposed slopes. It has to be remarked also that in the former the peduncles are very short and generally bear only one flower, while the longer inflor. with several flowers is only found with the second form. The plants from Molokai perfectly agree with those from Oahu, only that the leaves are rather glabrate."

Essentially Hillebrand's argument is that there are two forms: 1, the original var. *degenerans* Wawra, with shaggy, fusiform entire calyx opening by a distal slit, the peduncles short and 1-flowered, found in deep shady ravines; and 2, the new *C. latebrosa* Hbd. with the calyx splitting into five teeth or lobes, the peduncles 2-5-flowered, longer, and found on more exposed slopes. Hillebrand collected and cited it in Kalihi and Manoa, both but a few miles away, and there is also his collection from Nuuanu, the valley where he lived. His discussion would imply extensive field experience with the two forms, and this may well have influenced Rock in agreeing that var. *degenerans* Wawra

and *C. latebrosa* Hbd. were inseparable. Through changes resulting from city growth and deforestation, the plants are apparently extinct in Kalihi and Nuuanu. In Manoa they still existed as late as 1920 at 2,000 ft. alt. on the slopes of Konahuanui, and on May 27, 1945, the species was again collected (St. John 20,964) at apparently the same locality, Waihi Stream at 2,200 ft. alt. Only three stems, the tallest 1 meter tall, were found. In this one small patch no variation was noted. The steep valley slopes on either side were forested, but the coverage was sparse, the small trees were well spaced and the intervals choked with the weedy fern *Dicranopteris linearis*. There were no *Cyrtandra* plants on these adjacent slopes, so it was not possible to test here Hillebrand's theory that *C. degenerans* is a gulch form which grades into and blends into *C. latebrosa* on the upland sites of the sides of the valleys.

Hillebrand's collection from Manoa has not been seen. In Bishop Museum is an isotype of *C. latebrosa*, Kalihi, Oahu, Ex Museo botanico Berolinensi [W. Hillebrand]. It has three loose leaves and a bud and a fruit. The writer removes it from *C. latebrosa* and determines it as *C. degenerans*. There is also a third sheet, *Cyrtandra*—, Kalihi, Ex Herb. Rev. J. M. Lydgate collected by Hillebrand and Lydgate. It has two small branches, one with immature, sessile, long-beaked and shaggy hairy buds. The author considers it an isotype of the right-hand plant on the Hillebrand type sheet. It is here reidentified as *C. degenerans*. There is a fourth sheet from the Lydgate herbarium, labeled in Hillebrand's hand *Cyrtandra latebrosa* Hbd. There are two loose tickets with the data Nuuanu, and *Cyrtandra paradoxa* which was a manuscript name of Hillebrand's, published only in synonymy by C. B. Clarke under his *C. longifolia* var. *degenerans*. In his flora, Hillebrand did not list the plant from Nuuanu Valley, the intervening valley between Kalihi and Manoa. The sheet has three branches, numerous oblanceolate leaves, young buds, two flowers with deeply lobed calyx, seemingly identical to the lectotype in the Berlin herbarium. We accept it as authentic *C. latebrosa*, though there is one loose bud from quite another species.

Additional characters for the two forms discussed by Hillebrand are, for 1, calyx 29-48 mm. long, permanently brown shaggy villous, leaves 10-34 cm. long, 22-54 mm. wide, linear-oblanceolate, long tapering to the cuneate base, of thicker, heavier texture, and drying a darker color; 2, calyx 12-30 mm. long, sparsely pilose at anthesis, 3-5 lobed from the tip; leaves 10-22 cm. long, 13-52 mm. wide, narrowly elliptic, tapering and acute at both ends, thinner and drying a lighter color. Both of them still exist in the Koolau Range, and have been collected frequently. In no recent collections are the two forms intermingled nor has any recent collector left notes indicating that the two merge from the bottom to the sides of a ravine, as Hillebrand implied. The ranges overlap in the Nuuanu and Manoa regions, but are elsewhere distinct; the form 1 occurring on windward Oahu from Waikane to Kaipapau, whereas the form 2 is

found on the leeward side of the Koolau Range from Kipapa to the Anahulu Trail. The differences tabulated are considered constant and sufficient to separate the two forms as species. Whether Hillebrand found evidence of real intergrading of the two or not is not certain, at least he did not leave evidence proving it. His specimen retained in Berlin contains two branches. The one on the right is typical of *C. degenerans* with calyx 33 mm. long, subulate, long-beaked, entire, permanently shaggy villous, so short peduncled as to appear sessile, 1-flowered and becoming reflexed; the leaves are 20-27.3 cm. long, 32-40 mm. wide, linear-oblongate and long tapering to the base. This is an excellent specimen of form 1, or *C. degenerans*. The plant at the lower left has the calyx 16-20 mm. long, 5-lobed to below the middle, sparsely pilose; peduncles 1 cm. long, 3-5-flowered, ascending; leaves 9-13 cm. long, 28-45 mm. wide, broadly oblongate, short tapering to the base. This is here designated as the lectotype of *C. latebrosa* Hillebrand. The duplicate sheet from the Hillebrand and Lydgate collection shows the same mixture of plants. The two plants are very different, and will be maintained as distinct species, unless evidence is produced confirming Hillebrand's opinion that the two intergraded. In Punaluu and Kaluanui, along the Castle Trail, *C. degenerans* is common, and though it occurs in the shady gulches along the streams, it is even more common on the more open valley slopes. At present it seems that he found two kinds of *Cyrtandra* on the same day when collecting in Kalihi. They were different in structure, appearance, and habitat, but he put them on the same sheet, deciding that they were forms of the same species. The mere fact that they grew in the same vicinity should not decide the question, for in many areas two or more species of *Cyrtandra* or of many other genera grow in a vicinity or even side by side. They should be evaluated and classified on the basis of their morphological structure. On this basis the two are good species.

Wawra collected specimens without flowers or fruit and he considered the ovaries abortive, and hence gave the varietal name indicating a degenerate status, taking it from the Latin *degenerans*, being degenerate. Hillebrand, Rock, and the present author find that the plant flowers and fruits and does not deserve the opprobrium of being called degenerate. However, Wawra's varietal name was valid and effectively published, and was raised to specific rank by Heller. By the rules of nomenclature, this name must be adopted.

It would be of interest to know Wawra's precise type locality, but his publication and his type specimen, which was examined in Wien, give only the information that it was from dark ravines in the mountain forests of Oahu. His sketches from the voyage of the Donau (1872: 260) give a partial itinerary blended in an account of the plant zones of the Hawaiian Islands. From this it is gleaned that on Oahu he climbed Mt. Kaala, Punchbowl, Diamond-hill, Nuuanu Valley to the Pali, and up the western peak Waiolani which he, at one place, misprinted as Weciolari and for which he preferred the name Pohakupili [now called Lanihuli]. On page 300 (Vol. 22) when recounting his

climb through the upper forests of Waiolani he mentions, "eine zweite sonst häufige *Cyrtandra*, deren Kelche aber hier regelmässig degenerieren." The resident Dr. William Hillebrand received Wawra kindly, and guided him on excursions in the mountains. The upper reaches of Nuuanu Valley were a favorite botanizing ground of Hillebrand, so probably he led the visitor into the deep, wet woods of this beautiful valley. It is inferred that Wawra's type locality for *C. degenerans* is upper Nuuanu.

Although they all have long narrow leaves, no reason is apparent for retaining *C. latebrosa* as a variety of *C. longifolia* Hillebrand, as was done by Rock. That Kauai species has solitary axillary flowers on single peduncles 0-5 mm. long and the solitary pedicels 3-6 cm. long; the calyx 12-16 mm. long, campanulate, lobed $\frac{1}{3}$ - $\frac{2}{5}$ way to the base, slightly 2-lipped, with a sparse reddish brown appressed villosity, the lobes deltoid acuminate, subequal; and the corolla tube glabrous outside, minutely pubescent inside.

C. punaluuensis St. John & Storey (Fig. 166) was published in 1950 as distinct, for having shorter calyces and smaller leaves. On restudy it is seen to fall within the limits of *C. degenerans*, so we here reduce it to synonymy.

The Hillebrand specimen from Mopulehu [Mapulehu], Molokai, is not at hand, but it should probably be placed in one of the two forms of var. *degenerans* described by Rock (1917: 615-616) from that part of Molokai.

The known range of *C. degenerans* is discontinuous, and the gap between Kalihi and Waikane appears to be an actual one, and not due to lack of collections.

118. *Cyrtandra ellipticifolia* St. John, sp. nov. (Figs. 167, 168, 191).

Diagnosis Holotypi: Frutex, ramulis brunneo-villosis 4-7 mm. diametro subquadrangularibus in sicco contractis et sulcatis brunneis, cicatricibus 3-4 mm. altis late scutelliformibus separatis pallidis suberosis, fasciculis 5, ramulis foliosis ad 5 mm. diametro quadrangularibus dense crebre brunneo-villosis, internodis 7-40 mm. vel plerumque 15 mm. longis, novellis dense adpresse brunneo-villosis, *foliis* ternatis subaequalibus adscendentibus exaggregatis in 4-6 nodis superis affixis, petiolis 20-35 mm. longis crebre brunneo-villosis, *laminis* 10-21 cm. longis 40-79 mm. latis chartaceis late ellipticis in basi longe cuneatis et decurrentibus in apice acuminatis supra obscure viridibus subglabris sed sparsissime villosis infra albo-viridibus in intervallis molliter puberulis costa et nervis secundariis pilosis, marginibus in media externa remote depresso-serrulatis nervis secundariis 10-12 in uno latere valde adscendentibus proxime marginibus arcuatis et interconnectis in serris salientibus, *cymis* axillaribus verisimiliter 1-3-floriferis crebre brunneo-pilosis, pedunculis 12 mm. longis, bracteis ignotis, pedicellis 11-17 mm. longis, alabastris lanceo-fusiformibus crebre brunneo-pilosis lobis fere ad apicem connatis, *calycibus* in flore 32 mm. longis quando bullitis (in sicco 27-28 mm.) pallidis et membranaceis extra et intra crebre brunneo-pilosis apice corniforme curvato 10-11 mm. longo in flore inter labias 18-25 mm. partitis deinde paene ad basim partitis tubo 7-9 mm. longo obovoideo, labia supra trilobata inter lobas 1-10 mm. partitis, labia infera bilobata recurvata lobis 14-20 mm. longis 2.5-4 mm. latis in basi anguste lineari-lanceolatis in apice longi-subulatis, *corollis* albis 31 mm. longis quando bullitis tubo 21 mm. longo cylindrico in 45° recurvato in basi mediaeque 6 mm. diametro in orifice 7 mm. diametro extra crebre albi-villoso intra glabro, limba bilabiata 5-lobata lobis extra villosis intra ad orificem capitato-glanduloso-puberulis, lobis superis in 50° divergentibus

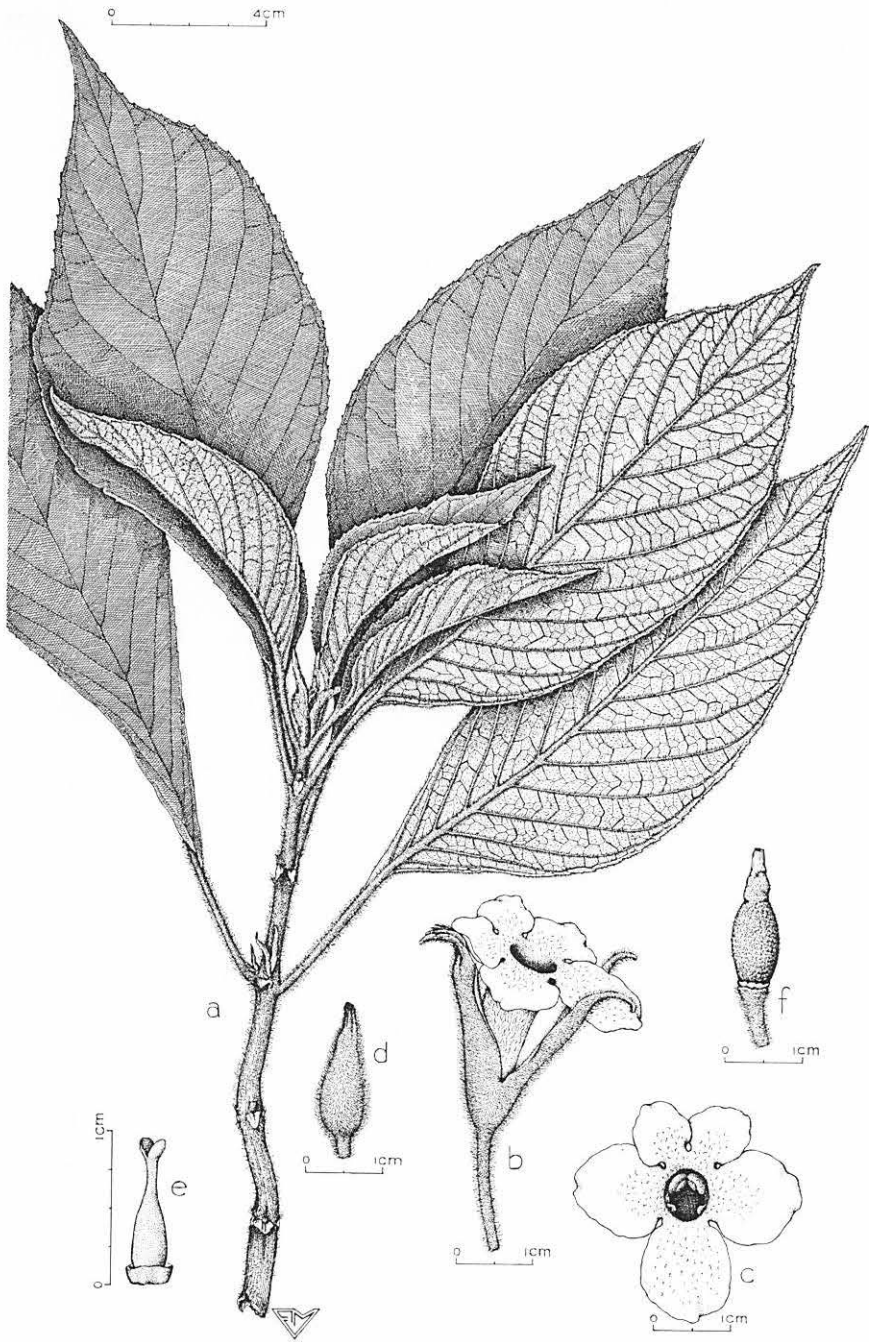


FIGURE 167.—*Cyrtandra ellipticifolia*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, young fruit, $\times 1$. Pupukea, Storey 248, holotype (Bishop Mus.).

8 mm. longis et latis oblique suborbicularibus, labia infera trilobata, lobis lateralibus 11 mm. longis et latis suborbicularibus, loba infera 13 mm. longa 12 mm. lata late elliptica, staminibus inferis binis fertilibus filamentis in tubo in 3 mm. ex orifice affixis parte libera 5 mm. longa gracilibus subulatis contorte adscendentibus, antheris 2.3 mm. longis 1.5 mm. latis oblique obovatis connectivo 2.2 mm. longo obovato, staminodiis lateralibus in tubo in 6 mm. ex orifice affixis partibus liberis 0.3 mm. longis subulatis apice 0.4 mm. longo pallido subulato, *stylo* 5 mm. longo tereto glabro, lobis stigmatibus 2 mm. longis obovatis in latere proximo glabro et $\frac{2}{3}$ connatis, *ovario* 12 mm. longo lanceoloideo glabro ad apicem sed aliter profuse minute capitato-glanduloso-punctato in basi cum disco cupulato 2 mm. alto cincto, fructibus ignotis.

Diagnosis of Holotype: Shrub; branchlets brownish villous, 4-7 mm. in diameter, subquadrangular, on drying shrinking and longitudinally furrowed, brown; leaf scars 3-4 mm. high, broad shield-shaped, distinct, pale, corky; bundle scars 5; leafy branchlets as much as 5 mm. in diameter, quadrangular, densely shaggy brownish villous; internodes 7-40 mm., averaging 15 mm. long; young shoots densely brownish appressed villous; *leaves* ternate, ascending, not crowded, borne at 4-6 upper nodes, those of a whorl subequal; petioles 20-35 mm. long, shaggy brownish villous; *blades* 10-21 cm. long, 40-79 mm. wide, chartaceous, broadly elliptic, at base long cuneate and decurrent, the apex acuminate, above dark green, nearly glabrous but with a few remote hairs of a villous nature, below whitish green, the intervals softly puberulous, the midrib and secondary veins spreading pilose, the margins in the upper half remotely low serrulate, the secondary veins 10-12 on a side, sharply ascending, nearly straight to the margin, then arcuate, inarched interconnecting and salient in the teeth; *cymes* axillary, probably 1-3-flowered, shaggy brownish pilose; peduncles 12 mm. long; bracts not seen; pedicels 11-17 mm. long; buds lance-fusiform, brownish shaggy pilose, the calyx lobes fused almost to top; *calyx* in anthesis when dried 27-28 mm. long (32 mm. when boiled), pale and membranous, densely shaggy brownish pilose without and within, ending in a curved beak 10-11 mm. long, early splitting to the base between the lips and caducous, but at flowering split down 18-25 mm. between the lips; the tube 7-9 mm. long, obovoid; upper lip 3-lobed, cleft 1-10 mm. between the subulate lobe tips but connate below; lower lip 2-lobed, recurving, the lobes 14-20 mm. long, narrowly linear-lanceolate, 2.5-4 mm. wide at base, the apex long subulate; *corolla* white, when boiled 31 mm. long, the tube 21 mm. long cylindrical, recurved at 45° to the axis of the lower tube, 6 mm. in diameter at base and middle, 7 mm. in diameter at the throat, without shaggy white villous, within glabrous; limb 2-lipped, 5-lobed, the lobes villous without, within capitate glandular puberulous towards the throat; upper lobes spreading at about 50° to the axis of the throat, 8 mm. long and wide, obliquely suborbicular; lower lip 3-lobed; lateral lobes 11 mm. long and wide, suborbicular; lower lobe 13 mm. long, 12 mm. wide, broadly elliptic; two lower stamens fertile, with filaments adnate to the corolla to within 3 mm. of the throat, the free portion 5 mm. long, slender subulate, spirally upcurved, the two perfect anthers 2.3 mm. long, 1.5 mm. broad, obliquely obovate, the connective 2.2 mm. long, obovate; the staminodia with filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion subulate 0.3 mm. long, the pale tip 0.4 mm. long, subulate; *style* 5 mm. long, terete, glabrous; two stigmatic lobes 2 mm. long, obovate, connate $\frac{2}{3}$ way up the proximal side, glabrous on the back; *ovary* 12 mm. long, lanceoloid, glabrous near the tip but elsewhere abundantly minutely capitate glandular dotted or puberulous, surrounded at base by a cupulate disk 2 mm. high; fruit unknown.

Distribution: Koolau Range, northwest end, at 1,500 ft. alt., in the Ohia Zone.

Holotypus: Oahu, Pupukea, Koolau Range, March 11, 1934, *W. B. Storey* 248 (BISHOP MUS.). This was collected along Kaunala Stream, 1,500 ft. altitude.

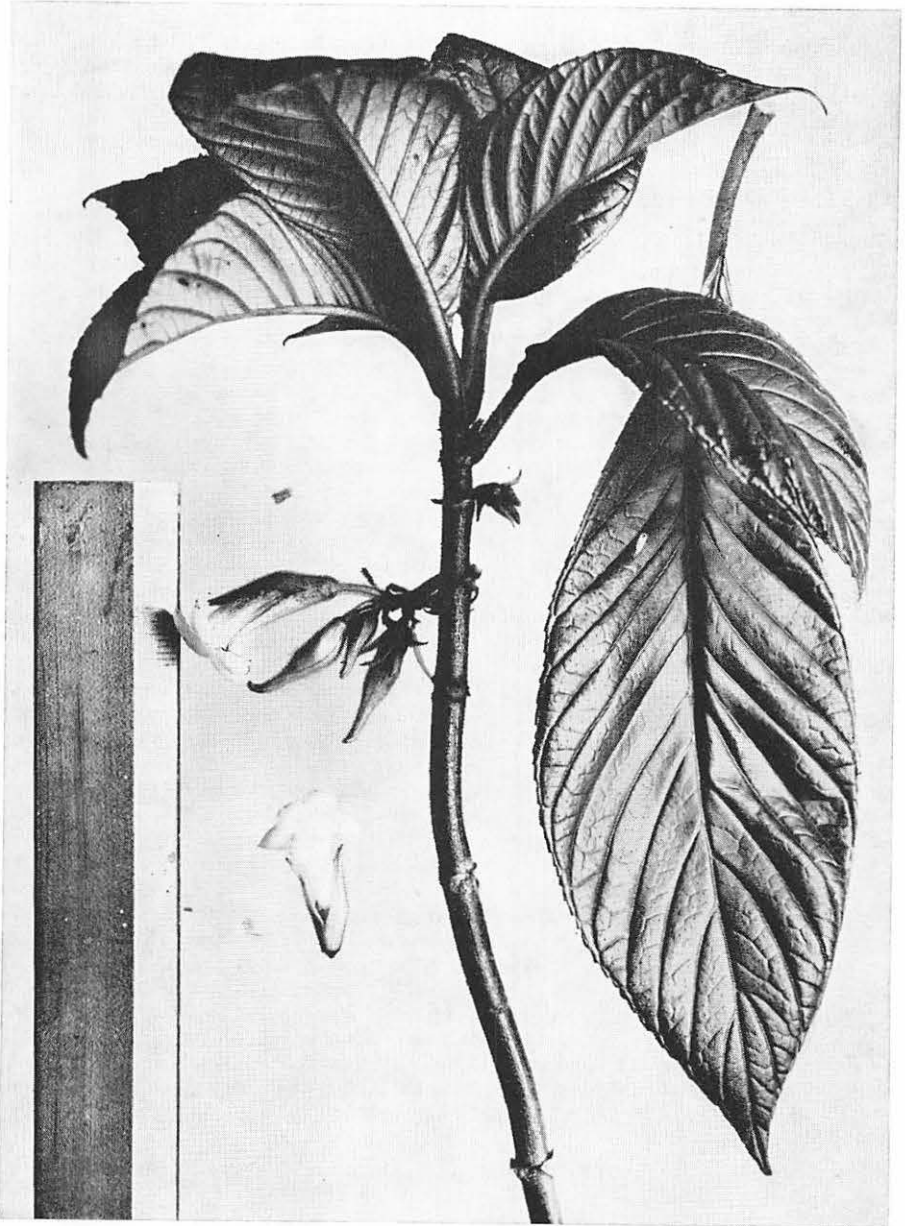


FIGURE 168.—*Cyrtandra ellipticifolia*, Pupukea, Storey 248, holotype (Bishop Mus.).

