REVISION OF THE HAWAIIAN SPECIES OF PEPEROMIA

BY
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INTRODUCTION

PURPOSE OF STUDY

This paper is an attempt to present systematically the species of *Peperomia* found in the Hawaiian Islands. Numerous collections of this genus have been accumulating in herbaria, but it has been difficult or impossible to make identifications with the use of existing keys and descriptions. It was thought, therefore, that a revision based on this large amount of accumulated material, interpreted in the light of field observations, would result in a more usable presentation of the Hawaiian species of the genus.

The present study has been made while on an appointment as a Bishop Museum Fellow in Yale University during the year 1932-1933. Nine months were spent in residence at Bernice P. Bishop Museum in Honolulu. During that time collecting expeditions were made on the five largest islands, Kauai, Oahu, Molokai, Maui, and Hawaii. The smaller islands, Niihau, Lanai, and Kahoolawe, where conditions are not so favorable for extensive development of *Peperomia,* were not visited. Ten species had been collected previously on Lanai and one on Niihau, but none have been seen from Kahoolawe. It is probable that all of the species now to be found on these smaller islands have been collected before.

Most of the plants are very fleshy and succulent, which makes it difficult to prepare good, taxonomically usable herbarium specimens. This fact, together with the wide range of variation exhibited by many of the species, emphasizes the necessity of studying the plants under field conditions.

An attempt has been made to account for all of the species which have been previously credited to the islands and also to present a complete synonymy so far as Hawaiian species are concerned. Each species is described, together with a drawing which shows the important features of the plants, and a list of the specimens which have been examined. The locality names in these lists are regarded as quoted from the collection labels: corrected spellings of names misspelled on the labels are given in brackets.

Unless otherwise stated, the measurements for the descriptions and drawings have been taken from dried materials; these, for the most part, are

considerably less than for living specimens. It is generally necessary to boil the spikes of dried specimens before the details can be determined. The measurements, sections of the fruit, and sketches of the reproductive structures were all made from such boiled materials as examined with the aid of a binocular microscope.

It is with some hesitancy that I propose a new subgenus without having had the opportunity of a comparative study of a large number of foreign species. From the materials which I have been able to study, however, together with the descriptions which have been made by former authors, I feel justified in making this new subdivision.

The Hawaiian name for Peperomias is *alaalawainui,* and different parts of the plants have been used in the past by the Hawaiians as remedial agents for various ailments.

Acknowledgments

I deeply appreciate the appointment as Bishop Museum Fellow in Yale University which enabled me to visit Hawaii and study the plants under field conditions. I wish also to express my appreciation to DePauw University for granting me a year's leave-of-absence, and to my wife, Ethel C. Yuncker, for assuming some of my departmental duties during my absence from the University, thus making it possible for me to take advantage of the Fellowship.

I have become greatly indebted to a number of persons who have generously assisted me while I have been in Hawaii: to Dr. Herbert E. Gregory, Director of Bernice P. Bishop Museum, for his cooperation in extending to me every facility of the Museum; to the several members of the museum staff who have always been ready to assist me in every way possible; to Mr. C. S. Judd, Territorial Forester, and Dr. F. G. Krauss, of the University of Hawaii, for suggestions relative to itineraries and for letters of introduction; to Mr. A. W. Duvel, Forester, and Mr. A. J. McDonald, Forest Ranger, on the island of Kauai, and to Mr. D. T. Fleming and Mr. Fred Krauss of the Baldwin Packers on the island of Maui for assistance in visiting different parts of those islands and making collections; to Mr. A. Gross, Secretary of the Y.M.C.A. on Kauai, who placed the facilities of the camp near Haena at my disposal; to Dr. Harold St. John, Professor of Botany in the University of Hawaii, for reading part of the manuscript and for valuable suggestions, and also for inviting me to accompany him on many collecting expeditions on the islands of Oahu and Molokai; and to Mr. Otto Degener for the many courtesies which he has shown me, and especially for placing at my disposal his very large collection of Peperomias, and also for inviting me to accompany him on many collecting excursions. I wish also to thank Dr. F. B. H.

Brown, who greatly assisted me by writing the Latin diagnoses of the new species and varieties.

Professor William Trelease, who, since the death of Casimir deCandolle, has become the leading authority on the Piperaceae, made valuable suggestions as well as placing at my disposal manuscript notes and sketches which he had made in European herbaria. These materials proved very valuable and I am deeply grateful for their use.

The large collections of Bernice P. Bishop Museum and of the Degener herbarium form the basis of the present study. In addition to these materials, I have had loans of types and other valuable specimens from the Berlin, deCandolle, Gray, University of Illinois, Kew, Vienna and U. S. National herbaria. I was also furnished photographs of four critical specimens in the British Museum. I wish to express my great appreciation and thanks for the privilege of consulting and studying the materials thus placed at my disposal.

History

With the exception of *Peperomia blanda,* described from Venezuela by Humboldt, Bonpland, and Kunth in 1815, and *Peperomia pallida* from the Society Islands and *Peperomia reflexa* from India, described by Dietrich in 1831, all of which were later credited to Hawaii, the first descriptions of Hawaiian Peperomias are those of *Peperomia membranacea* and *Peperomia leptostachya* by Hooker and Arnott in 1832 in the "Botany of Captain Beechey's Voyage." These two species were described from specimens collected in 1826-1827, presumably by Lay and Collie, botanists on the *Blossom* under the command of Captain Beechey.

In 1843 Miquel published the first fascicle of his "Systema Piperacearum," a comprehensive monographic treatment of the Piperaceae. In this work he included descriptions of five new species, *Peperomia sandwicensis, Peperomia latifolia, Peperomia hypoleuca, Peperomia pachyphylla,* and *Peperomia Gaudichaudii,* and one new form from Hawaii and a new species from the island of Juan Fernandez, *Peperomia fernandeziana,* which was subsequently erroneously credited to Hawaii. These new Hawaiian species were, in the main, based on collections made by Gaudichaud and by Meyen. In 1844 in his "Illustrationes Piperacearum" Miquel illustrated three of his Hawaiian species, and the following year in the London Journal of Botany he described an additional species, *Peperomia insularum,* from a specimen collected by Diell.

For more than 50 years Casimir deCandolle was a student of the Piperaceae. He early became a world authority in this difficult family, which position he maintained throughout his life. He described a large number of new

species from different parts of the world, and the majority of the species which have been credited to Hawaii were described by him. In 1866 he described *Peperomia Macraeana* from a specimen collected by Macrae in 1825, and in 1869 in his monograph of the family in the Prodromus he added three new species, *Peperomia purpurascens, Peperomia oahuensis,* and *Peperomia Cookiana,* and three new varieties from these islands.

In 1869 Dr. H. W. Wawra spent several weeks making collections in the islands. He published in 1875 the results of his study, which included two new species, *Peperomia mauiensis* and *Peperomia Hesperomanni,* and six new varieties.

Dr. William Hillebrand, who resided in Honolulu for 20 years, devoted much of his time to the study of the Hawaiian flora. The results of his botanical work are presented in his "Flora of the Hawaiian Islands" which appeared posthumously in 1888. In this publication he included 19 species and 13 varieties of *Peperomia;* 3 species, *Peperomia ligustrina, Peperomia parvula,* and *Peperomia pleistostachya,* and 12 varieties were described as new to science.

Between 1898 and 1912 deCandolle described five new species, *Peperomia Helleri, Peperomia Remyi, Peperomia lonchophylla, Peperomia asperulata,* and *Peperomia Hochreutineri,* and one new variety from collections made by Heller, Remy, and others, and in 1911 Léveillé added three species, *Peperomia Fauriei, Peperomia Helleri,* and *Peperomia refractifolia,* from collections made by Faurie in 1910.

In 1913 deCandolle presented in Bulletin Number 2 of the College of Hawaii the results of his study of collections which had been made by Faurie and by Rock. In this Bulletin he recognized 73 species, 5 varieties, and 13 forms, and described as new 47 species, 3 varieties, and 11 forms. The discovery of this remarkably large number of new species was explained by the more extensive collecting in remote and difficult regions of the higher rain forests where Peperomias are most abundant.

To this number are to be added one species, *Peperomia hiloana,* which deCandolle included in his "Clavis Analytica" of the Piperaceae which appeared posthumously in 1923, and one new species, *Peperomia Candollei,* described by St. John in 1931 from a specimen collected on the island of Niihau by Stokes.

Thus at the beginning of the present study 75 species and a number of varieties and forms were believed to be represented in the flora of Hawaii. In the present paper 38 species and 25 varieties are recognized, of which 8 species and 11 varieties are described as new to science. This great reduction in the number of previously described species has been made only after a careful study of most of the type specimens together with an abundance of

both dried and fresh materials for most of the species. I believe that several of the species were established by previous investigators on inadequate characters which I have been either unable to verify or to accept as indicative of specific rank. Peperomias thrive best at the higher altitudes in the rain forests. Some of these regions are reached with considerable difficulty and remain to be thoroughly botanized. It is likely that with additional materials and new evidence some of the species and varieties here recognized will be further reduced and also that new species will be discovered. I believe, however, that the number here presented more accurately represents the total of Hawaiian species than does deCandolle's total of 73 species. Nor do I share in Professor Rock's opinion, as expressed in the introduction to Bulletin Number 2 of the College of Hawaii, that "there remains at least twice that number of species yet to be discovered in these islands."

Geographical Distribution of Species

The family Piperaceae is naturally represented in Hawaii only by the genus *Peperomia.* Two species of *Piper* have been introduced. *Piper methysticum* Forster is found on the different islands commonly near dwellings or in previously inhabited regions where it appears to have become established. This species is known as *awa* by the natives, and the root is used in preparing an intoxicating beverage of the same name. *Piper betel* Linnaeus, the other introduced species, is not common. The only specimens of it which I have seen were collected near the city of Honolulu. The leaves of this species are chewed with the betel nut or used in cooking by orientals. The absence of any native species of *Piper* in Hawaii, where conditions are apparently favorable for their development, is in striking contrast to the situation in other parts of the world. For example, 87 species are credited by Quisumbing to the Philippine Islands, while hundreds of species are found in the Americas and West Indies. It is thus apparent that the agencies essential for the natural distribution of species of *Piper* have been lacking or at least unable to operate through the great distances separating the Hawaiian islands from other regions where species of *Piper* are more common.

With the exception of the widely distributed *Peperomia reflexa* of the subgenus *Micropiper,* the Hawaiian species of *Peperomia* are separable into two groups on the basis of fruit characters. One of the groups includes those species with globose to ovoid fruit with an oblique apex and a subapical stigma which apparently belong in the subgenus *Sphaerocarpidium* as established by Dahlstedt. The stigma is commonly single, as shown by Dahlstedt, but in certain of the Hawaiian species some of the stigmas may be divided and in others, nearly always divided. Inasmuch as the stigmas may appear single or divided in the same species and, not uncommonly, on the same plant,

I am amplifying the subgenus *Sphaerocarpidium* to include this character. The second group is composed of those species with leaves always opposite or verticillately arranged, with ovoid to obovoid or more or less turbinate fruit and a commonly rounded to pointed apex, and divided and mostly penicillate stigmas. So far as I can determine, species with this combination of characters are endemic in Hawaii and do not agree with any subgenus so far described. I am, therefore, proposing a new subgenus to include them.

The large subgenus *Sphaerocarpidium* is, in the main, composed of Central American and South American species. From an examination of available materials and from descriptions of them it appears that many of the species found in other parts of Polynesia and in the Galapagos and Juan Fernandez islands likewise belong to this subgenus. According to Quisumbing's descriptions of them, and from an examination of materials, the Philippine species are found to differ in possessing, for the most part, inconspicuous, single, apical, and often smooth stigmas. The available evidence indicates, therefore, that the Polynesian species, including those of Hawaii, are more closely allied with the species in the predominatingly American subgenus *Sphaerocarpidium* than with those of Malaysia, as represented by the Philippine species.

In Hawaii some of the species are restricted in distribution to a single island, or even to a limited area on an island (Table 1). However, several of the species are to be found throughout the archipelago where conditions allow for their development, and I believe that some of the species now seemingly limited in distribution will be found to be more widely disseminated as botanical exploration of the islands progresses. The majority of the species are found in the rain forests above an altitude of 1000 feet. A few species may be found at lower levels, and some species, *Peperomia reflexa* and *Peperomia leptostachya,* for example, not uncommonly grow in arid situations near sea level. *Peperomia reflexa* is also often found growing epiphytically, and a few other species may assume that type of habitat if conditions are favorable. Most species, however, seem to prefer the rich, moist humus of the forest floor or that which gathers in rock crevices.

Table 1. Distribution of Species of Peperomia in Hawaii.

Species	Niihau	Kauai	Oahu	Molokai	Maui	Lanai	Hawaii
alternifolia				×	?	×	
Cookiana		×		×	×		×
Cookiana variety flavinerva		×		×	×		
Cookiana variety minutilimba							×
Cookiana variety ovatalimba		×		×	×		×
Cookiana variety pukooana				×			
cornifolia							×
Degeneri				×			
eekana					×		

Species	Niihau	Kauai	Oahu	Molokai	Maui	Lanai	Hawaii
ellipticibacca			×		?		
erythroclada					×	×	
erythroclada variety picta					×		
expallescens				×	×		×
expallescens variety brevipilosa					×		
Fauriei				×			
Forbesii				×			
globulanthera					×		
hawaiensis							×
Helleri		×		×			
Helleri variety grossa		×					
Helleri variety Knudsenii		×					
Helleri variety subovata		×					
Hesperomanni		×					
Hesperomanni variety brevifolia		×					
hirtipetiola					×		
hirtipetiola variety longilimba					×	×	
hypoleuca			×				×
hypoleuca variety pluvigaudens			?				×
kokeana		×					
koolauana			×				
kulensis					×		
latifolia		×	×	×	×	×	×
leptostachya	×	×	×	×	×		×
ligustrina					×		×
ligustrina variety oopuolana				×	×		
lilifolia			×	×	×	×	×
lilifolia variety honokahauana					×		
lilifolia variety nudilimba			×	×	×		×
lilifolia variety obtusata				×			×
lilifolia variety psilostigma					×		×
Macraeana				?	×		×
mapulehuana				×			
mauiensis				×	×	×	
maunakeana							×
membranacea			×				
membranacea variety brevifolia		×	×				
membranacea variety puukukuiana					×		×
membranacea variety waimeana		×		×			
oahuensis			×				
oahuensis variety St.-Johnii			×				
reflexa		×	×	×	×	×	
reflexa variety elongata			×	×			
reflexa variety parvifolia		×	×	×	×	×	×
Remyi		×	×	×	×	×	×
Remyi variety waipioana						×	×
rigidolimba							×
Rockii				×			
sandwicensis		×	×	×	×		
sandwicensis variety robusta			×				
subpetiolata					×		
Treleasei				×			
trichostigma					×	×	
waikamoiana					×		
Total species and varieties	1	18	18	27	32	11	22

The largest number of species and varieties is represented on the island of Maui, where there are nearly twice as many different forms as on the island of Oahu. The adjacent island of Molokai has the second largest number. This is not to be explained on the basis of more careful exploration, for Oahu has probably received more attention from collectors in the past than have either Molokai or Maui. It is more probable that conditions for the growth and development of the genus are more favorable on those islands. I have obtained no evidence other than that of the large number of forms, which would indicate that the genus is older on those islands than it is elsewhere in Hawaii.

The fruits of most Hawaiian species are exceedingly viscid and adhere tenaciously to any object with which they come in contact. In this character they appear to be well adapted for animal distribution. That birds have been responsible for the distribution of Peperomias cannot be proved, but under present conditions birds appear to be the most logical means by which some of the species have become so widely disseminated. Most Hawaiian species show a distribution in the islands as would be expected. However, a few species have an irregular or discontinuous distribution, to be explained, perhaps, on the basis of the probable dissemination by birds and the comparatively short distances between the islands.

Morphology

Roots

The root system is shallow and of the fibrous type. It is composed mostly of short adventitious roots arising from the lower parts of the stem, although adventitious roots apparently may develop from any part of the stem where it comes in contact with the soil.

Stems

The stems are terete or subterete, fleshy, and with scattered vascular bundles. They range in size from a few centimeters in height and 1 or 2 millimeters thick at the base up to 120 centimeters tall and 2.5 centimeters thick in the large species. In a few species the stems are essentially erect, but more commonly they ascend from a prostrate or semiprostrate, rooting, lower portion. The length of the internodes varies considerably in most of the species and is of slight taxonomic value.

Leaves

Although the alternate arrangement of the leaves is common for the genus as a whole, only three Hawaiian species have their leaves so arranged. A few species have them predominatingly opposite, but most bear them in

whorls; there is, however, for the most part, no constancy in this character. In *Peperomia latifolia* the lower leaves are not uncommonly alternate, but because of what appears to be an irregular elongation of some of the internodes the upper leaves are generally opposite or whorled. The shape and size of the leaves vary considerably for many of the species, but within certain limits these characters are of taxonomic value. They range from a few millimeters up to 16 centimeters in length and from orbicular or ovate to linear-lanceolate, obovate, or spatulate in shape. The base is obtuse to cuneate and the apex is rounded to acuminate. None are peltate. The form of venation is fairly constant for the different species. In all of them there is present a more or less prominent midrib which extends to the apex of the leaf. In a few species with small leaves the lateral veins are lacking or very obscure. For the most part, however, there are present two or more prominent lateral veins which arise at the base of the blade in a true palmate manner, or they coalesce with the midvein for a greater or lesser distance, a condition referred to as plinerving. In two or three species the venation is subpinnate. The leaves are more or less fleshy and succulent in texture in the fresh condition, but in the dry state they are membranous or more commonly somewhat rigid and coriaceous. The petioles vary considerably in length for the different species as well as on the individual plants. The lower petioles are usually longer than those above. The leaves are sessile or subsessile only in *Peperomia subpetiolata.*

PIGMENT

Many Hawaiian species develop a light red to deep claret pigment which is located in a subepidermal layer of cells in the stems and lower surface of the leaves. This pigment occurs in varying amounts in different plants of the same species as well as in different parts of the same plant and is a character of little or no taxonomic importance. The entire stem may be reddish to purplish or it may show the color only in the lowermost part. The leaves commonly display the color on the lower surface as red intercostal areas; less commonly, the entire lower surface may be colored. *Peperomia sandwicensis* has been found to display the pigment to a greater extent than other species, but unpigmented plants of that species are not uncommon. The factors promoting the pigment production are not obvious. Both pigmented and unpigmented plants have been found growing together under what appear to be the same environmental conditions.

TRICHOMES

A few of the Hawaiian species are characteristically glabrous, but most of them develop epidermal hairs to a greater or lesser degree on the stems, leaves and peduncles. Only in *Peperomia reflexa* are hairs present on the rachis. The hairs are always unbranched, usually multicellular, and taper

from the base to an acute apex. They vary in size up to about 1.5 mm. in length. They are commonly erect or suberect, or in some species characteristically appressed. The abundance, location, size, and position of the hairs provide useful distinguishing characteristics. There are slight differences in the stiffness of the hairs, but these differences are difficult to describe. In the keys and descriptions the term "hirsute" is used to describe the parts with hairs commonly from 0.5 mm. to 1.5 mm. in length, and the term "hirtellous" where the hairs are mostly smaller.

SPIKES

Flowers. The flowers are borne on spikes of from 1 to 15 centimeters long composed of a somewhat fleshy rachis and a mostly shorter peduncle. The flowers are more or less spirally arranged or more commonly with no apparent regularity of position. They are densely produced and in contact with each other, or the spike is more loosely flowered with irregular intervals of sterile rachis separating them. The flowers are borne on the rachis in pits of different depths. In *Peperomia reflexa* they are sufficiently deep to enclose the young flower, but in the most of the Hawaiian species they are more shallow. The peduncle is terete and is commonly somewhat shorter than or up to twice the length of the petiole and exceeds the leaf length in but two species. Blossoming, in general, proceeds more or less regularly from the base of the spike upwards, but not infrequently there appears to be no regularity in this feature and matured fruits appear here and there interspersed with young undeveloped flowers. The spikes are terminal, axillary, or leaf-opposed. They may be single, but more commonly they are umbellately clustered. In a few specimens branched spikes have been observed, but this is rare and to be considered as unnatural for Hawaiian species. The spikes are commonly sufficiently rigid when fresh to be erect, although in those species with exceptionally long and slender spikes they are more or less flexuous.

Pseudopedicels. At the time of maturity of the fruit, the tissue at the base of the depression containing the flower develops a dome-shaped structure which projects the fruit to a greater or lesser degree from the rachis. When fresh, this structure, known as a pseudopedicel, is turgid and rounded and often longitudinally striated, and on either side of the fruit attachment are to be seen the scars of the deciduous stamens. Upon drying, the pseudopedicels become laterally flattened and remain as prominent projections on the rachis. The attachment of the ripened fruit to the pseudopedicel is weak, and it is uncommon to discover fruits remaining attached to them in herbarium specimens. The pseudopedicel apparently does not develop until the fruit is fully matured and is not seen in young specimens. It has

been found so frequently for the majority of the Hawaiian species, however, that I feel warranted in believing it to be present in all of them. It appears to be a device evolved for the purpose of placing the viscid fruit in a more advantageous position for distribution.

Bracts. Each flower is borne in the axil of a bract which is attached by a short pedicel at the lower side of the flower-bearing depression. In Hawaiian species this bract is always more or less orbicular although sometimes irregularly so, about 0.5 to 0.8 mm. in diameter, and peltate with the pedicel attached at or near the center. In the young spike each bract may overlap the one above, but as the inflorescence develops they become separated. The bract is fleshy through the center but thinner at the edge. Commonly there is a row of yellow gland-like cells near the outer edge of the bract.

Perianth. This structure is entirely lacking in the genus.

Stamens. Two stamens are present which are attached at the base and at either side of the ovary. The anthers are ellipsoidal to subglobose, and two-celled with one pollen sac commonly larger than the other. Dehiscence occurs along the suture. The filaments are slender or stoutish and commonly as long as or longer than the anthers. The stamens are early deciduous so that in matured spikes they are generally lacking.

Ovary and fruit. In *Peperomia reflexa* the lower half or third of the fruit is smooth and slightly thicker, forming what has been called a pseudocupule. This structure, which is characteristic of the subgenus *Micropiper,* is lacking in all the other Hawaiian species. The ovaries are one-celled and contain a very small embryo. The shape of the ovary and of the fruit is globose to ovoid, obovoid or turbinate, and within certain limits is fairly constant specifically. The fruit range from 0.75 to 1.25 mm. in length, although the size in a given species seems constant within narrow limits of variation. It is covered with papillae-like cells and a viscid material which enables it to adhere tenaciously to whatever it may come in contact with and which has undoubtedly been an important factor in the distribution of the plants. The ovaries are sessile and more or less sunken in depressions on the rachis, but as they increase in size they project more and more and finally upon maturity are generally pushed outward on the pseudopedicel formed at the base of the depression. A small pit or cleft forms at the apex or somewhat below the apex. The stigma is single and formed on the lower or anterior side of this pit, or it is double with the second stigmatic area developed on the posterior side.

In the subgenus *Sphaerocarpidium* the apex of the ovary and fruit is oblique and commonly more or less posteriorly rostrate. The stigma is subapical, smooth, or more or less penicillate, and mostly single, as described by Dahlstedt. Some species, however, have the stigmas more commonly

divided, and in a few species both single and divided stigmas have been found, not uncommonly on the same spike.

In the subgenus *Hawaiiana* the apex is rounded to pointed and but slightly if at all oblique. In this group the stigmas may differ in appearance considerably at different periods of their development. They may be very small and inconspicuous in young ovaries, and in some species they are easily deciduous, especially when fully matured or when boiled. All stages in the development and appearance of the stigmas of several of the species have been observed in fresh materials. If the stigmas are undeveloped, or have fallen off, the ovary or fruit appears to have an inconspicuous single stigma. I believe that this variation in appearance of the stigmatic region at different periods of its development accounts for several of deCandolle's species which I am unable to distinguish by any other characters.

TAXONOMIC ARRANGEMENT OF THE SPECIES

Key to the Subgenera

1. Fruit with a pseudocupule, rachis puberulent.....subgenus **Micropiper**
1. Fruit without any pseudocupule, rachis glabrous
   2. Fruit globose to ovoid, apex oblique, stigma subapical, single or divided.....subgenus **Sphaerocarpidium**
   2. Fruit mostly ovoid to obovoid-turbinate, apex mostly rounded or pointed, stigma divided, penicillate, apical or but slightly subapical....subgenus **Hawaiiana**

Subgenus MICROPIPER (Miquel) Dahlstedt

Subgenus *Micropiper* Dahlstedt, Kongl. Sv. Vet. Akad., Handl., vol. 33, no. 2, p. 138, 1900.

Section *Micropiper* Miquel, Syst. Pip., p. 76, 1843.

The only species of this subgenus in the Hawaiian flora is the pantropic species *P. reflexa.*

1. **Peperomia reflexa** A. Dietrich.

Peperomia reflexa A. Dietrich, Sp. Pl., vol. 1, pt. 1, p. 180, 1831.
Peperomia tetraphylla Hooker and Arnott, Bot. Beechey p. 97, 1832.
Peperomia reflexa forma *Forsteriana* Miquel, Syst. Pip., p. 173, 1843.
Peperomia reflexa variety *nervulosa* C. deCandolle, in DC Prodromus, vol. 16, pt. 1, p. 451, 1869.
Peperomia reflexa variety *subsessilifolia* C. deCandolle, in DC Prodromus, vol. 16, pt. 1, p. 452, 1869.
Peperomia reflexa variety *honolulensis* Wawra, Flora, vol. 58, p. 229, 1875.

Stems generally several, spreading from a common rooting base, decumbent and rooting at the nodes or ascending, angular and more or less sulcate, mostly 15 to 30 cm. long or less commonly somewhat longer, up to 4 mm. thick in dry specimens, simple or more commonly branching above, branches often dichotomous or trichotomous, internodes of various lengths up to 8 cm. long but mostly 2 to 4 cm. long, generally puberulent above, more or less glabrate below.

Leaves mostly in whorls of 4, less commonly in 3's, or rarely opposite, fleshy and turgid when fresh, drying coriaceous and wrinkled, glandular-punctate, sparingly puberulent beneath, glabrate above or sparsely hairy, oval-orbicular to subovate or subobovate or subrhombic, 0.7 to 1.3 cm. broad, 1 to 2 cm. long, palmately 3-nerved, nerves mostly obscure, apex obtuse, or more or less attenuate, base obtuse or briefly acute; petiole puberulent, mostly about 2 mm. long, leaf scars semicircular, bundle scars 3.

Spikes terminal, solitary, 1.5 to 4.5 cm. long, 2 to 3 mm. thick, densely flowered, peduncle 1 to 2.5 cm. long, puberulent; rachis deeply foveolate, ridges densely puberulent; bracts round, peltate, about 0.5 mm. broad; filaments about equaling or somewhat longer than the ellipsoidal anthers; ovary deeply immersed in the pits of the rachis, cylindric-ovoid, apex slightly oblique, stigma single, terminal or slightly subterminal, penicillate; fruit 1.25 mm. long, subcylindric, lower half (pseudocupule) yellow and smooth, viscid, upper part more or less roughened, apically pointed and briefly costate on the anterior side.

This species is pantropic. It has been found throughout the Hawaiian islands, commonly in rocky situations. The original description of the species is brief, but the plants examined seem to agree with it as well as with that of any of the numerous varieties which have been described. I have, therefore, followed deCandolle and Hillebrand in believing that the typical form of the species occurs in Hawaii.

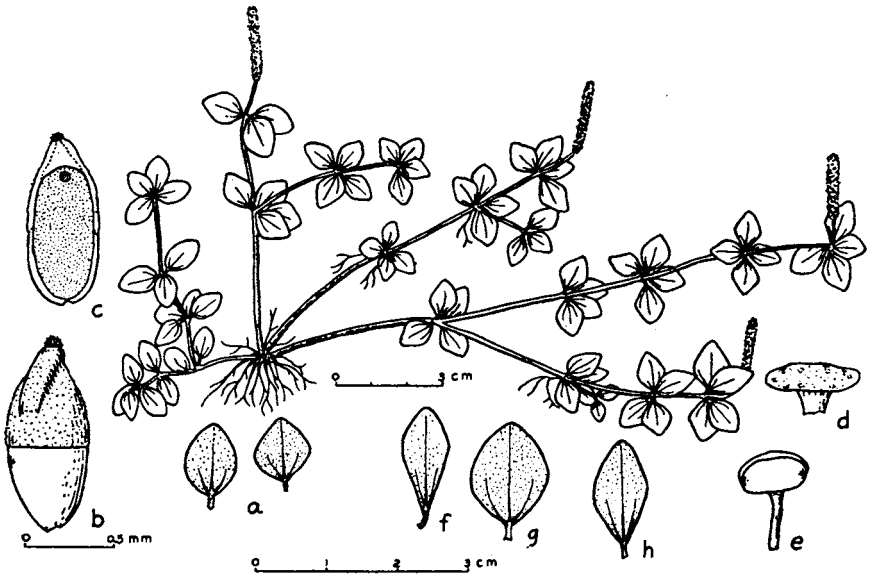

FIGURE 1.—*Peperomia reflexa* Dietrich, variety *parvifolia: a,* leaves; *b,* fruit; *c,* section of fruit; *d,* bract, enlarged; *e,* stamen, enlarged; *f-h,* leaves of *Peperomia reflexa.*

Kauai: Waimea Drainage Basin, Forbes nos. 953-K, 1068-K (B. P. Bishop Museum); on Kaholuamanoa [Kaholuamanu], above Waimea, Heller no. 2481 (B. P. Bishop Museum); Kumuweia Ridge, on ground in wet forest, altitude 3500 feet, Yuncker no. 3543 (B. P. Bishop Museum); along Kumuweia Ridge trail, epiphytic on tree, altitude 3500 feet, Yuncker no. 3544 (B. P. Bishop Museum); Na Pali coast, Hanakapiai Valley, St. John, Hosaka, Hume, Inafuku, Lindsay, Masuhara, Mitchell, and Wong no. 10981 (B. P. Bishop Museum); Waimea, altitude 1000 meters, Faurie no. 134 (de-Candolle).