Discussion: *C. ellipticifolia* is a member of the section *Verticillatae*. In that section the most similar species is *C. megastigmata* which is separable by having the petioles pilose, later subglabrate; blades 11-28 mm. wide, linear oblanceolate, the base long cuneate, the apex abruptly cuneate, below the intervals glabrous, at the main veins minutely appressed puberulous; corolla 32 mm. long, deflexed at 15°, the upper tube pilose in bands without; and the upper lobes 6 mm. long. On the other hand, *C. ellipticifolia* has the petioles shaggy villous; blades 40-79 mm. wide, broadly elliptic, the base long cuneate, the apex acuminate, below the intervals softly puberulous and the main veins spreading pilose; corolla 31 mm. long, deflexed at 45°, the upper tube shaggy villous, the upper lobes 8 mm. long.

The new specific name is coined from the Latin, *ellipticus*, elliptic; *folium*, leaf, in allusion to the broadly elliptic blades of the leaves.

119. *Cyrtandra fusiformis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 82, 1950. (Figs. 169, 187.)

Description of Holotype: Shrub up to 5 m. tall, broad-topped and many-branched, at base up to 6 cm. in diameter; main stem and larger branches smooth, straw-colored, the leaf scars 2-3 mm. high, pale, low cordate, confluent into a complete wavy raised ring; bundle scars 5; leafy branchlets stout, 8-11 mm. in diameter, greenish, fleshy, appressed dark brown pilose, tardily glabrate; young shoots closely appressed dark brown pilose but appearing blackish, terete; internodes 6-24 mm., averaging 15 mm. long; leaves all in a dense terminal plume, 5-7 but mostly 6 in a whorl, subequal; petioles 15-20 mm. long, 3-6 mm. in diameter, terete, the tapering base of the blade folded and ending in a narrow furrow on the upper side of the petiole; blades 12-15 cm. long, 35-50 mm. wide, oblanceolate, long cuneate at base, subacuminate at apex, thick and fleshy, above dark bluish green, shining, the midrib and main laterals impressed, the intervals strongly concave, the surface glabrous, the under side pale green, the midrib and main laterals strongly raised, the surface at first appressed dark brown pilose, later subglabrate except for the veins, lateral veins 12-15 on a side, arched ascending, the margin somewhat revolute, the lower third entire, the remainder toothed, grading from crenate below to low blunt serrate near the tip; flowers single, but numerous in a whorl several layers high, borne from one of the lower leafy nodes, while all the upper nodes are sterile; pedicel 3-5 mm. long in bud diverging, lengthening and recurving with maturity, in fruit 10-15 mm. long, 2-3 mm. in diameter, dark brown appressed pilose, in fruit sharply and often spirally reflexed, bractless; buds about 3 cm. long, fusiform, the apex a long acuminate, upturned beak, the whole connate; calyx 3-4 cm. long, 7-10 mm. in diameter, green, but castaneous shaggy villous, the beak 8-11 mm. long, fused but the tips of three teeth visible at the apex, brown pilose within especially on the longitudinal nerves, at anthesis opening only by a distal longitudinal slit near the end of the body of the calyx, through which the corolla pushes down and protrudes; after anthesis the calyx splits $\frac{1}{2}$ - $\frac{2}{3}$ way down into three lanceolate lobes with long acuminate tips; corolla 30-32 mm. long, white, obliquely funnelform, the tube 22 mm. long, glabrous, without and within, its basal portion 11 mm. long, 4 mm. in diameter, tubular, straight, its upper part 10 mm. long, abruptly expanded and funnelform, minutely capitate puberulous without, glabrous within, sharply reflexed at about 55° and protruding through the distal longitudinal slit in the body of the calyx, caused by anthesis, throat barely exerted; limb 2-lipped, 5-lobed, the two upper lobes 9-11 mm. long, 7-8.5 mm. wide, reflexed at about 130° from the axis of the throat, oval, without minutely glandular, within the marginal area glabrous, the middle or inner part capitate glandular puberu-

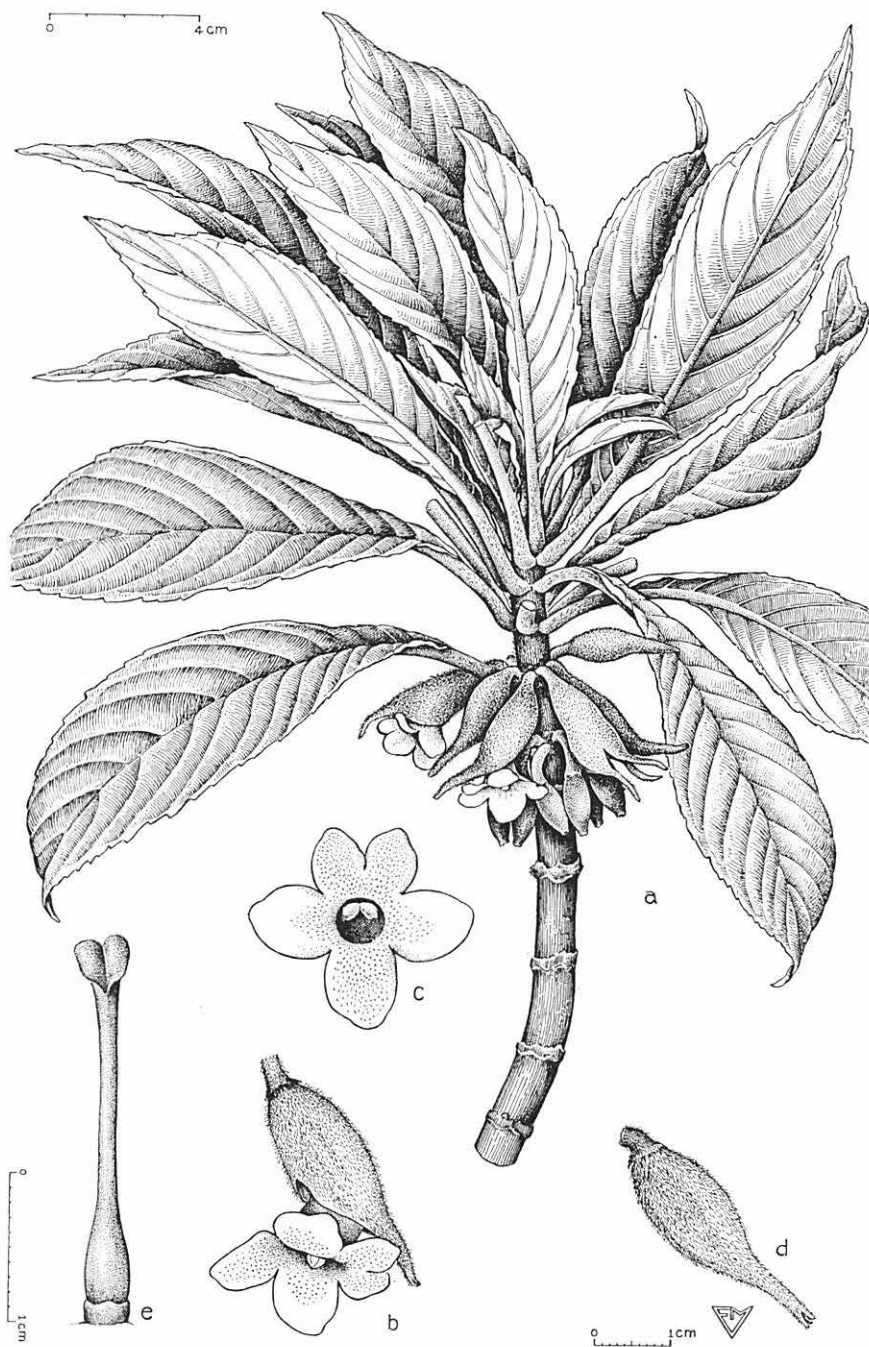


FIGURE 169.—*Cyrtandra fusiformis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Puu Kalena, St. John 22,565, holotype (Bishop Mus.).

lent; the three lower lobes spreading at about 45°; the two lateral ones 10 mm. long, 9.5 mm. wide, broadly oval; the middle or lower one 11 mm. long, 9 mm. wide, oval oblong, these three with similar pubescence to that of the upper, except that the lowest lobe has the pubescence of the upper side occurring generally except on the very margin; filaments adnate to the corolla tube to within 6 mm. of throat, the free portion 5 mm. long, subulate, spirally upcurved; anthers 3 mm. long, obliquely ovate, compressed; *style* glabrous, stout, about 15 mm. long, the two terminal stigmatic lobes 3.5 mm. long, suborbicular, connate $\frac{1}{2}$ way up the proximal side: *ovary* 6-7 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1 mm. high; fruit unknown.

Distribution: Oahu, Waianae Range, in wet forest near the summit of Puu Kalena, windward side, at 3,470 ft. alt., in the Ohia Zone.

Holotype: Oahu, Waianae Mts., Puu Kalena, Waianaeuka, 3,470 ft. alt., moist thicket with *Gunnera* and *Touchardia*, Feb. 16, 1947, *H. St. John 22,565* (BISHOP MUS.).

Discussion: *C. fusiformis* is a member of the section *Verticillatae*. It is in the affinity of *C. degenerans*, *C. latebrosa*, etc. The distinguishing characters are given in the key.

The specific name is derived from the Latin, *fusus*, a spindle; *forma*, shape, in allusion to the spindlelike form of the calyx in bud.

120. *Cyrtandra Garberi*, sp. nov. (Figs. 170, 193).

Diagnosis Holotypi: Frutex, ramulis hinnuleo-coloratis laevibus carnosus in sicco valde contractis et rugosis, cicatricibus 3-4 mm. altis depresso obdeltoideo-scutelliformibus, fasciculis 5, internodis 7-30 mm. vel plerumque 10 mm. longis; ramulis foliosis 4-6 mm. diametro carnosus brunneo-subadpressi-pilosis deinde glabratis, novellis brunneo-subadpressi-pilosis, *foliis* in 7 nodis superis affixis approximatis divergentibus inaequalibus uno $\frac{1}{4}$ majore, petiolis 6-20 mm. longis validis sparse subadpressi-pilosulis, *laminis* 2.6-18.2 cm. longis 17-45 mm. latis crassis subcoriaceisque oblanceolatis in basi longe cuneatis et breve decurrentibus apice acuminato marginibus grosse crenatis supra obscure viridibus et glabris excepta in nervo medio adpressi-pilosulo infra dense brunneo-adpressi-pilosulis in nervo medio et nervis secundariis sed intervallis pallide lutescenti-viridibus et glabratis, nervis secundariis 9-18 in uno latere apicibus adscendentibus arcuatis interconnectis proxime marginibus, *cymis* 3-floriferis axillaribus, pedunculis 1-2 mm. longis pilosis, pedicellis 4 mm. longis dense brunneo-adscendenti-pilosis, bracteis 6-11 mm. longis lanceolatis foliaceis brunneo-pilosis, alabastris lanceoloideis fusiformibus pilosis lobis calycorum connatis in rostro tenui 3-4 mm. longo, *calycibus* caducis in flore quando bullitis 26 mm. longis 9 mm. diametro oblanceoloideis membranaceis pallidis valde acute angulatis infra sinibus labiarum extra sparse brunneo-adpressi-pilosulis intra glabris, tubo 15-16 mm. longo, limbo bilabiato sinibus 12 mm. profundis extra sparse brunneo-pilosulis intra glabris, labia supera 10 mm. longa lobis latis in basi tota connatis sed in apice conspectis et digitis simulantibus, sinibus lobae mediae 5 mm. longis clausis vel semiclausis, labia infera 12 mm. longa bilobata sinu 11 mm. profundo lobis 5.5 mm. latis in basi oblique lanceo-deltoideis apice subulato valido 3 mm. longo, *corollis* quando bullitis 30 mm. longis infundibuliformibus tubo intra glabro 22 mm. longo in medio 3.5 mm. diametro in orifice 8 mm. diametro in orifice sparse brunneo-piloso e medio extrinsecus in medio valde deflexo in 35°, limbo intra sparse brunneo-piloso porro nervo medio e basi ad mediam et intra minute capitato-glanduloso-puberulo e medio ad orificem, sinibus inter labias 9 mm. profundis, labia supera bilobata lobis 5 mm. longis 5.5 mm. latis divergentibus in 60° semiorbicularibus sinu 3 mm. profundo, labia infera trilobata, lobis lateralibus 7 mm. longis 6.5 mm. latis suborbicularibus, loba infera 7 mm. longa 6 mm. lata ovali-suborbiculata intra capitato-glanduloso-puberula, *stylo* 6 mm.



FIGURE 170.—*Cyrtandra Garberi*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Palolo-Olympus Trail, Garber 292, holotype (Bishop Mus.).

longo piloso, lobis stigmatis binis 4 mm. longis late obovatis apice late obtuso vel emarginato $\frac{3}{4}$ connatis, ovario 11 mm. longo lineari-lanceoloideo supra piloso in basi cum disco cupulato 1.5 mm. alto cincto, fructu ignoto.

Description of All Specimens: Shrub; branches fawn-colored, smooth, fleshy and on drying much shrunken and with many longitudinal fissures and ridges; leaf scars 3-4 mm. high depressed obdeltoid-shield-shaped; bundle scars 5; nodes 7-30 mm. averaging 10 mm. apart; leafy branchlets 1-7 mm. in diameter, fleshy, brown subappressed pilose, then glabrate; young shoots subappressed brown pilose; leaves borne at the 7-9 upper nodes, ternate, approximate, divergent, unequal one or two of the trio being as much as $\frac{1}{4}$ the longer; petioles 6-20 mm. long, stout, sparsely subappressed pilosulous, then glabrate; blades 2.6-18.2 cm. long, 17-45 mm. wide, thick, subcoriaceous, oblanceolate, the base long cuneate and short decurrent, the apex acuminate, the margin coarsely crenate, above dark green and glabrous except for the appressed pilosulous midrib, below densely appressed brown pilosulous on the midrib and secondary veins, the intervals pale yellowish green and glabrous; secondary veins 9-18 on a side, arched ascending, interconnecting close to the margin; cymes 3-flowered, axillary; peduncles 1-2 mm. long, pilose, pedicels 4 mm. long, densely ascending brown pilose; bracts 6-11 mm. long, lanceolate, foliaceous, brown pilose; buds lanceoloid fusiform, pilose, the calyx lobes fused into a terminal slender beak 3-4 mm. long; calyx caducous, in anthesis (when boiled) 26 mm. long, 9 mm. in diameter, oblanceoloid, the lobes ascending or slightly inflexed, the texture membranous, pale, sharply angled from the base to the sinuses between the two lobes, without sparsely appressed brown pilosulous, within glabrous; the tube 15-16 mm. long, the limb 2-lipped, parted down 12 mm., without sparsely brown pilosulous, within glabrous; upper lip 10 mm. long, broad-based but the 3 upper lobes fused to tip but visible at the tip as points like finger tips, the sinuses bordering the middle lobe 5 mm. long, closed or occasionally with one open for part of its lower course; lower lip 12 mm. long, 2-lobed, the lobes divided by a 11 mm. suture, 5.5 mm. wide at base, obliquely broad lance-deltoid, ending in a stout subulate tip 3 mm. long; corolla (when boiled) 30 mm. long; funnellform, tube glabrous within, 22 mm. long, at the middle 3.5 mm. in diameter, at the throat 8 mm. in diameter, sparsely brown pilose from the middle upwards, sharply deflected at the middle at 35° to the axis of the lower throat, the tube narrowly funnellform; the limb within sparsely brown pilose up the midrib from the base to the middle, and within generally minutely capitate glandular puberulous from the middle down to the throat; sinus between the lips 9 mm. deep; upper lip 2-lobed, the lobes 5 mm. long, 5.5 mm. wide, spreading at 60° to the axis of the throat, semiorbicular, the central sinus 3 mm. deep; lower lip 3-lobed; lateral lobes 7 mm. long, 6.5 mm. wide, suborbicular; lower lobe 7 mm. long, 6 mm. wide, oval-suborbicular, the inner surface wholly capitate glandular puberulous; style 6 mm. long, pilose; stigmatic lobes two, 4 mm. long, broadly obovate, the apex wide obtuse or emarginate, connate $\frac{3}{4}$ way up the proximal side; ovary 11 mm. long, linear-lanceoloid, pilose above, glabrous below, the base surrounded by a cupulate disk 1.5 mm. high; fruit unknown.

Distribution: Koolau Range, leeward side, near Mt. Olympus and Puu Konahuanui, slopes of Manoa Valley, but the vegetational zone unknown.

Holotypus: Oahu: Palolo-Olympus Trail, March 7, 1920, *D. Wesley Garber* 292 (BISHOP MUS.).

Specimens Examined: Koolau Range, Leeward Side: Konahuanui, Jan. 6, 1909, *Forbes* 1,013.

Discussion: *C. Garberi* is a member of the section *Verticillatae*. Its closest relative is *C. sessilis* St. John & Storey which is characterized by having the leaves sessile, firm chartaceous, 8-20 cm. long, 20-64 mm. wide, the basal third oblong or cuneate-oblong, the base auriculate rounded, the outer two-thirds

oblanceolate, entire or minutely denticulate towards the tip, the apex subacuminate to the obtuse tip; corolla glabrous without; calyx glabrous or subglabrous except at the pilose base; and the style glabrous.

C. Garberi differs in having the petioles 6-18 mm. long; blades subcoriaceous, 6-16.5 cm. long, 18-45 mm. wide, oblanceolate, the apex acuminate, the margin coarsely crenate, at base cuneate decurrent; corolla throat pilose without and the lobes pilose up the middle on the outside; calyx appressed brown pilosulous except at the pilose base; and the style pilosulous.

121. *Cyrtandra hyperdasa* St. John, sp. nov. (Figs. 171, 193).

Diagnosis Holotypi: Frutex 1 m. alta, ramulis ad 8 mm. diametro brunneis vel pallide brunneis laevibus glabris subcarnosis sed in sicco contractis sulcatisque, cicatricibus 1.5-4 mm. altis depresso-obdeltoideis pallidis suberosis, fasciculis 5, novellis sparse adpresse brunneo-pilosulis, ramulis ad 7 mm. diametro subquadrangularibus glabris, internodiis 7-53 mm. plerumque 13 mm. longis, *foliis* 3-verticillatis subaequalibus adscendentibus in 45° in 5-12 nodis superis productis, petiolis 15-50 mm. longis gracilibus glabris, *laminis* 8-18.5 cm. longis 22-48 mm. latis crasse firmo-chartaceis oblanceolatis apice acuminato basi cuneata et decurrente supra viridibus glabris infra pallidioriviridibus glabris excepta costa et nervis secundariis minute adpresse pilosulis deinde glabris marginibus grosse crenatis excepta ad basim, nervis secundariis 14-19 in uno latere arcuato-adscendentibus interconnectis apicibus in dentibus callosis salientibus, *cymis* 3-5-floriferis axillaribus sparse breve brunneo-pilosulis, pedunculis 3-7 mm. longis validis divergentibus, pedicellis 5-12 mm. longis gracilibus sparse pilosis mox glabris, bracteis 6-7 mm. longis lanceolatis chartaceis subviridibus sparse breve adpresse pilosulis caducis, alabastris sparse breve adpresse brunneo-pilosulis chartaceis fusiformibus corpore elliptico-obovoideo in apice cornu 5-6 mm. longo terminante in apice lobis minime subseparatis, *calycibus* in flore 17 mm. longis (in sicco 15-17 mm.) extra glabris vel subglabris sed intra dense adpresse grosse brunneo-villosis inaequaliter bilabiatis et 5-lobatis, labia supera 7 mm. longa ovato-lanceolata apicibus lobarum separatis 2.5-3 mm. longis glabris crasse subulatis, labia infera 8-9 mm. longa lobis binis 7-8 mm. longis oblique ovato-lanceolatis apicibus glabris 3.5 mm. longis, *corollis* 25 mm. longis quando bullitis (in sicco 22 mm.) albis extra glabris tubo 20 mm. longo infra orifice glabro cylindrico in basi 3 mm. diametro in media 4 mm. in orifice 6 mm. supra media gradatim in 30° deflexa, limbo bilabiato 5-lobato extra glabro, labia supera in 40° divergente lobis binis 5 mm. longis 4 mm. latis ovali-suborbicularibus lobis omnibus intra capitato-glanduloso-puberulis excepta apicibus, labia infera 3-lobata, lobis lateralibus 7 mm. longis 6 mm. latis ovalibus basibus auriculatis et impensis, loba infera 7 mm. longa 6 mm. lata ovali intra loba et orifice capitato-glanduloso-puberulis, staminibus binis inferis perfectis filamentis in tubo in 5 mm. ex orifice affixis partibus liberis 3.5 mm. longis subulatis gradatim contorte adscendentibus, antheris 1.9 mm. longis late ellipticis connectivo 1.5 mm. longo ovato-suborbiculari, staminodiis in tubo in 9 mm. ex orifice adnatis partibus liberis 0.1 mm. longis subnigris apice antheroideo 0.3 mm. longo pallido subulato, *stylo* 7-8 mm. longo tereto glabro, lobis stigmatis binis 5 mm. longis late ovalibus in latere proximo $\frac{4}{5}$ connatis, *ovario* 5-9 mm. longo lanceoloideo glabro in basi disco cupulato 1.8 mm. alto cincto, *baccis* 18-22 mm. longis 12-14 mm. diametro late ellipsoideis albis, seminibus 0.34-0.43 mm. longis 0.21-0.32 mm. diametro late ellipsoideis in apicibus brunneis et subapiculatis cuti cum reticulis cellularibus prominentibus hexagonis $\frac{1}{7}$ - $\frac{1}{8}$ longis quam semen.

Description of All Specimens: Shrub 1 m. tall; branchlets as much as 8 mm. in diameter, brown or pale brown, smooth, glabrous, somewhat fleshy and on drying shrinking to form small longitudinal furrows and ridges; leaf scars 1.5-4 mm. high, low obdeltoid, pale, corky; bundle scars 5; young shoots sparsely short appressed brown pilosulous; leafy branchlets as much as 7 mm. in diameter, subquadrangular, glabrate;



FIGURE 171.—*Cyrtandra hyperdasa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, $\times 1$; f, pistil, $\times 2$; g, fruit, $\times 1$. Kahana Valley, Fosberg 10,408, holotype (Bishop Mus.).

internodes 7-53 mm., averaging 13 mm. apart; *leaves* in whorls of 3, ascending at about 45°, subequal, borne at the 5-12 upper nodes; petioles 15-50 mm. long, slender, glabrate; *blades* 8-18.5 cm. long, 22-48 mm. wide, thick firm chartaceous, oblanceolate, the apex acuminate, the base cuneate and decurrent, above green glabrous, below very pale green, glabrous except for the midrib and secondary veins which are minutely appressed pilosulous, then glabrate, the margin coarsely crenate except at the very base, the lateral veins 14-19 on a side, arched ascending, the tips inarched interconnecting and ending in a callus on the marginal teeth; *cymes* 3-5-flowered, axillary, sparsely brown short pilosulous; peduncles 3-7 mm. long, stout, diverging; pedicels 5-12 mm. long, slender, sparsely pilose, soon glabrate; bracts 6-7 mm. long, lanceolate, greenish chartaceous; sparsely short pilose, then glabrate, caducous; buds sparsely appressed short brown pilosulous, chartaceous, fusiform, the body elliptic-obovoid, ending in a slender straight beak 5-6 mm. long with the lobes barely separable at the apex; *calyx* at anthesis 17 mm. long (when dried 15-17 mm. long), glabrate or nearly so without, but within densely appressed brown coarse villous, unevenly 2-lipped and 5-lobed; upper lip 7 mm. long, ovate lanceolate, the 3 free lobe tips 2.5-3 mm. long, glabrous thick subulate; lower lip 8-9 mm. long, the 2 lobes 7-8 mm. long, obliquely ovate lanceolate, the subulate glabrous tips 3.5 mm. long; *corolla* 25 mm. long when boiled (22 mm. long when dried), white, glabrous without, tube 20 mm. long, glabrous below the throat, cylindrical below, at base 3 mm. in diameter, at the middle 4 mm., at the throat 6 mm., just above the middle gradually deflexed at 30° to the axis of the lower tube; limb 2-lipped, 5-lobed, glabrous without; upper lip spreading at about 40° to the axis of the throat, the two lobes 5 mm. long, 4 mm. wide, oval-suborbicular, they and all the lobes capitate glandular puberulent within below the tip; lower lip 3-lobed; the two lateral lobes 7 mm. long, 6 mm. wide, oval, at base auriculate and overlapping; lower lobe 7 mm. long, 6 mm. wide, oval, within capitate glandular puberulent throughout and so in the adjacent throat; the two lower stamens perfect, the filaments adnate to the corolla tube to within 5 mm. of the throat, the free portion 3.5 mm. long, subulate, gently spirally upcurved; the two perfect anthers 1.9 mm. long, connivent, subsymmetrically broadly elliptic, the heavy dark connective 1.5 mm. long, ovate-subcircular; the two lateral staminodia adnate to the corolla to within 9 mm. of the throat, their filaments 0.1 mm. long, dark, the antheroid tip 0.3 mm. long, sterile, pale, subulate; the upper staminodium similar but adnate to within 8 mm. of the throat; *style* 7-8 mm. long, terete, glabrous; stigmatic lobes two, 5 mm. long, broadly oval, connate $\frac{1}{2}$ way up proximal side; *ovary* 5-9 mm. long, lanceoloid, glabrous, the base surrounded by a cupulate disk 1.8 mm. high; *berry* 18-22 mm. long, 12-14 mm. in diameter, broadly ellipsoid, white; seeds 0.34-0.43 mm. long, 0.21-0.32 mm. in diameter, broadly ellipsoid, at either end darker and subapiculate, the body covered with raised cellular hexagonal, very heavy walled reticulations $\frac{1}{7-1/8}$ as long as the seed.

Distribution: Koolau Range, in the central portion of the range, on both sides, at the heads of Kahana and Kipapa Valleys, from 800 to 1,500 ft. alt., in the Ohia Zone.

Holotype: Kahana Valley, Ditch Trail, Koolau Mts., wet forest, bottom of small gully, 260 m. alt., Nov. 26, 1933, *F. R. Fosberg 10,408* (BISHOP MUS.).

Specimens Examined: Koolau Range.

Windward Side: Kahana Valley, in woods near Waikane-Kahana Gap, 800 ft. alt., Oct. 16, 1932, *Storey 192*; Waikane-Schofield Trail, 1,800 ft. alt., Oct. 16, 1932, *Yuncker 3,193* (US).

Leeward Side: Kipapa Gulch, North Fork of, on slopes above stream at about 1,500 ft. alt., Nov. 13, 1932, *Storey 214*.

Discussion: *C. hyperdasa* is a member of the section *Verticillatae*. In habit it closely resembles *C. paludosa* var. *paludosa*, but differs from it in having whorled leaves and in having the calyx within densely villous, and the young shoots sparsely appressed short brown pilose, the hairs being noticeably shorter.

The new specific name is from the Greek, *hyperdasus*, very hairy, in allusion to the villous inner surface of the calyx tube.

122. *Cyrtandra latebrosa* Hillebrand, Fl. Hawaiian Is. 337, 1888 (as to Kalihi specimen with lobed calyx, but excluding his synonym, *C. paludosa* Gaudichaud var. *degenerans* Wawra). (Figs. 172, 173, 190.)

Description of All Specimens Examined: Shrub 1-2 m. tall; branches as much as 10 mm. in diameter, fleshy, gray, on drying longitudinally furrowed and ridged; leaf scars 2-2.5 mm. high, obcordate-shield-shaped, corky; bundle scars 5; leafy branchlets 2-5 mm. in diameter, appressed pilose to glabrate; young shoots densely brown appressed pilose; internodes 2-60 mm., commonly 8 mm. long; leaves (3-) 4-6 in a whorl, ascending, equal or 1-2 of a whorl as much as $\frac{1}{5}$ smaller than the others; petioles 10-30 mm. long, slender, appressed brown pilose; blades 5.5-24 cm. long, 13-60 mm. wide, chartaceous, narrowly elliptic or if depauperate linear-oblongate, the apex acute or short acuminate, tapering decurrent on the petiole, the margin obscurely serrulate, above dark green, glabrous, below pale green, lightly brownish pilosulous especially on the veins; lateral veins 10-14 on a side, ascending, the tips arcuate, salient in the teeth; cymes axillary, densely brown, appressed pilose, 1-3-flowered; peduncles 2-15 mm. long; pedicels 6-14 mm. long; bracts 3-35 mm. long, narrowly lanceolate or oblanceolate, foliaceous, appressed pilose; bud fusiform, the base ellipsoid, the tip a beak 5-9 mm. long, arched ascending; calyx 18-31 mm. long, green, densely appressed brown pilose, but in age much of the pubescence caducous, the tube ellipsoid 8-13 mm. long, the beak early splitting into 3 or 5 lobes 10-18 mm. long, narrowly lanceolate, long acuminate; corolla 26-30 mm. long (when dried), white, funnelliform, the tube 20-24 mm. long, more or less hirsute without, abruptly deflexed at from 40° to 70° from the axis of the lower tube, the mouth 4-5 mm. in diameter; the limb 2-lipped, 5-lobed, the lobes spreading at about 80° from the axis of the throat; two upper lobes 5.5 mm. long, 5 mm. wide oval, glabrous without, but within glandular puberulous toward throat; two lateral lobes 7 mm. long, 6 mm. wide, obliquely oval, glandular puberulous within towards the throat; lower lobe 8 mm. long, 7 mm. wide, oval, glandular puberulous within except at the margin; filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 5 mm. long, spirally upcurved, subulate; anthers 2.8 mm. long, obliquely ovate; style 7 mm. long, glabrous; the 2 terminal stigmatic lobes 2.5-4 mm. long, oval, connate $\frac{1}{2}$ way up the proximal side; ovary 7 mm. long, linear-lanceoid, sparsely pilose, the base surrounded by a cupulate disk 1.5 mm. high; berry 13-19 mm. long (when dried), ellipsoid, white; seeds 0.27-0.30 mm. long, 0.18-0.21 mm. in diameter, broadly ellipsoid, honey-colored with dark brown apiculate apices, the body covered with raised polygonal cellular reticulations $\frac{1}{5}$ - $\frac{1}{6}$ as long as the seed.

Distribution: Koolau Range, on the leeward side, from the north at Anahulu to Nuuanu, at from 1,250 ft. to 2,150 ft. altitude in the Ohia Zone.

Lectotype: Kalihi in a deep gulch, Oahu, Jan. 1870, *W. Hillebrand* (B). This is the specimen on the lower left-hand corner of the sheet and the loose flowers in the pocket. The other larger specimen with beaked, unlobed calyx



FIGURE 172.—*Cyrtandra latebrosa*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, pistil, $\times 2$; e, fruit, $\times 1$. Kawaiiki, St. John 20,276.

and linear-oblongate blades is excluded, as *C. degenerans*. Type examined.

Specimens Examined: Koolau Range.

Windward Side: Between Waialae and Wailupe Valley, Aug. 23, 1924, *Harris C242099*.

Leeward Side: Anahulu Trail, along small stream below trail at 1,500 ft. elev., March 10, 1935, *Storey 264*; Kawaiiki Ditch Trail, Kawailoa, moist wooded gulch, 1,200 ft. alt., Nov. 9, 1941, *St. John 20,276*; South Opaëula Gulch, ridge S. of, Paalaa, moist, densely vegetated, 1,675 ft. alt., Sept. 25, 1932, *Fukuda*; Kipapa Gulch, along stream below the C.C.C. Trail, 1,600 ft. elev., Feb. 10, 1935, *Storey 257*; ditto, S. Ridge, 1,400 ft. elev., May 15, 1932, *Hosaka*; ditto, E. of Puu Kamana, moist gulch, 1,450 ft. alt., May 15, 1932, *St. John 11,648*; ditto, N. ridge, in moist gully, 1,200 ft. elev., July 10, 1932, *Hosaka 676*; ditto, N. Fork, in shade along dry stream bed, 1,250 ft. elev., Nov. 13, 1932, *Storey 211*; Nuuanu (the lower and the right hand branches, and pocketed flower and large bud only), Ex Herb. J. M. Lydgate, collected by *Hillebrand & Lydgate*.

Discussion: *C. latebrosa* is a member of the section *Verticillatae*. See the quotation from Hillebrand and the discussion under *C. degenerans*, detailing the reasons for separating the plants with the calyx splitting into 3 or 5 lobes and for resurrecting the name *C. latebrosa* Hillebrand for them. This plant was known to C. B. Clarke by a specimen bearing the manuscript name *C. paradoxa* Hillebrand which Clarke published in synonymy under *C. longifolia* Hillebrand, and Rock treated the same way.

The Hillebrand specimen from Nuuanu, from the Lydgate Herbarium, now in the B. P. Bishop Museum, bears a large ticket now pasted on, with "Cyrtrandra latebrosa Hbd." in Hillebrand's own hand. There are in the pocket two loose slips of paper apparently of different ages. On one is written "Nuuanu"; on the other "Cyrtrandra paradoxa, Nuuanu," the letters are rounder and more regular than those on the larger label, but they are, it seems, in Hillebrand's writing of an earlier age. One of these plant specimens has much larger peduncular bracts, up to 33 mm. in length, but this is deemed an occasional development without taxonomic significance.

The *Harris C242099* specimen is clearly labeled as from the "Windward side of Koolau Range between Waialae and Wailupe valleys. . . ." There is a discrepancy here, as the valleys of Waialae and Wailupe are on the leeward side of the range. On the opposite or windward side from them is Waimanalo, but there the mountain slope is a "pali" or sheer cliff, unscalable and running nearly straight for miles. The *Cyrtrandra* habitats of the southern Koolau Range end in Waimanalo, but *latebrosa* has not been found there in the gulches at the foot of the cliffs. It is probable that Harris climbed the mountains up the trail on the Waialae-Wailupe divide, and collected the *Cyrtrandra* just over

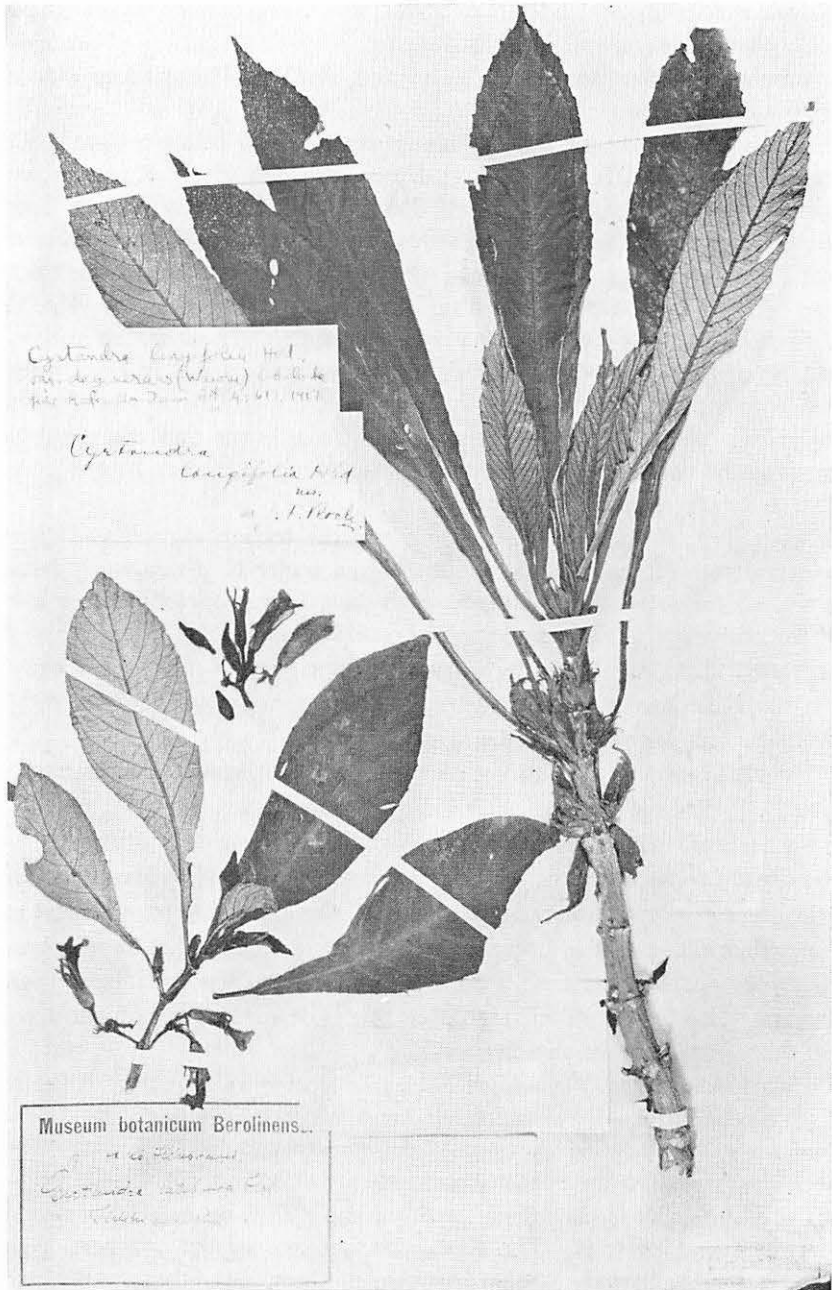


FIGURE 173.—*Cyrtandra latebrosa*, lectotype (Berlin). Kalihi, Hillebrand.

the crest, and hence on the windward side, at about 2,400 ft. The slopes at the crest are steep, but scalable on either side for several hundred feet. The area produces a dwarfed, windswept rain forest, a good habitat for, and supporting several species of *Cyrtandra*. By stating it as Waialae and Wailupe, the locality was narrowed down to a very small area, much more definite than if it had been called merely head of Waimanalo.

As here delimited, there are two definite trends within the species: 1, plants with oblanceolate blades, as in the type; 2, plants with narrowly linear-oblanceolate, smaller blades, common in Kipapa Gulch. These two have been compared and studied with care. Since there are blades of intermediate shape and size, some even on the same branch, the two are considered fluctuating extremes of the same species population.

The specific name was obviously taken from the Latin, *latebrosus*, secret, retired.

123. *Cyrtandra megastigmata* St. John, sp. nov. (Figs. 174, 192).

Diagnosis Holotypi: Frutex 2 m. alta, ramis 4-7 mm. diametro pallide brunneis laevibus carnosus in sicco longitudine sulcatis, cicatricibus 3-4 mm. altis late scutelliformibus distinctis, fasciculis 5, internodis 4-11 mm. sed plerumque 7 mm. longis, ramis foliosis 2-4 mm. diametro teretibus dense brunneo-pilosis tunc subglabris, novellis dense subadpressi-brunneo-pilosis, *foliis* adscendentibus incongregatis in nodis 5-7 superis affixis in ramis fortioribus ternatis sed in ramulis secundariis tenuibus oppositis, petiolis 10-32 mm. longis tenuibus brunneo-pilosis deinde subglabris, *laminis* 6-15 cm. longis 11-28 mm. latis lineari-oblanceolatis basi longissimi-cuneata apice abrupte acuminato carnosus sed in sicco subcoriaceis supra nigro-viridibus glabris infra albo-viridibus costa et nervis secundariis adpressi-pilosulis intervallis glabris marginibus grosse serratis nervis secundariis 10-15 in uno latere adscendentibus sed in vicine margine conjunctis et in serris salientibus, *cymis* axillaribus trifloris dense brunneo-adpressi-pilosis, pedunculis 1-3 mm. longis, pedicellis 8-9 mm. longis, bracteis 6-10 mm. longis anguste lineari-lanceolatis cum pilis densis obscuris, alabastris corporis lanceo-fusiformibus et cornu fere aequilongo, *calycibus* bullitis 26 mm. longis (in sicco 24 mm.) subviridibus fusiformibus dense brunneo-adscendenti-pilosis in scissura distala aperta, rostro 8 mm. longo curvato intra brunneo-piloso ad apicem 2-3-lobato, tubo 11 mm. longo elliptico-oblanceoloideo intra grosse brunneo-piloso; *cotillis* albis carnosus 32 mm. longis (bullitis), tubis 25 mm. longis 4 mm. diametro in basi et medio sed 7 mm. in orifice in medio ad 15° deflexis et e calyce protrudis extra ad basim glabris sed partibus extrusis in regionis costarum brunneo pilosis intra glabris, limbis 2-labiatis 5-lobatis, lobis extra in linea lata costarum brunneo pilosis intra lobis et orifice capitato-glanduloso-puberulentis sed marginibus glabris, lobis superioribus binis 6 mm. longis 5 mm. latis ovatis ad basim auriculatis et impensis, labia inferiore 3-lobata, lobis lateralibus 8 mm. longis 5.5 mm. latis late oblongo-ellipticis, loba inferiore 10 mm. longa 6 mm. lata late elliptice obtusa, staminibus binis inferioribus perfectis ad tubam adnatis in 6 mm. orificiorum, parte libera 4 mm. longa subulata curvata, antheris 3 mm. longis deltoideo-ovatis asymmetricalibus connectivo ovato, *stylo* 10 mm. longo valido subglabro, lobis stigmatis 7 mm. longis late obovato-spatulatis $\frac{2}{3}$ -connatis in dorso glabris, *ovario* 8 mm. longo lanceoloideo subglabro, fructu ignoto.

Description of Holotype: Shrub 2 m. tall; branches as much as 4-7 mm. in diameter, pale brown, smooth, fleshy and on drying with strong longitudinal furrows and ridges; leaf scars 3-4 mm. high, broad shield-shaped, separate; bundle scars 5; internodes 4-11 mm. but averaging 7 mm. long; leafy branches 2-4 mm. in diameter, terete, closely brown pilose, then subglabrate; young shoots densely subappressed brown pilose;



FIGURE 174.—*Cyrtandra megastigmata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. N. Halawa, St. John 20,409, holotype (Bishop Mus.).

leaves ascending, not crowded, borne at the 5-7 upper nodes, on main branches ternate, but on weak secondary branches opposite; petioles 10-32 mm. long slender, brown pilose, later subglabrate; *blades* 6-15 cm. long, 11-28 mm. wide, linear-oblongate, the base very long cuneate, the apex abruptly acuminate, fleshy but drying subcoriaceous, above dark green, glabrous, below whitish green, the midrib and secondaries minutely appressed pilosulous, the intervals glabrous, the margins remotely coarse serrate, the lateral veins 10-15 on a side, ascending, near the margin inarched interconnecting and salient in the teeth; *cymes* axillary, 3-flowered, densely appressed, brown pilose; peduncles 1-3 mm. long; pedicels 8-9 mm. long; bracts 6-10 mm. long, narrowly linear lanceolate, hidden by the dense pilosity; buds with a lance-fusiform body and a terminal beak almost as long as the body; *calyx* when boiled 26 mm. long (when dried 24 mm. long), fusiform, greenish, densely brown ascending pilose, opening by a distal slit; the beak 8 mm. long, upcurved, closely subappressed pilose, separating into 2-3 lobes, brown pilose within; the tube 11 mm. long, elliptic-oblongate, within shaggy brown pilose; *corolla* white, thick and fleshy, when boiled 32 mm. long, the tube 25 mm. long, 4 mm. in diameter at the base and middle, 7 mm. at the throat, at the middle deflexed at 15° from the axis of the lower throat and protruded from the calyx slit, without the tube glabrous where enclosed by the calyx, but from the middle upwards brown pilose in broad bands along the midrib of the lobes, within glabrous; limb 2-lipped, 5-lobed, the lobes brown pilose without on a broad band up the midrib as far as the center, within the lobes and throat capitate glandular puberulent except near the margins; upper lip 2-lobed, the lobes 6 mm. long, 5 mm. wide, ovate, auriculate and overlapping at base; lower lip 3-lobed; lateral lobes 8 mm. long, 5.5 mm. wide, broadly oblong elliptic; lower lobe 10 mm. long, 6 mm. wide, broadly elliptic, obtuse; two lower stamens perfect, the filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 4 mm. long, stout subulate, spirally upcurved; the two perfect anthers 3 mm. long deltoid-ovate, slightly asymmetric, the connective ovate; the staminodia adnate to the corolla tube to within 8-9 mm. of the throat, subulate, the filament 0.6 mm. long, the whitish tip 0.6 mm. long; *style* 10 mm. long, stout, essentially glabrous; two stigmatic lobes 7 mm. long, broad obovate-spatulate, connate $\frac{2}{3}$ way up proximal side, glabrous on the back; *ovary* 8 mm. long, lanceoloid, nearly glabrous; fruit unknown.