Oahu: Wawra no. 1984, type of variety *honoluensis* (Vienna); right fork of Niu Valley, Garber no. 451 (B. P. Bishop Museum); Niu Valley, Degener 4282 (Degener); middle ridge of Niu Valley on shaded rocks, Degener, Park, and Nitta no. 4273 (Degener); Manoa Valley above Wood-

lawn, bare, dry, rocky cliff, Fosberg no. 9299 (B. P. Bishop Museum); Nuuanu Pali, altitude 1200 feet, Hitchcock nos. 13777, 15576 (U. S. National, B. P. Bishop Museum); Manoa, cave, on rocks, Tam, Jan. 1929 (Degener); northwest slope of Kahana Valley, near summit, ¼ mile from ocean, Degener no. 4299 (Degener); from Kahana church up ridge to summit of mountain southeast of Kahana Bay, Degener and Park no. 4355 (Degener); lower slopes of north ridge at base of small rock pali, altitude 400 meters, Kaawa [Kaaawa], Hume no. 190 (B. P. Bishop Museum); gulch above Aiea, on overhanging cliffs along stream, Yuncker no. 3042 (B. P. Bishop Museum); ridge back of Red Hill, altitude 2000 feet, Degener, Oct. 9, 1932 (Degener); Waianae range, near Mauna Kapu, Degener and Wiebke no. 2600 (Degener, Illinois); Puu Kapu [Mauna Kapu], wet forest, altitude 500-600 meters, Christophersen, Wilder, and Hume no. 1530 (B. P. Bishop Museum); below Puu Kapu, dry ridge, altitude 350-500 meters, Christophersen, Wilder, and Hume, no. 1535 (B. P. Bishop Museum); Kolekole Pass, Forbes no. 2027-O (B. P. Bishop Museum); Mokuleia, slopes of Puu Kaala, Forbes no. 1782-O (B. P. Bishop Museum); northeast slope of Puu Kaala, on rocky side of fourth gulch east of Puu Kaupahale [Puu Kaupakuhale], altitude 2000 feet, Yuncker and Hosaka no. 3251 (B. P. Bishop Museum); on east side of valley below Palikea, Degener no. 4232 (Degener); southeast slope of Makua Gulch, altitude 1500 feet, Degener, Sept. 27, 1932 (Degener); Makaha Valley, Forbes, Feb. 12-19, 1909 (B. P. Bishop Museum); ravine on northeast slope of Puu Kaua, on rocks, altitude 1800 feet, Yuncker no. 3294; altitude 2200 feet, Yuncker nos. 3286, 3289 (B. P. Bishop Museum); gulch on northeast slope of Puu Hapapa, Degener, Topping, and Bush no. 4233 (Degener); west face of Puu Kalena, Waianae Mountains, Waianae-kai, Fosberg no. 9310 (B. P. Bishop Museum); northwest of summit of Piko trail, Makua, Degener no. 4279 (Degener); Piko trail, Mokuleia side, altitude 2000 feet, Yuncker no. 3362 (B. P. Bishop Museum); near summit of Piko trail, Makua Valley, Degener, Park, and Nitta, no. 4356 (Degener); Kalihi, Faurie no. 135 (deCandolle).

Molokai: north slope of Halawa Valley, on rocks in arid region, Degener and Wiebke no. 2996 (Degener, Illinois); Halawa Valley, on arid rocks, St. John, Baker, Coulter, Fosberg, and Yuncker no. 12679 (B. P. Bishop Museum); third ravine south of Maunahui, locally common on ground along dry ridges shaded by *Cyathodes* and dead *Dicranopteris,* Degener and Wiebke no. 2874 (Degener, Illinois); near Laianui, on ground and rocks in partly sunny valley, Degener and Wiebke no. 2876 (Degener, Illinois).

Maui: east Maui, Olinda, in moss along pipe line, Degener and Wiebke nos. 2631, 2634, 2641 (Degener, Illinois).

Lanai: Forbes no. 333-L (B. P. Bishop Museum); mountains near

Koele, Forbes no. 76-L (B. P. Bishop Museum); Puhielelu Ridge, Munro no. 470 (B. P. Bishop Museum).

Key to Varieties

1. Leaves 1 to 2 cm. (commonly about 1.5 cm.) long, stems and leaves more or less puberulent.....**P. reflexa**
1. Leaves commonly less than 1 cm. long
2. Leaves puberulent.....variety **parvifolia**
2. Leaves glabrous.....variety **elongata**

Peperomia reflexa variety **parvifolia** C. deCandolle.

Peperomia reflexa variety *parvifolia* C. deCandolle, in DC Prodromus, vol. 16, pt. 1, p. 452, 1869.

Peperomia reflexa variety *oahuensis* Wawra, Flora, vol. 58, p. 229, 1875.

Stems slender, rarely exceeding 10 cm. in length, decumbent and substoloniferous or ascending, often more or less tufted especially when epiphytic, puberulent above, glabrate below; leaves mostly less than 1 cm. in length or rarely up to 1.3 cm. long, elliptic to orbicular, subovate, or subrhombic, apex rounded or briefly attenuate, commonly more or less puberulent on both surfaces.

Type, island of Ceylon, Thwaites no. 2462, in the deCandolle Herbarium.

Originally described from Ceylon and Khasia. Found throughout Hawaii, commonly on mossy rocks or as an epiphyte on mossy tree branches.

Kauai: Near Kokee Forest Ranger station, Waimea, on arid rocks, altitude 3600 feet, Yuncker no. 3384 (B. P. Bishop Museum).

Oahu: Horner no. 2602 (Degener, Illinois); Wawra no. 1732, type of variety *oahuensis* (Vienna); Palolo Crater, southeast side within crater, Degener, Park, and Nitta no. 4268 (Degener); west branch of Palolo Valley, Degener, Park, and Nitta, March 20, 1932 (Degener); Waialae Iki, Forbes, Oct. 10, 1908 (B. P. Bishop Museum); head of Kalihi Valley, Christophersen, Wilder, and Hume no. 1497 (B. P. Bishop Museum); east ridge of Manoa Valley, epiphytic, exposed to the sun, altitude 2000 feet, Degener, Rodrigues, and Krauss, no. 3543 (Degener); Tantalus mountain, epiphytic on *Acacia koa,* Yuncker no. 3254 (B. P. Bishop Museum); epiphytic in light woods on Mt. Tantalus, Degener nos. 2438, 2439 (Degener); Mt. Tantalus, epiphytic on *kukui,* Degener and Wiebke no. 2614 (Degener, Illinois); Manoa spring, altitude 1500 feet, Bryan, Dec. 28, 1909 (B. P. Bishop Museum); Kaneohe, Degener and Park no. 4295 (Degener); Punaluu, Degener no. 4274 (Degener); Waihole [Waiahole]-Kahana trail, epiphytic, Degener and Hirai no 4031 (Degener); Kipapa Gulch, north ridge on dead tree, altitude 1200 feet, Hosaka nos. 572, 851 (B. P. Bishop Museum); moss-covered tree stump, Nitta, Feb. 16, 1930 (B. P. Bishop Museum); Waimanu, Topping no. 3111 (Degener, Illinois); Waikakalau [Waikakalaua] Gulch, moss-covered tree, altitude 1300 feet, Nitta, April 6, 1930 (B. P.

Bishop Museum); on Puu Kaua, Topping no. 3139 (Degener, Illinois); northeast slope of Puu Kaua on dry rock, altitude 2200 feet, Yuncker nos. 3285; 3290 (B. P. Bishop Museum); epiphytic on *Metrosideros polymorpha,* altitude 3000 feet, Yuncker no. 3288 (B. P. Bishop Museum); Waianae range, southeast side of Makua Gulch, on tree, altitude 2000 feet, Degener Sept. 27, 1932 (Degener); second gulch east of Puu Kaupakuhale, northeast slope of Puu Kaala, 10 feet up mossy tree trunk in moist woods, altitude 1600 feet, St. John and Fosberg no. 12135 (B. P. Bishop Museum); Puu Kaala, Wawra no. 2242 (Vienna); small canyon above Kaala trail, Waianae Mountains, Waianae-uka, Fosberg no. 9117 (B. P. Bishop Museum).

Molokai: Puu Kolekole, Forbes no. 174-Mo (B. P. Bishop Museum); Hanaliioliio [Hanalilolilo], epiphytic in damp shaded ravine, Degener and Wiebke no. 2738 (Degener, Illinois); Kaluaaha, shaded rocks at altitude about 1500 feet, Degener no. 2989 (Degener, Illinois); head of Waikolu Valley, Hanalilolilo, epiphytic, altitude 3800 feet, St. John, Baker, Coulter, Fosberg, and Yuncker no. 12404 (B. P. Bishop Museum); on ground, Punaula Valley, altitude 1600 feet, St. John and Fosberg no. 12821 (B. P. Bishop Museum).

Maui: Forbes no. 1974-M (B. P. Bishop Museum); east of Ukulele, Forbes no. 779-M (B. P. Bishop Museum); Kaupo Gap in Haleakala Crater, epiphytic on tree trunk in Paleku, Degener and Wiebke no. 2413 (Degener, Illinois); east Maui, Olinda, along pipe line, Degener and Wiebke no. 2632 (Degener, Illinois); north of Puu Ehu, epiphytic, Tam no. 3544 (Degener); along ditch trail from Haiku through Honomanu Valley to Keanae, Degener and Wiebke no. 2619 (Degener, Illinois); Makawao, Hillebrand and Lydgate (B. P. Bishop Museum).

Lanai: Munro, Forbes no. 337-L (B. P. Bishop Museum); Mahana Valley, Rock no. 8091 in part (Gray, B. P. Bishop Museum); pali above Waiopae [Waiaopae], Munro no. 273 (B. P. Bishop Museum); Waiopae, Munro no. 462 (B. P. Bishop Museum).

Hawaii: Kilauea Volcano, Rock no. 16027 (B. P. Bishop Museum); Kilauea, on trees, Rock no. 10397; Rock and Copeland no. 12594 (B. P. Bishop Museum); Kipuka Puaulu, altitude 4000 feet, Meebold, May, 1932 (B. P. Bishop Museum); Bird Park, Degener 2435; Degener, Brumaghim, Akau, and Iwasaki no. 3899 (Degener); Kona, Forbes no. 260-H (B. P. Bishop Museum).

Peperomia reflexa variety **elongata** Hillebrand.

Peperomia reflexa variety *elongata* Hillebrand, Fl. Hawaiian Is., p. 426, 1888.

Plants entirely glabrous, or with subpuberulent petioles and stems. Otherwise similar to variety *parvifolia.*

Type, Molokai, Mopulehu [Mapulehu], on trees, Hillebrand, in the Berlin Herbarium?

Distribution: Islands of Oahu and Molokai.

Oahu: Waianae range, Hoouliuli [Honouliuli], north fork of valley east of Palikea, on shaded boulder, altitude 1900 feet, St. John no. 10366 (B. P. Bishop Museum); on rocks, grassy slope, head of valley below Puu Kanehoa, Christophersen no. 3668 (B. P. Bishop Museum); northwest ridge of Puu Olomana, Kailua, Fosberg no. 9030 (B. P. Bishop Museum).

Molokai: Kapulei, on rocks in arid region, Degener and Wiebke no. 2982 (Degener, Illinois).

This species exhibits great variation in the size and pubescence of the stems, and size, form, and pubescence of the leaves. Not infrequently a considerable range in variation is to be found on the same plant, and it has not been considered advisable to establish new subdivisions however different the extremes of the variations may appear in themselves. The three forms here included are in the main recognizable, although intermediates are not uncommon.

Wawra described the leaves of his variety *honolulensis* as more than an inch long ("Folia . . . pollice longiora"), which does not agree with his type specimen as cited, which has leaves mostly 1.5 to 1.8 cm. and none more than 2 cm. long.

Forbes nos. 76-L and 333-L, collected on the island of Lanai, have leaves commonly only half as broad as long, but this character is not constant and some leaves are present which are of the broader form common to the species.

Subgenus SPHAEROCARPIDIUM Dahlstedt

Subgenus *Sphaerocarpidium* Dahlstedt, Kongl. Sv. Vet. Akad., Handl., vol. 33, no. 2, p. 92, 1900.

Leaves alternate, or, in the Hawaiian species, more generally opposite to whorled. Fruit globose to ovoid, apex oblique, often more or less obtusely rostrate, stigmas subapical, single or divided.

Dahlstedt did not describe the subgenus *Sphaerocarpidium* to include species with divided stigmas. Some of the Hawaiian species, however, which I believe belong in this subgenus, may have both single and divided stigmas, not uncommonly on the same spike.

Key to the Sections

Leaves alternate.....section **Alternifoliae**
Leaves opposite or whorled.....section **Verticillatae**

Section ALTERNIFOLIAE Dahlstedt

Section *Alternifoliae* Dahlstedt, Kongl. Sv. Vet. Akad., Handl., vol. 33, no. 2, p. 92, 1900

Leaves alternate. Fruit ovoid or globose, apex oblique, stigma single or divided, subterminal.

Key to the Species

1. Plants glabrous
   2. Stems up to 30 cm. tall and 4 mm. thick at the base when dry, leaves mostly 1.5 to 2 cm. broad and 6 to 8 cm. long (small, young plants may be confused with *P. alternifolia*) ..... **2. P. oahuensis**
   2. Stems mostly about 10 cm. tall and 1 mm. thick at the base when dry, leaves mostly 0.7 to 1 cm. broad and 2 to 4 cm. long ..... **3. P. alternifolia**
1. Plants more or less hairy, leaves mostly less than 1 cm. broad, plants delicate ..... **4. P. Degeneri**

2. **Peperomia oahuensis** C. deCandolle.

Peperomia oahuensis C. deCandolle, in DC Prodromus, vol. 16, pt. 1, p. 422, 1869.

Peperomia pallida Hooker and Arnott, Bot. Beechey, p. 96, 1832. Not Dietrich.

Peperomia lonchophylla C. deCandolle, in Schumann and Lauterbach, Die Flora der deutschen Schutzgebiete in der Südsee, p. 255, 1901.

Peperomia oahuensis forma *b* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 31, 1913.

Peperomia salmensis C. deCandolle, Candollea, vol. 1, p. 408, 1923, *Peperomia salmensis* forma *b* C. deCandolle, Candollea, vol. 1, p. 347, 1923, *Peperomia coahuensis* Schroeder, Candollea, vol. 3, p. 133, 1926, and *Peperomia coahuensis* forma *b* Schroeder, Candollea, vol. 3, p. 133, 1926 are misprints for *Peperomia oahuensis*.

Plants terrestrial or epiphytic, stems ascending from a decumbent, rooting base, mostly 15 to 30 cm. long and up to 3 mm. thick at the base in dry specimens, simple or less commonly branching upwards, green or somewhat red when fresh, more or less zigzag, internodes 2 to 6 cm. long.

Leaves alternate, glabrous, elliptic-lanceolate or rarely suboblanceolate, subrhombic or subfalcate, up to 3 cm. wide and 12 cm. long, mostly 1.5 to 2 cm. broad and 6 to 8 cm. long, 3 to 5-subplinerved, the lateral nerves slender, the innermost pair forking off the midrib in the lowermost 5 mm., apex acute or commonly attenuately acuminate, base cuneate; petiole 3 to 10 mm. long, mostly about 5 mm. long, leaf scar semicircular, bundle scars 3.

Spikes axillary, single or clustered, 5 to 7 cm. long and 1.5 mm. thick, moderately flowered; peduncles about 1 cm. long, glabrous; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments about as long as the ellipsoidal anthers, ovary obovoid, apex oblique, stigma single or commonly divided, subapical, commonly more or less penicillate; fruit 0.7 to 0.8 mm. long, globose-ovoid, verrucose, viscid, on pseudopedicels.

Type, Oahu, Beechey, in Kew Herbarium.

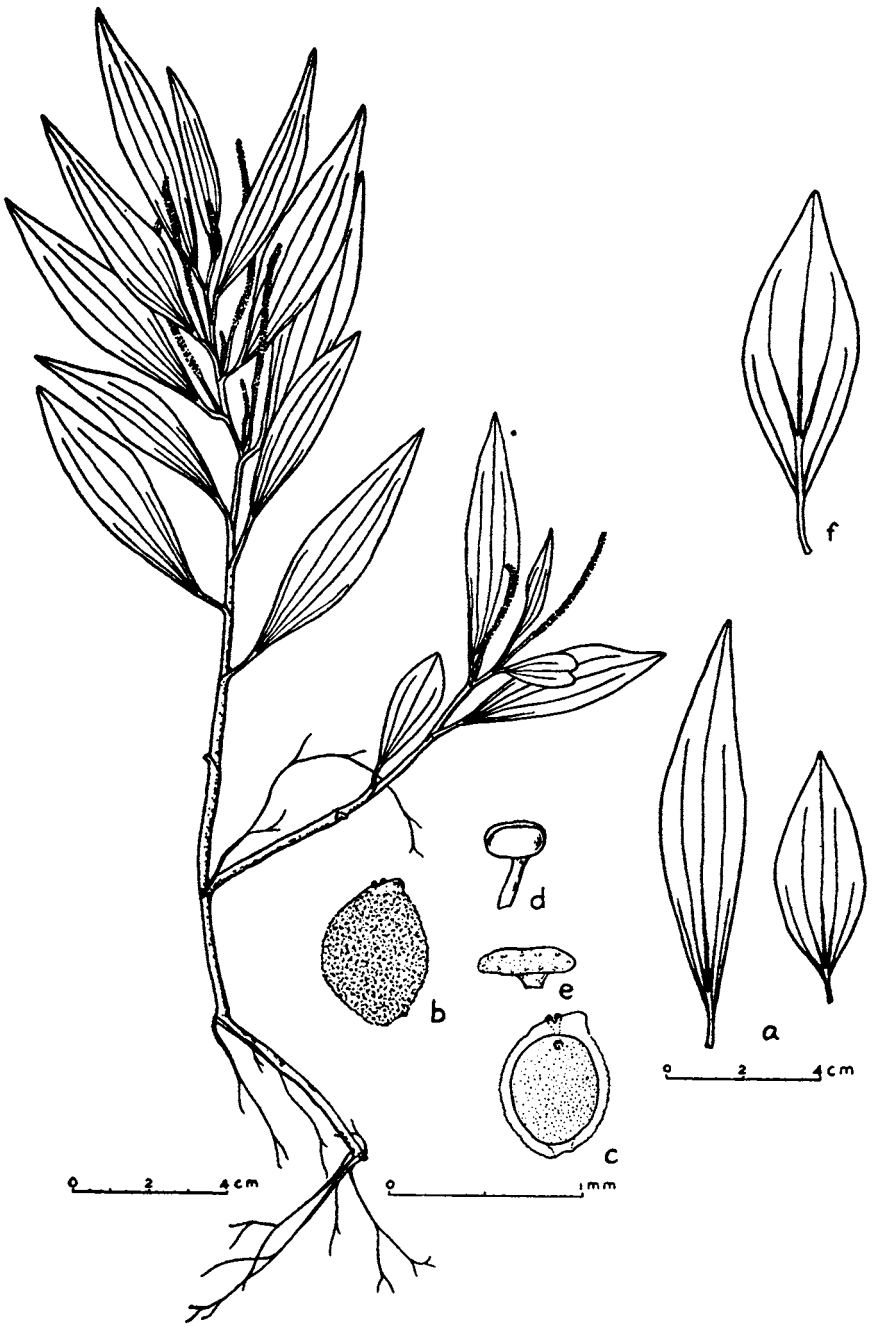

FIGURE 2.—*Peperomia oahuensis* C. deCandolle: *a*, leaves; *b*, fruit; *c*, section of fruit; *d*, stamen, enlarged; *e*, bract, enlarged; *f*, leaf of variety *St. Johnii*.

In Hawaii the species appears to be limited to the upper rain forest region of Koolau Range on the island of Oahu. It also occurs in Samoa.

Oahu. Beechey, type (Kew); Waialae Iki, Forbes, Oct. 10, 1908 (B. P. Bishop Museum); Palolo Valley, Swezey no. 12769 (B. P. Bishop Museum); Koolau mountains, Rock no. 1015 (B. P. Bishop Museum); Waikane-Schofield trail, Koolau mountains, Kahana, shaded stream banks, altitude 1800 feet, St. John no. 10170 (B. P. Bishop Museum); Waikane-Schofield trail, epiphytic on ***kukui,*** Degener, Park, and Hirai no. 4035 (Degener); Waikane-Schofield trail, Schofield side near summit, Yuncker no. 3151 (B. P. Bishop Museum); Kaipapau Valley, along stream, Degener and Westgate no. 4271 (Degener); Punaluu, Degener no. 4275 (Degener); Kaaawa ridges, Forbes and Spaulding, May 30, 1909 (B. P. Bishop Museum); Kaluanui, on mossy trunk of *Hibiscus Arnottianus,* 15 feet from the ground, altitude 1800 feet, St. John no. 10092 (B. P. Bishop Museum); Waiahole ditch trail, Meebold, June, 1932 (B. P. Bishop Museum); Waikakalaua Gulch, Waipio, altitude 1200 feet, Hosaka no. 202 (B. P. Bishop Museum); steep wet slope, altitude 1300 feet, Nitta, April 6, 1930 (B. P. Bishop Museum); on Helemano Ridge, Bush no. 4346 (Degener); Wahiawa Gulch, Forbes no. 1706-O (B. P. Bishop Museum); Wahiawa, head gate trail, Forbes no. 2209-O (B. P. Bishop Museum); Kipapa Gulch, wet slope, Nitta, Feb. 16, 1930 (B. P. Bishop Museum); on tree on wet wooded slope, altitude 1600 feet, Hosaka no. 816 (B. P. Bishop Museum); on mossy tree trunk, altitude 2800 feet, Hosaka no. 682 (B. P. Bishop Museum); second north fork, along moist stream bed, altitude 1700 feet, Hosaka no. 854 (B. P. Bishop Museum); Pupukea-Kahuku trail, Topping nos. 3088, 3257 (Degener).

Peperomia oahuensis variety **St.-Johnii,** new variety.

Caules 45 cm. longi vel longiores; folia superne alterna, inferne opposita vel alterna usque ad 3.5 cm. lata atque 9 cm. longa, 5-7-plinervia, vena media supra basin laminis 1-2 cm. furcata.

Stems 45 cm. or more long, up to 4 mm. thick at the base, leaves alternate above, opposite or alternate below, up to 3.5 cm. broad and 9 cm. long, 5 to 7-plinerved, the midrib forking 1 to 2 cm. above the base.

Type, Oahu, Kaluanui, mossy woods near divide, altitude 2000 feet, St. John no. 10102, in Bernice P. Bishop Museum.

Known only from the type locality.

Both Hillebrand and deCandolle apparently confused *P. oahuensis* with a species with weaker and more branched stems and smaller leaves which has been collected on some of the other islands, but not on Oahu. DeCandolle recognized these two forms (Bull. Coll. Hawaii no. 2, p. 31, 1913) referring the larger specimens to *P. lonchophylla* and the others to *P. oahuensis.* Beechey's specimen from Oahu, in Kew Herbarium, from which deCandolle

originally described *P. oahuensis,* is a young and very fragmentary specimen with a few juvenile leaves near the minimum in size for that species. It has, however, the more upright habit of growth and thicker stems characteristic of the plants which he later referred to *P. lonchophylla* and which I now believe to be the same. The smaller plants which deCandolle considered to be the same as his *P. oahuensis* I am now describing as a new species, *P. alternifolia.*

From *P. pallida* of the Society Islands *P. oahuensis* differs in its elliptic-lanceolate leaves with commonly attenuately acuminate apexes. Although *P. pallida* has been attributed to Hawaii, I agree with Hillebrand and deCandolle in believing that it does not occur there.

The species is readily recognized with the suberect stems up to 30 cm. or more long and longer, elliptic-lanceolate leaves. The variety *St.-Johnii* differs in the form of the venation and proportionately broader and, not uncommonly, opposite leaves.

3. Peperomia alternifolia, new species.

Caules complures, inferne sat furcati, adscentes, repentes radicantesque, superne sparse furcati, plus minusve tortuosi, plerumque haud ultra 15 cm. longi, glabri, internodis plerumque 1 cm. longis vel brevioribus. Folia alterna, glabra, elliptico-lanceolata, suboblanceolata vel subrhombea, plerumque 0.7-1 cm. lata, 2-4 cm. longa, 3-plinervia, apice acuta ad acuminata vel inferioria raro obtusa, basi acuta ad cuneata. Spicae axillares, plerumque haud longitudine foliorum longiores; fructus globoso-subovoideus, apice parum obliquus; stigma subterminale, divisum.

Stems several, branching and ascending from the more or less repent and rooting base, not commonly branching above, more or less zigzag, mostly less than 15 cm. long, up to 1 mm. thick at the base in dry specimens, glabrous, internodes commonly 1 cm. or less long.

Leaves alternate or rarely opposite at one or two nodes, glabrous, elliptic-lanceolate, suboblanceolate or subrhombic, not uncommonly somewhat falcate, mostly 0.7 to 1 cm. wide and 2 to 4 cm. long, 3-plinerved, the midrib forking in the lowermost 1 to 3 mm., apex acute to acuminate, the lower leaves rarely obtuse, base acute to cuneate; petiole 3 to 6 mm. long, glabrous, leaf scars semicircular, bundle scars 3, small.

Spikes axillary, single or clustered, mostly not exceeding the length of the leaves, moderately flowered; peduncle 5 to 7 mm. long, glabrous; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments about equal to the ellipsoidal anthers; ovary subovoid, apex somewhat oblique, stigma subterminal, divided, fruit globose-subobovoid, about 0.7 mm. long, verrucose, viscid, on pseudopedicels.

Type, Molokai, Mapulehu Valley, Forbes no. 302-Mo., in Bernice P. Bishop Museum.

Found on the islands of Molokai, Lanai, and Maui. I have seen no specimens from Maui, but deCandolle cites one as collected by Faurie (no. 140).

Molokai: Mapulehu Valley, Forbes no. 302-Mo. in part (B. P. Bishop Museum); west branches of Mapulehu Valley, Degener no. 4292 (Degener); along shaded stream bed among rocks, Wiebke no. 3069 (Degener, Illinois);

Wailau Valley, on ground in dark wet woods, Wiebke and Nitta nos. 3185, 3186 (Degener, Illinois); valley west of eastern Ohia, along stream on rocks, Degener and Wiebke no. 3065 (Degener, Illinois); ledge beside waterfall, Punaula Valley, altitude 1500 feet, St. John and Fosberg no. 12833 (B. P. Bishop Museum); mossy rocks in canyon bottom, Punaula Valley, altitude 1700 feet, St. John and Fosberg no. 12823 (B. P. Bishop Museum).

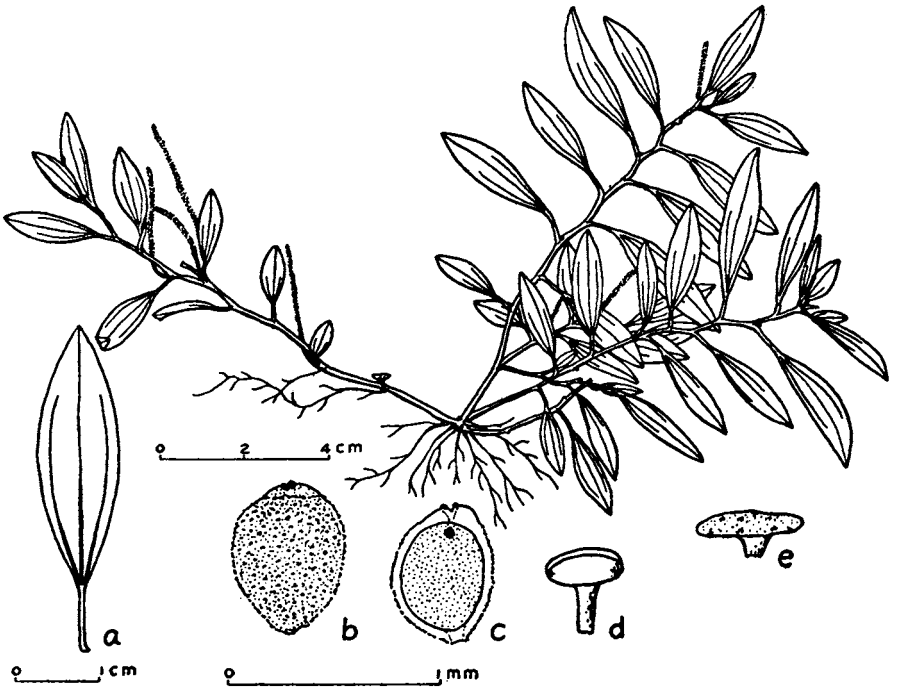

FIGURE 3.—*Peperomia alternifolia* Yuncker: *a*, leaf; *b*, fruit; *c*, section of fruit; *d*, stamen, enlarged; *e*, bract, enlarged.

Lanai: pali above Waiapaa, Munro no. 274 (B. P. Bishop Museum).

DeCandolle seemingly confused this species with his *P. oahuensis*. Examination of the type of *P. oahuensis* shows, however, that it is similar to the plants that he later called *P. lonchophylla*. This species is closely related to *P. oahuensis* and differs mainly in the different habit of growth, mostly shorter and more slender stems, and smaller leaves.

4. Peperomia Degeneri, new species.

Herba parva usque ad 5 cm. alta, sat hirsuta. Folia alterna, membranosa, subtus moderatim hirsuta, supra omnino hirsuta, vel basi vel statu juniore solum hirsuta, ovata vel elliptico-oblonga ad spathulata, 0.7-1.2 cm. lata, 1.5-2 cm. longa, obscure palmatim

3-nervia, apice rotunda vel brevissime acuta basi plerumque acuta; petiolus gracillimus, usque ad 1.2 cm. longus, hirsutus. Spicae usque ad 3 cm. longae, pedunculo usque ad 1 cm. longo; ovarium ovoideum, apice obliquum; stigmata subterminale, divisum.

Plants delicate, stems slender, up to 5 cm. long and 1 mm. thick in dry specimens, branching from a short, rooting base, mostly unbranched above, internodes up to 1.5 cm. long, moderately hirsute, hairs up to 0.5 mm. long.

Leaves alternate, drying thin and membranous, lower surface moderately hirsute, light green, upper surface darker green, moderately hirsute or glabrous except for scattered hairs at the base, oval or elliptic-oblong to spatulate, 0.7 to 1.2 cm. broad, 1.5 to 2 cm. long, rarely up to 1.7 cm. broad and 3.5 cm. long, obscurely palmately 3-nerved, apex rounded or very briefly pointed, base rounded to cuneate, mostly acute; petiole very slender, up to 1.2 cm. long, hirsute.

Spikes terminal and axillary, up to 3 cm. long and 1 mm. thick, loosely flowered; peduncle up to 1 cm. long, sparingly hirsute or glabrous; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments somewhat longer than the globose-ellipsoidal anthers; ovary ovoid, apex oblique, stigmas 2, subapical, penicillate; fruit ovoid, somewhat rostrate, about 0.7 mm. long, verrucose, viscid.

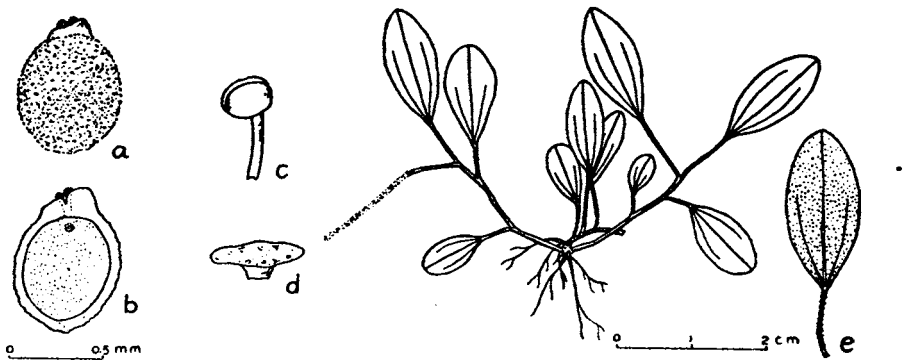

FIGURE 4.—*Peperomia Degeneri* Yuncker: *a*, fruit; *b*, section of fruit; *c*, stamen, enlarged; *d*, bract, enlarged; *e*, leaf.

Type, Molokai, east arm of Kaluaaha Valley on shaded cliffs, Degener and Wiebke no. 3061, in the Degener herbarium. Duplicate type in the University of Illinois herbarium.

Known only from the type locality.

This species is closely related to *P. latifolia* but differs from that species in its more delicate habit of growth and predominatingly alternate leaves. From *P. oahuensis* and *P. lonchophylla*, the only other alternate-leaved species in Hawaii, it differs in the size of the plant, shape of leaves, and especially in the hirsute stems and leaves.

I take pleasure in naming this species for Mr. Otto Degener, the senior collector, who has devoted several years to collecting and studying the Hawaiian flora.

Section VERTICILLATAE Dahlstedt

Section *Verticillate* Dahlstedt, Kongl. Sv. Vet. Akad., Handl., vol. 33, no. 2, p. 96, 1900.

Leaves opposite or whorled (may be alternate below in *P. latifolia* and *P. sandwicensis* or in seedlings). Fruit mostly globose to ovoid, apex oblique, often more or less bluntly rostrate, stigmas single or divided, subapical.

Key to the Species

1. Leaves mostly rounded to obovate, commonly 1.5 to 3.5 cm. broad, apex rounded, upper surface glabrous, lower leaves often alternate, plants low. (Commonly 5 to 10 cm. tall).....**5. P. latifolia**
1. Plants without above combination of characters
 2. Plants glabrous
  3. Leaves 3 to 5-palmately nerved
   4. Leaves less than 1.5 cm. broad, oblong to elliptic-lanceolate, plants less than 20 cm. tall.
    5. Leaves 4 to 8 mm. broad, commonly oblong-lanceolate, base acute..**6. P. ligustrina**
    5. Leaves 7 to 13 mm. broad, elliptic-lanceolate, base rounded or shortly acute .....**7. P. koolauana**
   4. Leaves and plants commonly larger
    5. Leaves oval or elliptic, 1 to 2 cm. broad, 1.8 to 3.5 cm. long, palmately 3-nerved, apex obtuse or acute.....**8. P. globulanthera**
    5. Leaves mostly elliptic-lanceolate or ovate-lanceolate, commonly larger, apex acute to acuminate.....**9. P. membranacea**
  3. Leaves 5-plinerved, stigmas penicillate.....**10. P. Forbesii**
 2. Plants more or less hairy
  3. Peduncles rarely exceeding 2 cm. in length
   4. Leaves and spikes more than 1 cm. long.
    5. Leaves mostly elliptic or elliptic-lanceolate, mostly less than 2 cm. broad, palmately nerved.
     6. Leaves mostly more than 2 times as long as broad.
      7. Plants mostly less than 15 cm. tall.
       8. Leaves mostly less than 2 cm. long, plants more or less hirtellous, hairs mostly less than 0.5 mm. long.
        9. Spikes single or more rarely in twos or threes.....**6. P. ligustrina** variety **oopuolana**
        9. Spikes in terminal clusters.....**11. P. Treleasei**
       8. Leaves 2 to 4 cm. long, plants hirsute or rarely hirtellous, hairs up to 1 mm. long.....**12. P. Helleri**
      7. Plants taller, commonly 20 to 60 cm. tall
       8. Plants hirsute
        9. Leaves mostly up to 3 times as long as broad, upper surface commonly hirsute.....**12. P. Helleri** variety **grossa**
        9. Leaves mostly proportionately broader, hirsute above mostly only at the base or along the nerves.....**18. P. Cookiana** variety **flavinerva**
       8. Plants densely hirtellous
        9. Leaves mostly more than 1.5 cm. broad.....**18. P. Cookiana** variety **pukooana**
        9. Leaves mostly 0.8 to 1.3 cm. broad.....**13. P. kokeana**

6. Leaves mostly less than 2 times as long as broad
7. Stigmas mostly divided, leaves drying sub-coriaceous and commonly salmon colored beneath, plants up to 30 cm. or more tall....**17. P. ellipticibacca**
7. Stigmas mostly single, leaves not as above, plants mostly less than 15 cm. tall
8. Plants less than 5 cm. tall, leaves less than 1 cm. long, hirtellous above only at the base....**18. P. Cookiana** variety **minutilimba**
8. Plants and leaves commonly much larger
9. Plants hirsute, hairs commonly up to 1 mm. long, leaves commonly 1 to 2 cm. broad....**18. P. Cookiana**
9. Plants hirtellous, hairs mostly shorter, leaves commonly less than 1 cm. broad....**12. P. Helleri** variety **subovata**
5. Leaves not entirely as above
6. Plants hirtellous, hairs mostly less than 0.5 mm. long (rarely up to 1 mm. long in *P. leptostachya*)
7. Leaves mostly 3.5 to 6 cm. long, plants up to 60 cm. tall
8. Leaves 3 to 5-plinerved or subpalmately nerved, elliptic, apex obtuse or subacute....**14. P. trichostigma**
8. Leaves palmately 3 to 5-nerved, elliptic-lanceolate or somewhat rounded, apex acute to acuminate....**15. P. Remyi**
7. Leaves mostly less than 4 cm. long
8. Leaves mostly whorled, plants commonly more than 20 cm. tall....**18. P. Cookiana** variety **pukooana**
8. Leaves mostly opposite easily deciduous, plants commonly less than 20 cm. tall, internodes mostly 1 to 2 cm. long....**16. P. leptostachya**
6. Plants hirsute, hairs mostly up to 1 mm. long.
7. Leaves 3 to 5-plinerved, upper surface subglabrous, spikes up to 4 cm. long....**17. P. ellipticibacca**
7. Leaves palmately 3 to 5-nerved, upper surface commonly more or less hirsute, spikes generally longer....**18. P. Cookiana**
4. Leaves and spikes less than 1 cm. long....**19. P. waikamoiana**
3. Peduncles mostly 2.5 to 6 cm. long, not uncommonly equaling or exceeding the rachis, leaves mostly obovate to spatulate, apex rounded, obtuse
4. Leaves 3 to 5-nerved, mostly 1 to 2 cm. broad and 1.5 to 2.5 cm. long, plants commonly 10 to 25 cm. tall....**20. P. sandwicensis**
4. Leaves 1 to 3-nerved, in whorls of 3 to 5, mostly less than 1 cm. broad and 1.8 cm. long, plants commonly smaller....**21. P. mauiensis**

5. Peperomia latifolia Miquel.

Peperomia latifolia Miquel, Syst. Pip., p. 128, 1843; Illustr. Pip., p. 20, pl. 15, 1844.

Peperomia latifolia? variety *alternifolia* Wawra, Flora, vol. 58, p. 231, 1875.

Peperomia hypeleuca forma *glabra* Wawra, Flora, vol. 58, p. 232, 1875 (evidently a misprint for *hypoleuca*).

Peperomia hypoleuca? variety *alternifolia* Wawra, Flora, vol. 58, p. 232, 1875.

Peperomia subcrenata Klotsch in Berlin Herbarium, according to Hillebrand, Flora Hawaiian Is., p. 424, 1888.

Peperomia dentulibractea C. deCandolle, Bull. Coll. Hawaii no. 2, p. 32, 1913.

Peperomia punaluuna C. deCandolle, Bull. Coll. Hawaii no. 2, p. 32, 1913.

Peperomia villapeduncula C. deCandolle, Bull. Coll. Hawaii no. 2, p. 37, 1913.

Stems single or commonly clustered, erect, or ascending from a short, decumbent, rooting base, reddish in color when fresh, mostly 5 to 10 cm., or rarely exceeding 15 cm. in length, up to 4 mm. thick in dry specimens or in fresh plants up to 8 mm. thick at the base, simple or more commonly divaricately and sometimes dichotomously branched above, abundantly hirsute when young, glabrate below, often subglabrate above in old plants or rarely so when young, hairs frequently reddish, internodes more or less tumid, commonly 1 to 3 cm. long, rarely up to 8 cm. long.

Leaves alternate or opposite below and mostly opposite or whorled above, lower surface pubescent and light green or sometimes with red intercostal areas, upper surface glabrous or sparingly hairy at the base or for a short distance along the midrib, mostly oval to orbicular, less commonly ovate or obovate-spatulate, not uncommonly the leaves on a single plant exhibit a wide range in shape, 1.5 to 6.5 cm. broad, 2 to 7.5 cm. long, mostly 2.5 to 3.5 cm. broad and 3 to 5 cm. long, palmately 5 to 7-nerved, the innermost pair of lateral nerves commonly coalescing with the midrib in the lowermost 5 mm., larger nerves commonly red in fresh specimens, apex rounded or less commonly briefly subattenuated, or rarely retuse, base mostly obtuse or shortly acute, less commonly cuneate; petiole mostly 0.8 to 2 cm. long, rarely up to 3 cm. long, pubescent or rarely glabrate; leaf scars suborbicular, bundle scars 3.

Spikes usually several, axillary or terminal, or sometimes leaf apposed, exceptionally cymosely branched, 1.5 to 8 cm. long, rarely up to 15 cm. long, moderately flowered; peduncle mostly 1 to 2.5 cm. long, or rarely somewhat longer and equaling or exceeding the length of the spike, pubescent; rachis glabrous; bracts orbicular, with more or less uneven edges, peltate, about 0.5 mm. broad or up to 1 mm. broad in fresh specimens; filaments about equaling the globose-ellipsoidal anthers; ovary ovoid, submersed, apex oblique, stigma subapical, divided or sometimes single, more or less penicillate; fruit globose-ovoid, verrucose, viscid, 0.7-1 mm. long, on pseudopedicels.

Type, Sandwich Islands, Gaudichaud, in the Delessert herbarium.

This species is very common and is to be found throughout Hawaii, mostly above altitude 500 feet, where it takes the place of *P. leptostachya,* the common lowland species. It, however, is usually not abundant above altitude 3000 feet. It prefers a moist shady environment and is most common on wet rocky cliffs, mossy ground, and tree trunks in association with species of mosses, ferns, *Selaginella,* and so forth.

Kauai: Hanalei Valley, Wawra no. 1844b, the type of *P. latifolia?* variety *alternifolia* (Vienna); Waimea Drainage Basin, west side, Forbes no. 955-K (B. P. Bishop Museum); along trail of Kilohana lookout, Waimea, in wet forest, altitude 3600 feet, Yuncker no 3545 (B. P. Bishop Museum); Waimea Drainage Basin, west side, Kalalau trail, Forbes no. 1109-K (B. P. Bishop Museum); along Kumuweia Ridge trail, altitude 3500 feet, Yuncker no. 3387 (B. P. Bishop Museum); Waioli Valley, Forbes no. 110 (B. P. Bishop Museum); Kaholuamanu, Rock, Oct., 1916 (B. P. Bishop Museum);

near Ka Loko Reservoir (Kilauea), Forbes nos. 583-K, 586-K (B. P. Bishop Museum); Hii Mountains, Forbes no. 699-K (B. P. Bishop Museum); wet cliff, Hanakapiai Valley, Napali coast, St. John, Hosaka, Hume, Inafuku, Lindsay, Masuhara, Mitchell, and Wong no. 10929 (B. P. Bishop Museum);

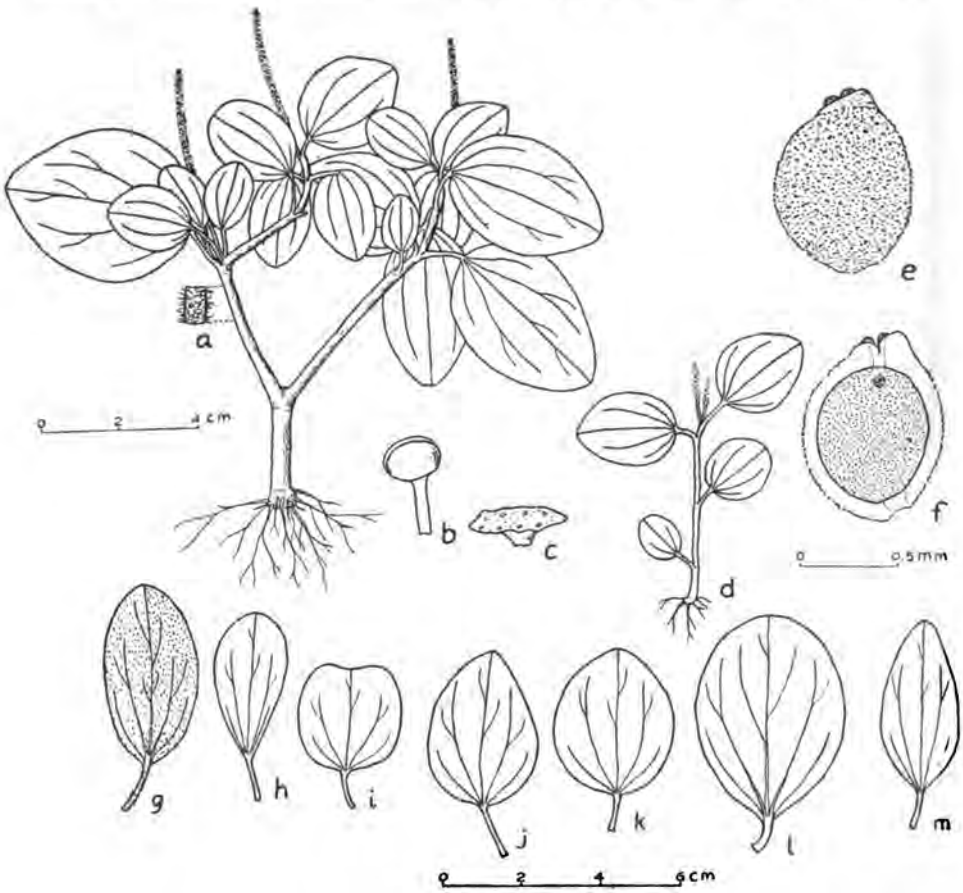

FIGURE 5.—*Peperomia latifolia* Miquel: *a*, section of stem, enlarged; *b*, stamen, enlarged; *c*, bract, enlarged; *d*, young plant with alternate leaves; *e*, fruit; *f*, section of fruit; *g-m*, different leaf shapes.

on rocks near waterfall along Na Pali coast trail, Yuncker no. 3390 (B. P. Bishop Museum).

Oahu: Wawra no. 1844a—Wawra lists this specimen from Kauai but the label gives the island as Oahu (Vienna); Mann and Brigham no. 243 (Gray); Hillebrand (Berlin); Meyen, May, 1831, cotype of *P. latifolia* (Berlin); rocks behind Honolulu, Wilkes Expedition, 1838-1842 (Gray);

between Wilhelmina Rise and summit back of Honolulu, Degener no. 4285 (Degener); Punaluu mountains, Rock no. 10371, considered as a duplicate type of *P. villapeduncula* (B. P. Bishop Museum); Rock no. 12501 (Gray, B. P. Bishop Museum); rocky ledge, altitude 700 feet, Yuncker no. 3364 (B. P. Bishop Museum); wet slope, Nitta, Nov. 30, 1929 (B. P. Bishop Museum); wet mountain ridge, Tanaka, Nov. 30, 1929 (B. P. Bishop Museum); mossy wooded ridge, altitude 2000 feet, St. John no. 10081 (B. P. Bishop Museum); altitude 2000 feet, Hosaka no. 49 (B. P. Bishop Museum); wet slope, upper part of west ridge, altitude 675 meters, Hume nos. 73, 74 (B. P. Bishop Museum); altitude 800 meters, Faurie no. 159, type of *P. punaluuna* (deCandolle); Haiku Valley, Waihole [Waiahole] Forest Reserve, Heeia, wooded ridge, altitude 900 feet, St. John no. 12273 (B. P. Bishop Museum); between Punaluu and Kaipaupau [Kaipapau]. Koolauloa mountains, Forbes and Thompson, May 8-13, 1909 (B. P. Bishop Museum); South Opaeula Gulch, Paalaa, Koolau Range, Nakagawa, Nov. 30, 1930 (B. P. Bishop Museum); south ridge on mossy logs, altitude 1400 feet, St. John no. 12095 (B. P. Bishop Museum); altitude 1600 feet, St. John no. 12096 (B. P. Bishop Museum); on mossy banks in woods, altitude 1700 feet, St. John no. 12097 (B. P. Bishop Museum); Waikane-Schofield trail, Koolau mountains, near summit, Yuncker nos. 3161, 3162 (B. P. Bishop Museum); altitude 1000 feet, on wet rocks, Waikane side, Yuncker nos. 3160, 3163 (B. P. Bishop Museum); in wet forest, Fosberg nos. 8760, 8764 (B. P. Bishop Museum); wet base of rocky summit ridges, Fosberg and Duker no. 8781 (B. P. Bishop Museum); on mossy ground, moist woods, Laie, Malaekahana ridge, Koolau mountains, altitude 2000 feet, St. John no. 13071 (B. P. Bishop Museum); moist shaded bank, altitude 2200 feet, St. John no. 10172 (B. P. Bishop Museum); altitude 1500 feet, on wet ledges, Yuncker no. 3205 (B. P. Bishop Museum); Kahana, mountains southeast of Kahana Bay, Degener no. 4287 (Degener); from Kahana church up ridge to summit of mountain southeast of Kahana Bay, Degener and Park no. 4354 (Degener); gulch above Aiea, on rocky ledges near stream, Yuncker nos. 3036, 3037, 3039, 3041 (B. P. Bishop Museum); Niu Valley, Degener no. 4283 (Degener); Tantalus mountain, Heller no. 2116 (Gray, B. P. Bishop Museum); wet slope, Nitta, Dec. 28, 1929 (B. P. Bishop Museum); in moist woods near top, altitude 1900 feet, Yuncker no. 3246 (B. P. Bishop Museum); altitude 1500 feet, Yuncker no. 3255 (B. P. Bishop Museum); along Castle trail, rocky, shaded embankment, Degener and Wiebke no. 2615 (Degener, Illinois); on dripping, shaded cliff, Degener and Tam no. 3545 (Degener, Illinois); east crest of Manoa Valley, on moist rocks, Degener and Nitta no. 3540 (Degener, Illinois); on partly shaded, moss-covered log, Degener, Rodrigues, and Krauss no. 3541 (Degener);

along Manoa cliff trail, Topping no. 3242 (Degener, Illinois); head of Kalihi Valley, open forest, altitude 300 to 500 meters, Christophersen, Wilder, and Hume no. 1498 (B. P. Bishop Museum); peak at head of Pauoa flats, altitude 620 meters, Fosberg no. 8974 (B. P. Bishop Museum); Pauoa Valley, Tantalus trail, Garber no. 411 (B. P. Bishop Museum); Konahuanui trail, Garber no. 122 (B. P. Bishop Museum); Forbes, July 28, 1908 (B. P. Bishop Museum); west ridge, Forbes no. 1441-O (B. P. Bishop Museum); Wawra no. 1715b—Wawra cited this specimen as 1815b but the label is clearly 1715b—, type of *P. hypoleuca* forma *glabra* (Vienna); Wawra 1715a—incorrectly cited as *P. hypoleuca* by Wawra (Vienna); Palolo Valley, Forbes no. 1958-O (B. P. Bishop Museum); Rock no. 10393 (B. P. Bishop Museum); on wet shaded rocks, Degener no. 2612 (Degener, Illinois); along ridge north of South Halawa Gulch, Degener and Park no. 4357 (Degener); Waiawa Gulch, on rocky embankment along ditch trail, Yuncker nos. 3060, 3074 (B. P. Bishop Museum); ridge back of Red Hill, altitude 2000 feet, Degener, Oct. 9, 1932 (Degener); Kipapa Gulch, Nitta nos. 3877, 3878 (Degener); wet slope, Nitta, Feb. 16, 1930 (B. P. Bishop Museum); along trail, Yuncker no. 3088 (B. P. Bishop Museum); near forester's rest-house, Yuncker no. 3087 (B. P. Bishop Museum); under trees in wet woods, altitude 2000 feet, Yuncker no. 3085 (B. P. Bishop Museum); Hosaka no. 684 (B. P. Bishop Museum); second north fork, in moist gully, altitude 1000 feet, no. 589 (B. P. Bishop Museum); altitude 1200 feet, Hosaka no. 852 (B. P. Bishop Museum); south ridge, in moist woods, altitude 1700 feet; Hosaka no. 622 (B. P. Bishop Museum); on moist wooded slope, altitude 1800 feet, Hosaka no. 815 (B. P. Bishop Museum); on ridges, Fosberg no. 8686 (B. P. Bishop Museum); Waialae Iki, Forbes, Oct. 10, 1908 (B. P. Bishop Museum); Waiolani [Waolani], Wawra no. 1674, type of *P. hypoleuca* variety *alternifolia* (Vienna); along ridge, Forbes, Sept. 17, 1908 (B. P. Bishop Museum); Pupukea-Kahuku trail, Koolauloa, near summit, on moist slope, Yuncker no. 3359 (B. P. Bishop Museum); Waihole [Waiahole]-Kahana trail, on damp rocks in shade, Degener and Hirai no. 4032 (Degener); Kaipaupau [Kaipapau] Valley, along stream, Degener and Westgate no. 4270 (Degener); Kaipaupau, Degener no. 4289 (Degener); head of Kuliouou Valley, wet shaded ravine, Degener no. 2418 (Degener, Illinois); Lanihuli trail, Forbes, Sept. 17, 1908 (B. P. Bishop Museum); at summit, Forbes and Stokes, June 28, 1908 (B. P. Bishop Museum); Kahuauli Ridge, altitude 500 to 750 meters, Christophersen and Hume no. 1408 (B. P. Bishop Museum); Waianae range, shaded rocks, Puu Hapapa, Nakagawa, Oct. 20, 1930 (B. P. Bishop Museum); gulch on northeast slope of Puu Hapapa, Degener no. 4234 (Degener); Puu Kalena, Waianae Kai [Waianae-kai], mossy shaded base of pali, St. John no. 12957 (B. P. Bishop

Museum); northwest of summit of Piko trail, Makua, Degener no. 4278 (Degener); along trail to summit of Puu Kaala, altitude 2900 to 3500 feet, Yuncker no. 3385 (B. P. Bishop Museum); Makaha Valley, Forbes, Feb. 12-19, 1909 (B. P. Bishop Museum); Mt. Kaala, altitude 2000 to 4000 feet, Hitchcock no. 13999, in part (B. P. Bishop Museum); altitude 2200 feet, Nitta no. 29 (B. P. Bishop Museum); Popouwela, Forbes, April 27, 1910 (B. P. Bishop Museum); Kalena Mountain [Puu Kalena] Topping no. 2860 (Degener).

Molokai: Stokes, 1909 (B. P. Bishop Museum); Maunahui Gulch, altitude, 3200 feet, Rock no. 6139, duplicate type of *P. dentulibractea* (B. P. Bishop Museum); near Laianui, wooded embankment, Degener and Wiebke no. 2875 (Degener, Illinois); Wailau Valley, rocky wet dark woods, Wiebke and Nitta no. 3188 (Degener, Illinois); Mapulehu Valley, Forbes no. 301-Mo. (B. P. Bishop Museum); Hanaliioliio [Hanalilolilo], in shaded moderately dry but fog-swept woods, Degener and Wiebke no. 2739 (Degener, Illinois); Gulch west of Ualapue, Degener and Wiebke no. 2954 (Degener, Illinois); Kalae, Forbes no. 50-Mo. (B. P. Bishop Museum); near Pepeopae, moss-covered log in dense shade, Degener and Wiebke no. 2728 (Degener, Illinois); near Kaluahauoni, on ground and fallen logs in rain forest, southwest of Waikolu Valley, Degener and Wiebke no. 2848 (Degener, Illinois); moist forest, Puu o Kaeha, Kawela, altitude 3600 feet, St. John, Baker, Coulter, Fosberg, and Yuncker no. 12469 (B. P. Bishop Museum); abundant on mossy rocks in wooded valley, Punaula Valley, altitude 500 to 1900 feet, St. John and Fosberg nos. 12808, 12815 (B. P. Bishop Museum); dry bank of gorge, upper Moaula Falls, Halawa Valley, 350 feet altitude, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12670, 12673 (B. P. Bishop Museum); in spray of the falls, St. John, Baker, Coulter, Fosberg, and Yuncker no. 12666 (B. P. Bishop Museum); on rocky ledges, Mapulehu Valley, Baker, Coulter, and Yuncker nos. 12756, 12760 (B. P. Bishop Museum).

Maui: east Maui, Nahiku, Forbes no. 247-M (B. P. Bishop Museum); Keanae, altitude 1000 feet, shaded cliffs by Punalau stream, St. John no. 10290 (B. P. Bishop Museum); Waikamoi ditch trail, Rock no. 10390 (B. P. Bishop Museum); ridge left of Kipahulu, Forbes no. 1727-M (B. P. Bishop Museum); west Maui, Haelaau, forest, altitude 3100 feet, St. John no. 10188 (B. P. Bishop Museum); Kaanapali, Hillebrand, 1870, in part (Berlin); Iao Valley, Forbes no. 105-M (B. P. Bishop Museum); Wailuku, St. John no. 10286 (B. P. Bishop Museum); near Waihee, on rocks, Degener and Wiebke no. 2626 (Degener, Illinois); near last ditchman's house on way to Mt. Eke [Mauna Eke], wet shaded embankment, Degener and Wiebke nos.

2393, 2411 (Degener, Illinois); along trail to Puu Kukui, altitude 3000 to 5780 feet, Yuncker no. 3419 (B. P. Bishop Museum).

Lanai: Forbes no. 318-L (B. P. Bishop Museum); Mahana Valley, altitude 2000 feet, Rock no. 8092 (B. P. Bishop Museum); mountains near Koele, Forbes no. 75-L (B. P. Bishop Museum).

Hawaii: Pololu Valley, rocky side of waterfall along ditch trail, Degener, Pohina and Iwasaki no. 3887 (Degener); Kilauea Volcano region, Rock, Aug., 1918 (B. P. Bishop Museum).

Miquel did not describe the stigma, but deCandolle considered it to be undivided. Stigmas are infrequently found undivided, but in all of the specimens examined the bilobulate condition appears to be dominant.

Although this species exhibits great range in the size and form of the leaves, the extremes are sometimes found on the same plant, making it impossible to establish segregates on the basis of these variations. Miquel described the position of the leaves as opposite or ternate, yet his illustration clearly shows some leaves to be alternate. Observation of this species in the field shows that the first few leaves on young plants are frequently alternate, but because of what appears to be a retardation in internodal elongation the upper leaves are more commonly opposite or whorled.

DeCandolle considered *P. latifolia* to have opposite or whorled leaves and a single stigma, and described his *P. dentulibractea, P. punaluuna,* and *P. villapeduncula* as differing with alternate leaves or bilobulate stigmas. Examination of the type specimens of these species, however, show that they are the same as *P. latifolia.*

6. **Peperomia ligustrina** Hillebrand.

Peperomia ligustrina Hillebrand, Fl. Hawaiian Is., p. 425, 1888; Mann, Am. Acad. Arts and Sci., Proc., vol. 7, p. 204, 1866, description without name.

Peperomia mauiensis variety *parvifolia* Hillebrand, Fl. Hawaiian Is., p. 425, 1888. Not C. deCandolle.

Peperomia ligustrina forma *b* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 14, 1913.

Stems several, ascending from a repent base, mostly 10 to 15 cm. long, up to 2 mm. thick at the base in dry specimens, branching upwards, glabrous, internodes 0.5 cm. above, up to 3 cm. long below, more or less sulcate.

Leaves opposite or ternate, glabrous, more or less apically ciliated, oblong-lanceolate, elliptic-lanceolate, or less commonly oblanceolate, 4 to 8 mm. broad, 1 to 2.5 cm. long, or rarely up to 3 cm. long, palmately 3-nerved, the midrib prominent, the lateral nerves somewhat obscure and disappearing at about the middle of the blade; apex subacute or obtuse, base acute and decurrent along the petiole forming narrow ridges; petiole about 3 mm. long, more or less flattened and laterally ridged, glabrous, articulate, the line of abscission mostly prominent, leaf scar raised, semicircular, with decurrent ridges below the node, bundle scars 3.

Spikes axillary or terminal, single, or, more rarely, in clusters of two or more, up to 5 cm. long, moderately flowered; peduncle 3 to 6 mm. long, glabrous; rachis glabrous; bracts round, peltate, about 5 mm. broad; filaments somewhat longer than the ellipsoidal or subglobose anthers; ovary globose-ovoid, apex oblique, stigma one, or more commonly divided, subapical; fruit globose-ovoid, about 0.75 mm. long, verrucose, viscid, on pseudopedicels.

Type, west Maui, valley of Waihee, Hillebrand, 1870, in the Berlin Museum. Known from the islands of Maui and Hawaii.

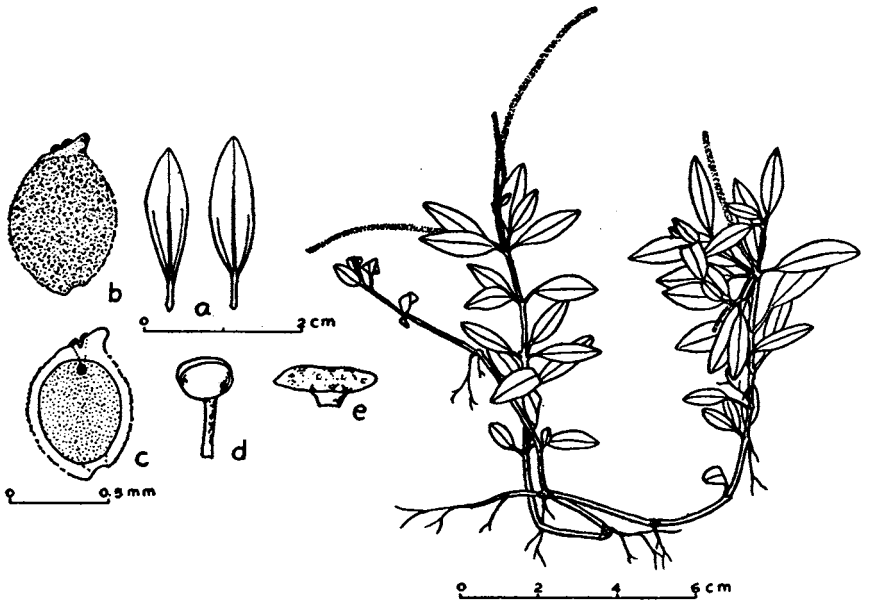

FIGURE 6.—*Peperomia ligustrina* Hillebrand: *a*, leaves; *b*, fruit; *c*, section of fruit; *d*, stamen, enlarged; *e*, bract, enlarged.

Maui: Remy no. 184 (Gray); west Maui, valley of Waihee, Hillebrand, Aug., 1870, type (Berlin); Kaanapali, Hillebrand, Aug., 1870 (Berlin); in the stream bed of Waikamoi on rocks, submerged, Rock no. 10375, duplicate type of forma *b* (Gray, B. P. Bishop Museum); Kipahulu stream, Forbes no. 1704-M (B. P. Bishop Museum); near Mount Eeke [Mauna Eke] by way of Waihee, on wet stones in stream bed, Degener and Wiebke no. 2624 (Degener, Illinois).