Distribution: Known only from the type collection in the Koolau Range, Halawa, leeward side, in a moist gulch, in the Ohia Zone.

Holotypus: North Halawa Stream, Koolau Range, moist shaded stream bank, 1,700 ft. alt., Dec. 12, 1943, *H. St. John 20,409* (BISHOP MUS.).

Discussion: *C. megastigmata* is a member of the section *Verticillatae*. Its closest relative is *C. ternata* St. John & Storey which also occurs only on the leeward side of the Koolau Range, but only by Poamoho Stream, some miles away. *C. ternata* has: leaf scars 2-2.5 mm. high, confluent and annular; blades 29-54 mm. wide, below at first pale puberulent; peduncles 5-12 mm. long; calyx tube 8-9 mm. long, the lobes 11-15 mm. long; corolla tube deflected at middle at 40°, the upper lobes 8 mm. wide, the lateral lobes 11-12 mm. long, 11 mm. wide, the lower lobe 13 mm. long, 12 mm. wide; style sparsely spreading hirsute; and the stigmatic lobes 3 mm. long. *C. megastigmata* has the contrasting characters: leaf scars 3-4 mm. high, separate; blades 11-28 mm. wide, below the intervals glabrous; peduncles 1-3 mm. long; calyx tube 11 mm. long, the lobes 15 mm. long; corolla tube deflected at 15°, the upper lobes 5 mm. wide, the lateral lobes 8 mm. long, 5.5 mm. wide, the lower lobe 10 mm. long, 6 mm. wide; style glabrous; and the stigmatic lobes 7 mm. long.

The new specific epithet is taken from the Greek *me-gas*, large; *stigma*, stigma, in allusion to the unusually large stigmas in this species.

124. *Cyrtandra nubincolens* St. John, sp. nov. (Figs. 175, 190).

Diagnosis Holotypi: Frutex; ramulis ad 7 mm. diametro glabris rubescenti-brunneis subcarnosis et in sicco contractis et sulcatis, cicatricibus 2-2.5 mm. altis depresso late scutelliformibus connatis et annulatis pallidis suberosis, fasciculis 3, ramulis foliferis 2-5 mm. diametro glabris rubescentibus, novellis sparse pilosis, internodis 8-30 mm. plerumque 12 mm. longis, *foliis* quaternatis adscendentibus deinde divergentibus inaequalibus in omnibus nodis 1-2 foliis $\frac{1}{6}$ - $\frac{1}{8}$ minoribus, petiolis 9-17 mm. longis rubescentibus ab initio sparse brunneo-pilosis deinde subglabris, *laminis* 4.5-11 cm. longis 15-22 mm. latis in sicco firmis et subcoriaceis sed in vivo verisimiliter carnosus lineari-oblan-ceolatis in apice subacuminatis in basi longe cuneatis et decurrentibus marginibus remote crenulatis ex medio ad apicem supra obscure- vel rubescenti-viridibus glabris infra albescenti-viridibus in nervo medio et nervis secundariis sparse adpressi-pilosulo nervis secundariis 7-10 in uno latere adscendentibus arcuatis apicibus interconnectentibus et in dentibus callosis-excurrentibus, *cymis* axillaribus 3-floriferis, pedunculis 2-3 mm. longis brunneo-pilosis, pedicellis 3-8 mm. longis adscendenti-brunneo-pilosis, bracteis 5-7 mm. longis lanceolatis supra brunneo-pilosis infra paene glabris, alabastris lanceo-fusiformibus solum in basi hirsutis, *calycibus* in flore (quando bullitis) 25 mm. longis (in sicco 22 mm.), tubo 14 mm. longo late oblanceoloideo in basi truncato tenue et submembranaceo pallide subviridi valde 5-angulato et sulcato in basi dense brunneo-hirsuto ad apicem minus hirsuto intra glabro, limbo bilabiato inter labias 11-13 mm. partito 3-4-lobato intra glabro, lobis superis in verite 3 sed connatis et postremo in 1-2 lobis partitis 7-10 mm. longis 5-6 mm. latis deltoideo-lanceolatis intra glabris extra in nervo et marginibus remote brunneo-hirsutis apicibus recurvatis, labia infera bilobata lobis 11 mm. longis 4 mm. latis arcuato-lanceolatis intra et extra glabris, *corollis* quando bullitis 32 mm. longis (in sicco 28 mm.) albis asymmetricis infundibuliformibus tubo 24 mm. longo valde oblique infundibuliformi extra glabro intra glabro excepta parte tertia supra capitato-glanduloso-puberulo in basi 3 mm. diametro in media 4 mm. in orifice 11 mm., labiis 9 mm. partitis extra glabris, lobis superis binis 8 mm. longis 6 mm. latis oblique ovalibus intra capitato-glanduloso-puberulentis excepta in apice, lobis laterali-bus 9 mm. longis 8 mm. latis oblique late ovalibus, loba infera 12 mm. longa 7.5 mm. lata late elliptica, staminibus binis inferis cum filamentis in tubo 4.5 mm. ex orifice affixis parte libera 4 mm. longa contorte adscendente, antheris 2.2-2.8 mm. longis 1.7 mm. latis oblique ovatis connectivo 1.3 mm. lato ovatis, staminodeis lateralibus in tubo 7 mm. ex orifice affixis parte libera 0.3 mm. longa subulata, antheroidio 0.1 mm. longo, *stylo* 1.1 cm. longo subulato subglabro (solo 1-2 pilis ferrentibus), lobis stigmatis 4 mm. longis oblique late obovatis $\frac{1}{3}$ connatis, *ovario* 6 mm. longo anguste lineari-lanceoloideo glabro in basi cum disco cupulato 1.3 mm. alto cincto, fructu ignoto.

Description of Holotype: Shrub; branchlets as much as 7 mm. in diameter, glabrous, reddish brown, somewhat fleshy and on drying with low longitudinal furrows and ridges; leaf scars 2-2.5 mm. high, low broad shield-shaped, but connected and annular, pale, corky; bundle scars 3; leafy branchlets 2-5 mm. in diameter, glabrous, reddish; young shoots sparsely pilose; internodes 8-30 mm., averaging 12 mm. long; *leaves* 4 in a whorl, ascending, then spreading, unequal, 1-2 of those of a whorl being $\frac{1}{6}$ - $\frac{1}{8}$ smaller than the others; petioles 9-17 mm. long, reddish, at first sparsely brownish pilose, later subglabrate; *blades* 4.5-11 cm. long, 15-22 mm. wide, firm and subcoriaceous when dried but probably fleshy when fresh, linear-oblan-ceolate, the apex subacuminate, the base long cuneate and decurrent, the margin remotely crenulate from the middle to tip, above dark green or reddish green, glabrous, below whitish green, the midrib and secondaries sparsely appressed pilose; lateral veins 7-10 on a side, ascending, arcuate, the tips inarched interconnecting and forming a callus on the marginal teeth; *cymes* axillary, 3-flowered; peduncles 2-3 mm. long, brown pilose; pedicels 3-8 mm.

long, ascending brown pilose; bracts 5-7 mm. long, lanceolate, above brown pilose, below nearly glabrous; bud lance-fusiform, hirsute only at the base; *calyx* in anthesis when boiled 25 mm. long (22 mm. long when dried), the tube 14 mm. long, broadly oblanceoloid with the base truncate, thin and almost membranous, pale greenish, strongly 5-angled and furrowed, the midribs salient as sharp angles, at base closely brown hirsute, sparsely brown hirsute on proximal side but decreasingly so upwards, glabrous

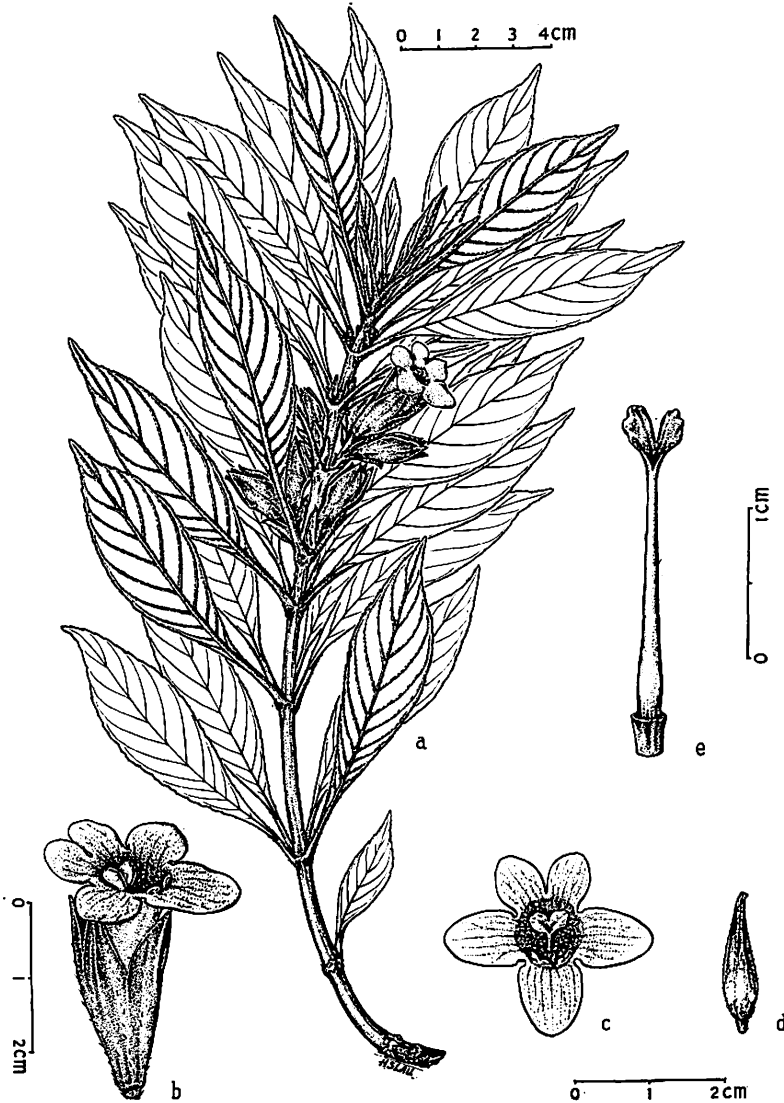


FIGURE 175.—*Cyrtandra mubincolens*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Puu Konahuanui, Conger, holotype (Bishop Mus.).

within; the limb 2-lipped, cleft down 11-13 mm. between the lips, 3-4-lobed, glabrous within; upper lobes originally 3 but more or less connate and separating into only 1-2 lobes, the single ones 7-10 mm. long, 5-6 mm. wide, deltoid-lanceolate, the tips decurved, remotely brown hirsute along midrib and margins, glabrous within; lower lip 1-2-lobed, individual lobes 11 mm. long, 4 mm. wide, arcuate-lanceolate, glabrous within and without; *corolla* 32 mm. long when boiled (when dried 28 mm. long), white, asymmetric funnellform, the tube 24 mm. long, very obliquely funnellform, glabrous without, glabrous within for lower $\frac{2}{3}$, but the expanded upper $\frac{1}{3}$ capitate glandular puberulous, at base 3 mm. in diameter, at the middle 4 mm., at the throat 11 mm., the general direction of the axis straight, but the throat much enlarged on the distal side and hence that side of the corolla projecting; the limb 2-lipped, cleft 9 mm. between the lips, 5-lobed, glabrous without; upper lip 2-lobed, the lobes 8 mm. long, 6 mm. wide, connate for 2 mm., obliquely oval, within capitate glandular puberulent except near the apex; lower lip 3-lobed, the lobes capitate glandular puberulent within except at the apex; two lateral lobes 9 mm. long, 8 mm. wide, obliquely broad oval; lower lobe 12 mm. long, 7.5 mm. wide, broadly elliptic; two lower stamens perfect, their filaments adnate to the corolla tube to within 4.5 mm. of the throat, the free portion 4 mm. long, spirally upcurved, the two perfect anthers 2.2-2.8 mm. long, 1.7 mm. wide, obliquely ovate, the connective 1.3 mm. wide, ovate, dark; the lateral staminodia adnate to the corolla tube to within 7 mm. of the throat, the free portion 0.3 mm. long, subulate, bearing a whitish, subulate antheridium 0.1 mm. long, the upper staminodium similar but smaller; *style* 1.1 cm. long, subulate, subglabrous (with only 1 or 2 hairs of a hirsute nature); stigmas 4 mm. long, obliquely broad obovate, connate $\frac{1}{3}$ way up proximal side; *ovary* 6 mm. long, narrowly linear lanceoloid, glabrous, the base surrounded by a cupulate disk 1.3 mm. high; fruit unknown.

Distribution: Koolau Range, on the highest peak, vegetational zone unknown.

Holotypus: Puu Konahuanui, June 21, 1942, *A. D. Conger* (BISHOP MUS.).

Discussion: *C. nubicolens* is a member of the section *Verticillatae*. Its closest relative is *C. hyperdasa* St. John of the central portion of the Koolau Range near Kahana, Waikane, and Kipapa. The two are adjacent in and are contrasted in the key.

The new specific epithet is coined from the Latin, *nubes*, cloud; *colens*, dwelling in, a name given in allusion to the plant's habitat on the cloud-capped summit of the mountains.

125. *Cyrtandra oblanceolata* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 83, 1950. (Figs. 176, 192.)

Description of All Specimens Examined: Shrub 0.5-1.5 m. tall, erect or decumbent at base, the stem single, unbranched; stem 12-18 mm. in diameter, terete, the bark greenish gray to gray, smooth, corky; leaf scars completely confluent into a pale buff ring, the individual leaf scars 4-7 mm. high, the bundle scars 5 or 7; internodes 6-30 mm., averaging about 12 mm. long; leafy branchlets 5-12 mm. in diameter, greenish, glabrate below; young shoots densely appressed, olive brown pilose; *leaves* in whorls of 3-4, or on weaker branches opposite, subequal, ascending; petioles of mature stems 2-5 mm. long, 5-9 mm. in diameter, subterete, finally glabrate, perfoliate around the node, the connecting tissue making a green band 1-1.5 mm. high, 1.5-2 mm. wide; on young slender shoots the petioles 15-30 mm. long, more slender; *blades* 14-37 cm. long,



FIGURE 176.—*Cyrtandra oblanceolata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, $\times 1$; f, fruit, $\times 1$; g, pistil, $\times 2$. Waiahole Ditch, Waiahole, St. John 22,577, holotype (Bishop Mus.).

33-107 mm. wide, oblanceolate or oblanceolate-elliptic, and basal quarter long cuneate attenuate into a straplike, auriculate base, soft chartaceous, above dark shiny green, the lateral veins impressed, fully glabrous or with only a few hairs along the midrib, below retaining a sparse brown appressed pilosity, the midrib and lateral veins raised and prominent, and appressed brown pilose, the apex acute, the base abruptly auriculate, the margin low flat serrulate except for the entire ligulate basal part; *cymes* from the leaf axils, or very rarely cauliflorous, 3-5-flowered, densely appressed brown pilose throughout; peduncles 2-5 mm. long; pedicels 6-10 mm. long; bracts 15-17 mm. long, lanceolate; buds fusiform, beaked, densely brown appressed pilose, opening in the outer third by a distal longitudinal slit through which the corolla bud extrudes; *calyx* 20-31 mm. long, 8-10 mm. in diameter, densely brown appressed pilose towards the base and towards the tip at least on the veins, the tissue green, within similarly densely hairy except at the very tip, by full anthesis the distal slit running from midway to the tip, and two lateral slits separating two lower calyx teeth down almost to the middle; upper teeth commonly remaining connate into the beak; the lower teeth narrowly lanceolate, long acuminate; corolla bud with the limb forming an enlarged orbicular tip, still imbricate and closed when extruded; *corolla* 27-42 mm. long (when fresh), white, the tube 18-30 mm. long, cylindrical, gently recurved at 35°, glabrous within and without, enlarging upwards to the throat, which is somewhat flattened laterally and 11 mm. wide; the limb 2-lipped, 5-lobed, the 2 upper lobes 7-9 mm. long, 6-7 mm. wide, oval, the 2 lateral lobes 8-10 mm. long oblong, broadly obtuse; lower lobe 9-11 mm. long, suborbicular, all lobes glabrous without, but within closely capitate glandular puberulent except near the tip, the lobes spreading at from 70° to 90° from the axis of the upper tube and throat; filaments fused to the tube to within 5 mm. of the throat, the free portion 4 mm. long, spirally upcurved; anthers 4 mm. long, obliquely ovate-deltoid, the outer cell the larger; *style* 12 mm. long, glabrous, the 2 terminal stigmatic lobes 4 mm. long, broadly oval, opposite, fused up one side $\frac{2}{3}$ way; *ovary* glabrous, lanceoloid, the basal cupulate disk obsolete; half ripe *fruit* with calyx already deciduous, this small green fruit 21 mm. long, lanceoloid, glabrous; mature fruit 25 mm. long, 15 mm. in diameter, oblong-ellipsoid, white, glabrous; seeds 0.17-0.18 mm. long, 0.09-0.10 mm. in diameter, white, ellipsoid, the surface with prominent raised cellular reticulations that are quadrangular, oblong or squarish, $\frac{1}{13}$ - $\frac{1}{15}$ as long as the seed.

Distribution: Central portion of the Koolau Range, in moist gulches in the Ohia Zone, on the windward side at 750-800 ft. alt., and on the leeward side at 1,500 ft. alt.

Holotype: Oahu: Waiahole Ditch Trail, North Fork of Waianu Stream, Waiahole, 800 ft. alt., in moist shaded gulch, March 23, 1947, *H. St. John* 22,577 (BISHOP MUS.).

Specimens Examined: Koolau Range, Windward Side: Waiahole Ditch Trail, Waiahole, wet shady gulch with Intake no. 26, at 750 ft. alt., April 29, 1956, *St. John* 25,966.

Leeward Side: Kipapa Gulch, S. ridge, E. of Puu Kamana, Waipio, 1,500 ft. alt., May 15, 1932, *St. John* 11,649.

Discussion: *C. oblanceolata* is a member of the section *Verticillatae*, and is closely related to *C. latebrosa* Hillebrand which has narrower blades, only 13-60 mm. wide, and the ovary pilose. In contrast, *C. oblanceolata* has its well developed leaves 7-10 cm. wide, and the ovary glabrous.

The new specific epithet is taken from the Latin, *ob*, inversely; *lanceolatus*, lance-shaped, in reference to the oblanceolate shape of the leaf blades.

126. *Cyrtandra perstaminodica* St. John, sp. nov. (Figs. 177, 187).

Diagnosis Holotypi: Frutex, ramulis validis 6-10 mm. diametro glabris pallide brunneis teretibus subcarnosis et in sicco contractis et sulcatis, cicatricibus 4-7 mm. altis obcordato-scutelliformibus pallidis suberosis plerumque separatis, fasciculis 7, ramulis foliosis ad 6 mm. diametro subteretibus pilosulis ad glabratis, internodis 9-35 mm. plerumque 14 mm. longis, novellis subadpresse brunneo-pilosulis, *foliis* ternatis excepta in ramulis secundariis debilibus et ad basim in ramis aliquibus inaequalibus uno $\frac{1}{8}$ minore, foliis adscendentibus subcongregatis in 4-7 nodis superis affixis, petiolis 1-6 cm. longis validis sparse brunneo-pilosulis, *laminis* 22-35 cm. longis 56-97 mm. latis chartaceis elliptico-oblanceolatis subacuminatis in basi cuneatis et decurrentibus supra obscure viridibus et inconspicue remote pilosis infra ab initio molliter brunneo-pilosulis sed deinde pilis inmanifeste in intervallis sed costa et nervis secundariis manifeste pilosulis marginibus remote calloso-serrulatis nervis secundariis 17-25 in uno latere adscendentibus arcuatis ad apices interconnectis et in serris salientibus, *cymis* axillaribus 3-7-floriferis subadpresse brunneo-pilosulis, pedunculis 2-5 mm. longis, pedicellis 1-2 mm. longis, bracteis 8-20 mm. longis foliaceis lanceolatis ad lanceo-ovatis sparse pilosulis, alabastris fusiformibus brunneo-pilosulis lobis calycis in rostro 5 mm. longo connatis, *calycibus* in flore quando bullitis 30 mm. longis (in sicco 25-27 mm.) membranaceis subviridibus in basi extra adpresse brunneo-pilosulis sed in media et parte supera minus itaque intra crebre brunneo-villosis fissura distali apicali 12-16 mm. longa scindentibus rostro bipartito in lobis 14 mm. longis (11 mm. in sicco) basi late deltoidea vel ovata et apice longiori subulato, *corollis* albis quando bullitis 27 mm. longis (in sicco 23-25 mm.) tubo 19 mm. longo infra subcylindrico in tertia supera extrusa distenta et infundibuliformi in 65° recurvato in basi 4 mm. diametro in media 3.5 mm. in orifice 7.5 mm. extra infra media glabro supra in locis circa sinibus et in nervis aliquibus et praeter in flexo infra labia infera piloso, limba inter labias 8 mm. partita, lobis superis 7 mm. longis 5 mm. latis oblique oblongo-suborbicularibus extra glabris intra crassis carnosisque capitato-glanduloso-puberulis, lobis lateralibus 9 mm. longis 6.5 mm. latis late ellipticis marginibus tenuibus extra glabris intra carnosis et capitato-glanduloso-puberulis excepta in marginibus, loba infera 8 mm. longa 5.5 mm. lata late elliptica extra glabra intra carnosae et capitato-glanduloso-puberula marginibus membranaceis, staminibus inferis binis in tubo 5 mm. ex orifice affixis parte libera 3.5 mm. longa valide subulata contorte adscendente, antheris 4 mm. longis 3 mm. latis oblique ovatis connectivo crasso 2.5 mm. lato oblique ovato, staminodiis in tubo 5 mm. ex orifice affixis eis lateralibus majoribus et parte libera subnigri 2 mm. longa subcontorta antheroidea 1 mm. longa alba complanata late ovata vel cordata, *stilo* 6 mm. longo valido filiformi ad apicem subpiloso, lobis stigmatis binis 3.5 mm. longis obovatis in latere proximo glabro $\frac{2}{3}$ connatis, *ovario* 7 mm. longo anguste lanceoloideo glabro in basi disco cupulato 1.3-1.7 mm. alto cincto, fructibus incognitis.

Description of All Specimens: Shrub; branchlets stout, 6-10 mm. in diameter, pale brownish, glabrous, terete, somewhat fleshy and on drying shrinking to form numerous shallow furrows and narrow ridges; leaf scars 4-7 mm. high, obcordate-shield-shaped, mostly distinct, pale, corky; bundle scars 7; leafy branchlets as much as 6 mm. in diameter, subterete, sparsely pilosulous to glabrate; internodes 9-35 mm., averaging 14 mm. long; young shoots subappressed brown pilosulous; *leaves* in whorls of 3 above and on the main and strong branches but on some opposite below and on weak secondary branchlets, ascending, moderately crowded, borne at the 4-7 upper nodes, unequal, one at a node being about $\frac{1}{8}$ smaller; petioles 1-6 cm. long, stout, sparsely brownish pilosulous; *blades* 22-35 cm. long, 56-97 mm. wide, chartaceous, elliptic oblanceolate, at base long cuneate and decurrent, apex subacuminate, above dark green and inconspicuously distant pilose, below at first softly brownish pilosulous but later the hairs noticeable only on the midrib and laterals and but scarcely noticeable on the intervals, the margins remotely depressed callous serrulate, the secondary veins 17-25 on a side, ascending arcuate, the tips inarched interconnecting and salient in the teeth; *cymes*

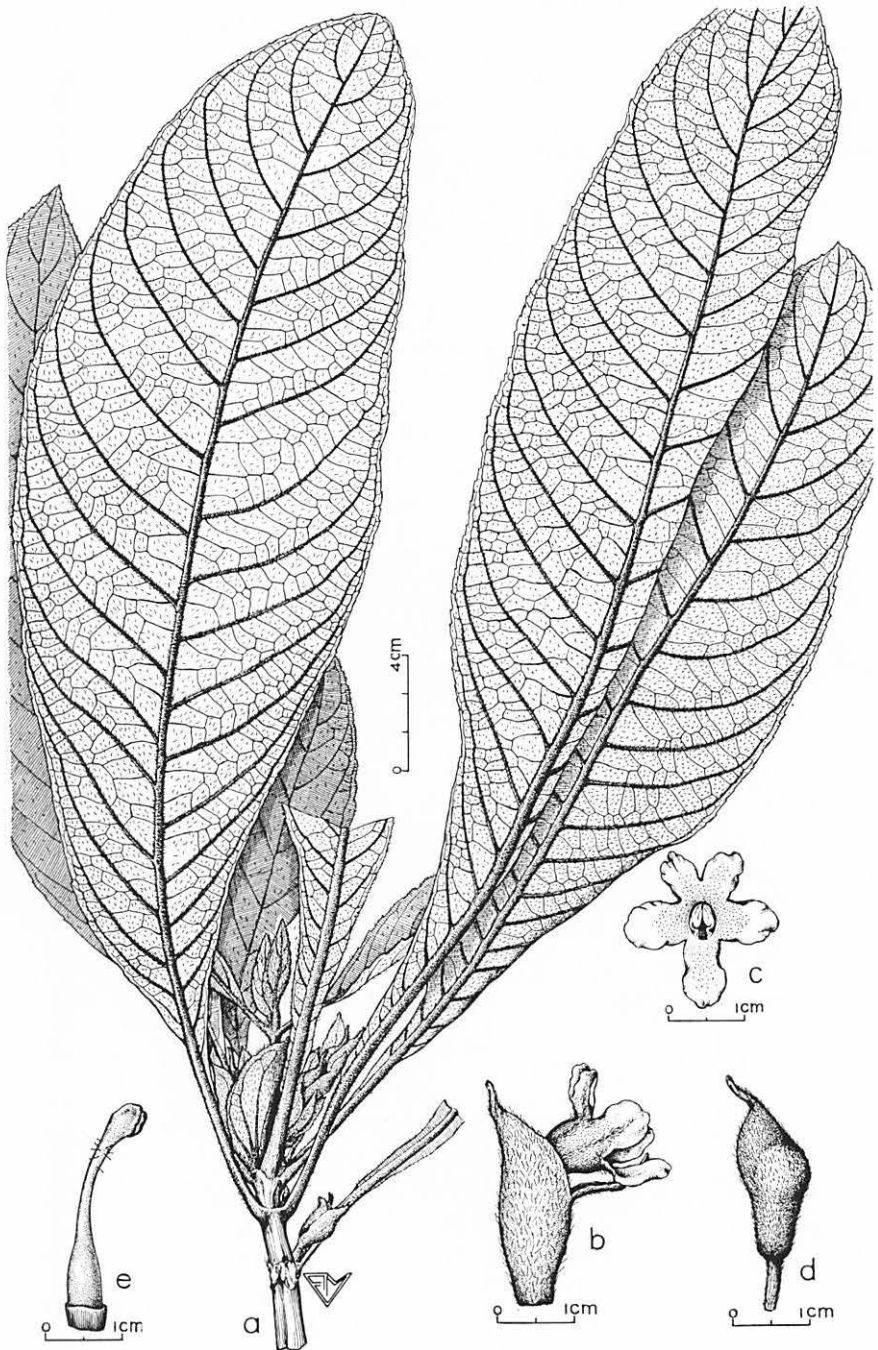


FIGURE 177.—*Cyrtandra perstaminodica*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$. Kipapa Gulch, Storey 216A, holotype (Bishop Mus.).

axillary, 3-7-flowered, subappressed brownish pilosulous; peduncles 2-5 mm. long; pedicels 1-2 mm. long; bracts 8-20 mm. long, foliaceous, lanceolate to lance-ovate, sparsely pilosulous; buds fusiform, brownish pilosulous, the calyx lobes fused into a beak 5 mm. long; *calyx* in anthesis when boiled 30 mm. long (when dried 25-27 mm. long), membranous, greenish, at base appressed brown pilosulous without and on the middle and upper parts sparsely so, within shaggy brown villous, opening by a distal slit from the apex running down 12-16 mm., the upturned apical beak parted into two lobes 14 mm. long (11 mm. when dried), these with a broadly deltoid or ovate base ending in a longer subulate tip; *corolla* white, when boiled 27-32 mm. long (when dried 23-30 mm. long), the tube 19 mm. long, subcylindric below, expanded and funnellform in the upper third, decurved at 65° from the axis of the lower throat and the upper third protruded from the calyx, at the base 4 mm. in diameter, at the middle 3.5 mm., at the throat 7.5 mm., without glabrous below the middle, above it pilose in patches below the sinuses, on some of the nerves and especially on the curve just below the lower lip, parted 8 mm. between the lips; upper lobes 7 mm. long, 5 mm. wide, obliquely oblong-suborbicular, without glabrous, within thick and fleshy and capitate glandular puberulous; lateral lobes 9 mm. long, 6.5 mm. wide, broadly elliptic, the margin thin, without glabrous, within except for the margin fleshy thickened and capitate glandular puberulous; lower lobe 8 mm. long, 5.5 mm. wide, broadly elliptic, the margin membranous, without glabrous, within fleshy thickened and capitate glandular puberulous; two lower stamens fertile, with filaments adnate to the corolla to within 5 mm. of the throat, the free portion 3.5 mm. long, stout subulate, spirally upcurved, the two perfect anthers 4 mm. long, 3 mm. wide, obliquely ovate, the heavy connective 2.5 mm. wide, obliquely ovate; the staminodia with filaments adnate to the corolla tube to within 5 mm. of the throat, the two lateral ones enlarged and with dark, stout, subulate filaments 2 mm. long, gently spiralling, bearing an abortive anther 1 mm. long, white, flat, broadly ovate or cordate; *style* 6 mm. long, stout filiform, sparsely pilose at the apex; two stigmatic lobes 3.5 mm. long, obovate, connate $\frac{2}{3}$ way up the proximal side, glabrous on the back; *ovary* 7 mm. long, narrowly lanceoloid, glabrous, surrounded at base by a dark, fleshy cupulate disk 1.3-1.7 mm. high; *fruit* when dried 21-24 mm. long, 6-8 mm. in diameter, lance-ellipsoid; seeds 0.26-0.29 mm. long, 0.14-0.19 mm. in diameter, pale honey-colored, broadly ellipsoid, with short brown apiculations at either end, the body covered with raised, cellular, broad polygonal reticulations $\frac{1}{2}$ as long as the seed.

Distribution: Koolau Range on both windward and leeward sides at 900 feet altitude or more, in the Ohia Zone.

Holotypus: North Fork of Kipapa Gulch, Waipio, Nov. 13, 1932, *W. B. Storey 216A* (BISHOP MUS.).

Specimens Examined: Koolau Range, Windward Side: Waikane-Schofield Trail in Waikane Valley, in small ravine at about 900 ft., May 10, 1931, *Storey 132*.

Discussion: *C. perstaminodica* is a member of the section *Verticillatae*. Its closest relative, *C. ellipticifolia* has its branchlets brownish villous; leafy branchlets densely shaggy brownish villous; petioles shaggy brownish villous; blades below with the intervals softly puberulous, the midrib and laterals spreading pilose, secondary veins 10-12 on a side; peduncles 12 mm. long; pedicels 11-17 mm. long; calyx densely shaggy brownish pilose without and within; corolla 21 mm. long, 4 mm. in diameter at the throat, without shaggy white villous, the upper lobes 3.8 mm. long, the lower lobe 5.5 mm. long, suborbicular; lateral staminodia with filaments minute, pale, free for 0.3 mm.; and the style glabrous. *C. perstaminodica* differs by having the branchlets gla-

brous; leafy branchlets sparsely pilosulous to glabrate; petioles sparsely pilosulous; blades below pilosulous on the principal nerves and almost imperceptibly so on the intervals, secondary veins 17-25 on a side; peduncles 2-5 mm. long; pedicels 1-2 mm. long, calyx at base appressed brown pilosulous without and on the middle and upper parts sparsely so, within shaggy brown villous; corolla 27-32 mm. long, 7.5 mm. in diameter at the throat, without the tube pilose on a few spots below the lobes; upper lobes 7 mm. long; lower lobe 8 mm. long, broadly elliptic; lateral staminodia with free part of the filaments dark, stout, 2 mm. long; and the style sparsely pilose at the apex.

The new specific name is coined from the Latin, *per*, very or strongly; *staminodium*, an abortive stamen.

127. *Cyrtandra plurifolia* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6) : 83, 1950. (Figs. 178, 179, 190.)

Description of Holotype: Erect shrub 1-2 m. tall, few branched; branches brownish to pale gray, glabrate, smooth; leaf scars 2.5-3.5 mm. high, low shield-shaped, corky, pale; bundle scars 5; internodes 2-5.5 cm. long; leafy branches subquadrangular, reddish pilose to subglabrate, 4 mm. in diameter below the lowest leaves, bearing about 4-5 whorls of divergent-ascending, well-spaced leaves; young shoots marked by a dense ferruginous pilose coating; *leaves* whorled, 3 at a node, at each node the leaves unequal, with two smaller ones alike and one about $\frac{1}{4}$ larger; petioles 2-6 cm. long, slender, subterete, ferruginous spreading pilose; *blades* 11-15 cm. long, 40-62 mm. wide, oblanceolate, at apex acute or subacuminate, the base cuneate and slender tapering, the blade slightly asymmetric and the two halves of the blade perceptibly unequal, chartaceous, above when fresh dark green, and remotely crinkly rusty pilose, below whitish green, and rusty pilose especially on the veins, the margin entire on the tapering base, but the rest low callous apiculate serrate, the teeth becoming larger towards the apex; principal lateral veins 6-9 on a side, ascending and gently upcurved, the tips arched and interconnecting; *cymes* from the leaf axils, ferruginous pilose, 2-flowered, peduncle 15 mm. long, ascending; pedicels in anthesis 13 mm. long; bracts 15 mm. long, lanceolate, foliaceous; buds unknown; *calyx* in anthesis when fresh 26 mm. long (20 mm. when dried), pale greenish, the outer surface soft pilose, narrowly campanulate with ascending lobes, definitely 2-lipped, the suture between the lips cut down 16 mm.; upper lip with 3 connivent lobes 13 mm. long, subulate; lower lip with 2 lobes 17 mm. long, narrowly lanceolate, attenuate, the calyx within pilose almost to the base; *corolla* 35 mm. long (30 when dried), white, more or less glandular pilosulous on the exposed parts, tube 22-25 mm. long, 4 mm. in diameter at base, 7 mm. at the middle, 9 mm. at the throat vertically, 7 mm. laterally, the tube subcylindric, narrowed to the straight basal 10 mm. section, the upper part deflected at 50° and thus protruded between the two lower calyx lobes, the throat enlarged, shaggy pilose without; limb 2-lipped; upper lip with the lobes 2, diverging at 70° to the axis of the upper throat, 8 mm. long, 9.5 mm. wide, broadly cordate, the basal auricles overlapping, within sparsely glandular puberulent, without glandular pilosulous towards the base, the margin ciliate below the middle; lower lip of 3 lobes, spreading at 80°, similarly pubescent and ciliate, the 2 lateral lobes 11 mm. long and wide, ovate-suborbicular, the lowest lobe 9 mm. long, 11 mm. wide, depressed ovate-suborbicular; 2 lower stamens perfect, the filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 3.5 mm. long, terete, spirally upcurved; the 2 perfect anthers 3 mm. long, 2.5 mm. wide, slightly obliquely oval, connate at apex; upper staminodium 1 mm. long, subulate; two lateral staminodia 2.5 mm. long, subulate; the apex dilated; *style* 4 mm. long, stout, very short, at apex capitate glandular pilose, 2 stigmatic lobes 3 mm. long, 2.2 mm. wide, oblong oval, cleft



FIGURE 178.—*Cyrtandra plurifolia*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, pistil, $\times 2$. Pupukeya-Kahuku Trail, Ohia Ai Gulch, St. John 20,222, holotype (Bishop Mus.).

down $\frac{2}{3}$ way equally on both sides; ovary 10 mm. long, narrowly lanceoloid, glabrous, the base surrounded by a collarlike disk 1.5 mm. high; fruit unknown.

Distribution: Koolau Range, at the north end, Ohia Zone, 1,300 feet altitude, known only from the type collection.

Holotype: Oahu, Koolau Range, Pupukea-Kahuku Trail, Ohia Ai Gulch, Kahuku, 1,300 ft. alt., moist wooded gulch, only one seen, April 6, 1941, *H. St. John 20,222* (BISHOP MUS.).

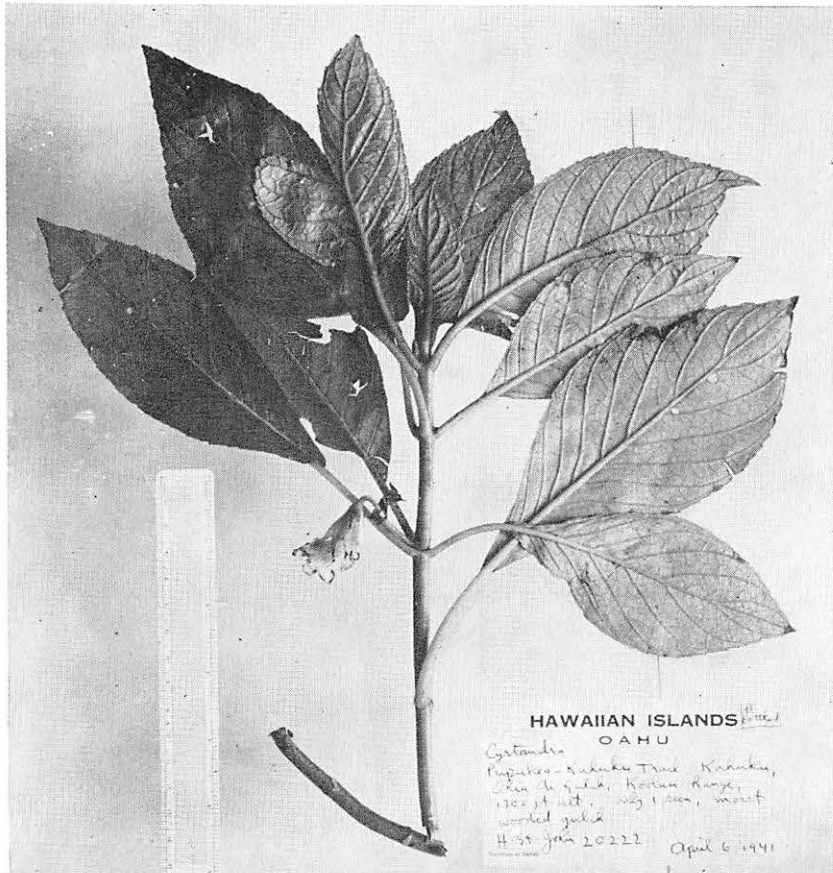


FIGURE 179.—*Cyrtandra plurifolia*, Kahuku, St. John 20,222, holotype (Bishop Mus.).

Discussion: *C. plurifolia* is a member of the section *Verticillatae*. The closest relative is *C. crenata* St. John & Storey. Besides the key characters given, that species differs in shorter, more winged leaf bases, more linear calyx lobes, narrower corolla lobes, longer and more hairy style, and larger, unequally cleft stigmatic lobes.

There is a collection, apparently of this species, with doubtful data: Oahu, W. slope at 1,200 ft., April 6, 1930, *Nitta* (*Degener 7,567*) (NY).

The new name, coined in allusion to the several leaves at a node, comes from the Latin *pluris*, more, and *folium*, leaf.

128. *Cyrtandra sessilis* St. John & Storey, B. P. Bishop Mus., Occ. Papers 20 (6): 84, 1950. (Figs. 180, 181, 185.)

Description of All Specimens: Shrub 0.5-1 m. tall, erect and bushy branched; branches pale brown, corky; leaf scars 2.5-3 mm. high, depressed shield-shaped; bundle scars 5; internodes 13-85 mm., averaging 25 mm. long; leafy branchlets 4-7 mm. in diameter, thick and fleshy, pale, promptly glabrate, only the youngest tips being brown pilose; *leaves* ternate, well-spaced, subequal, ascending at about 45° to stem, sessile; *blades* 8-20 cm. long, 20-64 mm. wide, firm and thick chartaceous, the basal third oblong or cuneate-oblong, 5-20 mm. wide, the base auriculate or rounded, the outer $\frac{2}{3}$ oblanceolate, the margin entire throughout or minutely denticulate towards the tip, the tip sub-acuminate to the obtuse apex or, on small and reduced leaves, merely acute, the upper surface dark green, glabrous except for the midrib which is brown pilosulous at first, but later glabrate, the lower surface pale green, at first sparsely brown appressed pilosulous on the surface but early glabrate, the raised midrib and principal veins densely appressed brown pilosulous; *cymes* 3-8-flowered, axillary, in flower in the upper axils, in fruit in the lower; peduncles 1-7 mm. long, densely subappressed brown pilose; bracts 4-9 mm. long, foliaceous, lance-linear to almost linear, sparsely brown pilose; pedicels 3-10 mm. long, subappressed brown pilose; buds fusiform, the lobes connivent and connate; *calyx* caducous, in anthesis, when fresh 20-22 mm. long (or when dried shrivelling to 14-27 mm. long and 6-7 mm. in diameter), 8-9 mm. in diameter, firm chartaceous pale, glabrous or subglabrous throughout or pilose only at the very base, or very rarely pilose at anthesis, lance-ellipsoid, obtusely angled below the lobes and channeled below the sinuses, 2-lipped, the lower 2-cleft $\frac{2}{3}$ way into broadly deltoid-lanceolate lobes, the upper 3-cleft into connivent, subulate lobes 2-3 mm. long, calyx glabrous within; *corolla* when fresh 28-35 mm. long, the tube 5-7 mm. in diameter, 15-24 mm. long and at its middle deflected at about 45° and thus sharply twisted down from the calyx, the tube glabrous without and within, the lower part straight, lance-cylindric, the upper part funnelliform, the throat open, the limb glabrous without but within capitate glandular pilosulous, 2-lipped, the 2 upper lobes 3-4.5 mm. long, semi-orbicular, spreading at about 40° from the line of the throat, the lower lip of 3 lobes, the middle one the largest, 8-10 mm. long, semi-orbicular, descending at about 70°, the two lateral lobes 4-7 mm. long, oblong-suborbicular, spreading at 40°, the lobes all capitate glandular pilosulous within as is the throat; filaments fused to the corolla tube to within 7 mm. of the throat, the free portion 5 mm. long, spirally incurved; anthers 3.2 mm. long, obliquely ovate, connate at the apiculate tip; *style* 7 mm. long, terete, stout, glabrous; stigma 5 mm. long, flat, obcordate, the apical sinus only 0.5 mm. deep; *ovary* linear-lanceoloid glabrous; *berry* 15 mm. long, 8 mm. in diameter, ellipsoid, white; seeds 0.42-0.46 mm. long, 0.17-0.20 mm. wide, ellipsoid straw-colored, each end with a broad yellowish umbo, the surface with a raised reticulation, the meshes nearly regular hexagonal, about 0.07 mm. in diameter, the perfect seeds few, about 99% of the seeds shriveled and abortive.

Distribution: Koolau Range, windward side, in Ohia Zone and Cloud Zone, at 1,600 to 2,000 feet altitude.

Holotype: Oahu: Kahana, Waikane-Schofield Trail, thicket on upper wind-swept slopes, 2,000 ft., May 18, 1941, *H. St. John & W. B. Storey 20,241* (BISHOP MUS.).