Hawaii: Honaunau mountains, altitude 2000 to 3000 feet, Hitchcock no. 14574 (U. S. National, B. P. Bishop Museum).

Peperomia ligustrina variety **oopuolana**, new variety.

Herba plus minusve pilosa. Folia elliptica ad elliptico-lanceolata vel oblongo-lanceolata.

Plants with various degrees of pubescence from a sparsely hirtellous to a more or less completely hirtellous condition. Leaves elliptic to elliptic-lanceolate or oblong-lanceolate, and commonly somewhat broader than for the species.

Type, east Maui, vicinity of Oopuola stream, Degener and Wiebke no. 2628, in the Degener herbarium.

Found on the islands of Maui and Molokai.

Maui: east Maui, vicinity of Oopuola stream, Degener and Wiebke no. 2628, the type (Degener, Illinois).

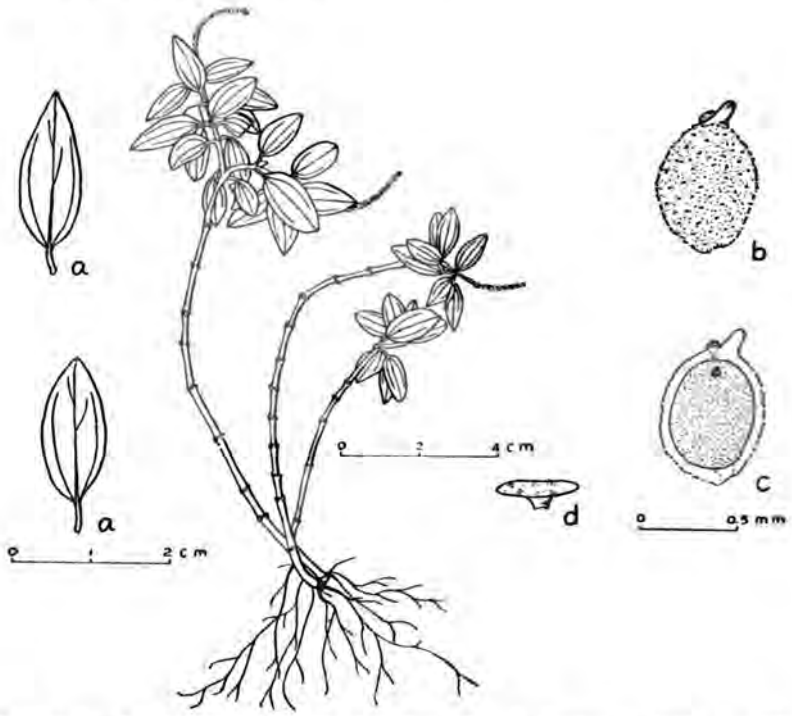

FIGURE 7.—*Peperomia koolauana* C. deCandolle: *a*, leaves; *b*, fruit; *c*, section of fruit; *d*, bract, enlarged.

Molokai: Mapulehu Valley, Forbes no. 302-Mo., in part (B. P. Bishop Museum); west branches of Mapulehu Valley, along shaded stream bed among rocks, Wiebke no. 3071 (Degener, Illinois); east Ohia, wet rocks, Wiebke 3068 (Degener, Illinois); valley west of east Ohia, Degener and Wiebke no. 3066 (Degener, Illinois); Punaula Valley, on ground in shade, altitude 1400 feet, St. John and Fosberg no. 12827 (B. P. Bishop Museum).

The short plants, sulcate stems, narrow leaves, raised leaf scars, and laterally ridged petioles serve to distinguish this species.

7. **Peperomia koolauana** C. deCandolle.

Peperomia koolauana C. deCandolle, Bull. Coll. Hawaii no. 2, p. 15, 1913.

Stems clustered, ascending from a repent base, up to 17 cm. long and 2.5 mm. thick in dry specimens, branching above, glabrous, internodes 1 to 3 cm. long.

Leaves opposite or whorled, sparsely ciliated near the apex, otherwise glabrous, elliptic-lanceolate, 0.7 to 1.3 cm. wide, 1 to 3 cm. long or less commonly up to 3.5 cm. long, palmately 3- to 5-nerved, the outermost pair of nerves obscure, upper surface dark green, light green beneath, apex acute to acuminate or more rarely obtusish, base shortly acute or rounded, more or less suboblique; petiole glabrous, 4 to 6 mm. long, leaf scars semicircular, bundle scars 3.

Spikes axillary and terminal up to 6 cm. long, moderately flowered; peduncle glabrous, about 0.7 mm. long; rachis glabrous; bracts about 4 mm. broad, round, peltate; filaments longer than the subglobose anthers; ovary globose-ovoid, apex oblique, stigma one, subterminal, penicillate; fruit ovoid, about 0.8 mm. long, verrucose, viscid, on pseudopedicels.

Type, Oahu, Koolau mountains, altitude 2500 feet, Rock no. 66, in the deCandolle herbarium.

Known only from Koolau Range, Oahu.

Oahu: Koolau mountains, altitude 2500 feet, Rock no. 66, duplicate type (B. P. Bishop Museum); Rock no. 1016, cotype (B. P. Bishop Museum); between Punaluu and Kaipaupau [Kaipapau], Forbes and Thompson, May 8-13, 1909 (B. P. Bishop Museum); Moanalua Valley, Forbes no. 1417-O (B. P. Bishop Museum).

This species is closely related to *P. membranacea* but differs mainly in the shape and proportion of the leaves, which may have a suboblique base, and the smaller size of the plants.

8. **Peperomia globulanthera** C. deCandolle.

Peperomia globulanthera C. deCandolle, Bull. Coll. Hawaii no. 2, p. 14, 1913.

Peperomia subnudilimba C. deCandolle, Bull. Coll. Hawaii no. 2, p. 27, 1913.

Stems ascending from a repent base, up to 40 cm. long and 2 mm. thick in dry specimens, simple or sparingly branched, glabrous, internodes up to 6 cm. long but mostly 2 to 3 cm. long.

Leaves opposite or whorled, marginally ciliated toward the apex, otherwise glabrous, oval, elliptic-ovate, or subobovate, 1 to 2 cm. broad, 1.8 to 3.5 cm. long, mostly about 1.2 cm. broad and 2 cm. long, palmately 3-nerved, apex blunt or acute, base briefly acute; petiole about 5 mm. long, glabrous, leaf scars semicircular, bundle scars 3.

Spikes axillary and terminal, single or clustered, up to 6 cm. long, mostly about 3 cm. long, loosely to moderately flowered; peduncle up to 1 cm. long, glabrous; rachis glabrous; bracts about 0.5 mm. broad, round, peltate; filaments longer than the subglobose anthers; ovary ovoid, apex oblique, stigma subapical, single or divided; fruit about 1 mm. long, obliquely rostrate, verrucose, viscid, on pseudopedicels.

Type, Maui, on the high swampy plateau and along the trail leading to Puu Kukui, Rock, in the deCandolle herbarium; Rock no. 10377, duplicate type in Bernice P. Bishop Museum.

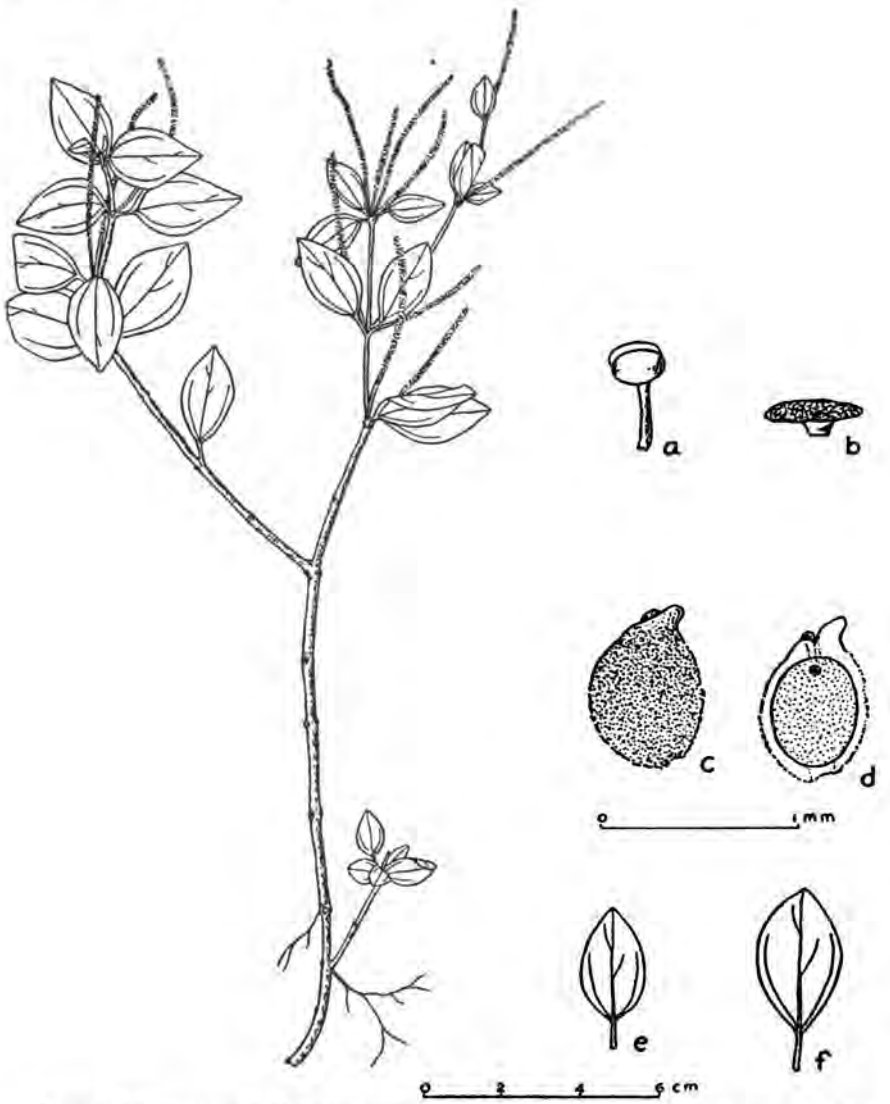

FIGURE 8.—*Peperomia globulanthera* C. de Candolle: *a*, stamen, enlarged; *b*, bract, enlarged; *c*, fruit; *d*, section of fruit; *e*, *f*, leaves.

Known only from the island of Maui.

Maui: west Maui, swampy plateau, Puu Kukui, Rock no. 10377, duplicate type (B. P. Bishop Museum); Rock, type of *P. nudilimba* (deCandolle),

duplicate type as Rock no. 10385 (Gray, B. P. Bishop Museum); along the trail to Puu Kukui, altitude 3000 to 5700 feet, Yuncker no. 3425 (B. P. Bishop Museum); Upulele [Ukulele], Forbes no. 970-M (B. P. Bishop Museum); east of Ukulele, Forbes no. 858-M (B. P. Bishop Museum); Keanae Gap, Halehaku, Haleakala, Forbes nos. 1044-M, 1078-M (B. P. Bishop Museum).

This species is closely related to *P. membranacea*. It differs chiefly in the size and form of the 3-nerved leaves, the shorter spikes, not uncommonly divided stigmas, and commonly more repent stems.

9. Peperomia membranacea Hooker and Arnott.

Peperomia membranacea Hooker and Arnott, Bot. Beechey, p. 96, 1832.
Peperomia Gaudichaudii Miquel, Syst. Pip., p. 137, 1843.
Peperomia membranacea variety *Gaudichaudii* Hillebrand, Fl. Hawaiian Is., p. 422, 1888.

Stems green, or suffused with red towards the base when fresh, single, or clustered, erect or ascending from a decumbent or substoloniferous, rooting base, up to 75 cm. long, and 1 cm. thick in fresh specimens, simple or branching above, entirely glabrous, internodes up to 15 cm. long but commonly 3 to 6 cm. long.

Leaves whorled above but commonly opposite below, upper surface green, lower surface light green, semifleshy when fresh but drying membranous, ciliated towards the apex, otherwise glabrous, elliptic-lanceolate or less commonly elliptic-ovate, mostly 2 to 3 cm. broad and 3 to 6 cm. long or rarely up to 4 cm. broad and 8 cm. long, palmately 5-nerved, or the midrib and innermost pair of lateral nerves not uncommonly coalescent in the lowermost 1 to 3 mm., apex acute to attenuately acuminate, base acute; petiole 0.6 to 1.5 cm. long, glabrous.

Spikes axillary and terminal, commonly clustered, slender, mostly 4 to 8 cm. long, moderately to loosely flowered; peduncle 1 to 2 cm. long, glabrous; rachis glabrous, bracts round, peltate, up to 0.75 mm. broad; filaments longer than the rounded or ellipsoidal anthers; ovary globose-ovoid, apex oblique, stigma single, subterminal, not penicillate; fruit about 0.85 mm. long, globose-ovoid, obliquely rostrate, verrucose, viscid, on pseudopedicels.

Type, Oahu, Beechey, in Kew Herbarium.

Found in moist woods mostly above an altitude of 1000 feet on both ranges on Oahu.

Oahu: Beechey, type (Kew); Seeman no. 2258 (Kew); Hillebrand (Berlin); Meyen, May, 1831, cotype of *P. Gaudichaudii* (Berlin); Niu Valley, Degener no. 4844 (Degener); right fork of Niu Valley, Garber no. 462 (B. P. Bishop Museum); at head of Kuliouou Valley, wet shaded ravine, Degener no. 2417 (Degener, Illinois); Palolo Valley, Rock nos. 100 (B. P. Bishop Museum), 10392 (Gray, B. P. Bishop Museum); Olympus trail, Garber no. 278 (B. P. Bishop Museum); west branch of Palolo Valley, Degener, Park, and Nitta no. 4272 (Degener); along Castle trail, Mount Tantalus, rocky shaded embankment, Degener and Wiebke no. 2613 (Degener, Illinois); Mount Tantalus, moist shaded slope, Degener no. 2616 (Degener,

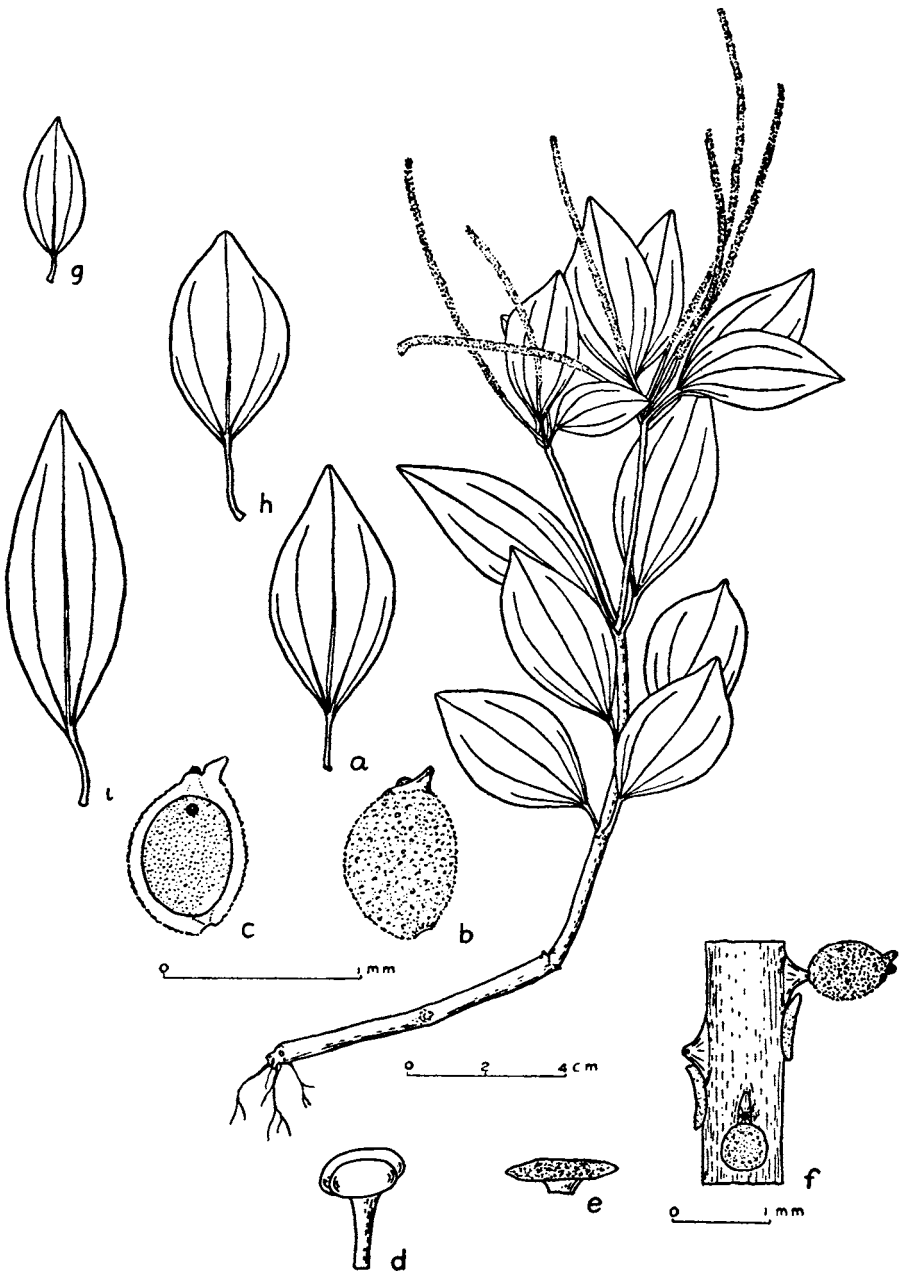

FIGURE 9.—*Peperomia membranacea* Hooker and Arnott: *a*, leaf; *b*, fruit; *c*, section of fruit; *d*, stamens, enlarged; *e*, bract, enlarged; *f*, section of spike to show pseudopedicels; *g*, leaf of variety *brevifolia*; *h*, leaf of variety *puukukuiana*; *i*, leaf of variety *waimeana*.

Illinois); altitude 1200 feet, Yuncker no. 3249 (B. P. Bishop Museum); in shaded moist soil under shrubs, altitude 1400 feet, Yuncker no. 3244 (B. P. Bishop Museum); epiphytic on semiprostrate log, altitude 1500 feet, Yuncker no. 3247 (B. P. Bishop Museum); near summit, under trees, altitude 1900 feet, Yuncker no. 3245 (B. P. Bishop Museum); wet slope, Nitta, Dec. 28, 1929 (B. P. Bishop Museum); in woods, St. John no. 9882 (B. P. Bishop Museum); east rim of Tantalus crater, wet shaded ground, Degener and Nitta no. 3409 (Degener); Konahuanui, Olympus trail, Garber nos. 237, 492 (B. P. Bishop Museum); east ridge of Manoa Valley, on shaded, rocky embankment, Degener, Rodrigues, and Krauss no. 3542 (Degener, Illinois); Degener and Krauss no. 4296 (Degener); Pauoa Valley, Rock no. 17176 (B. P. Bishop Museum); base of cliffs northeast of Nuuanu Pali, on moist rocks in woods, Degener and Rodrigues no. 3536 (Degener, Illinois); west side of Nuuanu Valley near the Pali, Forbes, July 25, 1908 (B. P. Bishop Museum); Kapalama Valley, Forbes no. 1854-O (B. P. Bishop Museum); Haiku Valley, Waiahole Forest Reserve, Heeia, altitude 800 feet, St. John no. 12274 (B. P. Bishop Museum); Punaluu mountains, Rock no. 12500 (Gray, B. P. Bishop Museum); along Pig God trail, Degener no. 4297 (Degener); on moist rocks along trail in gulch above Aiea, Yuncker nos. 3034, 3035, 3040, 3044, 3045 (B. P. Bishop Museum); ridge above Red Hill, Degener, Oct. 9, 1932 (Degener); Waikakalaua Gulch, wet slope, altitude 1300 feet, Nitta, April 6, 1930 (B. P. Bishop Museum); Kawailoa, Forbes no. 2109-O (B. P. Bishop Museum); Kipapa Gulch, wet slope, Nitta, Feb. 16, 1930 (B. P. Bishop Museum); south ridge in moist gully, altitude 900 feet, Hosaka no. 584 (B. P. Bishop Museum); north ridge, in moist woods, altitude 1300 feet, Hosaka no. 650 (B. P. Bishop Museum); second north fork in moist woods, altitude 1300 feet, Hosaka no. 853 (B. P. Bishop Museum); Waihole [Waiahole]-Kahana trail, on ground in damp woods, Degener and Hirai no. 4033 (Degener); Waianae range, southeast base of Mount Kaala, near fire-break trail, Degener no. 4269 (Degener); Mount Kaala, altitude 2000 to 4000 feet, Hitchcock no. 14011 (B. P. Bishop Museum); along trail to summit of Puu Kaala, altitude 1000 to 4000 feet, Yuncker nos. 3368, 3369, 3370 (B. P. Bishop Museum); second gulch east of Puu Kaupakuhale, northeast slope of Puu Kaala, moist woods, altitude 1500 feet, St. John and Fosberg no. 12141 (B. P. Bishop Museum); west slope of Puu Kaala, above Waianae village, Yuncker no. 3312 (B. P. Bishop Museum); lower slopes of Puu Kaala, Waianae-uka, altitude 1000 feet, Hume no. 51 (B. P. Bishop Museum); Puu Kalena, Waianae Kai [Waianae-kai], tuft on old stone wall in woods, altitude 1700 feet, St. John no. 12950 (B. P. Bishop Museum); northeast slope of Puu Hapapa, altitude 1600 feet, Yuncker no. 3259 (B. P. Bishop Museum); Puu Kaua, Topping

no. 3134 (Degener, Illinois); northeast side of Puu Kaua, in gulch, altitude 2000 feet, Yuncker no. 3291 (B. P. Bishop Museum); east ridge of Puu Kaua, in wet forest, altitude 950 meters, Fosberg no. 8997 (B. P. Bishop Museum); Makaha Valley, Forbes, Feb. 12-19, 1909 (B. P. Bishop Museum); Piko trail, Mokuleia side, altitude 2000 feet, Yuncker no. 3360 (B. P. Bishop Museum); northwest of summit of Piko trail, Makua, Degener no. 4277 (Degener); between Puu Manawahua and Palikea along the ridge, Degener and Park no. 4286 (Degener); valley southeast of Kawaihapai railroad station, on wet shaded rocks, Degener no. 3539 (Degener, Illinois); southeast side of Makua Gulch, altitude 1500 feet, Degener, Oct. 9, 1932 (Degener). Also, Mount Kapu, Waianae range, altitude 3000 feet, A. F. Judd, April 22, 1933. This specimen was near the maximum in size for the species when fresh (B. P. Bishop Museum).

Key to Varieties

1. Leaves elliptic-lanceolate or ovate-lanceolate
 2. Veins mostly 5, leaves about 2 times as long as broad
  3. Leaves mostly 3-6 cm. long.....**P. membranacea**
  3. Leaves mostly 2-3 cm. long..... variety **brevifolia**
 2. Veins mostly 3, leaves 2 to 3 times as long as broad.....variety **waimeana**
1. Leaves subobovate to oval or ovate-lanceolate, apex constricted, mostly 5-nerved, commonly less than 2 times as long as broad....variety **puukukuiana**

Peperomia membranacea variety **brevifolia**, new variety.

Herba 15-30 cm. alta. Folia plerumque 1-1.5 cm. lata atque 2-3 cm. longa, obscure palmatim 5-nervia, elliptico-lanceolata ad ovato-lanceolata, basi acuta aut rotunda.

Plants mostly smaller, 15 to 30 cm. tall, leaves mostly 1 to 1.5 cm. broad and 2 to 3 cm. long, obscurely 5-nerved, elliptic-lanceolate to ovate-lanceolate, base acute or rounded.

Type, Oahu, Tantalus, moist rocks, altitude 1800 feet, Yuncker no. 3367, in Bernice P. Bishop Museum.

Found on the islands of Oahu and Kauai.

Oahu: Bennett (Berlin); Mount Tantalus, moist rocks, altitude 1800 feet, Yuncker no 3367, type (B. P. Bishop Museum); Pauoa-Pacific Heights ridge, Garber no. 351 (B. P. Bishop Museum); Koolauloa mountains between Punaluu and Kaipaupau [Kaipapau], Forbes and Thompson, May 8-13, 1909 (B. P. Bishop Museum); Waianae range, Makaha Valley, Forbes, Feb. 12-19, 1909 (B. P. Bishop Museum); Piko trail, Mokuleia side, altitude 2000 feet, Yuncker no. 3361 (B. P. Bishop Museum); ridge on northeast slope of Puu Kaua, altitude 2000 feet, Yuncker no. 3293 (B. P. Bishop Museum); summit of Puu Kaala, altitude 4030 feet, Yuncker no. 3371 (B. P. Bishop Museum).

Kauai: Waioli Valley, Forbes no. 87-K (B. P. Bishop Museum).

Peperomia membranacea variety **waimeana,** new variety.

Folia plerumque palmatim 3-nervia, 2- 3-plo latitudine longiora.
Leaves commonly 3-nerved, 2 to 3 times as long as broad.

Type, Kauai, Kaholuamano [Kaholuamanu], Rock no. 17183, in Bernice P. Bishop Museum.

Known only from the Waimea Canyon region and the higher altitudes of central Kauai, and near Pepeopae, Molokai.

Kauai: Kaholuamano [Kaholuamanu], Rock nos. 17180, 17183 (type), 17185, 17188, 17189 (B. P. Bishop Museum); altitude 3600 feet, Hitchcock no. 15318 (U. S. National); Hitchcock no. 15413 (B. P. Bishop Museum); above Waimea, Heller no. 2612 (Gray, U. S. National); Waimea Drainage Basin, Kalalau trail, Forbes no. 1108-K (B. P. Bishop Museum); in stream bed at Keaku, high plateau, altitude 4600 feet, Rock no. 8875 (B. P. Bishop Museum); Alakai swamp, Yuncker no. 3391 (B. P. Bishop Museum); trail along Kumuweia ridge, Waimea, altitude 3500 feet, Yuncker no. 3392 (B. P. Bishop Museum); near Kilohana lookout, Waimea, altitude 3500 feet, Yuncker 3393 (B. P. Bishop Museum).

Molokai: dark damp woods east of Pepeopae, Degener no. 4291 (Degener); near Puu o Wahaula, in mossy rain forest, Degener and Wiebke no. 2759 (Degener, Illinois).

Peperomia membranacea variety **puukukuiana,** new variety.

Folia usque ad 3.5 cm. lata atque 5 cm. longa vel raro longiora, ovalia ad sub-ovata vel ovato-lanceolata, apice breviter attenuato-acuta, palmatim 3-5-nervia.
Leaves up to 3.5 cm. broad and 5 cm. long or rarely somewhat larger, oval to sub-ovate or ovate-lanceolate, apex shortly and attenuately acute, palmately 3 to 5-nerved, the outer pair of nerves slender and more or less obscure.

Type, west Maui, on the high swampy plateau and along the trail leading to Puu Kukui, altitude 5700 feet, Rock no. 10376 in Bernice P. Bishop Museum.

Found on the islands of Maui and Hawaii.

Maui: Forbes, 1910 (B. P. Bishop Museum); Puu Kukui trail, swampy forest, altitude 5700 feet, Rock 10376, type (B. P. Bishop Museum); wooded crest, 5788 feet altitude, St. John no. 10271 (B. P. Bishop Museum); east Maui, Olinda, Kula pipe line, St. John no. 10300 (B. P. Bishop Museum); wet woods along pipe line, Degener and Wiebke nos. 2394, 2630, 2636 (Degener, Illinois); Yuncker no. 3428 (B. P. Bishop Museum).

Hawaii: fern forest at Kilauea, moist shaded situation, Degener no. 2437 (Degener); between eastern fern forest trail and Annumea [Anuhea] golf course, Kilauea, on wet shaded ground, Degener 3807 (Degener); between Volcano House and 29 Miles, Kilauea, on moss-covered stump, Degener and Swezey no. 3804 (Degener).

Peperomia membranacea is readily identified by the entirely glabrous condition, palmate nerving, oblique and more or less rostrate apex of the ovary, undivided stigma, and thinner leaves than is common for the genus as represented in the Hawaiian islands. Some of the specimens from the Waianae Mountains listed under the typical form approach variety *puukukuiana* with somewhat broader and more oval leaves.

The smaller size of the plants and of the leaves serve to distinguish variety *brevifolia* which is apparently intermediate between *P. membranacea* and *P. koolauana.* Some of the specimens of variety *brevifolia* have some larger leaves, and the plants may represent merely an ecological form of *P. membranacea,* although both forms are found growing under what appear to be similar environmental conditions. It differs from *P. globulanthera* in the generally more elliptic-lanceolate form of the mostly 5-nerved leaves and with more attenuately acute to acuminate apexes.

Variety *waimeana* bears some resemblance to *P. Hochreutineri,* but its undivided and laterally placed stigma allies it more definitely with *P. membranacea,* from which it differs in its more elongated and mostly 3-nerved leaves.

10. Peperomia Forbesii, new species.

Caules usque ad 30 cm. longi vel longiores, glabri. Folia membranosa, plerumque opposita, superne interdum ternata, glabra, elliptico-lanceolata, 1.5-2.5 cm. lata, 4-7 cm. longa, 5-plinervia, apice sensim acuminata, basi acuta; petioli 1-2.5 cm. longi, tenues, glabri. Spicae axillares terminalesque, circiter 4 cm. longae, pedunculo 4-8 mm. longo; ovarium ovoideum apice obliquum; stigma subterminale, divisum vel integrum, copiose penicillatum.

Stems erect (?), up to 30 cm. or more long and 3 mm. thick at the base in dry specimens, with slender branches above, glabrous, internodes 3 to 4 cm. long.

Leaves thin and membranous, mostly opposite or less commonly ternate above, ciliated towards the apex, otherwise glabrous, upper surface dark green, lower surface light green, elliptic-lanceolate, 1.5 to 2.5 cm. broad, 4 to 7 cm. long, 5-plinerved, the innermost pair of nerves forking off the midrib 5 to 7 mm. above the base, the lateral nerves slender, apex attenuately acuminate, base acute; petioles 1 to 2.5 cm. long, slender, glabrous, leaf scars semicircular, bundle scars 3.

Spikes axillary and terminal, about 4 cm. long, 1 mm. thick, moderately flowered; peduncle 4 to 8 mm. long, glabrous; rachis glabrous; bracts about 0.5 mm. broad, round, peltate; filaments shorter than the ellipsoidal anthers; ovary ovoid, apex oblique, stigma subterminal, divided or single, abundantly penicillate; matured fruit not present.

Type, Molokai, Pukoo, Forbes no. 276-Mo, in Bernice P. Bishop Museum.

Known only from the type locality.

This species is closely related to *P. membranacea* but differs from it with its 5-plinerved and mostly opposite leaves, and commonly bilobed and penicillated stigmas.

This species is named in honor of C. N. Forbes, a young botanist who made a large collection of Hawaiian plants and whose premature death closed what promised to be a brilliant scientific career.

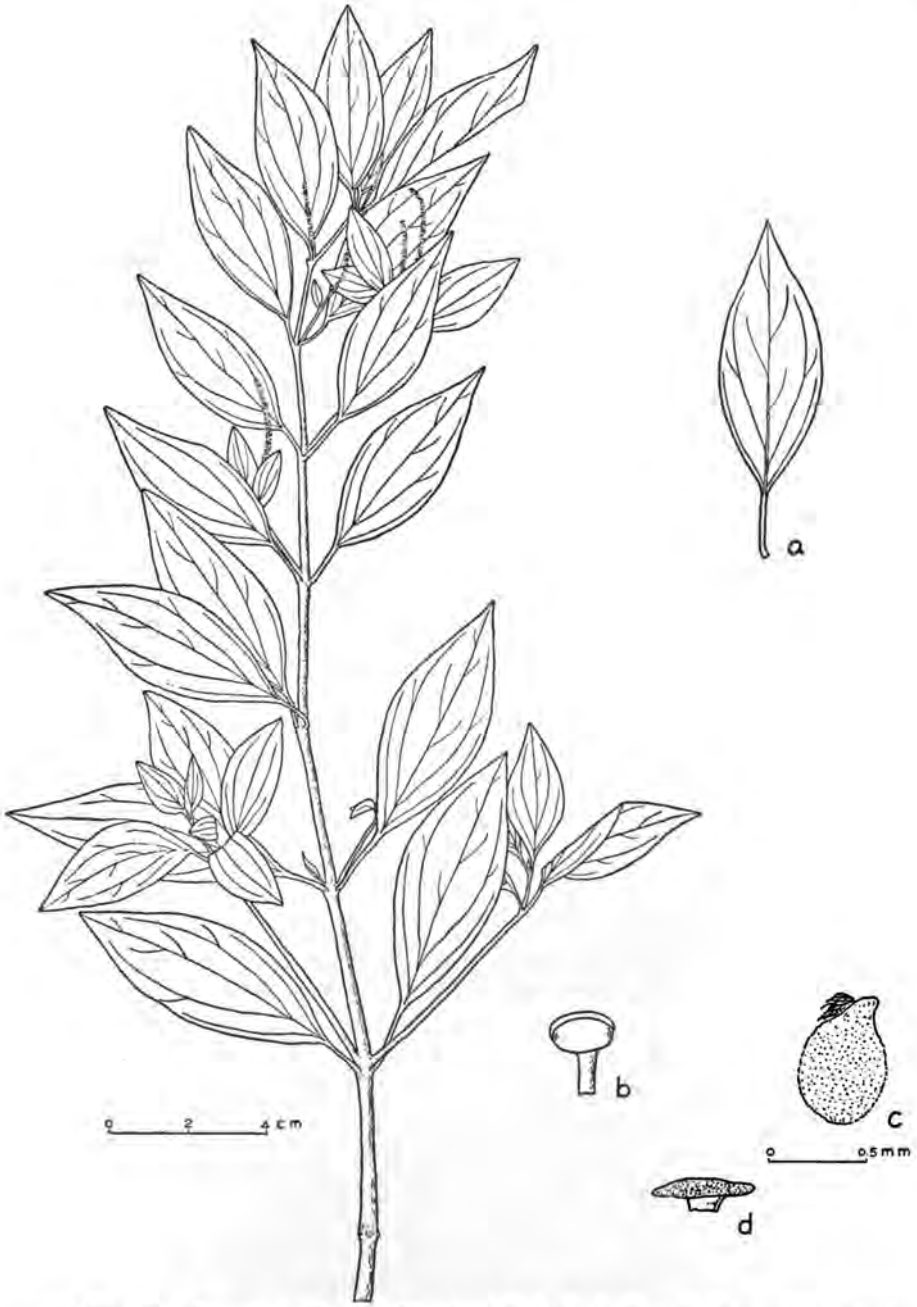

FIGURE 10.—*Peperomia Forbesii* Yuncker: *a*, leaf; *b*, stamen, enlarged; *c*, ovary; *d*, bract, enlarged.

11. Peperomia Treleasei, new species.

Caules graciles, e basi prostrata stoloniferaque adscendentes, usque ad 15 cm. alti, copiose ramosi, sat subadpresso-hirtelli. Folia opposita vel verticillata, utrinque sparse ad moderatim hirtella, plerumque elliptica vel ovata, non numquam subovata, 1-2 cm. longa, 5-9 mm. lata, 1-nervia vel obscure palmatim 3-nervia, apice obtusa ad subacuta, basi acuta; petiolis usque ad 5 mm. longis, plus minusve hirtellis. Spicae graciles, plerumque terminales acervatim confertae, usque ad 3.5 cm. longae; pedunculis usque ad 8 mm. longis plus minusve hirtellis. Fructus globosus apice obliquus, stigma subterminale.

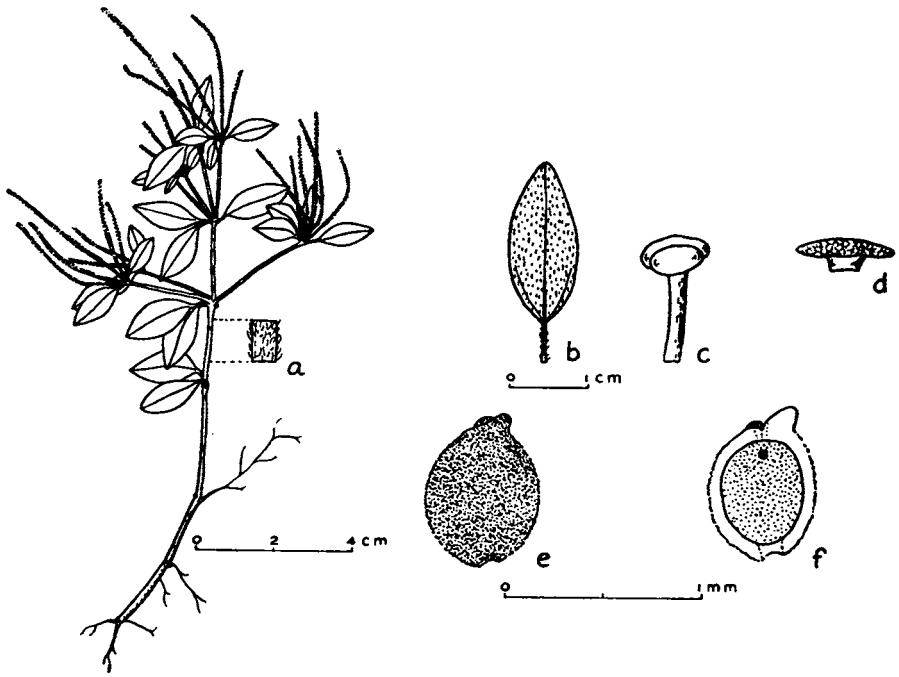

FIGURE 11.—*Peperomia Treleasei* Yuncker: *a*, section of stem, enlarged; *b*, leaf; *c*, stamen, enlarged; *d*, bract, enlarged; *e*, fruit; *f*, section of fruit.

Stems slender and weak, ascending from a prostrate, stoloniferous base, up to 15 cm. high, 1 to 1.5 mm. thick in dry specimens, abundantly branching, moderately subappressed hirtellous, internodes mostly 1 to 4 cm. long.

Leaves opposite or whorled, drying membranous, sparingly to moderately hirtellous on both surfaces, mostly elliptical or oval, less commonly subobovate, 1 to 2 cm. long, 5 to 9 mm. broad, 1-nerved or obscurely palmately 3-nerved, apex obtuse to subacute, base acute; petiole up to 5 mm. long, more or less hirtellous.

Spikes slender, mostly in terminal clusters, up to 3.5 cm. long, moderately flowered; peduncles up to 8 mm. long, more or less hirtellous; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments somewhat longer than the ellipsoidal anthers; ovary ovoid, apex oblique, stigma subterminal; fruit about 0.75 mm. long, globose, verrucose, viscid, on pseudopedicels.

Type, Molokai, Pukoo, Forbes no. 274-Mo, in Bernice P. Bishop Museum.

Found only in the southeastern part of the island of Molokai.

Molokai: Pukoo, Forbes no. 274-Mo (B. P. Bishop Museum); on humus-covered rock in dark stream bed, southeast of Pepeopae, Degener and Wiebke no. 2873 (Degener, Illinois); on wet humus near cascade at end of Hanolilolilo [Hanalilolilo] pipe line, Degener and Wiebke no. 2843 (Degener, Illinois).

This species appears to be closely related to *P. Cookiana,* from which it is to be distinguished, however, by its small and weak stems, and elliptical or oval, membranous, and hirtellous leaves. It differs from *P. ligustrina* variety *oopuolana* in its proportionately broader leaves and clustered terminal spikes.

This species is named in honor of Professor William Trelease who, since the death of Casimir deCandolle, has become the world's leading authority on the Piperaceae.

12. Peperomia Helleri C. deCandolle.

Peperomia Helleri C. deCandolle, Ann. Cons. Bot. Genève, vol. 2, p. 283, 1898.

Peperomia asperulata C. deCondolle, Ann. Cons. Bot. Genève, vols. 15 and 16, p. 233, 1911 and 1912.

Peperomia Helleri variety *ternifolia* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 29, 1913.

Stems up to 15 cm. long and 1.5 mm. thick at the base in dry specimens, ascending from a prostrate, rooting base, simple or branching, densely hirsute, hairs up to 1 mm. long, or uncommonly hirtellous with shorter hairs, internodes 1 to 6 cm. long, mostly 1 to 3 cm. long.

Leaves opposite or in whorls of 3 or 4, hirsute on both surfaces, but commonly somewhat less so on the upper surface, elliptic-lanceolate, elliptic, or suboblanceolate, 0.5 to 1.5 cm. broad, 2 to 4 cm. long, mostly up to 1 cm. broad and 3 cm. long, palmately 3-nerved, the two lateral nerves disappearing at about the middle, apex acute or obtuse, commonly subacute, base acute; petiole mostly less than 1 cm. long, densely hirsute, leaf scars semicircular, bundle scars obscure.

Spikes axillary and terminal, up to 8 cm. long, loosely flowered; peduncle up to 1.5 cm. long, hirsute; rachis glabrous; bracts round, peltate, about 0.6 mm. broad; filaments somewhat longer than the ellipsoidal anthers; ovary ovoid, apex oblique, stigma subterminal, single or divided, more or less penicillate; fruit about 0.8 mm. long, verrucose, viscid, ovoid, somewhat rostrate, on pseudopedicels.

Type, on the ridge of the Hanapepe River, Kauai, Heller no. 2632, in the deCandolle herbarium.

Found in wet forests of central Kauai commonly forming low mats under ferns and shrubs, and on the island of Molokai.

Kauai: forest of Kahaoluamano [Kaholuamanu], Rock no. 1556 (B. P. Bishop Museum); Kaholuamano [Kaholuamanu], Hitchcock no. 15410

(B. P. Bishop Museum); Forbes no. 329-K (B. P. Bishop Museum); Rock no. 17177 (B. P. Bishop Museum); Waimea Drainage Basin, Forbes nos. 952-K, 954-K, 1067-K (B. P. Bishop Museum); Kalalau Valley, Forbes no. 64-K (B. P. Bishop Museum); Nualolo trail, Na Pali Kona Forest Reserve,

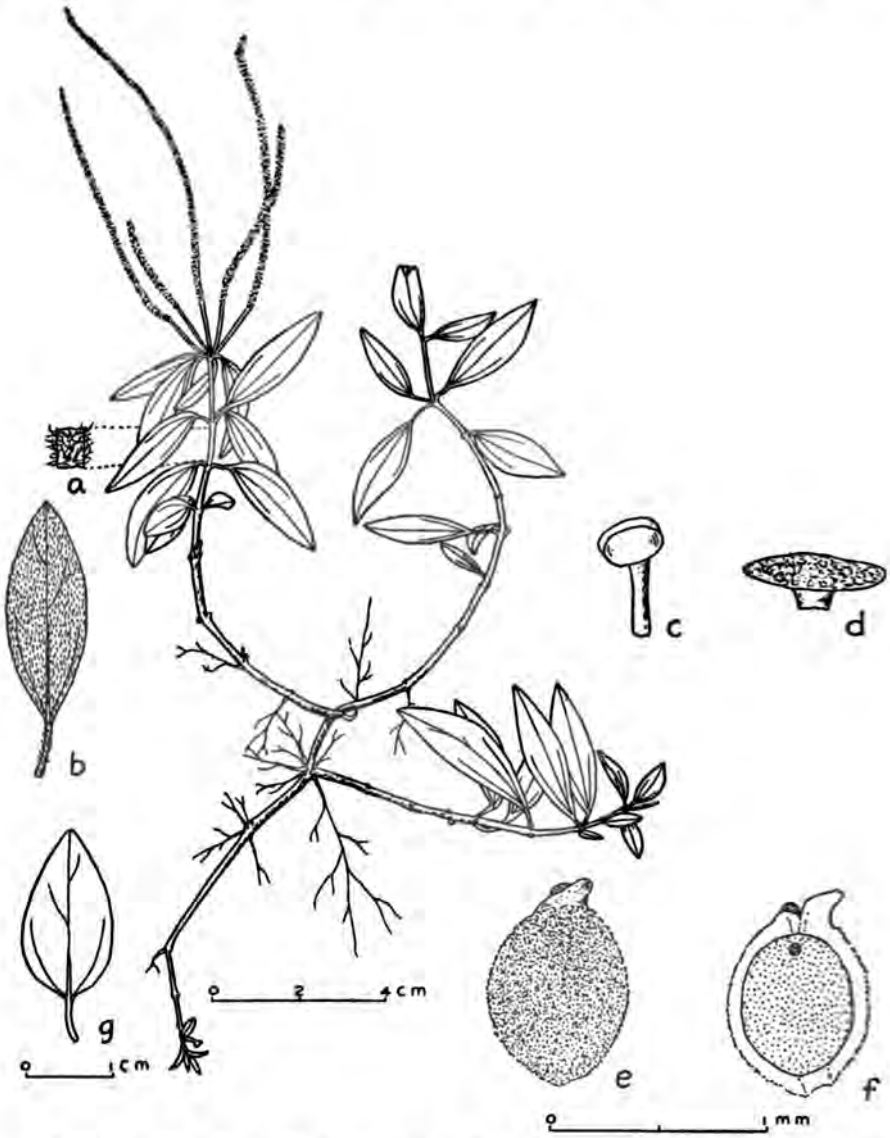

FIGURE 12.—*Peperomia Helleri* C. deCandolle: *a*, section of stem, enlarged; *b*, leaf; *c*, stamen, enlarged; *d*, bract, enlarged; *e*, fruit; *f*, section of fruit; *g*, leaf of variety *subovata*.

altitude 2000 to 3750 feet, St. John, Hosaka, Hume, Inafuku, Lindsay, Masuhara, Mitchell, and Wong no. 10836 (B. P. Bishop Museum); Nualolo trail near Forest Ranger station, Kokee, under ferns in wet forest, altitude 3600 feet, Yuncker no. 3394 (B. P. Bishop Museum), along trail to Kilohana lookout above Kokee Forest Ranger station, altitude 3600 feet, Yuncker no. 3395 (B. P. Bishop Museum). Also, ridge west of Hanapepe River, Heller no. 2632 (deCandolle); Waimea, altitude 1000 meters, Faurie no. 117 (deCandolle).

Molokai: on moist embankment in moderately dry region, third ravine south of Maunahui, Degener and Wiebke no. 2880 (Degener, Illinois); small ravine south of Maunahui, on dry rocks, Degener no. 2727 (Degener, Illinois). These specimens differ from the typical wet forest specimens of Kauai in having shorter hairs, but in other characteristics they appear to agree with the Kauai specimens included here. Fruits are lacking on both specimens.

Key to the Varieties

1. Plants mostly less than 15 cm. tall
2. Leaves hirsute on the upper surface
3. Leaves mostly elliptic-lanceolate, up to 3.5 cm. long.....**P. Helleri**
3. Leaves oval or subovate to elliptic-lanceolate, mostly less than 2.5 cm. long .....variety **subovata**
2. Leaves glabrous on the upper surface, or hairy only at the base and along the nerves.....variety **Knudsenii**
1. Plants mostly 30 to 60 cm. tall, leaves mostly hirsute above.....variety **grossa**

Peperomia Helleri variety **subovata,** new variety.

?*Peperomia Helleri* variety *kaholumanana* C. deCandolle, Candollea, vol. 1, p. 391, 1923, as name only, in index without description.

Folia elliptica, elliptico-lanceolata, vel subovata, apice obtusa ad acutula, basi acuta vel rotunda, plerumque 0.8-1 cm. lata atque 1.5-2.5 cm. longa.

Leaves elliptic, elliptic-lanceolate, or subovate, apex obtuse to acutish, base acute or rounded, up to 1.5 cm. broad and 3 cm. long, mostly 0.8 to 1 cm. broad and 1.5 to 2.5 cm. long, spikes mostly 2 to 3 cm. long.

Type, Kauai, Kaholuamano [Kaholuamanu], Rock no. 17179, in Bernice P. Bishop Museum.

Known from the higher altitudes of central Kauai.

Kauai: Kaholuamano [Kaholuamanu], Rock nos. 17179, 17182, 17184, 17187 (B. P. Bishop Museum); Hitchcock no. 15408 (U. S. National, B. P. Bishop Museum); Waimea Drainage Basin, west side, Forbes no. 1116-K (B. P. Bishop Museum).

Peperomia Helleri variety **Knudsenii,** new combination.

Peperomia Knudsenii C. deCandolle, Bull. Coll. Hawaii no. 2, p. 16, 1913.

Leaves glabrous above or hirsute only at the base and along the nerves. Otherwise similar to the typical form. DeCandolle described the leaf size as up to 1 cm. broad,

and 4.5 cm. long. The leaves on the specimens examined, however, do not have leaves exceeding 3 cm. in length.

Type, Kauai, Knudsen, in the Berlin Herbarium?

Known from the island of Kauai.

Kauai: Waimea Drainage Basin, west side, Forbes nos. 1119-K, 1694-K (B. P. Bishop Museum).

Peperomia Helleri variety **grossa,** new variety.

Herba 30-60 cm. alta. Folia elliptica vel elliptico-lanceolata, plerumque 1.5-2 cm. lata atque 4-6 cm. longa, utrinque hirsuta.

Plants 30 to 60 cm. tall. Stems ascending from a rooting base, simple or moderately branching. Leaves elliptic or elliptic-lanceolate, up to 4 cm. broad and 8 cm. long, but mostly about 1.5 to 2 cm. broad and 4 to 6 cm. long, hirsute on both surfaces or less commonly with some leaves hirsute on the upper surface only at the base and along the nerves; petioles up to 2 cm. long.

Type, Kauai, Na Pali Forest Reserve, along trail to Kilohana Lookout, altitude 3600 feet, Yuncker no. 3400, in Bernice P. Bishop Museum.

Found in wet forests, Waimea district, Island of Kauai.

Kauai: Waimea Drainage Basin, west side, Forbes no. 956-K (B. P. Bishop Museum); Nualolo trail near Kokee Forest Ranger station, altitude 3600 feet, Yuncker no. 3398 (B. P. Bishop Museum); Na Pali forest reservation, along trail to Kilohana Lookout, altitude 3500 feet, Yuncker nos. 3399, 3400 (B. P. Bishop Museum); Nualolo trail, Na Pali Kona Forest Reserve, altitude 2000 to 3750 feet, St. John, Hosaka, Hume, Inafuku, Lindsay, Masuhara, Mitchell, and Wong no. 10835 (B. P. Bishop Museum).

Peperomia Helleri is closely related to *P. Cookiana.* It differs from it mainly in the mostly smaller and less branching plants with more narrowly elliptic leaves. Some specimens of variety *subovata* have some leaves similar to those of *P. Cookiana,* but the general appearance of the plants and the presence of oval to lanceolate leaves allies them more closely with *P. Helleri.* Variety *grossa* resembles *P. Cookiana* variety *flavinerva* but differs in the mostly larger leaves with the upper surface more or less completely hirsute. In those leaves which are hirsute only at the base and along the nerves as in variety *flavinerva* the hairs are generally longer and less crisp.

13. **Peperomia kokeana,** new species.

Caules parce flexuosi, e basi decumbente radicanteque adscendentes, plerumque 30-50 cm. alti, superne dense adpresso-hirtelli, inferne glabrati. Folia 3-5-verticillata, raro opposita, utrinque hirtella, oblongo-lanceolata vel elliptico-lanceolata, nonnumquam oblanceolata vel parce falcata, plerumque 0.8-1.2 cm. lata, 3-5 cm. longa, palmatim 3-nervia, apice acuta ad acuminata, basi acuta ad cuneata; petiolus circiter 1 cm. longus, hirtellus. Spicae axillares terminalesque, usque ad 9 cm. longae. Fructus ovoideus, apice obliquus; stigma subterminale.

Stems somewhat flexuous, ascending from a decumbent, rooting base, mostly 30 to 50 cm. long, up to 3.5 mm. thick at the base in dry specimens, simple or more commonly

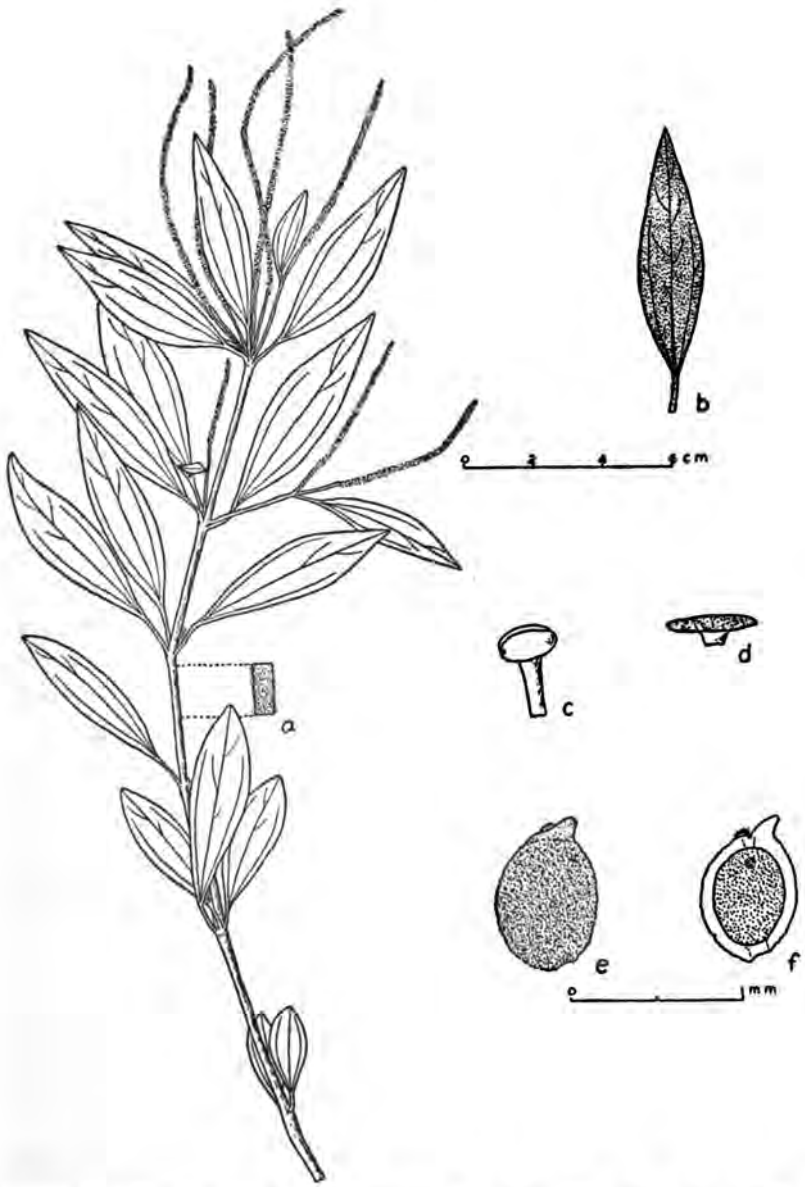

FIGURE 13.—*Peperomia kokeana* Yuncker: *a*, section of stem, enlarged; *b*, leaf; *c*, stamen, enlarged; *d*, bract, enlarged; *e*, fruit; *f*, section of fruit.

branching above, densely appressed, and somewhat crisply hirtellous above, glabrate below, internodes up to 7 cm. long.

Leaves in whorls of 3 to 5, rarely opposite, both surfaces hirtellous, but more sparingly so above, oblong-lanceolate, elliptic-lanceolate or less commonly oblanceolate, or somewhat falcate, 0.5 to 1.8 cm. broad, 2.5 to 6 cm. long, mostly 0.8 to 1.2 cm. broad and 3 to 5 cm. long, palmately 3-nerved, apex sharply acute to acuminate, base acute to cuneate; petiole mostly about 1 cm. long, densely appressed hirtellous, leaf scars semicircular or suborbicular, bundle scars 3.

Spikes axillary and terminal, up to 9 cm. long, moderately flowered; peduncle 0.5 to 1 cm. long, densely appressed hirtellous; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments about equalling the ovoid anthers; ovary ovoid, apex oblique, stigma subterminal, penicillate; fruit about 0.8 mm. long, ovoid, verrucose, viscid, eventually on pseudopedicels.

Type, Kauai, Kokee, Waimea, Na Pali-Kona Forest Reserve, St. John, Hosaka, Hume, Inafuku, Lindsay, Masuhara, Mitchell, and Wong no. 10714, in Bernice P. Bishop Museum.

Found only in the Na Pali-Kona Forest Reserve on the western part of the island of Kauai, commonly in clumps under trees and shrubs.

Kauai: Waimea Drainage Basin, west side, Forbes no. 1069-K (B. P. Bishop Museum); Kokee, Waimea, Na Pali-Kona Forest Reserve, St. John, Hosaka, Hume, Inafuku, Lindsay, Masuhara, Mitchell, and Wong no. 10714, type (B. P. Bishop Museum); near Kokee Forest Ranger station, altitude 3600 feet, Yuncker nos. 3401, 3406, 3407 (B. P. Bishop Museum); along Mililii trail below Kokee Ranger station, Yuncker no. 3402 (B. P. Bishop Museum); large patch in wet woods, along road about 1 mile above Kokee Ranger station, altitude 3600 feet, Yuncker no. 3403 (B. P. Bishop Museum); along the road to lookout, Kumuweia Ridge, altitude 3500 feet, Yuncker nos. 3404, 3405, 3408, 3409, 3410 (B. P. Bishop Museum); Kaholuamano [Kaholuamanu] Hitchcock no. 15363 (B. P. Bishop Museum).

The densely appressed hirtellous stems and leaves, and the 3- to 4-whorled, elongated leaves distinguish this species from *P. Helleri,* with which it appears to be most closely allied.

14. Peperomia trichostigma C. deCandolle.

Peperomia trichostigma C. deCandolle, Bull. Coll. Hawaii no. 2, p. 25, 1913.

Peperomia trichostigma forma *b,* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 25, 1913.

Stems erect or ascending from a short, decumbent, rooting base, up to 6 dcm. long and 8 mm. thick at the base in dry specimens, branching above, densely pubescent above, glabrate below, hairs less than 0.5 mm. long, subappressed, internodes up to 15 cm. long, but mostly much shorter.

Leaves opposite or whorled, lower surface moderately pubescent, often with red intercostal areas, upper surface sparsely pubescent, at least towards the base and along the nerves, elliptic, 1.8 to 3 cm. broad, 3 to 5 cm. long, mostly 2 to 2.5 cm. broad and

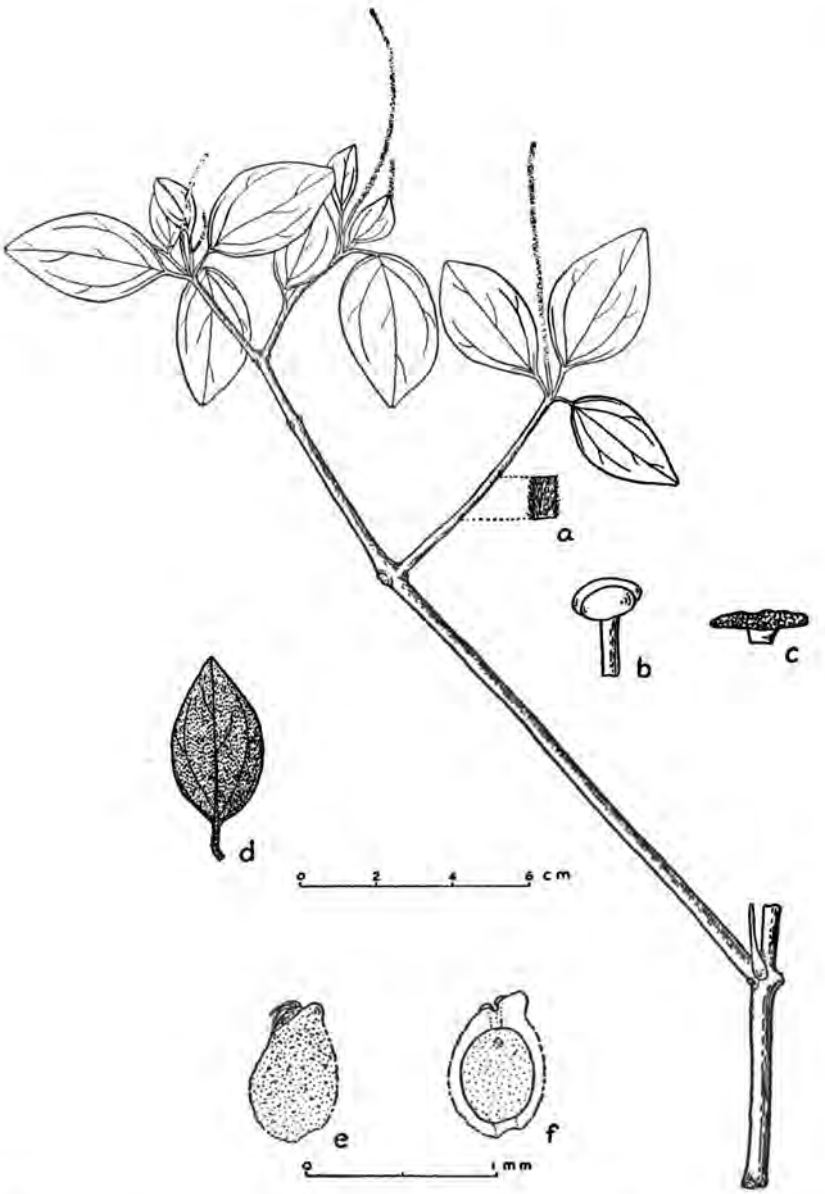

FIGURE 14.—*Peperomia trichostigma* C. deCandolle: *a*, section of stem, enlarged; *b*, stamen, enlarged; *c*, bract, enlarged; *d*, leaf; *e*, ovary; *f*, section of ovary.

3 to 4 cm. long, 3 to 5-plinerved, the midrib forking within the lowermost 5 mm., some leaves subpalmately nerved, apex obtusish to shortly and attenuately acute, base shortly acute; petiole up to 2 cm. long, pubescent, leaf scars semicircular, bundle scars 3.