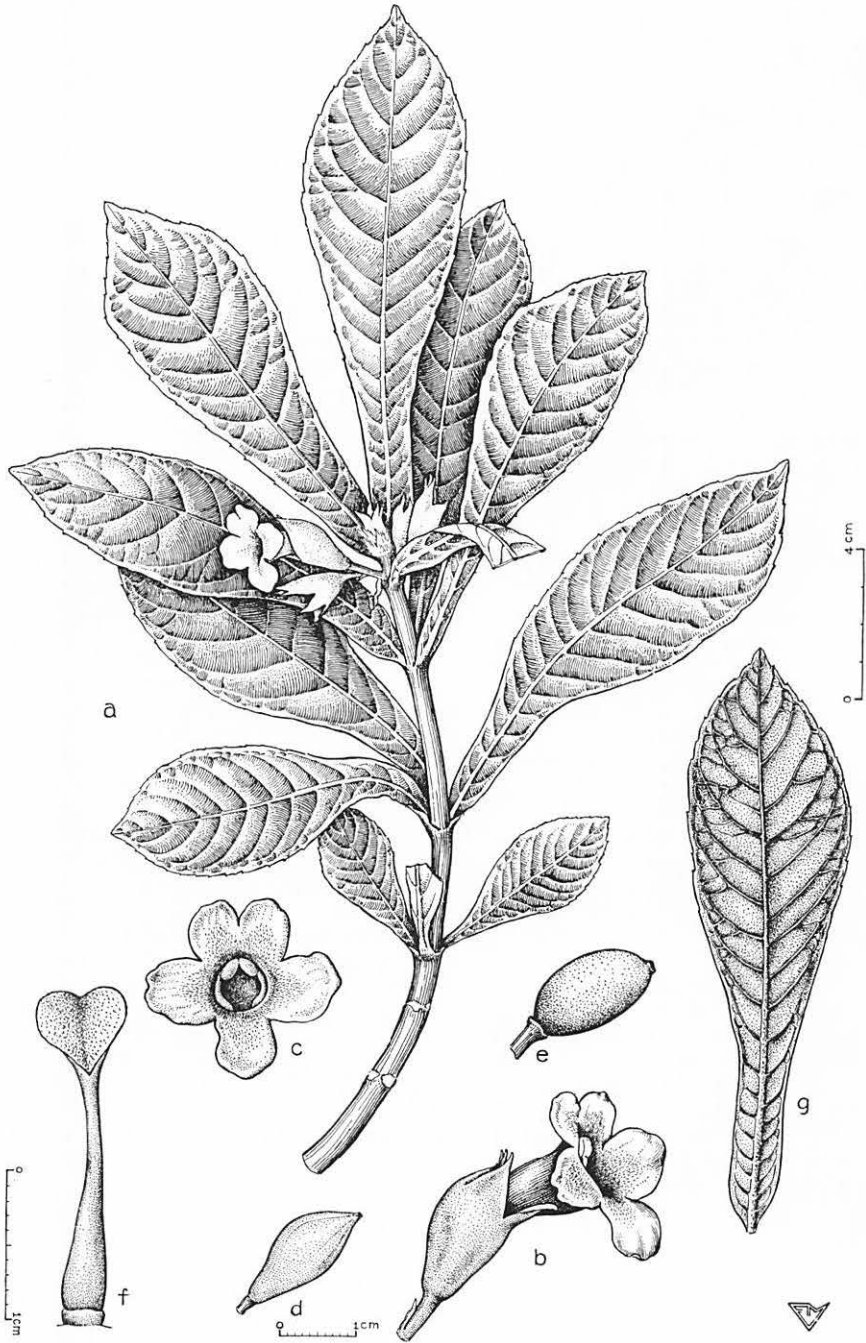


FIGURE 180.—*Cyrtandra sessilis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, fruit, $\times 1$; f, pistil, $\times 2$; g, leaf, $\times \frac{1}{2}$. Waikane-Schofield Trail, Kahana, St. John and Storey 20,241, holotype (Bishop Mus.).



FIGURE 181.—*Cyrtandra sessilis*, Waikane-Schofield Trail, Kahana, Storey 267.

Specimens Examined: Koolau Range.

Windward Side: Kahana Valley, head of, Koolau Mts., Waikane-Schofield Trail, wet forest, steep slope, 600 m. alt., Nov. 10, 1935, *Fosberg 12,322*; ditto, *Fosberg 12,323A*; ditto, elev. 1,600 ft., wooded slope, low shrub, April 17, 1932, *Hume 536*; ditto, 1,600 ft. alt., May 18, 1941, *Kawahara*; ditto, 2,100 ft. alt., shaded stream bank, Jan. 19, 1930, *St. John 10,150*; ditto, high ridge, Sept. 17, 1926, *Skottsberg 1,832*; ditto, 1,800-2,000 ft., common in woods, April 17, 1932, *Storey 180*; ditto, 1,800 ft. elev., May 6, 1934, *Storey 267*; ditto, 1,600 ft., rocky wet ridge, May 18, 1941, *C. Wong* (in part, mixed with *C. calpidicarpa*). The following was doubtless from the Waikane-Schofield Trail in Kahana, though the brief temporary labeling states merely, Waikane, 2,000 ft., Oct. 16, 1932, *Storey 194*.

Discussion: *C. sessilis* is a member of the new section *Verticillatae*. Its leaves are always in whorls, and as indicated by the abundant specimens, they are always three at a node. The branchlets are unusually fleshy, so much so that Fosberg noted the habit as herbaceous. This tendency is confirmed by the large shrinkage of the young branchlets on drying. However, the branches all contain abundant woody tissue, and on drying are seen to be definitely fruticose.

The most similar known relative is *C. longifolia* Hillebrand var. *degenerans* C. B. Clarke forma *auriculaefolia* Rock, of Honokawai Gulch, western Maui. This has the calyx thin, submembranous, cleft into linear-lanceolate, long acuminate lobes, and the leaves are quaternate.

C. sessilis has the calyx firm chartaceous, funnellform strongly 2-lipped, cleft $\frac{1}{3}$ way into deltoid, acute lobes, and the leaves are ternate.

The *Skottsberg 1,832* specimen from high ridge above Kahana, seems correctly placed here because of the oblong leaf bases. The calyx is more hairy, being definitely pilose, instead of early glabrate, as is usual. This number was distributed with a manuscript varietal name under *C. paludosa* Gaudichaud. This name is as yet unpublished and now has apparently been retracted, as in 1936 (p. 177) Skottsberg listed this number as straight *C. paludosa*.

129. *Cyrtandra subrecta* St. John, sp. nov. (Figs. 182, 190).

Diagnosis Holotypi: Frutex 1 m. alta, ramulis 8-10 mm. diametro glabris laevibus pallide brunneis carnosus et in sicco contractis et sulcatis, cicatricibus 3-5 mm. altis distinctis scutelliformibus pallidis suberosis, fasciculis 5, novellis dense adpresse brunneo-pilosulis, ramulis foliferis 3-5 mm. diametro subquadrangularibus adpresse pilosis ad subglabratibus, internodis 18-47 mm. plerumque 27 mm. longis, foliis ternatis adscendentibus in 4-5 nodis superis affixis, petiolis 10-14 mm. longis adpresse brunneo-pilosulis, laminis 20-22 cm. longis 50-90 mm. latis crasse chartaceis late elliptico-oblongatis acuminatis in basi gradatim cuneatis et longe decurrentibus supra obscure viridibus apparente glabris sed veriter remote pilosis infra albi-viridibus in nervis adpresse pilosulis in intervallis remotiore et minute adpresse pilosulis marginibus depresso crenatis nervis secundariis 10-12 in uno latere adscendentibus arcuatis interconnectis et in dentibus salientibus, cymis 3-5-floriferis adpresse brunneo-pilosulis, pedunculis 5-8

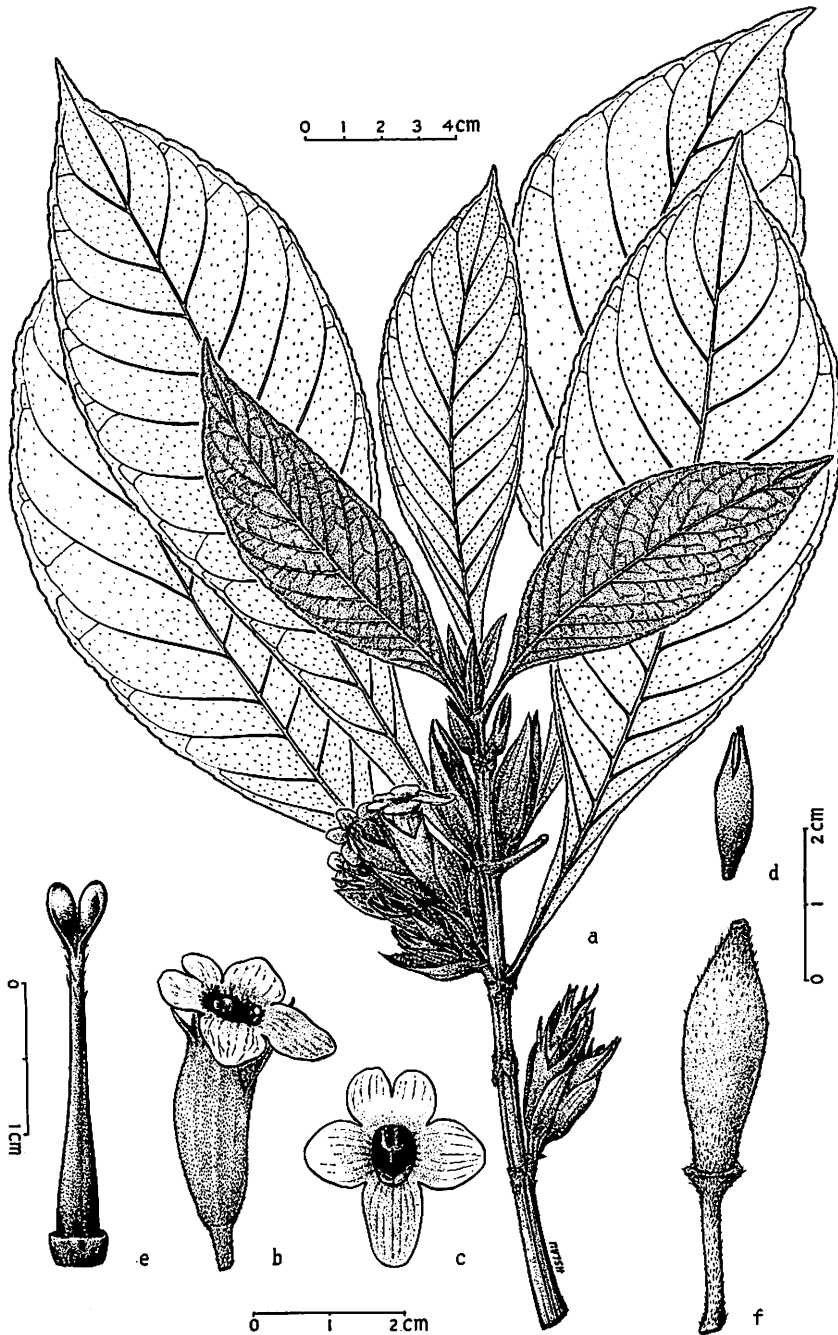


FIGURE 182.—*Cyrtandra subrecta*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, fruit, $\times 1$. Kipapa Gulch, Hosaka 587, holotype (Bishop Mus.).

mm. longis, pedicellis 8-12 mm. longis, bracteis 25-30 mm. longis foliaceis lanceolatis caducis, alabastris fusiformibus, *calycibus* in flore quando bullitis 37 mm. longis (in sicco 36 mm.) viridibus chartaceis post flore caducis extra in basi brunneo-pilosulis sed in partibus alteris sparse brunneo-pilosulis intra tubo et basibus lobarum dense brunneo-pilosulis apicibus lobarum sparsissime brunneo-pilosulis bilabiatis inter lobas 15 mm. partitis tubo 22 mm. longo oblanceoloideo, lobis superis 15 mm. longis in basi 3.5 mm. latis lineari-lanceolatis apice multo longiore subulato uninervato, lobis inferis binis 13 mm. longis 5 mm. latis basi oblique lanceolata longiori quam apice subulato, *corollis* quando bullitis 37 mm. longis (in sicco 35 mm.) albis tubo 28 mm. longo subcylindrico in basi mediaque 7 mm. diametro in orifice 12 mm., tubo extra glabro excepta proxima orifice sparse piloso intra glabro in media gradatim in 15° deflexis, lobis superis 7 mm. longis 8 mm. latis suborbicularibus extra glabris intra ex orifice ad median capitato-glanduloso-puberulis, lobis lateralibus 7 mm. longis 8.5 mm. latis obliquissime transverse ovalibus extra glabris intra itaque puberulis, loba infera 11 mm. longa 10 mm. lata ovali-suborbiculari extra glabri intra capitato-glanduloso-puberula, staminibus inferis binis perfectis in tubo 8 mm. ex orifice adnatis partibus liberis 4 mm. longis contorte adscendentibus, antheris 4 mm. longis oblique ovoideis connectivo 3 mm. longo oblique ovato, staminodiis binis lateralibus in tubo 7 mm. ex orifice affixis partibus liberis 0.5 mm. longis apice 0.3 mm. longo pallido subulato, *stylo* 11 mm. longo crasse subulato ad apicem sparse piloso, lobis binis stigmatis 5 mm. longis obovatis glabro in latere proximo $\frac{1}{3}$ connatis, *ovario* 10 mm. longo lineari-lanceoloideo glabro in basi disco cupulato 1.5 mm. alto cincto, *baccis* in sicco 37 mm. longis 12 mm. diametro albis anguste lanceo-ellipsoideis, seminibus 0.31-0.38 mm. longis 0.14-0.17 mm. diametro pallide citri-coloratis ellipsoideis superfcie reticulis elevatis cellulosis polygonatis isodiametricis $\frac{1}{4}$ - $\frac{1}{7}$ longis quam seminam.

Description of Holotype: Shrub 1 m. tall; branchlets 8-10 mm. in diameter, glabrous, smooth, pale brown, fleshy and on drying shrinking to form many longitudinal furrows and ridges; leaf scars 3-5 mm. high, shield-shaped, separate, pale, corky; bundle scars 5; young shoots densely appressed brown pilosulous; leafy branchlets 3-5 mm. in diameter, subquadrangular, appressed pilose to subglabrate; internodes 18-47 mm., averaging 27 mm. long; *leaves* ternate, ascending, borne at the 4-5 upper nodes; petioles 10-14 mm. long, appressed brown pilosulous; *blades* 20-22 cm. long, 50-90 mm. wide, thick chartaceous, broadly elliptic-oblanceolate, the apex acuminate, the base gradually cuneate and long decurrent, above dark green, appearing glabrous but very remotely pilose, below whitish green, appressed pilosulous on the veins and very remotely and minutely so on the intervals, the margin remotely low crenate, the lateral veins 10-12 on a side, ascending, arcuate, inarched interconnecting and salient in the teeth; *cymes* 3-5-flowered, appressed brown pilosulous; peduncles 5-8 mm. long; pedicels 8-12 mm. long; bracts 25-30 mm. long, foliaceous, lanceolate, caducous; buds fusiform; *calyx* in anthesis when boiled 37 mm. long (36 mm. when dried), the tissue green, chartaceous, caducous from the young fruit, on the outside brownish pilosulous at base but above it only sparsely so, within the tube and the base of the lobes densely brownish pilosulous, the tips of the lobes very sparsely so, cleft 15 mm. between the lobes, 2-lipped, the tube oblanceoloid, 22 mm. long; three upper lobes 15 mm. long, the base 3.5 mm. wide linear-lanceolate, much exceeded by the subulate, 1-nerved tip; two lower lobes 13 mm. long, 5 mm. wide, the base obliquely lanceolate, longer than the subulate apex; *corolla* 37 mm. long when boiled (35 mm. when dried), white, the tube 28 mm. long, subcylindric, 7 mm. in diameter at base and middle, 12 mm. at the throat, the tube without glabrous elsewhere but towards the apex sparsely pilose, within glabrous, gently deflexed at the middle at 15° to the axis of the lower tube; two upper lobes 7 mm. long, 8 mm. wide, suborbicular, without glabrous, within capitate glandular puberulous from the throat to the middle; lateral lobes 7 mm. long, 8.5 mm. wide, very obliquely transversely oval, without glabrous, within capitate glandular puberulous from the throat to above the middle; lower lobe 11 mm. long, 10 mm. wide, oval-suborbicular, without glabrous, within capitate glandular puberulous; two perfect stamens adnate to

the corolla tube to within 8 mm. of throat, free portions of the filaments 4 mm. long, spirally upcurved; anthers 4 mm. long, obliquely ovoid; connective 3 mm. long, obliquely ovate; two lateral staminodia with filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 0.5 mm. long, the pale subulate tip 0.3 mm. long; *style* 11 mm. long, thick subulate, sparsely pilose near the tip; two stigmatic lobes 5 mm. long, obovate, connate $\frac{1}{2}$ way up the proximal side, glabrous on the back; *ovary* 10 mm. long, linear-lanceoloid, glabrous, surrounded at base by a dark cupulate disk 1.5 mm. high; *berry* when dried 37 mm. long, 12 mm. in diameter, white, narrowly lance-ellipsoid; seeds 0.31-0.38 mm. long, 0.14-0.17 mm. in diameter, pale lemon-colored, ellipsoid, the body covered with raised cellular polygonal isodiametric reticulations $\frac{1}{6}$ - $\frac{2}{7}$ as long as the seed.

Distribution: Koolau Range, leeward side, in moist gulch at 1,200 ft. alt., in the Ohia Zone.

Holotypus: Koolau Range, Waipio, Kipapa Gulch, 2nd N. fork, moist gulch, 1,200 ft. el., June 26, 1932, E. Y. Hosaka 587 (BISHOP MUS.).

Discussion: *C. subrecta* is a member of the section *Verticillatae*. It seems to be more closely related to *C. ternata* which has the leaf scars connected and annular; blades 29-54 mm. wide, oblanceolate, above glabrate, the margin low serrate; cymes appressed sericeous; calyx 22-26 mm. long, lobed $\frac{2}{3}$ way to base, glabrous within; corolla 30-34 mm. long, the tube 20-23 mm. long, deflected at 40°, the exposed parts shaggy pilose outside; lateral lobes 11-12 mm. long; style hirsute throughout; and the berry 15-23 mm. long, oblong- or ovoid-ellipsoid. *C. subrecta* has the contrasting characters: leaf scars separate; blades 50-90 mm. wide, broadly elliptic-oblanceolate, above remotely pilosulous, the margin remotely low crenate; cymes appressed pilosulous; calyx 37 mm. long, lobed $\frac{2}{5}$ way to base, densely pilosulous within; corolla 37 mm. long, the tube 28 mm. long, deflected at 15°, glabrous without except on spots near base of corolla lobes, where pilose; lateral lobes 7 mm. long; style sparsely pilose near tip; and the berry 37 mm. long, narrowly lance-ellipsoid.

The specific name is coined from the Latin *sub*, somewhat so; *recta*, straight, in allusion to the nearly straight corolla tube.

130. *Cyrtandra ternata* St. John, sp. nov. (Figs. 183, 190).

Diagnosis Holotypi: Frutex 1-1.5 m. alta adscendens pluriramosa, ramis 1.5 cm. diametro teretibus laevibus pallide brunneis, cicatricibus 2-2.5 mm. altis anguste deltoideo-lunatis interconnectis et annularibus pallidis prominentibus, fasciculis 5, internodiis 12-65 mm. plerumque 20 mm. longis, ramis foliosis teretibus 3-7 mm. diametro viridibus et carnosus adpresse vel adscendenter olivaceo-brunneo-pilosis, 5-8 nodis superis foliosis, *foliis* ternatis adscendentibus subaggregatis, novellis nitentibus cum pilis lucidis olivaceo-brunneis, petiolis 15-48 mm. longis adpresse olivaceo-brunneo-pilosulis sed in senectute pilis paucioribus, *laminis* 11-21 cm. longis 29-54 mm. latis oblanceolatis in basi cuneata et decurrenta in apice acuto vel raro subacuminato molliter carnosus-chartaceis supra obscure viridibus glabris infra albescentibus in juvente minute pallide puberulis deinde glabratis nerva media et nervis lateralibus principalibus adpresse brunneo-pilosulis marginibus depresso serratis nervis secundariis 9-13 in uno latere adscendentibus curvatis et in serris excurrentibus, *cymis* axillaribus 3- (raro 1-)-floriferis adpresse olivaceo-brunneo-sericeis adscendentibus deinde reflexis, pedunculis 5-12 mm. longis, pedicellis 7-13 mm. longis, bracteis 2-6 mm. longis lanceolatis caducis foliaceis sed adpresse

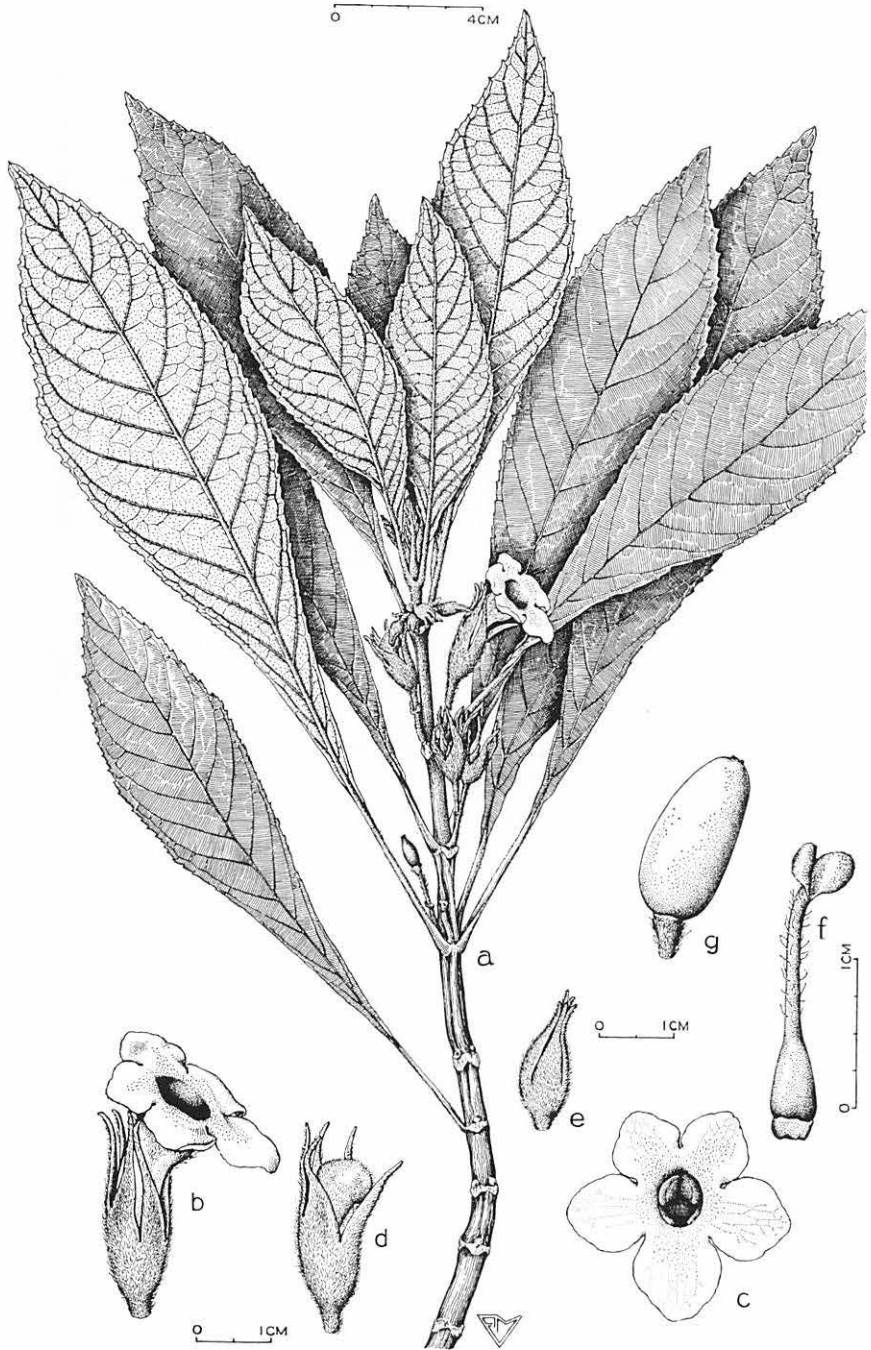


FIGURE 183.—*Cyrtandra ternata*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, e, bud, $\times 1$; f, pistil, $\times 2$; g, fruit, $\times 1$. Poamoho Stream, St. John 23,558, holotype (Bishop Mus.).

olivaceo-brunneo-pilosulis, alabastris valde reflexis lanceo-fusiformibus clausis, *calycibus* 22-26 mm. longis (in vivo) viridibus et foliaceis extra adscende olivaceo-brunneo-pilosulis etiam densiore ad basim intra glabris anguste campanulatis $\frac{2}{3}$ lobatis tubo 8-9 mm. longo semiellipsoideo inter labiis 11-15 mm. partitis, labia supra trilobata 12-14 mm. partita lobis lineari-lanceolatis acuminatis decurvatis, labia infera bilobata 15-16 mm. partita lobis lineari-lanceolatis acuminatis, *corollis* 30-34 mm. longis (in vivo) albis tubo 20-23 mm. longo in media 4 mm. diametro in orifice 4 mm. diametro subcylindrico in media in 40° deflexo extra ad basim glabro sed partibus albo-crebro-piloso intra glabro, limbo divergenti 2-labiato 5-lobato lobis extra pilosis excepta ad margines, lobis superis binis 7-8 mm. longis 8 mm. latis ovato-suborbicularibus obtusis intra capitato-glanduloso-puberulis excepta ad margines, labia infera trilobata lobis in 60° divergentibus marginibus erosis intra dense capitato-glanduloso-puberulis excepta ad margines, lobis lateralibus 11-12 mm. longis 11 mm. latis obtusis rhombico-ellipticis, loba infera 13 mm. longa 12 mm. lata ovato-suborbiculari obtusa, staminibus binis distantibus perfectis in tubo 7 mm. ex orifice adnatis parte libera 3 mm. longa filiforme contorte adscendente, antheris 2.5 mm. longis asymmetrico-ovalibus compressis, staminodeis lateralibus 1.5 mm longis subulatis, staminodeo supero 0.7 mm. longo subulato, *style* 12 mm. longo valide filiformi sparse hirsuto, lobis stigmatis binis 3 mm. longis late ovalibus obtusis in latere proximali $\frac{2}{3}$ connatis glabris, *ovario* 5 mm. longo lanceoloideo glabro in basi cum disco cupulato 1.2 mm. alto cincto, *baccis* 15-23 mm. longis 8-12 mm. diametro oblongo-ellipsoideis vel ovoideo-ellipsoideis albis nudatis a calycibus caducis, seminibus 0.43-0.56 mm. longis 0.17-0.18 mm. latis fusiformibus olivaceo-brunneis reticulis superficeis validis quadratis vel polygonatis isodiametricis quam semine $\frac{1}{7}$ ad $\frac{1}{6}$ longis.

Description of Holotype: Shrub 1-1.5 m. tall, ascending, several times branched; stem 1.5 cm. in diameter, terete, smooth, pale brownish; leaf scars, 2-2.5 mm. high, shallow narrow triangular lunate, laterally connected and thus annular, pale, raised; bundle scars 5; internodes 12-65 mm., but usually about 20 mm. long; leafy branches terete, 3-7 mm. in diameter, green and fleshy, with olive brown, appressed or ascending pilosity; shoots with 5-8 whorls of 3 equal, ascending, rather crowded *leaves*; young shoots covered with dense, glistening, olive-brown pilosity; petioles 15-48 mm. long, appressed olive brown pilosulous, though the pubescence diminishing with age and scanty on the oldest petioles; *blades* 11-21 cm. long, 29-54 mm. wide, oblanceolate, the base tapering cuneate and decurrent, the apex acute or less frequently subacuminate, texture soft fleshy chartaceous, above dark green, glabrous, below whitish, the surface in youth minutely pale puberulous, later glabrate, the midrib and stronger laterals appressed brown pilosulous, the margin low serrate, the principal lateral veins 9-13 on a side ascending upcurved, the tips excurrent at the serrations; *cymes* from the leaf axils 3- (or rarely 1-) flowered, olive brown, appressed sericeous, at first ascending, later reflexed; peduncles 5-12 mm. long; pedicels 7-13 mm. long; bracts 2-6 mm. long, lanceolate, caducous, foliaceous but olive brown appressed pilosulous; buds sharply reflexed, with calyx lance fusiform, closed; *calyx* 22-26 mm. long (when fresh), green and foliaceous, without ascending olive-brown pilosulous, more densely so at base, within glabrous, narrowly campanulate, lobed about $\frac{2}{3}$ way to the base; the tube 8-9 mm. long, semiellipsoid; the cleft between the two lips 11-15 mm. deep, upper lip of 3 lobes cleft down 12-14 mm., the lobes linear-lanceolate, tapering to the slender downcurved tip; lower lip of 2 lobes, cleft down 15-16 mm. at the distal suture, the lobes linear-lanceolate, tapering; *corolla* 30-34 mm. long (when fresh), white, the tube 20-23 mm. long, 4 mm. in diameter at the middle, 4 mm. at the throat, subcylindric, at the middle deflexed at 40° to the axis of the lower tube, outside the lower tube glabrous, the exposed parts white, rather shaggy pilose, within glabrous, limb spreading, 2-lipped, 5-lobed, the lobes pilose without except near the margin; upper lip of 2 lobes 7-8 mm. long, 8 mm. wide, ovate-suborbicular, obtuse, within closely capitate glandular puberulous except near the margins; lower lip with 3 lobes, spreading at 60° from the axis of the throat, each erose on the margin, within closely capitate glandular puberulous except

near the margin, the 2 lateral lobes 11-12 mm. long, 11 mm. wide rhombic-elliptic obtuse; lowest lobe 13 mm. long, 12 mm. wide, ovate-suborbicular, obtuse; 2 lower stamens perfect, the filaments adnate to the corolla tube to within 7 mm. of the throat, the free portion 3 mm. long, filiform, spirally upcurved; the 2 perfect anthers 2.5 mm. long, asymmetric oval, compressed, connate at apex; 2 lateral staminodia 1.5 mm. long, subulate; upper staminodium 0.7 mm. long, subulate; *style* 12 mm. long, stout filiform, sparsely spreading hirsute throughout; 2 stigmatic lobes 3 mm. long, broadly oval, obtuse, connate $\frac{2}{3}$ way up proximal side, glabrous on the back; *ovary* 5 mm. long, lanceoloid, glabrous, the base surrounded by a collarlike disk 1.2 mm. high; *berry* 15-23 mm. long, 8-12 mm. in diameter, oblong-ellipsoid or ovoid-ellipsoid, white, exposed by the caducous calyx; seeds 0.43-0.56 mm. long, 0.17-0.18 mm. wide fusiform, olive brown, the surface covered with raised, cellular reticulations that are squarish or polygonal, isodiametric, heavy, $\frac{1}{7}$ to $\frac{1}{6}$ as long as the seed.

Distribution: Koolau Range, leeward side, Ohia Zone, known only from the type collection.

Holotypus: Poamoho Stream, Wahiawa, steep rocky banks of stream in Ohia Zone, 2,000 ft. alt., Feb. 20, 1949, *H. St. John 23,558* (BISHOP MUS.).

Discussion: *C. ternata* is a member of the section *Verticillatae*. It is a close relative of *C. plurifolia* which occurs near Kahuku at the north end of the Koolau Range. *C. ternata* is distinguished by having its blades broadly lanceolate, unequal, one of each trio being $\frac{1}{4}$ larger; and the style capitate glandular pilose. *C. plurifolia* has the blades oblanceolate, those of each trio equal; and the style sparsely hirsute.

The specific name is from the Latin *terni*, three together, in allusion to the ternate leaf attachment.

131. *Cyrtandra waiomaensis* St. John, sp. nov. (Figs. 184, 195).

Diagnosis Holotypi: Frutex 1.5 m. alta, ramis ad 8 mm. diametro carnosus pallide griseo-brunneis mox glabris in sicco contractis et rugosis sulcatis, cicatricibus 2.5-3.5 mm. altis late scutelliformibus pallidis corticaceis interconnectis annulatisque, fasciculis 5, ramulis foliosis 2-4 mm. diametro brunneo-adpressi-pilosis, internodis 3-50 mm. sed plerumque 3-7 mm. longis, novellis dense olivaceo-brunneo-pilosulis, *foliis* ramulis majoribus 3 verticillatis sed eis ramulis minoribus lateralibus nonnusquam oppositis subaequalibus petiolis perfoliatis interconnectis, petiolis 7-25 mm. longis gracilibus dense olivaceo-brunneo-pilosulis, *laminis* 5-14 cm. longis 23-43 mm. latis crasso-chartaceis ellipticis apice acuto basi longe cuneata et decurrenta marginibus minute puberulis crenulatis supra viridibus mox glabris infra albescentibus intervallis minute puberulis costa et nervis secundariis olivaceo-brunneo-pilosulis, *cyms* 3-floriferis axillaribus sparse brunneo-adpressi-pilosulis, pedunculis 7 mm. longis, pedicellis 2-4 mm. longis, bracteis 11-14 mm. longis lanceolatis foliaceis sparse brunneo pilosulis, alabastris lanceo-fusifformibus longe rostratis, *calycibus* 28 mm. longis asymmetrico-fusifformibus extra et intra parte dimidia infera et in nervis principalibus parte supera sparse brunneo-pilosulis, tubo 22 mm. longo ellipsoideo fisso in linea distalia in quae corolla protrusa est, rostro 7 mm. longo arcuato-ascendente in apice 3 lobis connatis perceptibilibus, *corollis* immarcidis 38 mm. longis albis infundibuliformibus extra glabris tubo 29 mm. longo abrupte in 50° deflexo in medio 6 mm. diametro 9 mm. in orifice, limbo bilabiato 5-lobato, lobis in 50°-60° divergentibus, intra capitato-glanduloso-puberulentis, lobis binis superis 7 mm. longis 6 mm. latis late ovalibus, lobis binis lateralibus 10 mm. longis 8 mm. latis oblique late ovalibus, loba infera 11 mm. longa 8 mm. lata late ovalibus obtusis, staminibus binis inferis perfectis in tubo corollae 6 mm. ex orifice adnatis

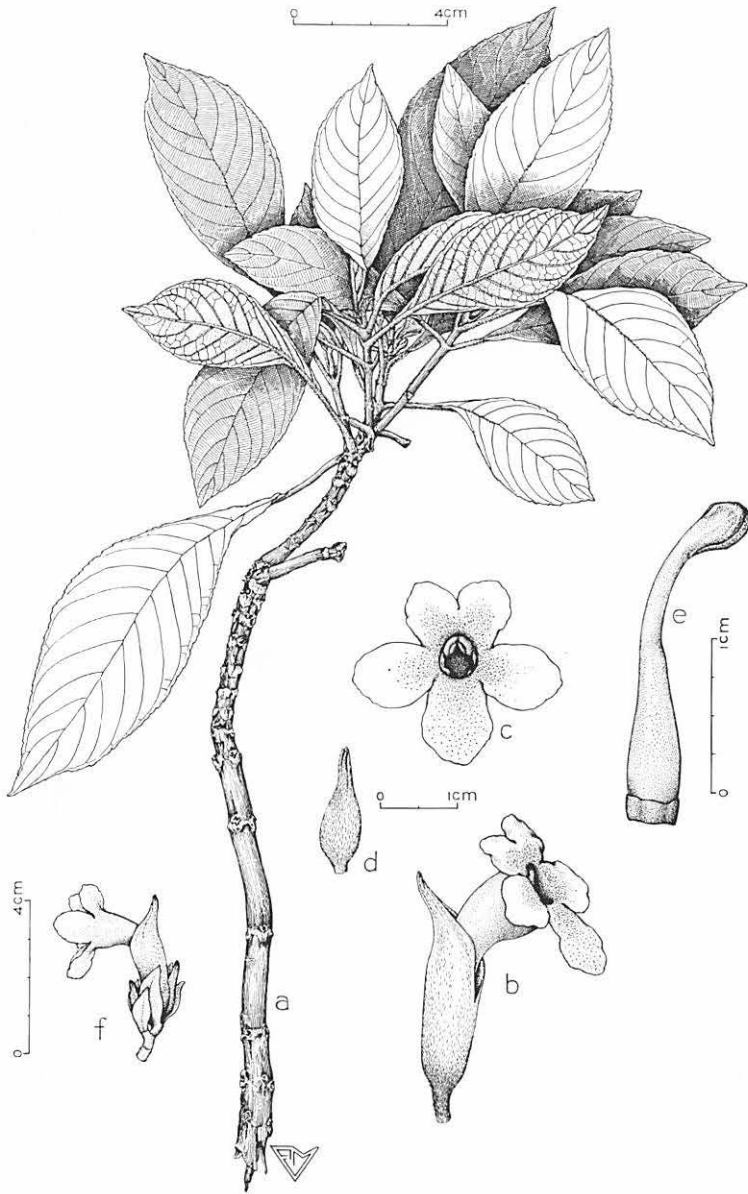


FIGURE 184.—*Cyrtandra waiiomaensis*: a, habit, $\times \frac{1}{2}$; b, c, flower, $\times 1$; d, bud, $\times 1$; e, pistil, $\times 2$; f, open flower, $\times \frac{1}{2}$. Palolo, St. John 24,781, holotype (Bishop Mus.).

parte libera 4 mm. longa validi incurvata, antheris 2.8 mm. longis conniventibus oblique ovatis connectivo late oblique ovato, staminodiis 1.2 mm. longis in tubo 7 mm. ex orifice adnatis apice antheroideo 0.5 mm. longo, *style* 7 mm. longo glabro, lobis stigmaticis binis 4.5 mm. longis late ellipticis $\frac{1}{2}$ connatis, *ovario* 12 mm. longo lineari-lanceolato glabro in basi disco cupulato 1.5 mm. alto cincto, fructu ignoto.

Description of Holotype: Shrub 1.5 m. tall; branches as much as 8 mm. in diameter, fleshy, pale grayish brown, early glabrate, on drying shrinking into longitudinal furrows and ridges; leaf scars 2.5-3.5 mm. high, broad shield-shaped, interconnected to form a sinuous annular scar, pale, corky; bundle scars 5; leafy branchlets 2-4 mm. in diameter, appressed brown pilose; internodes 3-50 mm., commonly 3-7 mm. long; young shoots densely olive brown pilosulous; *leaves* on main branches in whorls of 3, but on small lateral branchlets they may be opposite, subequal, with a low interpetiolar ridge which dehisces with the leaves and makes the scar annular; petioles 7-25 mm. long, slender, densely olive brown pilosulous; *blades* 5-14 cm. long, 23-43 mm. wide, thick chartaceous, elliptic, the apex acute, the base long cuneate and decurrent, the margin minutely low crenulate, above bright, shiny green and early glabrate, below whitish, the intervals minutely puberulous, the midrib and laterals olive brown pilosulous; *cymes* 3-flowered, axillary, sparsely appressed brown pilosulous; peduncles 7 mm. long; pedicels 2-4 mm. long; bracts 11-14 mm. long, lanceolate, foliaceous, sparsely brown pilosulous; buds lance-fusiform, long-beaked; *calyx* 28 mm. long, asymmetric fusiform, sparsely brown pilosulous without, and within below the middle and above the middle on the main veins, the tube 22 mm. long, ellipsoid, splitting on the distal side to allow the emergence of the corolla, the beak 7 mm. long, arched ascending, at the tip the 3 fused lobe tips are perceptible; *corolla* 38 mm. long (when fresh), white, funnellform, glabrous without, the tube 29 mm. long, abruptly deflexed at 50° from the axis of the lower tube, the tube 6 mm. in diameter at the bend, 9 mm. at the throat; the limb 2-lipped, 5-lobed, the lobes spreading at 50° to 60° from the axis of the throat; two upper lobes 7 mm. long, 6 mm. wide, broad oval, these and the other lobes capitate glandular puberulent within; two lateral lobes 10 mm. long, 8 mm. wide, obliquely broad oval; lower lobe 11 mm. long, 8 mm. wide, broad oval, obtuse; two lower stamens perfect, with filaments adnate to the corolla tube to within 6 mm. of the throat, the free portion 4 mm. long, stout terete, spirally upcurved; the anthers connivent, 2.8 mm. long, obliquely ovate, the connective broad oblique ovate; the staminodia with the filaments adnate to the corolla tube to within 7 mm. of the throat, staminodia 1.2 mm. long, subulate, the sterile antheroid tip 0.5 mm. long; *style* 7 mm. long, glabrous; stigmatic lobes two, 4.5 mm. long, broadly elliptic, connate almost $\frac{1}{2}$ way up the proximal side; *ovary* 12 mm. long, linear lanceoloid, glabrous, surrounded at base by a cupulate disk 1.5 mm. high; fruit unknown.

Distribution: Koolau Range, leeward side, Ohia Zone, at 1,200 ft. alt., known only from the type locality.

Holotypus: Waiomao Stream, Palolo, wet *Metrosideros* forest, 1,200 ft. alt., by stream, Feb. 12, 1952, *H. St. John 24,781* (BISHOP MUS.).

Discussion: *C. waiomaoensis* is closely related to *C. degenerans* (Wawra) Heller which is known from Manoa, the next valley to Palolo, and ranges from there almost to the north end of the Koolau Range. This widely distributed species has the leaves constantly verticillate, and the calyx shaggy brown vilous. *C. waiomaoensis*, on the other hand, has the smaller, weak lateral branches with opposite leaves while on the main branches these are ternate, and the calyx is merely pilosulous. It is known only from the type collection, taken on Waiomao Stream above the tributary Seven Falls.

The name is coined from the locality name and *-ensis*, Latin, an adjectival place ending.

132. *Cyrtandra adpressipilosa* × *stupantha*, hybrid nov.

Ad *C. adpressipilosa* simulantem in foliis, pilis et in stylo glabro, sed distincto in calycibus erecto-hirsutulis.

Similar to *C. adpressipilosa* in leaves, pubescence, and in glabrous style, but differing in having the calyx spreading hirsutulous.

Holotypus: Oahu: Koolau Range, windward side: west side of Kahana Valley, 6 km. upstream, small ravine in moist lower forest, 100 m. alt., April 18, 1937, *F. R. & V. O. Fosberg 13,713* (BISHOP MUS.).

133. *Cyrtandra cordifolia* × *propinqua*, hybrid nov.

Fruticibus cum structura intermedia; ramulis et foliis villosis.

Shrubs intermediate in character between the two species, and found near where the parents occur.

Range: Koolau Range, both sides, with or near the supposed parents.

Holotypus: Paalaa-Kawailoa Divide, shaded moist ravine at 1,800 ft., Oct. 4, 1931, *W. B. Storey 123A* (BISHOP MUS.).

Discussion: The details of this collection are given in the Introduction under Hybridism. It recombines in different degrees the characters of the supposed parents which occur in or near to the same areas. Although two seem to be setting fruit, the only one with good flowers shows abortion of the anthers. In consideration of these facts, the specimens are judged to be hybrids.

EXCLUDED SPECIES

Cyrtandra Lessoniana sensu F. D. Bennett (non Gaudichaud), Narrative Whaling Voyage Round the Globe, 1833-1836, 2: 328, 1840. He recorded under this name, "This is an umbrageous tree of respectable stature. Its flowers are white, monopetalous, and very fragrant; some of the blossoms are supported on peduncles which emerge at once from the trunk or bare boughs of the tree. The fruit is an oval white berry, of waxen appearance; it is fleshy, and contains many small seeds, lodged in two distinct cells.

"Sandwich Isles. Native name *ōawai*."

Frederick Debell Bennett, M.D., was a surgeon who made a three-year voyage on the "Tuscan" in order to study the anatomy of the sperm whale. He also was a naturalist, and made general collections. He brought back 233 preparations of animals, most of which were rare, and many unique. On page viii of Vol. 1, it is stated that he brought back 743 dried specimens of plants. "The principal part of the botanical collection is now in the possession of A. B. Lambert, Esq. and Professor Don." They do not seem to be in Kew or the British Museum, but before 1941 a number of his collections were seen and cited by monographers as in the herbarium at Berlin. They were doubtless destroyed in World War II.

Bennett in his book gives considerable attention to his plant finds. Some he merely lists, but for other larger and more notable ones, he gives a brief description and some comments. These seem to be original, not compiled. His vernacular names are obviously personally recorded, and correct at the time. However, as to this *Cyrtandra*, *C. Lessoniana* Gaudichaud is one of the commonest and the most widely distributed species on Oahu. But, it is not an umbrageous tree. None of the Hawaiian species have very fragrant flowers. Some of the small shrubs do show cauliflory, as does *C. stupantha* and a few others, but none of these are trees. As read now, his statements sound like a mixture of fact and fable. If his specimens ever turn up, then they can be re-determined. In the meantime this record is rejected.