Spikes axillary and terminal, up to 7 cm. long and 1 mm. thick, moderately flowered; peduncles about 1 cm. long, pubescent or glabrescent; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments about equal to the ellipsoidal anthers; ovary ovoid, apex oblique, stigma single or divided, abundantly penicillate; fruit not seen.

Type, Maui, on the high swampy plateau and along the trail leading to Puu Kukui, altitude 5780 feet, Rock, in the deCandolle herbarium.

Known from the islands of Maui and Lanai.

Maui: swampy plateau of Puu Kukui, Rock no. 10381, duplicate type (B. P. Bishop Museum).

Lanai: Forbes nos. 338-L, 360-L (B. P. Bishop Museum).

This species resembles *P. erythroclada* variety *picta* in many respects but differs from it in its commonly more slender spikes, more or less pubescent upper leaf surface, and the oblique apex of the ovary with subterminal stigmas. From *P. Cookiana* variety *pukooana* it differs in its mostly larger, elliptic, plinerved, and briefly acute or obtusish leaves, and from *P. Remyi* by its plinerved and obtusish leaves.

15. **Peperomia Remyi** C. deCandolle.

Peperomia Remyi C. deCandolle, Ann. Cons. Bot. Genève, vol. 2, p. 286, 1898.

Peperomia lanaiensis, C. deCandolle, Bull. Coll. Hawaii no. 2, p. 26, 1913.

Peperomia blanda variety *Remyi* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 26, 1913.

Peperomia blanda variety *glabrior* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 26, 1913.

Stems erect or ascending from a decumbent, rooting base, up to 45 cm. long and 4 mm. thick at the base in dry specimens, branching, moderately subappressed hirtellous above, or rarely subglabrate, glabrate below, hairs mostly 0.2 to 0.3 mm. long, internodes up to 8 cm. long, mostly 4 to 6 cm. long.

Leaves opposite or more commonly whorled, lower surface hirtellous, upper surface sparingly hirtellous at least at base or along the nerves, elliptic-lanceolate, 2 to 5 cm. broad, 3.5 to 9 cm. long, mostly 2 to 3 cm. broad and 4 to 6 cm. long, 3- to 5-palmately nerved, apex attenuately acute to acuminate, base acute to cuneate, rarely some leaves subobtuse; petiole up to 1.5 cm. long, hirtellous, leaf scar semicircular, bundle scars 3.

Spikes axillary or terminal, up to 15 cm. long, loosely flowered; peduncle mostly 1 to 2 cm. long, hirtellous or glabrate, rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments longer than the globose-ellipsoidal anthers; ovary ovoid, apex oblique, stigma one, subterminal; fruit about 0.75 mm. long, ovoid-globose, bluntly rostrate, verrucose, viscid, on pseudopedicels.

Type, Kauai, Remy no. 188, in the Paris Herbarium. The sketch of the type by Professor Trelease was examined.

Found on the islands of Kauai, Oahu, Lanai, Molokai, Maui, and Hawaii.

Kauai: on the ridge west of Hanapepe River, Heller no. 2633 (Gray).

Oahu: Kaliki, Faurie no. 163, the type of *P. blanda* variety *glabrior* (deCandolle).

Lanai: Forbes no. 363-L (B. P. Bishop Museum); Mahana Valley, alti-

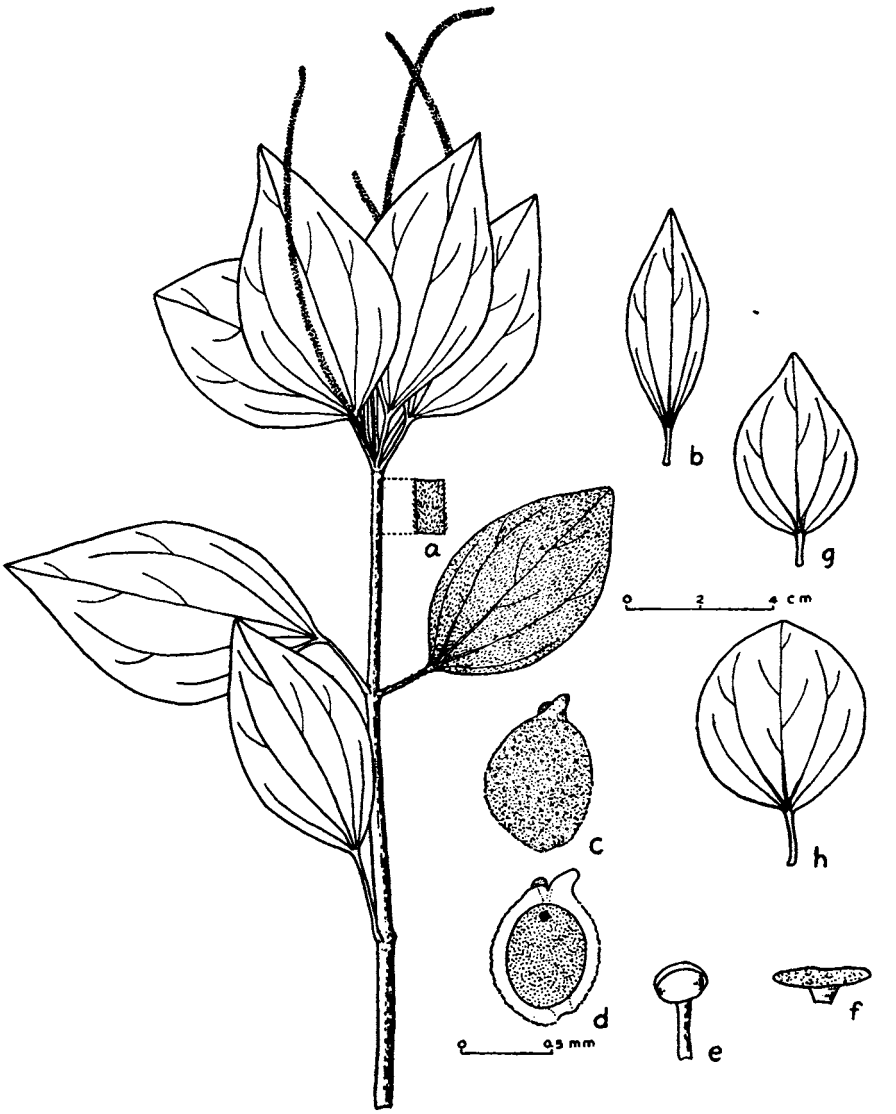

FIGURE 15.—*Peperomia Remyi* C. deCandolle: *a*, section of stem, enlarged; *b*, leaf; *c*, fruit; *d*, section of fruit; *e*, stamen, enlarged; *f*, bract, enlarged; *g*, *h*, leaves of variety *waipioana*.

tude 2000 feet, Rock no. 8089, duplicate type (Gray, B. P. Bishop Museum); ravine in mountain, moist woods, Hitchcock no. 14699 (U. S. National, B. P. Bishop Museum).

Molokai: Kaluoaha [Kaluaaha] Valley, Forbes no. 367-Mo (B. P. Bishop Museum); Wailau Valley, on ground in wet dark woods, Wiebke and Nitta no. 3187 (Degener, Illinois); gulch west of Ualapue, wet rocky woods, Degener no. 2955 (Degener, Illinois); Iloli above Kalaupapa, woods in gully, Degener and Wiebke no. 2992 (Degener, Illinois); Mapulehu Valley, along rocky stream bank, altitude 1000 feet, St. John, Baker, Coulter, Fosberg, and Yuncker no. 12749 (B. P. Bishop Museum).

Maui: Forbes nos. 2408-M, 2462-M (B. P. Bishop Museum); Honokahau Drainage Basin, Forbes no. 487-M (B. P. Bishop Museum).

Hawaii: Waipio Valley, Rock no. 10364 (B. P. Bishop Museum); Halawa, Faurie no. 114 (deCandolle); Kohala, Faurie no. 115 (deCandolle).

Peperomia Remyi variety **waipioana,** new variety.

Peperomia ovatilimba forma *b,* in part, C. deCandolle, Bull. Coll. Hawaii no. 2, p. 23, 1913.

Folia rotundo-ovata ad elliptica, basi obtusa vel breviter acuta.
Leaves rounded-ovate to elliptical, base obtuse or shortly acute.

Type, Hawaii, Waipio Valley, Rock no. 4646, in Bernice P. Bishop Museum.

Found in the Kohala mountain region on the island of Hawaii, and on the island of Lanai.

Hawaii: Waipio Valley, Rock no. 4646, the type (B. P. Bishop Museum); Pololu Valley, rocky wooded slope along ditch trail, Pohina and Iwasaki no. 3885 (Degener, Illinois).

Lanai: Mahana Valley, Rock no. 8093 (Gray; also as no. 10374 in B. P. Bishop Museum).

This species is distinguished chiefly by its finely hirtellous condition, moderately large leaves, and long spikes. Rock's no. 10364 was identified by deCandolle as *P. blanda* and so cited by him without number (Bull. Coll. Hawaii no. 2, p. 26, 1913). I find the hairs on this specimen slightly longer than those on the other specimens included here and in that character thus approaching *P. blanda* to some extent. I do not believe, however, that *P. blanda* occurs in the Hawaiian islands.

Variety *waipioana,* with its more ovate leaves and commonly with obtusish base, approaches *P. Cookiana,* but the hirtellous rather than hirsute condition of the plant, and the generally larger size of the leaves serve to distinguish it from that species. Some of the leaves on Pohina and Iwasaki's no. 3885 are essentially orbicular, while other leaves on the same specimen are ovate to elliptic.

16. Peperomia leptostachya Hooker and Arnott.

Peperomia leptostachya Hooker and Arnott, Bot. Beechey, p. 96, 1832.
Peperomia insularum Miquel, London Jour. Bot., vol. 4, p. 422, 1845.
Peperomia leptostachya variety *nodosa* Hillebrand, Fl. Hawaiian Is., p. 423, 1888.
Peperomia leptostachya forma *carnosior,* in part, C. deCandolle, Bull. Col. Hawaii no. 2, p. 22, 1913.
Peperomia Candollei St. John, B. P. Bishop Mus., Occ. Papers, vol. 19, no. 14, p. 6, 1931.

Stems erect or ascending from a decumbent, rooting base, mostly 15 to 20 cm. tall, green or reddish in color and up to 6 mm. thick at the base in fresh specimens, hirtellous, hairs mostly less than 1 mm. long, simple or with spreading to ascending branches, especially above, nodes tumid, internodes mostly 1 to 3.5 cm. long, rarely somewhat longer.

Leaves opposite or less frequently ternate, green or less commonly the lower surface red, fleshy, the lower leaves commonly somewhat turgid when fresh, drying thin and membranous and commonly semitranslucent, mostly somewhat concave above and reflexed at the junction of the blade and petiole, articulated at the base of the petiole and easily deciduous, leaving a slightly raised, semicircular leaf scar with 3 bundle scars, in dry specimens the leaves are not uncommonly mostly free from the stem, hirtellous on both surfaces, oval-obovate, oval, or rarely somewhat ovate, 1.2 to 3.5 cm. broad, 1.5 to 6 cm. long, commonly 1.3 to 1.8 cm. broad and 1.8 to 2.5 cm. long, 3- or 5-palmately nerved, the outermost pair of nerves slender and more or less inconspicuous, apex briefly and attenuately acute, or rounded, base acute to cuneate; petioles 0.5 to 1 cm. long, hirtellous.

Spikes slender, numerous, axillary and terminal, up to 10 cm. long, moderately flowered; peduncles 1 to 2 cm. long, hirtellous; rachis glabrous; bracts about 0.75 mm. broad, round, peltate; anthers ellipsoidal, on filaments of about the same length or somewhat longer; ovary globose-ovoid, with oblique apex, stigma one, subterminal, sparingly penicillate; fruit globose-subobovoid, about 0.9 mm. long, verrucose, viscid, on short pseudopedicels.

Type, Oahu, Beechey, in the Kew Herbarium.

This species grows at lower elevations and under more arid conditions than any other Hawaiian species. The plants occur singly or more commonly in clumps on dry rocks or on the ground under *Lantana* and other shrubs or rarely epiphytically, from sea level to an altitude of 1000 feet or rarely higher. It is found throughout the Hawaiian islands and other parts of Polynesia.

Niihau: foot of mountain on west side, Stokes, Jan., 1912, type of *P. Candollei* (B. P. Bishop Museum).

Kauai: along Hanapepe river near the falls, Heller no. 2510 (deCandolle, U. S. National); on dry cliffs near Haena, Yuncker no. 3388 (B. P. Bishop Museum); on dry rocks along Na Pali coast trail, Yuncker no. 3389 (B. P. Bishop Museum); Koloa, Faurie no. 152 (deCandolle); Maunapulo [Maunapuluo], Hanakapiai, Na Pali coast, St. John, Hosaka, Hume, Inafuku,

Lindsay, Masuhara, Mitchell, and Wong no. 10864 (B. P. Bishop Museum); Haupu Range, near Nawiliwili Bay, Forbes no. 716-K (B. P. Bishop Museum).

Oahu: Beechey, type of *P. leptostachya* (Kew); Diell no. 53, type of *P. insularum* (Kew); Hillebrand, 1867, type of *P. leptostachya* variety

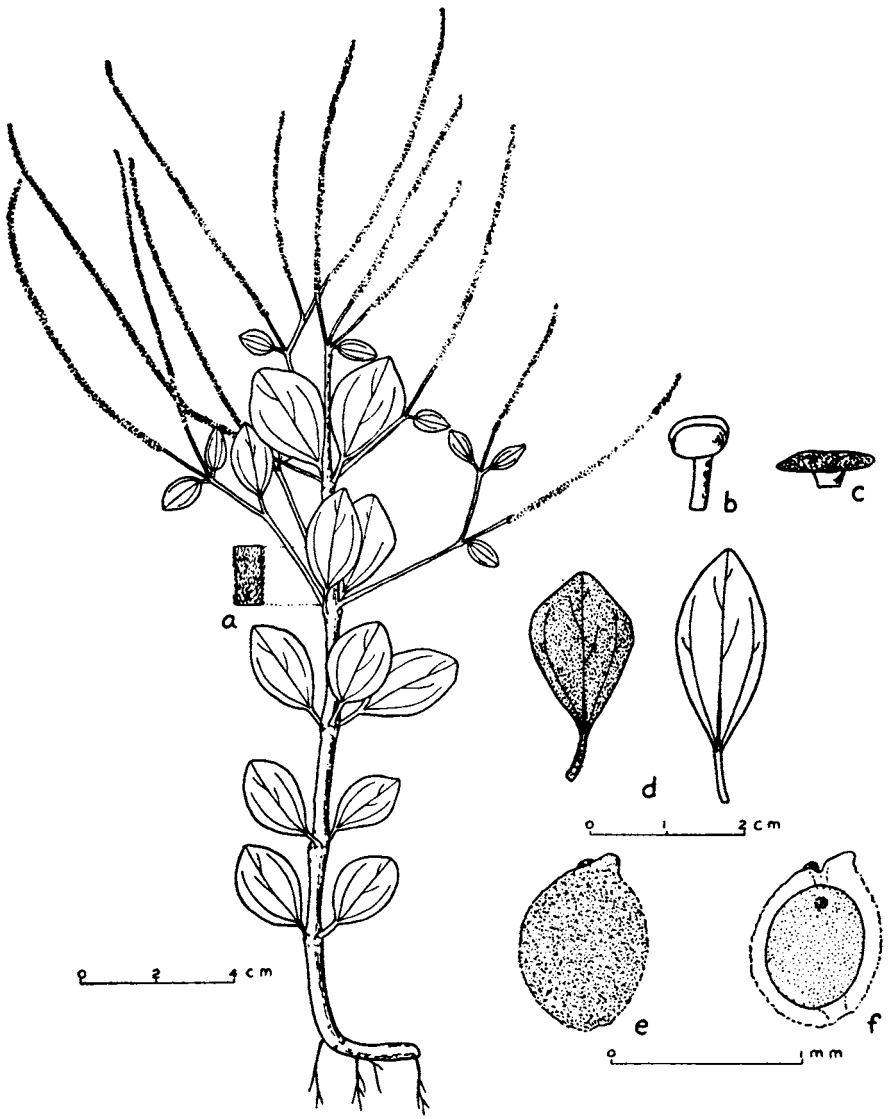

FIGURE 16.—*Peperomia leptostachya* Hooker and Arnott: *a*, section of stem, enlarged; *b*, stamen, enlarged; *c*, bract, enlarged; *d*, leaves; *e*, fruit; *f*, section of fruit.

nodosa (Berlin); Waialae Nui, Forbes, April 20, 1909 (B. P. Bishop Museum); Waialae Valley, Forbes no. 1952-O (B. P. Bishop Museum); under ***kukui*** trees, altitude 1000 feet, Heller no. 2237 (deCandolle, U. S. National, Gray); Tantalus mountain, wet rocky ravine, Tam no. 3537 (Degener); on dripping, shaded cliff, Degener and Tam no. 3546 (Degener); on rocks, Degener no. 1569 (Degener); Makiki, Tantalus trail, Garber no. 336 (B. P. Bishop Museum); Makiki Valley, Degener no. 2432 (Degener); Palolo Valley, Garber no. 200 (B. P. Bishop Museum); rocks in Kalihi, Faurie no. 154 (deCandolle); Pauoa Valley, Heller no. 2010 (U. S. National); Honolulu, Yuncker no. 3464 (B. P. Bishop Museum); on rocky ledges, Kapalama Heights above Honolulu, Yuncker no. 3365 (B. P. Bishop Museum); Manoa Valley above Woodlawn, bare, dry rock ledges on cliff, Fosberg no. 9294 (B. P. Bishop Museum); lower Manoa Valley, Yuncker no. 3110 (B. P. Bishop Museum); west side Manoa Valley, Yuncker no. 3203 (B. P. Bishop Museum); Red Hill, altitude 2000 feet, Degener, Oct. 9, 1932 (Degener); gulch above Aiea, Yuncker no. 3046 (B. P. Bishop Museum); northwest ridge of Puu Olomana, Kailua, on dry rocks, Fosberg and Duker nos. 9029, 9033 (B. P. Bishop Museum); Waimanu, Topping no. 3109 (Degener, Illinois); Kipapa Gulch, in dry place around basalt, altitude 500 feet, Hosaka no. 887 (B. P. Bishop Museum); northwest slope of Kahana Valley, near summit, Degener no. 4298, in part (Degener); Waimea River, Waimea, on rocks under trees, Fosberg and Duker nos. 8870, 8872 (B. P. Bishop Museum); Waianae range, dry rocks on ridge on northeast slope of Puu Kaala, altitude 1000 feet, Yuncker and Hosaka no. 3253 (B. P. Bishop Museum); dry slope, altitude 1500 feet, Yuncker and Hosaka no. 3366 (B. P. Bishop Museum); head of Makua Valley, wet rocks by stream, altitude 500 meters, Fosberg and Duker no. 9040 (B. P. Bishop Museum); Piko trail, Makua side, dry rocks, altitude 500 feet, Yuncker no. 3363 (B. P. Bishop Museum); gulch on northeast slope of Puu Kaala, Yuncker no. 3411 (B. P. Bishop Museum); west slope of Puu Kaala, above Waianae village, Yuncker no. 3310 (B. P. Bishop Museum); Waianae Valley, altitude 2000 feet, Christophersen, Dec. 13, 1924 (B. P. Bishop Museum); on east side of valley below Palikea, Degener no. 4231 (Degener); west face of Puu Kalena, Waianae-kai, Fosberg no. 9268 (B. P. Bishop Museum); west of Kawaihapai, on rocks in arid region, altitude 500 feet, Degener, Park, and Hirai no. 4034 (Degener); hill east of Kawaihapai, on rocks near sea level in arid region, Degener, Park, and Hirai, no. 4039 (Degener); Kawaihapai, Degener no. 4288 (Degener); Kewaula [Keawaula] Valley, Degener, Park, Nitta, and Westgate no. 4247 (Degener); narrow northeast gully in Ohikilolo Valley, on dry rocks, Degener no. 4267 (Degener).

Molokai: Stokes, 1909 (B. P. Bishop Museum); Pelekunu forests, alti-

tude 4000 feet, Rock no. 10372 (B. P. Bishop Museum); valley west of eastern Ohia, wet rocks, Degener and Wiebke no. 3067 (Degener, Illinois); Kupulei [Kapulei], amid rocks in arid region, Degener and Wiekbe no. 2984 (Degener, Illinois); gully east of Kapulei, dry rocky ground, Degener and Wiebke no. 2990 (Degener, Illinois); north slope of Halawa Valley, amid rocks in arid region, Degener and Wiebke no. 2997 (Degener, Illinois); west side of Halawa Valley, arid rocks, Degener no. 2991 (Degener); Halawa Valley, on dry rocks along stream and at base of upper and lower Moaula Falls, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12689, 12691, 12694, 12697, 12700, 12702, 12706, 12708, 12712 (B. P. Bishop Museum); near Waiahewahewa, on cliff in extremely arid district, Degener and Wiebke no. 2841 (Degener); near Waiahewahewa Gulch, in rock crevices of cliff in very dry region, Degener and Wieke no. 2757 (Degener, Illinois); Kalae, Hillebrand (Berlin); Punaula Valley, altitude 400 feet, St. John and Fosberg no. 12805 (B. P. Bishop Museum); on prostrate tree trunk, altitude 500 feet, St. John and Fosberg no. 12828 (B. P. Bishop Museum); rocks in gorge, altitude 800 feet, St. John and Fosberg no. 12826 (B. P. Bishop Museum); on mossy rocks, altitude 1000 feet, St. John and Fosberg no. 12817 (B. P. Bishop Museum); Kamolo [Kamalo], Faurie nos. 151, 156, 166 (deCandolle); rocks along river gorge, Mapulehu Valley, Baker, Coulter, and Yuncker no. 12758 (B. P. Bishop Museum).

Maui: Forbes no. 1767-M, 1950-M, 1951-M (B. P. Bishop Museum); Remy no. 181 (Gray); west Maui, Kaanapali, Hillebrand, 1870 (Berlin); on moist, rocky cliff, Iao Valley, Yuncker no. 3546 (B. P. Bishop Museum); east Maui, vicinity of Hana, in woods, Degener and Wiebke nos. 2391, 2635 (Degener, Illinois); Kula, Forbes no. 2178-M (B. P. Bishop Museum); Makawao, Hillebrand and Lydgate (B. P. Bishop Museum); foot of Haleakala, Wawra no. 1870 (Vienna); Nuu, down deep in a-a lava, Forbes no. 1907-M (B. P. Bishop Museum); Keanae, rocky bank, Punaau stream, altitude 250 feet, St. John no. 10291 (B. P. Bishop Museum).

Hawaii: near Kaalualu, dry a-a desert forest, Degener and Kai no. 2465 (Degener); above Hoopuloa, on rocks in arid region near forest belt, altitude 700 feet, Degener and Iwasaki no. 3881 (Degener); near 1788 lava flow, near Kalapana, on a-a lava in arid, sunny district, Degener and Iwasaki no. 3884 (Degener); Hilo, on rocks on shady river bank, Degener no. 2429 (Degener); near Rainbow Falls, Hitchcock no. 14196 (B. P. Bishop Museum); in fern forest, Kilauea, Degener no. 2434 (Degener, Illinois); Kona, near Kahalua [Kahaluu], on old lava wall, Yuncker no. 3465 (B. P. Bishop Museum); on old a-a lava near Napoopoo, Yuncker no. 3466 (B. P. Bishop Museum); on old a-a lava above Alikapapa, Yuncker no. 3467 (B. P. Bishop Museum).

This species is easily recognized by its tumid nodes, short internodes, more or less oval-obovate and articulated leaves, and the completely hirtellous condition of the plant.

17. Peperomia ellipticibacca C. deCandolle.

Peperomia ellipticibacca C. deCandolle, Bull. Coll. Hawaii no. 2, p. 19, 1913.

Peperomia eekana C. deCandolle, Bull. Coll. Hawaii no. 2, p. 16, 1913, in part.

Peperomia hypoleuca variety *montis-eeka* Hillebrand, Fl. Hawaiian Is., p. 422, 1888, in part.

Stems up to 30 cm. tall and 5 mm. thick, ascending from a substoloniferous base, simple or branching, internodes up to 8 cm. long, mostly 2 to 4 cm. long, densely hirsute with rusty-brown hairs.

Leaves opposite or more commonly in whorls of three to eight, drying subcoriaceous, lower surface densely hirsute and frequently a rusty-salmon color in dry specimens, upper surface impressed along the nerves, glabrous or sparingly hirsute, especially at the base and along the nerves, elliptic-ovate or oval, rarely suborbicular, up to 2 cm. broad and 4.5 cm. long, commonly about 1 cm. broad and 2 to 2.5 cm. long, 3- to 5-plinerved, midnerve branching in the lower 5 mm. or palmately 3-nerved in small leaves, apex obtuse or subacute, base rounded to acute; petioles 5 to 8 mm. long or in larger leaves up to 1.5 cm. long, densely hirsute.

Spike axillary and terminal, single or clustered, up to 4 cm. long and 1.5 mm. thick, but mostly shorter, moderately flowered; peduncle about 1 cm. long, hirsute; rachis glabrous; bracts round, peltate, edges somewhat irregular, up to 0.7 mm. broad; anthers globose-ellipsoidal, exserted on slender filaments; ovary subglobose, apex suboblique, stigmas mostly divided, subterminal, smooth or often penicillate; fruit about 1 mm. long, verrucose, viscid, subobovoid, on pseudopedicels.

Type, Oahu, Punaluu, Faurie no. 131, in the deCandolle herbarium.

Known from the higher rain forests of west Maui (?) and the Koolau Range on the island of Oahu.

Oahu: Koolau mountains, Punaluu, Rock no. 457, cotype (B. P. Bishop Museum); Rock no. 10 (Gray, B. P. Bishop Museum); Rock no. 23 (B. P. Bishop Museum); Lanihuli Peak, Garber no. 264 (B. P. Bishop Museum); Lanihuli trail, Forbes and Stokes, June 28, 1908 (B. P. Bishop Museum); Kipapa Gulch, Yuncker no. 3096 (B. P. Bishop Museum); summit of Koolau mountains, above Kipapa Gulch, Waiahole, shaded ravine, Fosberg no. 8694 (B. P. Bishop Museum); south ridge, Kipapa Gulch, on mossy tree trunk, altitude 2200 feet, Hosaka no. 683 (B. P. Bishop Museum); Koolauloa mountains, between Punaluu and Kaipaupau [Kaipapau], Forbes and Thompson, May 9-13, 1909 (B. P. Bishop Museum); Waiolani [Waolani] Ridge, Forbes, Sept. 17, 1908 (B. P. Bishop Museum); peak of Mount Olympus, Garber no. 296 (B. P. Bishop Museum); at summit of Waikane-Schofield trail, in rain forest, Yuncker no. 3164 (B. P. Bishop Museum); Degener,

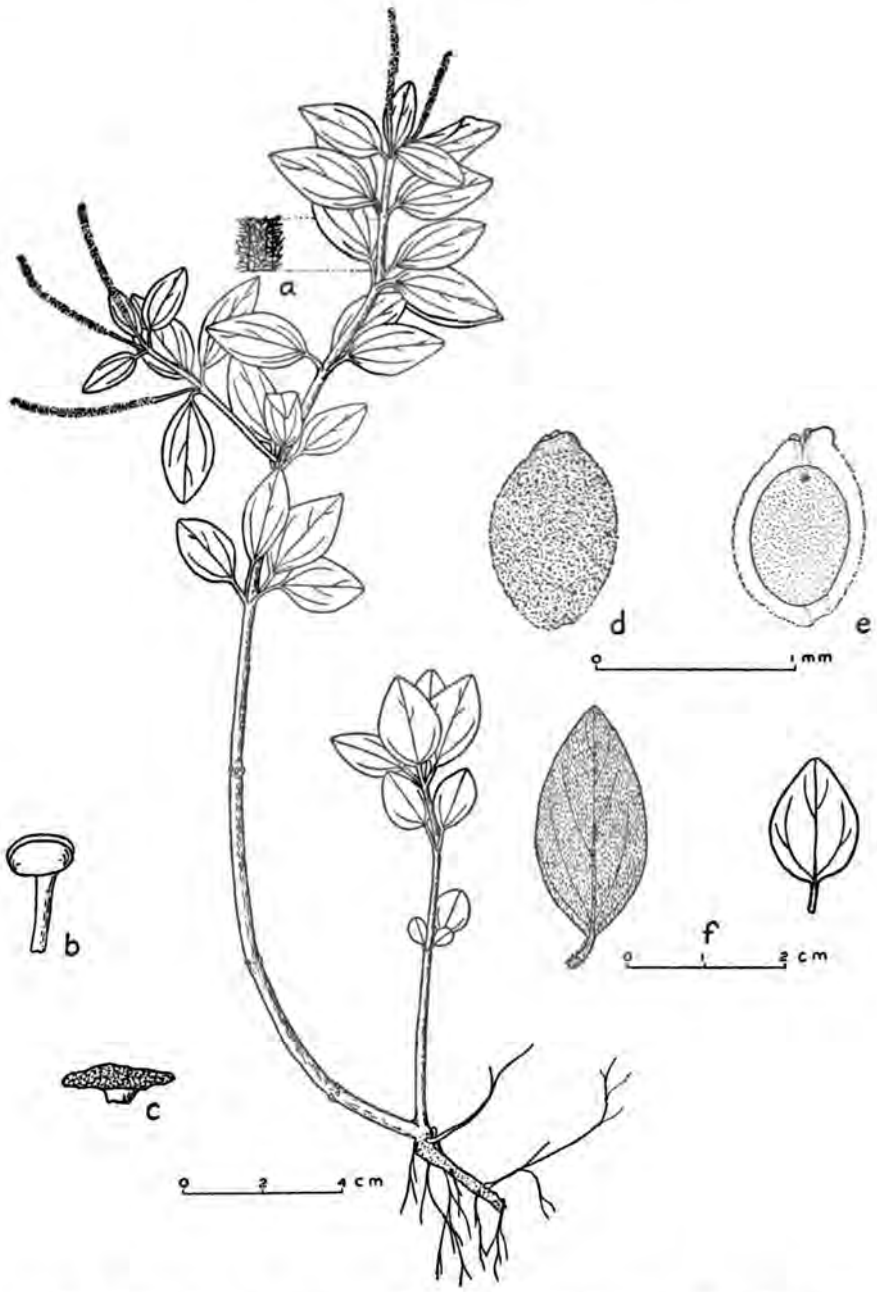

FIGURE 17.—*Peperomia ellipticibacca* C. deCandolle: *a*, section of stem, enlarged; *b*, stamen, enlarged; *c*, bract, enlarged; *d*, fruit; *e*, section of fruit; *f*, leaves.

Park and Hirai no. 4037 (Degener); Konahuanui, near summit, Heller no. 2243 (U. S. National, Gray); peak at head of Pauoa Flats, Koolau mountains, Fosberg no. 8956 (B. P. Bishop Museum).

Maui: west Maui, Kaanapali, Hillebrand, Aug., 1870, in part (Berlin); Mount Eeka [Mauna Eke], Hillebrand, in part (Berlin).