C. Wainihaensis L'éveillé, Fedde Repert. Sp. Nov. 10: 123, 1911. This was described from *Faurie 640*, Oahu, Wainiha, Jan. 1910. The type has not been seen, and the plant is probably not from Oahu. There is no locality on Oahu named Wainiha, but there is a well-known one on Kauai, and Faurie is known to have collected there.

DISTRIBUTION OF CYRTANDRA

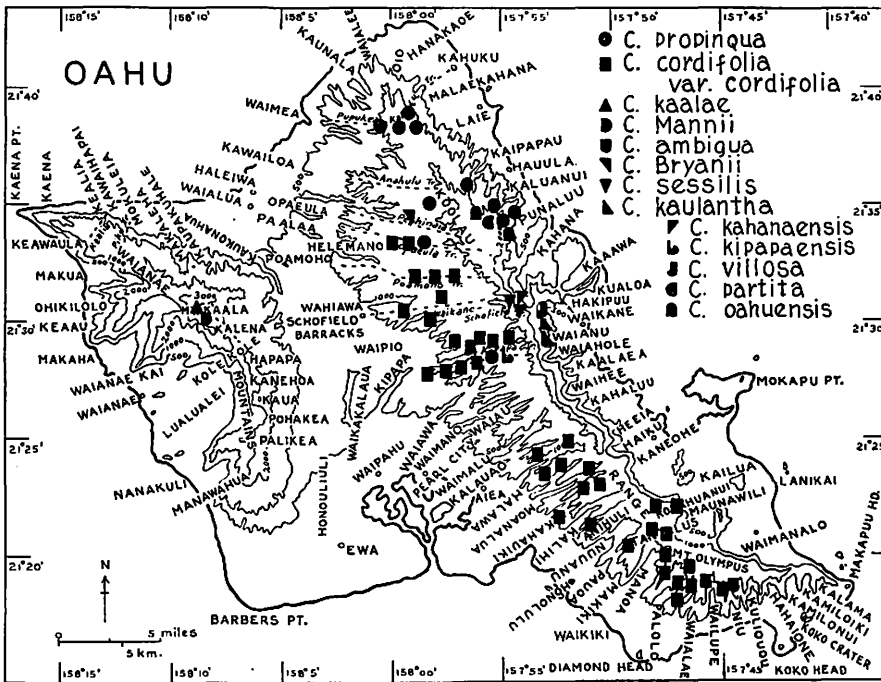


FIGURE 185.—Distribution of *Cyrtandra* spp. on Oahu.

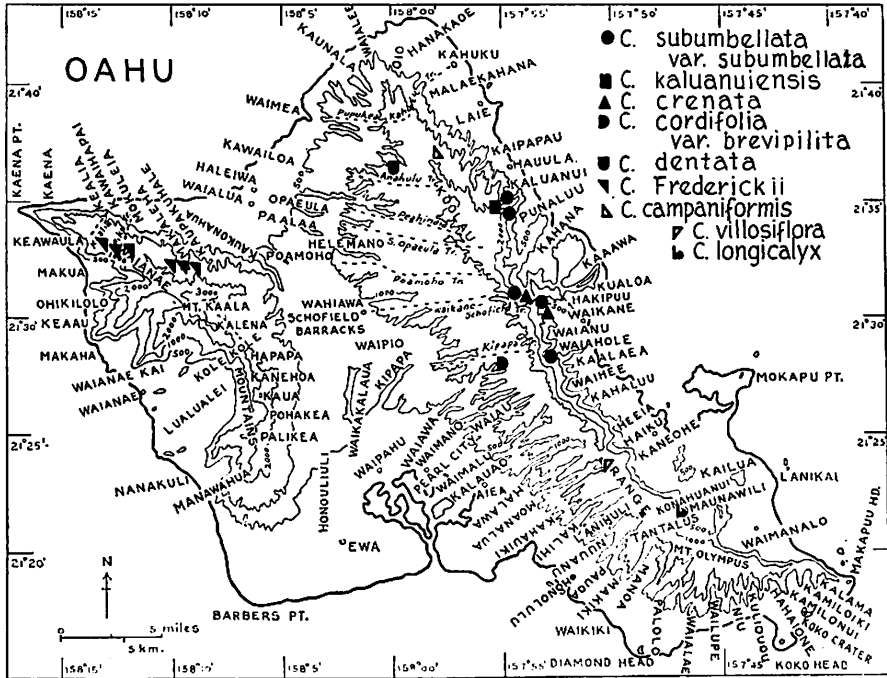


FIGURE 186.—Distribution of *Cyrtandra* spp. on Oahu.

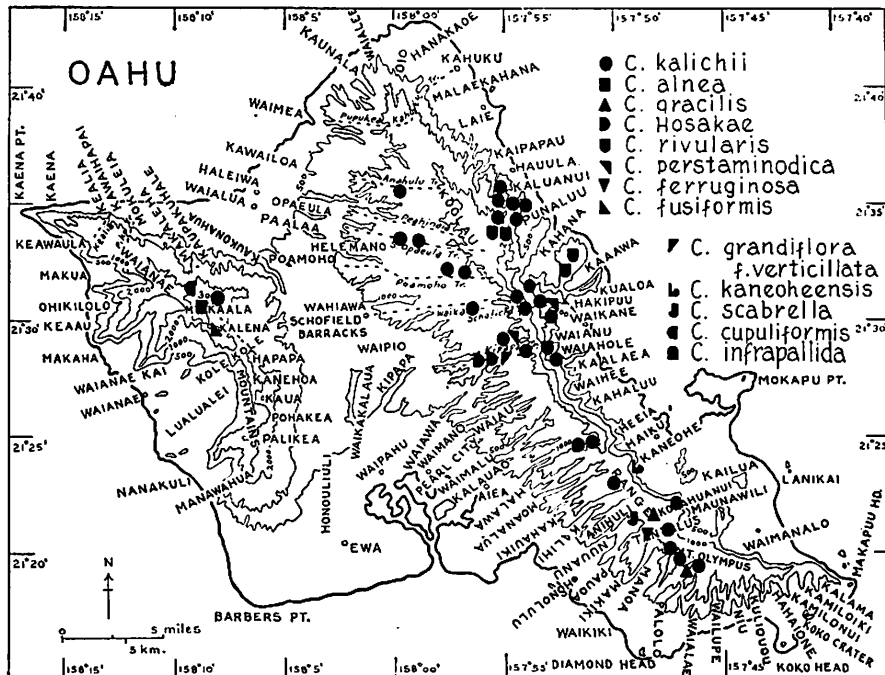


FIGURE 187.—Distribution of *Cyrtandra* spp. on Oahu.

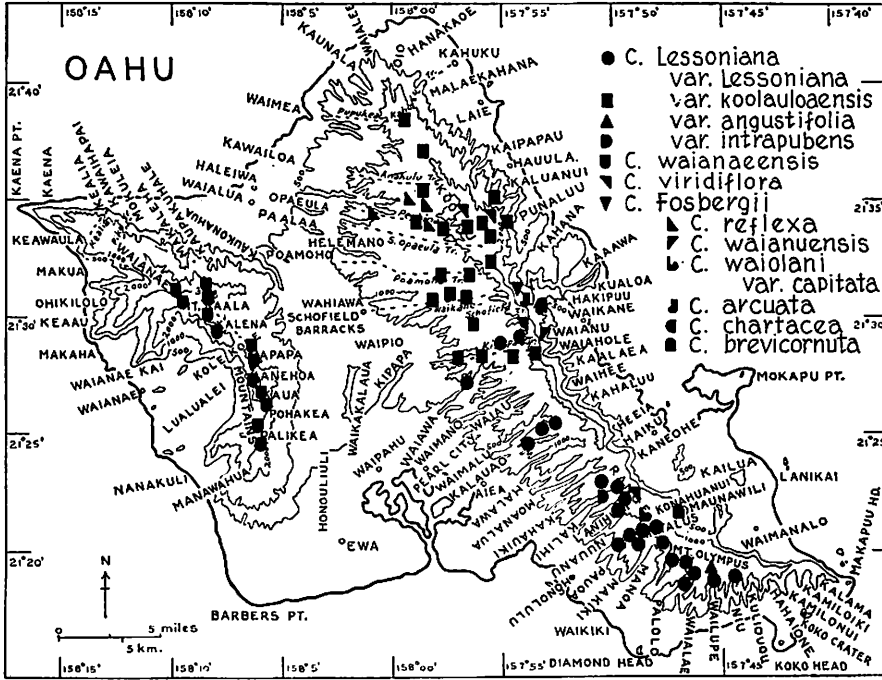


FIGURE 188.—Distribution of *Cyrtandra* spp. on Oahu.

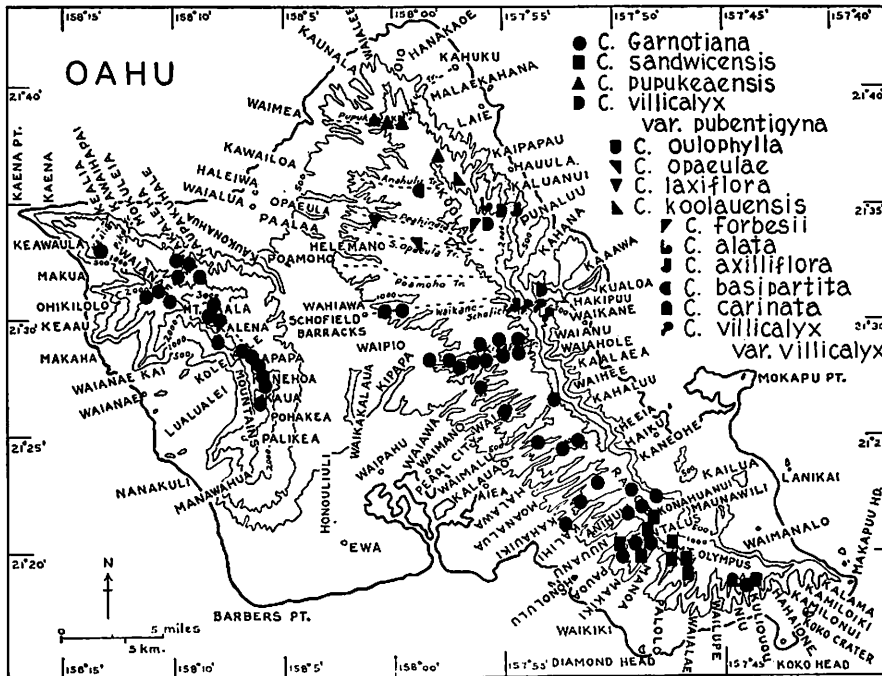


FIGURE 189.—Distribution of *Cyrtandra* spp. on Oahu.

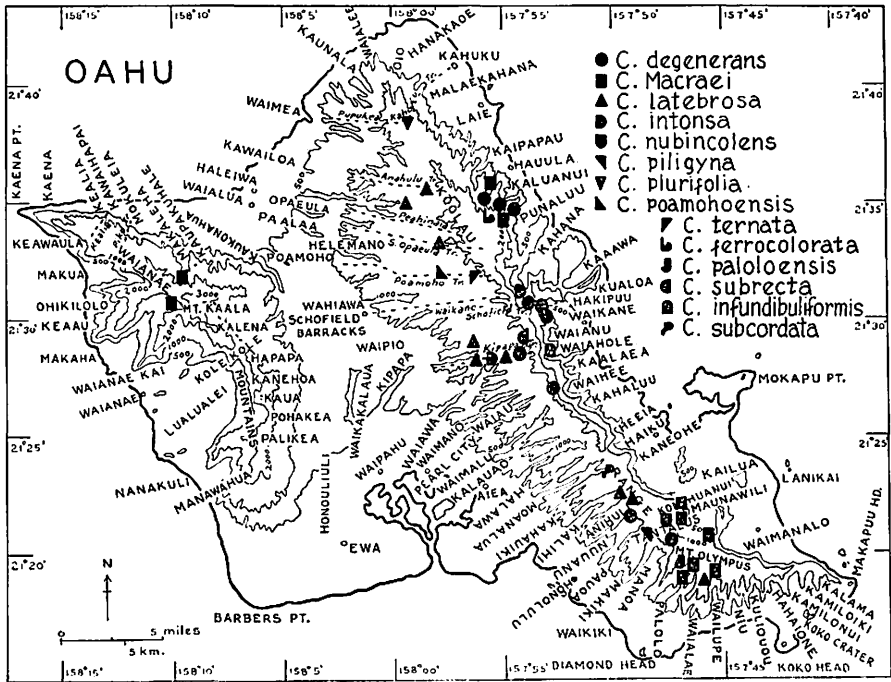


FIGURE 190.—Distribution of *Cyrtandra* spp. on Oahu.

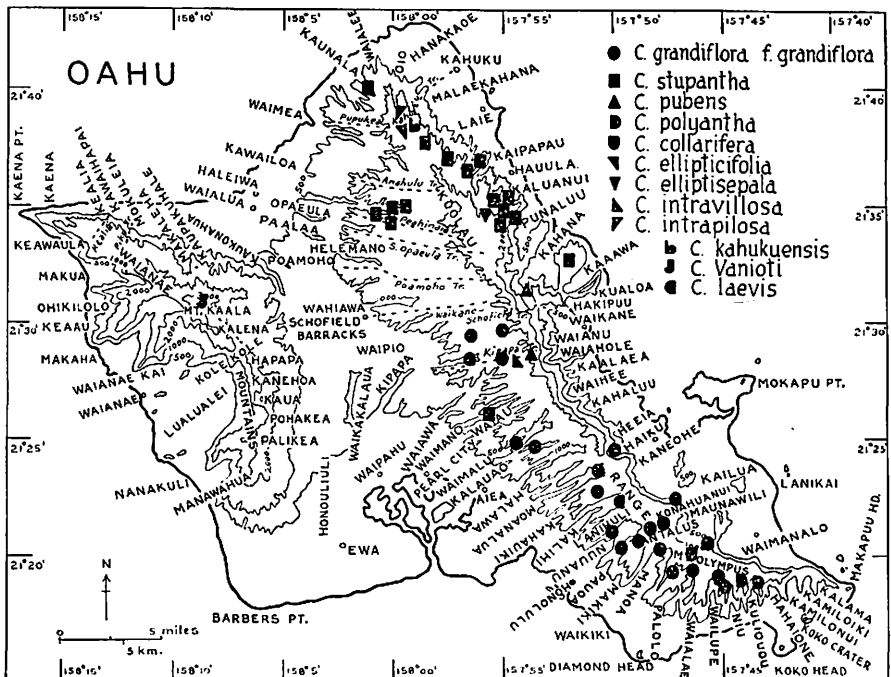


FIGURE 191.—Distribution of *Cyrtandra* spp. on Oahu.

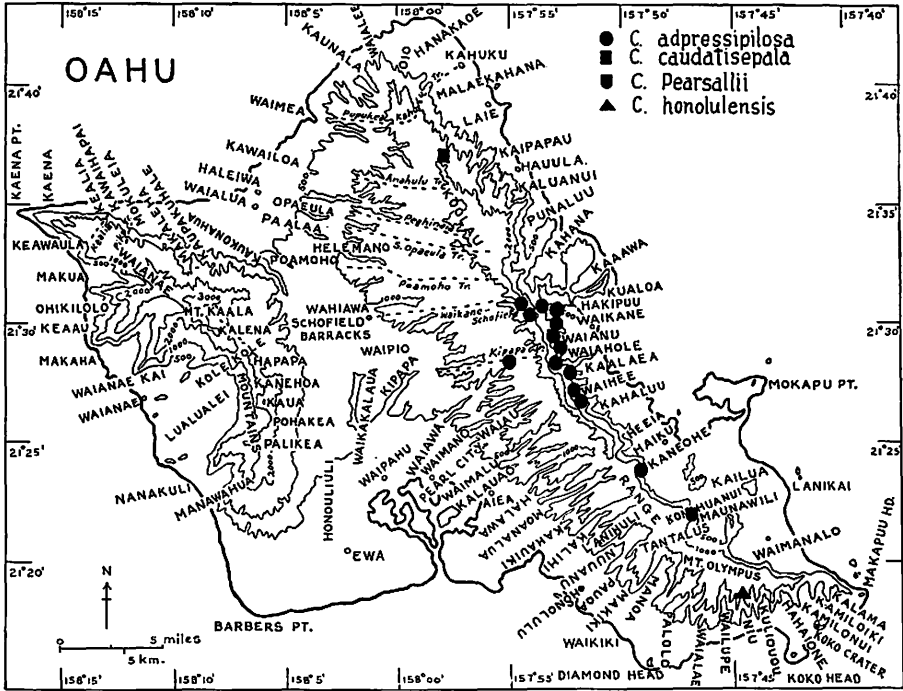


FIGURE 194.—Distribution of *Cyrtandra* spp. on Oahu.

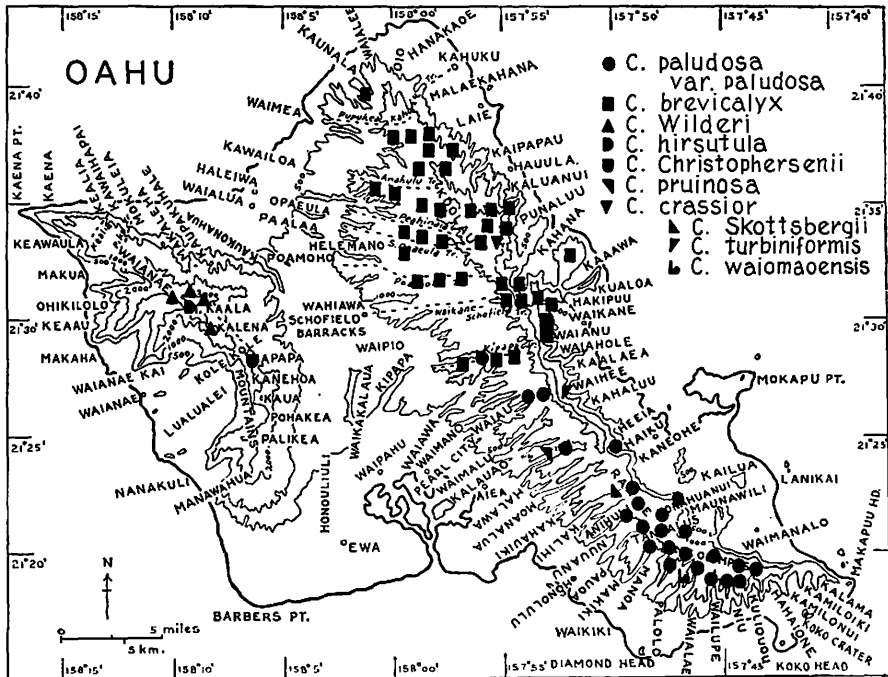


FIGURE 195.—Distribution of *Cyrtandra* spp. on Oahu.

LIST OF EXSICCATAE

For each collector's number is given a reference to the species number in this monograph.

Andersson, N. J.	Cranwell, L. M.	7,684 : 68
Honolulu : 5, 48	(with others)	7,687 : 68
Panama or Sandwich Is. : 48	3,667 : 14	7,688 : 64
Barclay, G.	Degener, O.	7,689 : 48
Oahu : 5, 107	(alone or with others)	7,690 : 11
Sandwich Is : 5	Anahulu : 35	7,694 : 107
Woahu : 107	1,565 : 63	7,695 : 5
Bergman, H. F.	7,496 : 107	7,764 : 48
Kaala : 41, 66, 89	7,497 : 63	10,513 : 48
Mt. Kaala : 5	7,499 : 93	10,514 : 63
Brown, F. B. H.	7,502 : 5	10,515 : 5
1,287 : 5	7,504 : 5	10,516 : 68
Bryan, E. H., Jr.	7,509 : 25	10,517 : 45
Kipapa : 68	7,513 : 117	10,523 : 5
799 : 93	7,514 : 58	10,524 : 107
813 : 33	7,516 : 25	11,572 : 66
834 : 58	7,519 : 117	11,573 : 89
854 : 5	7,520 : 22	12,057 : 33
859 : 33	7,520 : 68	12,058 : 28
Bryan, W. A.	7,536 : 5	12,177 : 66
Pacific Hts. : 48	7,539 : 117	12,178 : 30
529 : 48	7,543 : 107	12,179 : 112
533 : 5	7,544 : 107	12,250 : 54
Christopherson, E.	7,546 : 5	12,306 : 52
(alone or with others)	7,554 : 93	12,748 : 5
1,378 : 58	7,555 : 58	12,771 : 93
1,506 : 107	7,562 : 34	12,780 : 51
1,533 : 107	7,565 : 25	12,907 : 5
1,601 : 68	7,567 : 127	12,991 : 112
1,689 : 66	7,569 : 45	12,992 : 117
1,691 : 45	7,570 : 96	17,125 : 33
1,768 : 66	7,571 : 93	17,126 : 51
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Conger, A. D.	7,577 : 96	17,201 : 63
Konahuanui : 124	7,578 : 68	17,202 : 112
Cowan, R. S.	7,656 : 107	17,361 : 22
680 : 58	7,664 : 45	17,398 : 93
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	7,667 : 107	17,716 : 22

- 18,056: 5
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 20,803: 5
 20,864: 5
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 3,479: 22
 3,529: 5
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 Pupukea: 52
 Waiahole: 30
 Faurie, U.
 Punaluu: 58
 1: 11
 602: 68
 606: 45
 614: 93
 619: 117
 635: 5
 636: 51
 637: 11
 638: 23
 1,144: 83
 Forbes, C. N.
 (alone or with others)
 Hillebrand's Glen: 96
 Kaala: 22, 66, 89
 Kalihi: 28, 48, 65, 68, 96
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 Nuuanu: 5, 107
 Oahu: 65, 81
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 93, 111, 117, 124
 Wahiawa: 5
 Waialae Iki: 68
 Waiolani: 48, 55, 107
 157: 68
 1,011: 48
 1,012: 107
 1,013: 120
 1,273: 103
 1,413.0: 65
 1,488: 107
 1,611.0: 5
 1,662.0: 5
 1,672.0: 107
 1,708: 51
 1,963.0: 107
 1,964.0: 22
 1,965.0: 65
 1,984.0: 113
 2,012.0: 107
 2,059.0: 93
 2,297.0: 5
 2,447.0: 11
 2,538.0: 64
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