Specimens of what appear to be this species, collected by Hillebrand and now in the Berlin herbarium, are mounted on sheets with specimens of Hillebrand's *P. hypoleuca* variety *montis-eeka,* and were apparently included by him in his description of that variety. All of the specimens examined for this species came from Koolau Range on the island of Oahu with the exception of the Hillebrand specimens. The two species seem to be sufficiently distinct morphologically and, with the exception of Hillebrand's possibly mixed specimens, are also geographically separated. Apparently C. deCandolle confused *P. ellipticibacca* with *P. eekana* and *P. sarcostigma* which I now consider to be the same as his *P. eekana.*

18. Peperomia Cookiana C. deCandolle.

Peperomia Cookiana C. deCandolle in DC Prodomus, vol. 16, part 1, p. 450, 1869.

Peperomia pleistostachya Hillebrand, Fl. Hawaiian Is., p. 427, 1888.

Peperomia refractifolia Léveillé in Fedde, Repert., vol. 10, p. 151, 1911; emended by C. deCandolle, Bull. Coll. Hawaii no. 2, p. 22, 1913.

Peperomia opacilimba C. deCandolle, Bull. Coll. Hawaii no. 2, p. 21, 1913.

Peperomia kohalana C. deCandolle, Bull. Coll. Hawaii no. 2, p. 21, pl. 2, 1913.

Peperomia leptostachya forma *carnosior,* in part, C. deCandolle, Bull. Coll. Hawaii no. 2, p. 22, 1913.

Peperomia ovatilimba forma *b,* in part, C. deCandolle, Bull. Coll. Hawaii no. 2, p. 23, 1913.

Peperomia leptostachya variety *carnosa* C. deCandolle, Candollea, vol. 1, p. 394, 1923. As name in index only and undoubtedly an error for forma *carnosior.*

Peperomia hiloana C. deCandolle, Candollea, vol. 1, p. 300, 1923; Schroeder, Candollea, vol. 3, p. 126, 1926.

Stems mostly ascending from a repent base, commonly about 15 cm. long, or less commonly up to 30 cm. long, up to 4 mm. thick in dry specimens, generally abundantly and diffusely branching from the base upwards, densely hirsute, hairs commonly rusty-brown in color when dry, erect or rarely subappressed, up to 1 mm. long, internodes mostly 3 to 6 cm. long.

Leaves opposite or more commonly in whorls of 3 to 4, lower surface abundantly hirsute and not uncommonly with red intercostal areas, upper surface commonly hirsute or at least at the base and along the nerves, ovate or subelliptic or more rarely with some leaves rounded or obovate, commonly drying firm and opaque, 1 to 2.2 cm. broad, 1 to 3 cm. long, mostly about 1.5 cm. broad and 2 cm. long, palmately 3-nerved or rarely

obscurely 5-nerved, apex obtuse to shortly acutish or rarely subacuminate, base obtuse to shortly acute; petioles 0.3 to 1 cm. long, generally about 0.5 cm. long, densely hirsute, leaf scars semicircular, bundle scars 3.

Spikes in terminal and axillary clusters or rarely single, up to 8 cm. long, loosely flowered; peduncle 0.8 to 2 cm. long, densely hirsute to glabrescent; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments about equaling the ellipsoidal anthers; ovary ovoid, apex oblique, stigma single, subterminal, more or less penicillate; fruit globose-ovoid, about 0.75 mm. long, subrostrate, verrucose, viscid, on pseudopedicels.

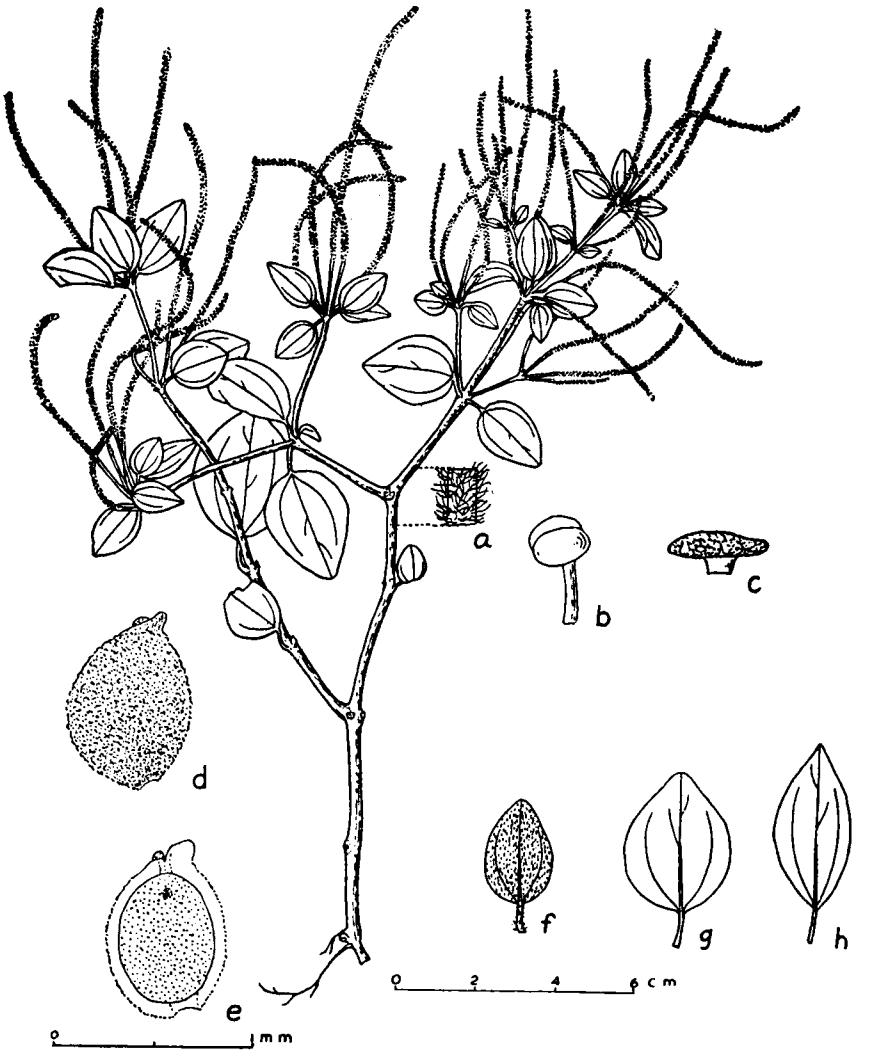

FIGURE 18.—*Peperomia Cookiana* C. deCandolle: *a*, section of stem, enlarged; *b*, stamen, enlarged; *c*, bract, enlarged; *d*, fruit; *e*, section of fruit; *f*, leaf; *g*, leaf of variety *ovatilimba*; *h*, leaf of variety *flavinerva*.

Type, "Sandwich Islands," Gaudichaud, in the deCandolle herbarium. A sketch by Professor Trelease of a duplicate type at Paris was also examined.

Known from the islands of Kauai, Molokai, Maui, and Hawaii.

"Sandwich Islands," Gaudichaud, 1839, the type (deCondolle).

Kauai: Wahiawa mountains, Forbes no. 230-K (B. P. Bishop Museum).

Molokai: Hanaliioliio [Hanalilolilo], in shaded moderately dry but often fogswept woods, Degener and Wiebke nos. 2740, 2741, 2743 (Degener, Illinois); head of Waikolu Valley, Hanlilolilo [Hanalilolilo], altitude 3800 to 3900 feet, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12396, 12406, 12411 (B. P. Bishop Museum); between Waikolu Valley and probably northern base of Puu Alii, in thicket in rain forest, Degener and Wiebke nos. 2763, 2764, 2766 (Degener, Illinois); moist, open forest, Puu o Kaeha, Kawela, altitude 3800 feet, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12465, 12467, 12484, 12486 (B. P. Bishop Museum); few hundred feet northwest of Maunahui, wet, rich embankment in ravine, Degener and Wiebke no. 2879 (Degener, Illinois); near Pepeopae, on damp ground in dense shade, Degener and Wiebke nos. 2731, 2734, 2735 (Degener, Illinois); near Kaluahuaoni [Kaluahauoni], on partly sunny ground in rain forest, Degener and Wiebke nos. 2849, 2850 (Degener, Illinois); Kahuaawi Gulch, shaded rocky side of spring, Degener no. 2895 (Degener); east side of Puu Kaeo, on moss-covered, partly exposed bank, Degener and Wiebke no. 2847 (Degener, Illinois); ridge between Hanalilolilo and Pepeopae, Waikolu Valley, Kawela, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12577, 12585 (B. P. Bishop Museum); Pukoo, altitude 800 meters, Faurie no. 133 (deCandolle).

Maui: Forbes nos. 1832-M, 1891-M, 2140-M, 2461-M (B. P. Bishop Museum); Puu Kukui, altitude 3000 to 5000 feet, Hitchcock no. 14791 (B. P. Bishop Museum); wooded crest, altitude 5788 feet, St. John no. 10270 (B. P. Bishop Museum); Olinda, along pipe line, Degener and Wiebke nos. 2633, 2638, 2640, 2642 (Degener, Illinois); Yuncker no. 3416 (B. P. Bishop Museum); Kula pipe line, mossy woods, altitude 4500 feet, St. John no. 10301 (B. P. Bishop Museum); Olinda, along ditch trail, Degener and Wiebke nos. 2390, 2415 (Degener, Illinois); along ditch trail from Haiku through Honomanu Valley to Keanae, Degener and Wiebke no. 2618 (Degener, Illinois); in Koolau Gap of Haleakala Crater, on fogswept eroded a-a lava, Degener no. 2420; Degener and Wiebke no. 2392 (Degener, Illinois); northeast of Ulupalakua, Degener and Wiebke no. 2620 (Degener, Illinois); Makawao, Hillebrand and Lydgate (B. P. Bishop Museum); woods of Hamakua, altitude 4000 feet, Rock nos. 8583 (deCandolle, B. P. Bishop Museum), 8584 (B. P. Bishop Museum); woods near Ukulele, above Olinda, Forbes no. 198-M (B. P. Bishop Museum); Haleakala, Forbes, July-Sept.,

1919 (B. P. Bishop Museum); Ukulele, Forbes no. 734-M (B. P. Bishop Museum); west branch of Honomanu Gulch, Forbes no. 2590-M (B. P. Bishop Museum); Nahiku, Faurie no. 121 (deCandolle).

Hawaii: Brigham, 1899 (B. P. Bishop Museum); Mauna Kea, altitude 2000 meters, Faurie nos. 158, 169—type of *P. opacilimba* (deCandolle); Kilauea volcano region, Rock no. 17172; Forbes, Brigham, and Thompson, Sept., 1908 (B. P. Bishop Museum); damp locality along Byron Walk, Degener no. 2431 (Degener); near Fern Forest, on wet ground, Degener no. 3805 (Degener); Bird Park, on ground in open woods, Degener and Nitta no. 3897 (Degener); Yuncker no. 3473 (B. P. Bishop Museum); among rocks, Wiebke and Akwai no. 3789 (Degener, Illinois); between Volcano House and 29 Miles, Kilauea, Degener and Swezey no. 3803 (Degener); between Glenwood and 29 Miles, on ground in wet jungle, Wiebke nos. 3714, 3783 (Degener, Illinois); forest of Kilauea Volcano, Rock, July, 1911 (B. P. Bishop Museum); 40 miles along road from Hilo into Kau Desert, on ground in dry woods, Degener no. 3782 (Degener, Illinois); Paauhau Forest, Rock no. 4428, duplicate type of *P. kohalana* (B. P. Bishop Museum); Moonuiahea, Hualalai Rock no. 4430 (B. P. Bishop Museum); Hinakapauula, slopes of Hualalai, above Huehue, on *Acacia koa*, growing in moss, altitude 5500 feet, Rock no. 3796 (B. P. Bishop Museum); summit of Hualalai, Forbes no. 216-H (B. P. Bishop Museum); Kipuka in 1823 flow, level of Keawe Wye [Keawe Wai], Forbes no. 974-H (B. P. Bishop Museum); Puuwaawaa, Forbes no. 1-H (B. P. Bishop Museum); near Kipuka Puaulu, Rock no. 17175 (B. P. Bishop Museum); Kulani, Forbes no. 982-H (B. P. Bishop Museum); trail between Halelouolu [Haleloulu] and Wailuku, Forbes no. 717-H (B. P. Bishop Museum).

Key to Varieties

1. Leaves mostly ovate to subelliptic or suborbicular and commonly obtuse
   2. Leaves more than 1 cm. long, stems mostly densely hirsute
      3. Leaves commonly about 1.5 cm. broad and 2 cm. long, mostly hirsute above ..... **P. Cookiana**
      3. Leaves commonly 1.8 to 2.5 cm. broad and 2.5 to 3.5 cm. long, mostly hirsute above only at the base and along the nerves..... variety **ovatilimba**
   2. Leaves less than 1 cm. long, stems hirtellous..... variety **minutilimba**
1. Leaves mostly elliptic to elliptic-lanceolate or oblanceolate to obovate and commonly more or less acute or obtuse
   2. Stems hirsute, upper surface of the leaves hirsute at the base and along the nerves, or glabrous..... variety **flavinerva**
   2. Stems subappressed hirtellous, upper surface of the leaves hirtellous ..... variety **pukooana**

Peperomia Cookiana variety **ovatilimba,** new combination.

Peperomia ovatilimba C. deCandolle, Bull. Coll. Hawaii no. 2, p. 23, 1913.

Peperomia ovatilimba forma *c* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 23, 1913.

Leaves ovate to ovate-elliptic, or oval, apex obtuse or acutish, base obtuse or briefly acute, lower surface hirsute, upper surface hirsute at the base and along the nerves, up to 3.5 cm. broad and 5.5 cm. long, but mostly about 1.8 to 2.5 cm. broad and 2.5 to 3.5 cm. long.

Type, Kauai, Olokele, altitude 1000 meters, Faurie no. 125, in the deCandolle herbarium.

Found on the islands of Kauai, Molokai, Maui, and Hawaii.

Kauai: along the trail from the Kokee Forest Ranger station to Kilohana lookout, Waimea, sprawling on the ground in wet forest, altitude 3600 feet, Yuncker nos. 3382, 3383 (B. P. Bishop Museum).

Molokai: near Laianui, on moist ground, Degener and Wiebke no. 2878 (Degener, Illinois).

Maui: Kaupo Gap, crater of Haleakala, Forbes nos. 1116-M, 1125-M (B. P. Bishop Museum). These two specimens are more robust and with larger and more oval than ovate leaves, but otherwise I am unable to differentiate them from the Hawaii and Kauai specimens.

Hawaii: Kukaiau ranch, altitude 3600 feet, Hitchcock no. 14230 (U. S. National, B. P. Bishop Museum); Forest of Paauhau, Rock nos. 3253 (Gray), 4419, 4426, 4429 (B. P. Bishop Museum); Kohala Mountains, Rock no. 10370 (B. P. Bishop Museum).

Peperomia Cookiana variety **minutilimba,** new variety.

Caules circiter 4 cm. alti, hirtelli. Folia usque 8 mm. lata atque 9 mm. longa, palmatim 3-nervia, ovata ad orbicularia, subtus hirtella, supra basi hirtella. Spicae circiter 1.5 cm. longae.

Stems delicate, about 4 cm. tall, hirtellous. Leaves up to 8 mm. broad and 9 mm. long, palmately 3-nerved, oval to orbicular, upper surface hirtellous at the very base, lower surface moderately to sparingly hirtellous; petioles up to 3 mm. long, articulate, leaf scars somewhat raised, decurrent, forming longitudinal internodal ridges. Spikes terminal, solitary, about 1.5 cm. long, peduncles 3 to 4 mm. long, glabrous.

Type, Hawaii, Kipuka in 1855 flow, below Halealoha, Forbes no. 766(a)-H, in Bernice P. Bishop Museum.

Known only from the type locality.

Peperomia Cookiana variety **flavinerva,** new combination.

Peperomia flavinerva C. deCandolle, Bull. Coll. Hawaii no. 2, p. 24, pl. 3, 1913.

Peperomia kamoloana C. de Candolle, Bull. Coll. Hawaii no. 2, p. 17, 1913.

Stems hirsute, leaves elliptic to elliptic-lanceolate or less commonly obovate or oblanceolate, the lower surface hirsute, the upper surface glabrous or hirsute mostly

only at the base and along the nerves, the hairs more or less crisp, mostly 1.5 to 2 cm. broad and 2.5 to 4.5 cm. long, apex obtuse or more or less attenuately acute or acuminate, base commonly acute, more rarely obtuse.

Type, Molokai, Pelekunu forest, altitude 4800 feet, Rock no. 6142, in the deCandolle herbarium.

Found on the islands of Kauai, Molokai, and Maui.

Kauai: on Kaholuamanua [Kaholuamanu], above Waimea, Heller no. 2632 (U. S. National, B. P. Bishop Museum); Waimea District, along the Milolii trail, Yuncker no. 3397 (B. P. Bishop Museum).

Molokai: Pelekunu Forest, swampy plateau, altitude 4800 feet, Rock no. 6142, duplicate type of *P. flavinerva* (Gray, B. P. Bishop Museum); near Pepeopae, on damp ground in dense shade, Degener and Wiebke nos. 2732, 2736, 2737 (Degener, Illinois); head of Waikolu Valley, Hanalilolilo, altitude 3800 feet, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12394, 12397 (B. P. Bishop Museum); west branch of Mapulehu Valley, along shaded stream bed among rocks, Wiebke no. 3070 (Degener, Illinois); Punaula Valley, on mossy rocks, altitude 600 to 1900 feet, St. John, Baker, Coulter, Fosberg nos. 12786, 12802 (B. P. Bishop Museum); ridge east of Mapulehu Valley overlooking Wailau Valley, on partly shaded, prostrate branch, Degener and Wiebke nos. 2898a, 2898b—some leaves in this specimen are up to 3.5 cm. broad and 6.5 cm. long approaching those of *P. lanaiensis* in size, but the plant is hirsute rather than hirtellous (Degener); ridge between Hanalilolilo and Pepeopae, Waikolu Valley, Kawela, along rocky bank, altitude 3800 feet, St. John, Baker, Coulter, Fosberg, and Yuncker no. 12581 (B. P. Bishop Museum); west side of Waikolu Valley, Degener no. 4293 (Degener); Kamolo [Kamalo], Faurie no. 124, the type of *P. kamoloana* (deCandolle); between Waikolu Valley and probably northern base of Puu Alii, open rain forest, Degener and Wiebke nos. 2762, 2765 (Degener, Illinois); Puu o Kaeha, Kawela, altitude 2700 to 4000 feet, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12473, 12475, 12480 (B. P. Bishop Museum).

Maui: Honokahau Drainage Basin, Forbes no. 454-M (B. P. Bishop Museum); forest of Hamakua, altitude 4000 feet, Rock no. 8581 (Gray, B. P. Bishop Museum); along pipe line trail above Olinda, Yuncker nos. 3532, 3533 (B. P. Bishop Museum).

Lanai: Kaiholena, Munro no. 50 (B. P. Bishop Museum). This specimen approaches variety *pukooana* in being more hirtellous than hirsute.

Peperomia Cookiana variety **pukooana**, new combination.

Peperomia pukooana C. deCandolle, Bull. Coll. Hawaii no. 2, p. 25, 1913.

Leaves mostly elliptical, apex acute to acuminate, base acute, up to 2.3 cm. broad and 4.3 cm. long, all parts of the plant subappressed hirtellous.

Type, Molokai, Pukoo, Faurie no. 120, in the deCandolle herbarium.

Found on the island of Molokai.

Molokai: Pukoo, Faurie nos. 119, 120 type of *P. pukooana* (deCandolle); Kahuaawi Gulch, partly shaded, moist rocky slope, Degener no. 2896 (Degener, Illinois); ravine south of Maunahui, shaded, comparatively dry slope, Degener no 2726 (Degener, Illinois).

There is considerable variation in the size of the plants, shape, texture, and size of the leaves, and the character of the pubescence within the limits as indicated in the descriptions. They all agree in general to such an extent, however, that it has been impossible to maintain satisfactorily on a specific basis the various forms included here. The hairiness of the upper surface of the leaves varies from a completely hirsute to a subglabrous condition. In the varieties *ovatilimba* and *flavinerva* the hairs on the upper surface are commonly restricted to the base and along the nerves. Some of the specimens included under the typical form agree with Hillebrand's description of *P. pleistostachya,* especially Degener's no. 2766 from Molokai which exhibits a larger number of spikes that are somewhat shorter than is common for the species. Variety *minutilimba* differs greatly from the other forms in the size of the plants and of the leaves and in the form of the pubescence. Seedlings and very young plants of typical *P. Cookiana,* however, approach the variety in size but ordinarily differ in being much more hirsute. Faurie's no. 169, the type of *P. opacilimba* is a young and fragmentary specimen, but it agrees in all respects with *P. Cookiana.*

The mostly hirsute, much branched, and generally sprawling character of the plants serves to distinguish this species from *P. leptostachya,* the smaller leaves and more hirsute condition, from *P. lanaiensis.*

19. Peperomia waikamoiana, new species.

Herbae usque ad 6 cm. altae, e basi radicante adscendentes, divaricatim ramosae, dense hirsutae, pilis circiter 0.5 mm. longis. Folia opposita vel verticillata, utrinque hirsuta, ovato-orbicularia, circiter 5 mm. longa, 1-nervia vel obscure palmatim 3-nervia, apice rotunda, basi obtusa vel obscure palmatim 3-nervia, apice rotunda, basi obtuse vel brevissime acuta, petiolis 2-3 mm. longis, hirsutis. Spicae terminales axillaresque acervatim confertae, 5-8 mm. longae, pedunculis 3-5 mm. longis, hirsutis. Fructus ovoideo-globosus, apice obliquus, stigma subterminale.

Plants up to 6 cm. tall, ascending from a rooting base, divaricately branching, densely hirsute, hairs about 0.5 mm. long, internodes up to 1 cm. long.

Leaves opposite or whorled, hirsute on both surfaces, oval-orbicular, about 5 mm. long, 1-nerved, or palmately 3-nerved with the two lateral nerves very obscure, apex rounded, base obtuse or very shortly acute; petiole 2 to 3 mm. long, hirsute, leaf scars semicircular, bundle scars obscure.

Spikes in terminal and axillary clusters, 5 to 8 mm. long, moderately flowered; peduncle 3 to 5 mm. long, hirsute; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments about as long as the ellipsoidal anthers; ovary ovoid, apex oblique, stigma subterminal; fruit about 0.8 mm. long, ovoid-globose, verrucose, viscid.

Type, Maui, Kula pipe line, Waikamoi, Forbes no. 1280-M, in Bernice P. Bishop Museum.

Known only from the type locality.

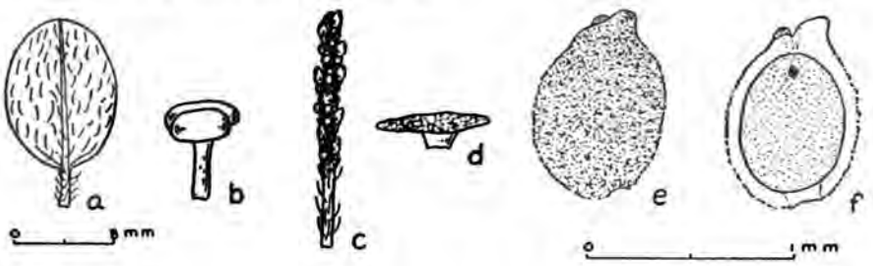

FIGURE 19.—*Peperomia waikamoiana* Yuncker: *a*, leaf; *b*, stamen, enlarged; *c*, spike, enlarged; *d*, bract, enlarged; *e*, fruit; *f*, section of fruit.

This is one of the smallest species seen. It is probably closely related to *P. Cookiana* variety *minutilimba*, but appears to be sufficiently distinct with its numerous very short spikes and densely hirsute stems and leaves. The type specimen is a fully matured plant with an abundance of fruit and is not to be considered as representing a seedling stage.

20. Peperomia sandwicensis Miquel.

Peperomia sandwicensis Miquel, Syst. Pip., p. 126, 1843; Illustr. Pip., p. 19, pl. 14, 1844.

Peperomia verticillata Hooker and Arnott, Bot. Beechey, p. 96, 1841. Not Dietrich.

Peperomia pachyphylla Miquel, Syst. Pip., p. 137, 1843.

Peperomia purpurascens C. deCandolle, in DC Prodromus, vol. 16, part 1, p. 417, 1869.

Peperomia pachyphylla variety *picta* Hillebrand, Fl. Hawaiian Is., p. 424, 1888.

Peperomia pachyphylla variety *insularum* Hillebrand, Fl. Hawaiian Is., p. 424, 1888.

Peperomia pachyphylla variety *molokaina* C. deCandolle, Ann. Cons. Bot. Genève, vol. 2, p. 287, 1898.

Stems red or purplish to almost black towards the base when fresh, erect or ascending from a short, decumbent and rooting base, single or clustered, mostly 10 to 20 cm. or more rarely up to 30 cm. tall, generally dichotomously or verticillately branching above, densely, appressed hirtellous above, glabrate below, internodes 2 to 4 cm. or uncommonly up to 7 cm. long.

Leaves when fresh light green beneath or more commonly with various degrees of red to deep claret pigmentation, darker green above, and not uncommonly with the veins lighter green producing a network of light green with darker colored areas, alternate in very young plants, but soon opposite or in whorls of 3 to 6, hirtellous

beneath, glabrate above excepting at the base, along the nerves, or when young, mostly obovate or oval-obovate to suborbicular, rarely subovate, mostly 1 to 1.8 cm. broad and 1.5 to 3 cm. long, or rarely to 4 cm. long, palmately 3-nerved or obscurely 5-nerved, nerves commonly more or less raised on the upper surface and subimpressed beneath in dry specimens, apex rounded, obtuse or slightly attenuated, base acute to cuneate;

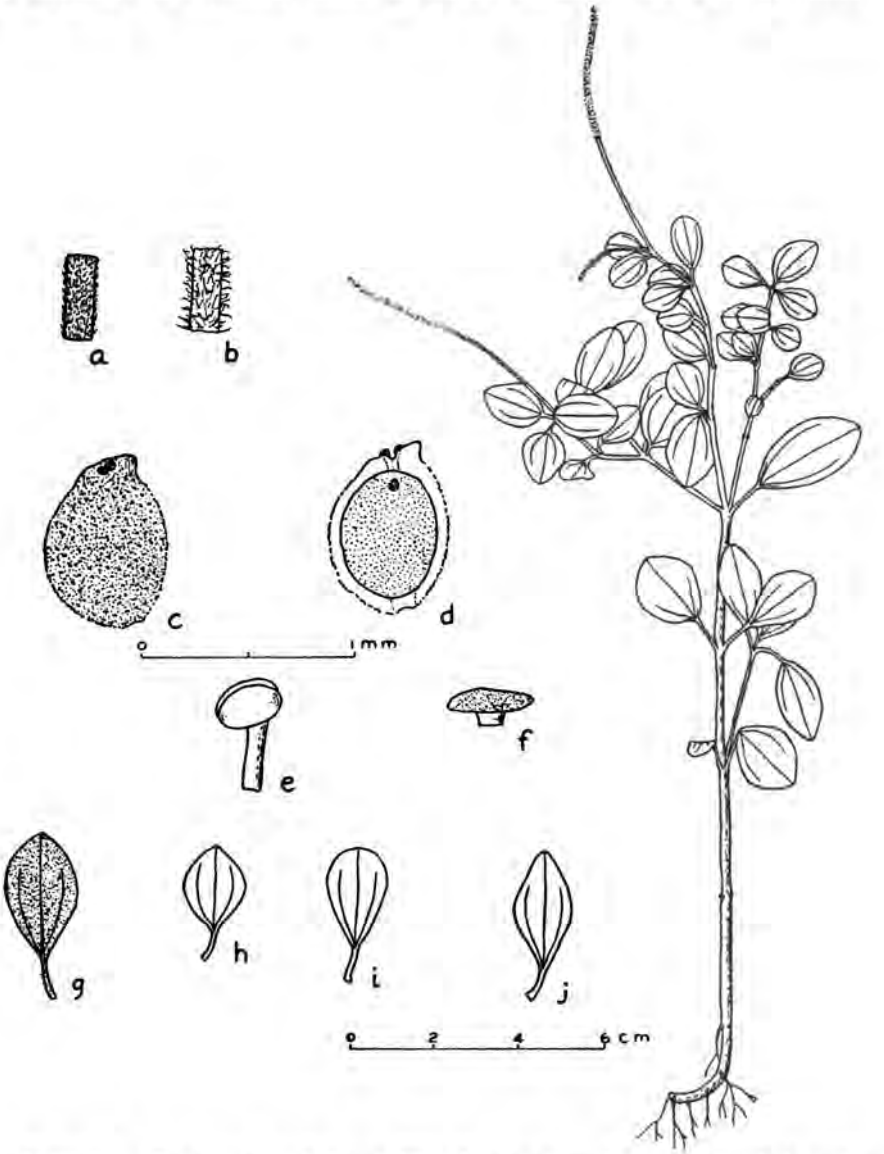

FIGURE 20.—*Peperomia sandwicensis* Miquel: *a*, section of stem, enlarged; *b*, section of stem of variety *robusta*, enlarged; *c*, fruit; *d*, section of fruit; *e*, stamen, enlarged; *f*, bract, enlarged; *g-j*, leaves.

petiole 5 to 10 mm. long, or rarely somewhat longer, hirtellous or glabrate, leaf scar semicircular, bundle scars 3.

Spikes mostly single and apical, rarely lateral or clustered, up to 6 cm. long or rarely somewhat longer, moderately to densely flowered; peduncle subclavate, 2.5 to 6 cm. long, mostly sparsely hirtellous; rachis glabrous; bracts round, peltate, about 0.3 mm. broad; filaments about equaling the globose-ellipsoidal anthers; ovary ovoid, apex oblique, stigmas mostly divided, subapical, penicillate though often inconspicuously so, fruit globose-ovoid, about 0.8 mm. long, verrucose, viscid, in shallow pits, pseudopedicels not observed.

Type, Oahu, Meyen, May, 1831, in the Berlin herbarium.

Abundant on the island of Oahu. Less frequent on the islands of Kauai, Molokai, and Maui. It occurs at about the same altitude and under similar environmental conditions as does *P. latifolia.*

Kauai: Alakai swamp, Rock, Jan., 1920 (B. P. Bishop Museum); Hanakapiai Valley, Napali coast, St. John, Hosaka, Hume, Inafuku, Lindsay, Masuhara, Mitchell, and Wong nos. 10928, 10980, 10982 (B. P. Bishop Museum); Hanapepe River near the falls, Heller no. 2478 (U. S. National, Gray, B. P. Bishop Museum).

Oahu: Meyen, May, 1831, type of *P. sandwicensis* (Berlin); Beechey, named *P. verticillata,* taken to be a duplicate type of *P. pachyphylla* (Kew); Didrichsen no. 3432 (Berlin); Rock no. 10396 (Gray); Hillebrand and Lydgate (B. P. Bishop Museum); Degener and Wiebke no. 2603 (Degener, Illinois); Hillebrand, taken to be the type of variety *picta* (Berlin); rocks behind Honolulu, Wilkes Expedition (Gray); upper Kalihi Valley, Garber no. 100 (B. P. Bishop Museum); right fork of Niu Valley, Garber no. 453 (B. P. Bishop Museum); on wet ditch bank, Waiawa Gulch, Yuncker nos. 3048, 3049, 3061 (B. P. Bishop Museum); on rocks along stream in gulch above Aiea, Yuncker nos. 3038, 3043 (B. P. Bishop Museum); Wailupe Valley, Forbes no. 2526-O (B. P. Bishop Museum); Hauula, Topping no. 3150 (Degener, Illinois); Waimanu, Topping no. 3110 (Degener, Illinois); near Hauula, on wet shaded rocks, Degener and Wiebke no. 2421 (Degener, Illinois); Punaluu, wet slope, west ridge of valley, on rock, altitude 650 meters, Hume no. 75 (B. P. Bishop Museum); Haiku Valley, Waihole [Waiahole] Forest Reserve, Heeia, wooded ridge, altitude 800 to 900 feet, St. John no. 12272 (B. P. Bishop Museum); head of Kuliouou Valley, on wet shaded rocky embankment, Degener 2419 (Degener, Illinois); west side of Nuuanu Valley, near the Pali, Forbes, July 25, 1908 (B. P. Bishop Museum); Kawailoa, Forbes nos. 2106-O, 2108-O (B. P. Bishop Museum); western ridge of Waipaupau [Kaipapau] Valley, on rocks near stream in dark ravine, Degener and Park no. 4281 (Degener); base of cliffs northeast of Nuuanu Pali, on wet rocks in woods, Degener and Rodrigues no. 3538 (Degener, Illinois); ridge above Red Hill, Degener, Oct. 9, 1932 (Degener); Kipapa Gulch, south ridge, in moderately moist gully, altitude 1100 feet,

Hosaka no. 877 (B. P. Bishop Museum); Kipapa Gulch, wet slope, Nitta, Feb. 16, 1930 (B. P. Bishop Museum); Halawa Gulch, Degener nos. 4290, 4298 in part (Degener); bottom of ridge north of South Halawa Gulch, Degener 4139 (Degener); along Kaipapau stream, wet cliffs, Degener, Kwon, and Park no. 4266 (Degener); southeast side near head of Makua Valley, on rocks in shaded gully, Degener and Park no. 4246 (Degener); Waianae range, southeast slope of Makua Gulch, altitude 1500 feet, Degener, Sept. 27, 1932 (Degener); Makaha Valley, Forbes, Feb. 12-19, 1909 (B. P. Bishop Museum); along Piko trail, Mokuleia side of Waianae range, altitude 2000 feet, Yuncker nos. 3356, 3358 (B. P. Bishop Museum); northeast slope of Puu Kaua, Waianae range, altitude 2000 to 2200 feet, Yuncker nos, 3283, 3284, 3287, 3292 (B. P. Bishop Museum); Puu Hapapa, Honouliuli, Waianae range, altitude 1600 feet, under shade of rocks near stream, St. John no. 10437 (B. P. Bishop Museum); gulch on northeast slope of Puu Hapapa, Waianae range, on rock bank, Yuncker no. 3256 (B. P. Bishop Museum); moist woods, second gulch east of Puu Kaupakuhale, northeast slope of Puu Kaala, Mokuleia, St. John and Fosberg no. 12137 (B. P. Bishop Museum); third gulch east of Puu Kaupakuhale, northeast slope of Puu Kaala, Yuncker and Hosaka no. 3250 (B. P. Bishop Museum); western slope of Puu Kaala above Waianae village, Yuncker no. 3309 (B. P. Bishop Museum); base of Puu Kaala on Schofield side, Degener, Nitta, and Park no. 4248 (Degener); along trail to summit of Puu Kaala, in shade under shrubs, altitude 2000 feet, Yuncker no. 3386 (B. P. Bishop Museum).

Molokai: Pelekunu Valley, Forbes no. 580-Mo (B. P. Bishop Museum); gulch west of Ualapue, on wet cliffs, Degener and Wiebke no. 3055 (Degener, Illinois); valley west of east Ohia, on wet rocks, Degener and Wiebke no. 3063 (Degener, Illinois); Wailau Valley, rocky wet dark woods, Wiebke and Nitta no. 3189 (Degener, Illinois); pali of Wailau, Hillebrand (Berlin); base of upper Moaula Falls, altitude 350 feet, St. John, Baker, Coulter, Fosberg, and Yuncker no. 12660 (B. P. Bishop Museum).

Maui: west Maui, Hillebrand (Berlin); Kanapali [Kaanapali], west Maui, Hillebrand, 1870, in part, mixed with *P. latifolia* (Berlin).

Peperomia sandwicensis variety **robusta** Wawra, emended.

Peperomia sandwicensis? variety *robusta* Wawra, Flora vol. 58, p. 192, 1875.

The hairs in this variety are longer and erect (spreading hirsute) rather than appressed hirtellous as in the typical form.

Type, Oahu, Mt. Kaala, Wawra no. 1726b, in the herbarium of the Museum of Natural History at Vienna.

So far as has been discovered this variety is restricted to the Waianae

Mountains on the island of Oahu, where it is found under the same conditions as the typical variety.

Oahu: Mount Kaala, Wawra no. 1726b, type (Vienna); valley below Palikea, on east side, Degener no. 4230 (Degener); gulch on northeast slope of Puu Hapapa, Degener no. 4235 (Degener); three-fourths way up Puu Hapapa, Honouliuli, Nakagawa, Oct. 20, 1930 (B. P. Bishop Museum); Puu Kaneoha [Puu Kanehoa], Honouliuli, wooded ridge, altitude 2750 feet, St. John no. 11040 (B. P. Bishop Museum); Puu Hapapa, Honouliuli, wooded upper ridge, altitude 2600 feet, St. John nos. 10428, 10429 (B. P. Bishop Museum); northwest of summit of Piko trail, Makua, Degener no. 4280 (Degener); along the Piko trail, Mokuleia side of Waianae range, altitude 2000 feet, Yuncker no. 3357 (B. P. Bishop Museum); Makaha Valley, Forbes, Feb. 12 to 19, 1909 (B. P. Bishop Museum); Mokuleia, slopes of Puu Kaala, Forbes, April 26 to May 16, 1912 (B. P. Bishop Museum); Honouliuli, north fork, valley east of Palikea, erect on flat rock in open woods, altitude 1300 feet, St. John no. 10367 (B. P. Bishop Museum); Waialua side of Puu Kaala, altitude 4000 feet, Meebold, June, 1932 (B. P. Bishop Museum); Puu Kapu, wet forest, altitude 500 to 600 meters, Christophersen, Wilder, and Hume no. 1589 (B. P. Bishop Museum); northeast slope of Puu Hapapa, altitude 1500 feet, Yuncker no. 3261 (B. P. Bishop Museum); in thicket on east ridge of second gulch east of Puu Kaupakuhale, northeast slope of Puu Kaala, Mokuleia, St. John and Fosberg no. 12149 (B. P. Bishop Museum); west side of Puu Kaala above Waianae village, Yuncker no. 3311 (B. P. Bishop Museum); Puu Kaala, altitude 2000 to 4000 feet, Hitchcock no. 13999 in part (B. P. Bishop Museum); Waianae Valley toward Puu Kaala, Degener no. 4249 (Degener).

The size of the plants and of the leaves varies considerably in this species. The leaves are often more deeply red pigmented than in any other species observed, yet some specimens entirely lack the red color, and all inter-gradations of color are to be found, not infrequently on the same plant, as also are the extremes in leaf size.

Miquel described this species from a young and immature specimen with leaves near the minimum in size for the species, and his *P. pachyphylla* was described from a specimen which, as far as I can discover, differs only in being larger and more robust. I have been unable to maintain forms or varieties based on differences of pigmentation or size and form of plant or leaf. Nor do I find the specimen collected at Kaanapali on the island of Maui by Hillebrand and designated by him in his "Flora of the Hawaiian islands" (p. 425) as an unnamed variety (*P. sandwicensis* variety . . .) to differ essentially from the other forms included here.

This species is most closely related to *P. mauiensis,* from which it to be distinguished by its commonly larger plants and larger and proportionately broader leaves.

I find the characters which Wawra indicated as distinguishing his variety *robusta* to be untenable. However, the spreading-hirsute character of the plant is quite constant in the specimens examined and is in marked contrast to the appressed-hirtellous condition of the typical form.

Examination of a photograph of Nuttall's plant which is the type of *P. purpurascens,* and now in the herbarium of the British Museum, shows that the leaves are more opposite than alternate and that it apparently is the same as *P. sandwicensis.*

21. Peperomia mauiensis Wawra.

Peperomia mauiensis Wawra, Flora, vol. 58, p. 225, 1875.

Peperomia mahanana C. deCandolle, Bull, Coll. Hawaii no. 2, p. 33, 1913.

Peperomia mauiensis variety *parvifolia,* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 21, 1913. Not Hillebrand.

Peperomia maniensis C. deCandolle, Candollea, vol. 1, pp. 297, 303, 1923. A misprint for *P. mauiensis.*

Stems erect or ascending from a short, decumbent, rooting base, mostly less than 10 cm. long, rarely up to 20 cm. long, up to 2 mm. thick in dry specimens, solitary or more commonly branching at the base, divaricately and commonly subdichotomously branching above, densely subappressed hirtellous above, glabrate below, or in some plants the stems more or less entirely glabrate, internodes up to 5 cm. long, mostly less than 5 cm. long.

Leaves in whorls of 3 to 5 or rarely up to 9, lower surface hirtellous, upper surface hirtellous or glabrate, often with light green veins and dark green intercostal areas producing a mottled effect, oblong-spatulate or obovate-spatulate, 4 to 9 mm. broad, 1.2 to 2 cm. long, 1-nerved, or obscurely palmately 3-nerved, apex rounded, base acute to cuneate; petiole 3 to 5 mm. long, subappressed hirtellous, or glabrate.

Spikes terminal, solitary, mostly 4 to 6 cm. long, rarely up to 10 cm. long, moderately to loosely flowered; peduncle slender, up to 5 cm. long, mostly equaling or exceeding the leaf blade, subappressed hirtellous, or glabrate; rachis glabrous; bracts round, peltate, about 0.3 mm. broad; filaments about as long as the ovoid anthers; ovary globose-obovoid, apex oblique, stigma divided, subterminal, penicillate; fruit about 0.8 mm. long, ovoid, verrucose, viscid, on pseudopedicels.

Type, "Maui; feuchte Schluchten im Wailukuthal," Wawra no. 1828, in the herbarium of the Natural History Museum in Vienna.

Known from the islands of Molokai, Maui, and Lanai.

Molokai: Pukoo, Forbes no. 299-Mo (B. P. Bishop Museum); "Basi rupium in vallibus," Faurie no. 103—the label clearly states "Molokai" and not "Maui", as cited by deCandolle (deCandolle); branch of Mapulehu Valley, on ground in dark woods, Wiebke no. 3184 (Degener, Illinois); western branch of Mapulehu Valley, epiphytic in woods, Wiebke no. 3118 (Degener,

Illinois); east arm of Kaluaaha Valley, shaded cliffs, Degener and Wiebke no. 3062 (Degener, Illinois); base of upper Moaula Falls, Halewa Valley, altitude 250 to 350 feet, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12661, 12732 (B. P. Bishop Museum).

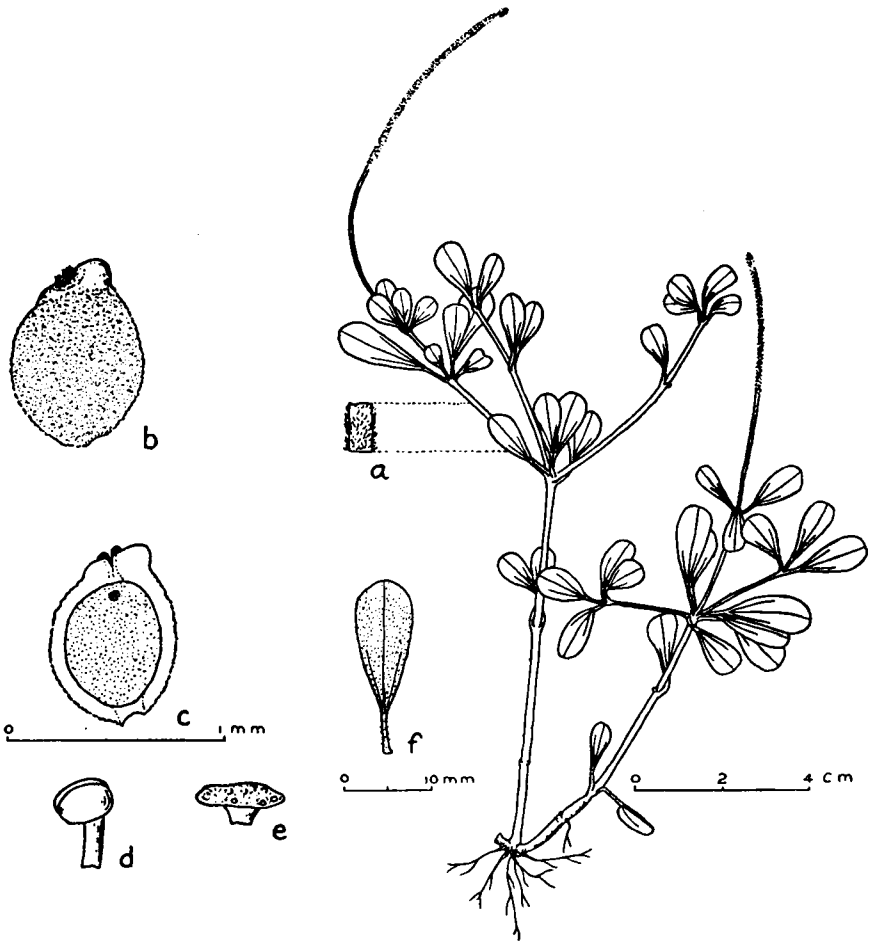

FIGURE 21.—*Peperomia mauiensis* Wawra: *a*, section of stem, enlarged; *b*, fruit; *c*, section of fruit; *d*, stamen, enlarged; *e*, bract, enlarged; *f*, leaf.

Maui: Wawra no. 1828 (Vienna); Wiebke and Topping no. 2643 (Degener, Illinois); Makawao, altitude 700 meters, Faurie no. 102 (deCandolle); Hamakua, Hillebrand and Lydgate (B. P. Bishop Museum); west Maui, Waikapu Valley, Forbes nos. 135-M, 136-M (B. P. Bishop Museum); ridge west of Iao Valley, Forbes, June, 1910 (B. P. Bishop Museum);

"lacunis secus torrentes," Faurie no. 110 (deCandolle); Iao Valley, Wailuku, dripping stream gorge, altitude 1200 feet, St. John nos. 10284, 10285 (B. P. Bishop Museum); Wailuku, Hillebrand—Hillebrand describes this specimen as glabrous but I do not find it so (Berlin); Mauna Hooma, Forbes and Cooke no. 27-M (B. P. Bishop Museum); Olowalu Valley, Forbes no. 2381-M (B. P. Bishop Museum); Honokahau Drainage Basin, Forbes no. 455-M (B. P. Bishop Museum); near last ditchman's house on way to Mount Eke, Degener and Wiebke no. 2412 (Degener, Illinois); near Waihee, on somewhat dry cliff, Degener and Wiebke no. 2625 (Degener, Illinois).

Lanai: Kaiholena, Munro nos. 215, 360 (B. P. Bishop Museum) Mahana, on trunk of *Aleurites moluccana,* Rock no. 8090 (Gray, B. P. Bishop Museum —duplicate type of *P. mahanana*); Rock no. 10373, as no. 8091, in part (B. P. Bishop Museum).

This species and *P. sandwicensis* are closely related and are the only species occurring in Hawaii with unusually long peduncles. The smaller of the two species is *P. mauiensis* which bears narrower and more spatulate leaves often hairy on the upper surface. While there is variation in leaf size, the limits of variation may often be observed on the same plant and it does not appear advisable to distinguish varieties on this basis.

DeCandolle considered the stigma of *P. mauiensis* to be single and described his *P. mahanana* from the island of Lanai as differing in the possession of a divided stigma. Examination of specimens of both species as cited by him, however, shows positively that the stigma is divided in all these specimens. Nor am I able to distinguish any other differences by means of which *P. mahanana* is to be maintained. Hillebrand's *P. mauiensis* variety *parviflora* is based on a specimen of *P. ligustrina.*

Subgenus **HAWAIIANA**, new subgenus

Herbae magnitudine admodum variabiles, caulibus usque ad 120 cm. altis atque basi usque ad 2.5 cm. diametro. Folia opposita aut potius 3-8-verticillata. Ovarium globosum aut potius obovoideo-turbinatum, apice rotundum vel acutulum, haud rostratum; stigmata 2, apicalia vel parum subapicalia, antero-posteriora, plerumque penicillata. Fructus plerumque ovoideus ad obovoideo-turbinatus, apice rotundus vel acutulus atque divisus.

Plants of various sizes up to 12 dcm. high and 2.5 cm. thick at the base when fresh. Leaves opposite or more commonly in whorls of 3 to 8. Ovary globose or more commonly obovoid-turbinate, apex slightly, if at all, oblique, with a small pit-like depression at or near the apex. On the posterior and anterior sides of this depression two commonly penicillate stigmatic areas are developed. Fruit mostly ovoid to obovoid-turbinate, apex rounded or

becoming somewhat pointed and divided, more rarely slightly oblique, never rostrate.

The bistigmatic condition is not always evident in young ovaries. Also, the stigmatic areas may be deciduous in some species so that some fully matured fruits do not have the stigmas present.

The type species is *P. lilifolia* C. deCandolle.

Key to the Species

1. Plants more or less hairy
 2. Leaves glabrous, oblong, 3 to 4 mm. broad, stems slightly pubescent above ..... **22. P. Fauriei**
 2. Not as above
  3. Leaves mostly less than 2 cm. long
   4. Leaves mostly 1-nerved, petioles slender..... **23. P. mapulehuana**
   4. Leaves mostly 3-nerved, petioles moderate..... **24. P. eekana**
  3. Leaves mostly more than 2 cm. long
   4. Plants densely appressed hirtellous hairs mostly 0.5 mm. or less long
    5. Leaves 2 to 3 cm. long, 3 to 5-plinerved, obovate, base acute to acuminate..... **33. P. expallescens** variety **brevipilosa**
    5. Leaves larger, 5- to 7-plinerved
     6. Leaves mostly 5-plinerved, the midrib forking within the lowermost 1 cm.
      7. Leaves elliptic to elliptic-obovate..... **34. P. erythroclada** variety **picta**
      7. Leaves ovate to ovate-lanceolate..... **25. P. maunakeana**
     6. Leaves mostly 7-plinerved, the midrib forking 1 to 2 cm. above the base, base acute..... **26. P. Macraeana**
   4. Plants hirsute, hairs mostly 0.5 to 1.5 mm. long
    5. Leaves ovate to elliptic-lanceolate, apex acute to acuminate
     6. Leaves 10 to 13 cm. long, 9- to 11-nerved, petiole 1 cm. or less long..... **27. P. kulensis**
     6. Leaves mostly shorter or the petiole more than 1 cm. long
      7. Leaves 5-plinerved, base acute to subcuneate..... **28. P. lilifolia**
      7. Leaves 7- to 11-plinerved or pinnately nerved, base rounded or shortly acute
       8. Leaves sparsely hairy above, especially at the base, elliptic-ovate.. **29. P. Rockii**
       8. Leaves more or less pilose on the upper surface, elliptic-lanceolate..... **30. P. hirtipetiola**
    5. Leaves elliptic to obovate, apex obtuse or acute
     6. Leaves 6 to 10 cm. long and mostly 3 to 4 cm. broad, base cuneate..... **31. P. cornifolia**
     6. Leaves mostly less than 6 cm. long (up to 8 cm. long in *P. erythroclada*)
      7. Stems densely hirsute, at least above, leaves palmately 3-nerved or 5-plinerved
       8. Stems sparingly branched, leaves 3 to 7 cm. long oblong-obovate..... **32. P. rigidolimba**
       8. Stems abundantly branched, leaves mostly 2 to 2.5 cm. long, oval to orbicular or obovate..... **33. P. expallescens**
      7. Stems sparingly to moderately hirsute, leaves 5- to 7-plinerved
       8. Leaves elliptic to elliptic-obovate, base acute to cuneate, spikes up to 3 mm. thick
        9. Leaves elliptic to elliptic-obovate, glabrous above..... **34. P. erythroclada**
        9. Leaves elliptic, sparingly hirsute above, especially along the midrib..... **28. P. lilifolia** variety **obtusata**
       8. Leaves elliptic-oblanceolate or obovate-spatulate, base cuneate, spikes slender ..... **35. P. hypoleuca**

1. Plants glabrous
 2. Leaves palmately 3 to 5-nerved (or veins coalescing in the lowermost 2 mm.), elliptic-obovate or oblanceolate, up to 4 cm. long.....**36. P. hawaiensis**
 2. Leaves 5-plinerved
  3. Leaves less than 8 cm. long, with definite petioles
   4. Leaves mostly elliptic to obovate to oblanceolate
    5. Leaves elliptic-obovate or elliptic, commonly opposite.....**35. P. hypoleuca** variety **pluvigaudens**
    5. Leaves elliptic-oblanceolate or elliptic-lanceolate, commonly whorled.....**37. P. Hesperomanni**
   4. Leaves elliptic-lanceolate.....**28. P. lilifolia** variety **honokahauana**
  3. Leaves up to 16 cm. long, lanceolate, sessile or subsessile.....**38. P. subpetiolata**

22. **Peperomia Fauriei** Léveillé.

Peperomia Fauriei Léveillé in Fedde, Repert., vol. 10, p. 151, 1911; emended by C. deCandolle, Bull. Coll. Hawaii no. 2, p. 32, 1913.

Stems erect, about 25 cm. tall and 3 mm. thick in dry specimens, subdichotomously branching above, glabrous excepting the young branches which are sparsely and transiently hirtellous, internodes up to 5 cm. long.

Leaves fleshy, in whorls of 3 to 5, glabrous or sparsely ciliated toward the apex, narrowly oblong or some leaves subelliptic, 3 to 4 mm. broad, 1.5 to 1.8 cm. long, one-nerved or obscurely palmately 3-nerved, apex blunt or subacute, base subcuneate, petiole 1.5 mm. long, glabrous, leaf scars small, semicircular, bundle scars 3.

Spikes terminal, up to 4 cm. long and 1 mm. thick, loosely flowered; peduncle up to 1.8 cm. long, glabrous; rachis glabrous; bracts round, peltate, 0.3 to 0.4 mm. broad; filaments about equaling the ellipsoidal anthers; ovary ovoid, stigma terminal, divided, penicillate; "bacca elliptica glandulis nigris parce asperulata apice stigmata apiculata" (DC).

Type, "Molokai in petrosis rivulorum Pukoo," Faurie no. 108, in the deCandolle herbarium. Type specimen examined.

Known only from the type locality.

This appears to be a well-marked species with its narrow, subsessile and clustered leaves. It is perhaps most closely related to *P. mauiensis* but it differs from that species in the habit of growth and length of the peduncles.

23. **Peperomia mapulehuana,** new name.

Peperomia Helleri Léveillé, in Fedde, Repert., vol. 10, p. 151, 1911. Emended. Not deCandolle, 1898.

Caules e basi radicante prostrataque adscendentes, usque ad 25 cm. alti, dichotome vel trichotome furcati, dense hirsuti. Folia plerumque 3-6-verticillata, utrinque sat ad sparse hirsuta, obovato-spathulata raro ovata ad suborbicularia, 0.5-1 cm. lata, 1-1.8 cm. longa, 1-nervia vel obscure palmatim 3-nervia, apice rotunda, obtusa vel breviter subacuta, basi cuneata ad acuta; petioli graciles, usque ad 1 cm. longi, hirsuti. Spicae plerumque terminales acervatim confertae, usque ad 3 cm. longae; fructus ovoideus; stigma divisum parum subterminale.

Stems ascending from a prostrate, rooting base, up to 25 cm. tall and 2 mm. thick at the base in dry specimens, dichotomously or trichotomously branching, densely hirsute above, hairs mostly 0.5 to 0.8 mm. long and erect, internodes mostly 1.5 to 4 cm. long.

Leaves opposite or more commonly in whorls of 3 to 6, lower surface moderately to

sparingly hirsute, pale green, with dark dots, upper surface moderately hirsute, to glabrescent, darker green, obovate-spatulate, less commonly oval to suborbicular, some leaves with revolute margins, 0.5 to 1 cm. broad, mostly 1 to 1.5 cm. long, rarely up to 1.8 cm. long, conspicuously 1-nerved, or palmately 3-nerved with the lateral nerves indistinct, apex rounded, obtuse or rarely shortly subacute, base cuneate or rarely somewhat acute; petioles mostly slender, up to 1 cm. long, moderately to densely hirsute, leaf scars semicircular, bundle scars indistinct.

Spikes single, or more commonly in terminal clusters, uncommonly axillary, up to 3 cm. long, moderately flowered, peduncle about 6 mm. long, hirsute or glabrescent, rachis glabrous; bracts round, peltate, about 0.5 mm. broad, filaments about equal to the ellipsoidal anthers, ovary obovoid-turbinate or subglobose, stigma divided, slightly subterminal, moderately to sparingly penicillated; fruit ovoid, about 1 mm. long, verrucose, viscid.

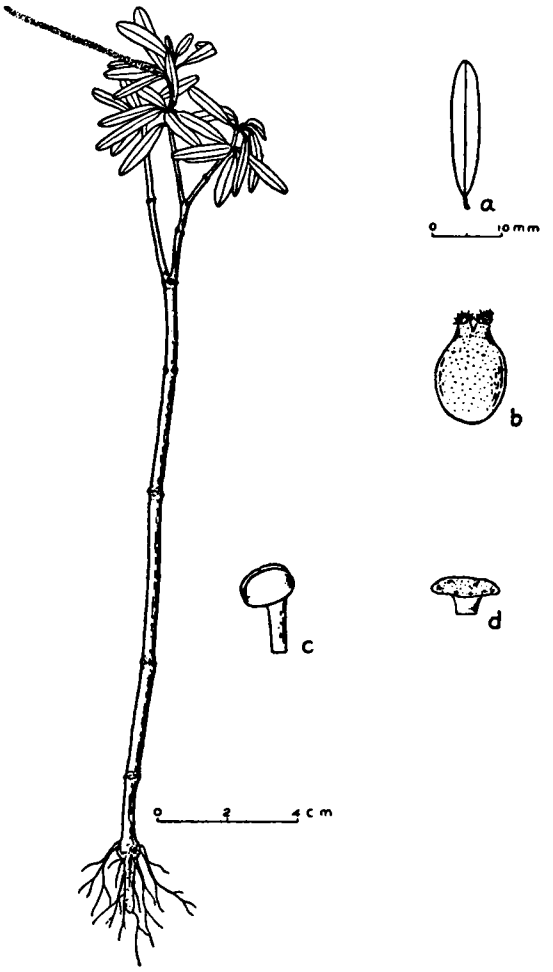

FIGURE 22.—*Peperomia Fauriei* Léveillé: *a*, leaf; *b*, ovary, enlarged; *c*, stamen, enlarged; *d*, bract, enlarged.

Type, Molokai, Pukoo, altitude 800 meters, Faurie no. 109, in the deCandolle herbarium, duplicate in Bernice P. Bishop Museum.

Known only from the vicinity of Mapulehu Valley on the southeastern part of the island of Molokai.

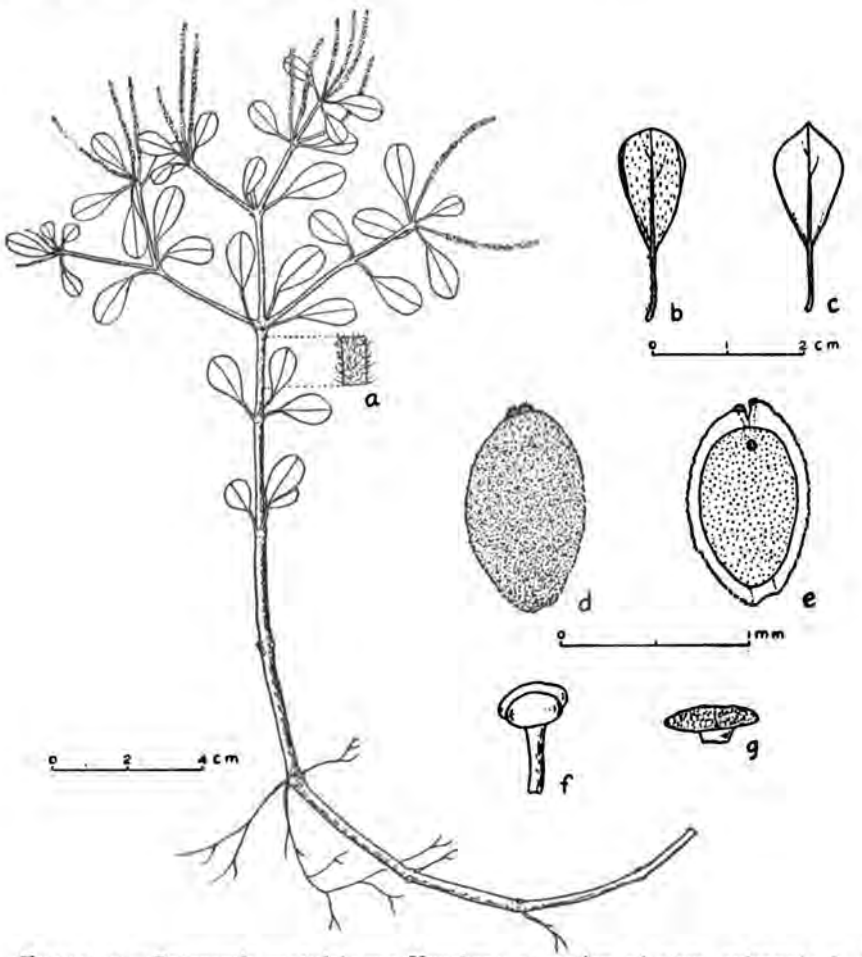

FIGURE 23.—*Peperomia mapulehuana* Yuncker: *a*, section of stem, enlarged; *b*, *c*, leaves; *d*, fruit; *e*, section of fruit; *f*, stamen, enlarged; *g*, bract, enlarged.

Molokai: Pukoo, altitude 800 meters, Faurie no. 109, duplicate type (B. P. Bishop Museum); pali of Wailau, altitude 4500 feet, Rock no. 7071 (B. P. Bishop Museum); in Wailau Valley, on wet ground, altitude 3150 feet, St. John and Fosberg no. 12851 (B. P. Bishop Museum); ridge east of Mapulehu Valley, on mossy tree trunks, altitude 3000 to 3100 feet, St. John and Fosberg nos. 12842, 12853, 12878 (B. P. Bishop Museum).

This species resembles *P. eekana* from the island of Maui in the general habit of growth, but is to be distinguished from that species principally by the more delicate character of the plants and with leaves less coriaceous in texture, commonly hirsute on the upper surface, mostly 1-nerved, and with mostly very slender petioles. In the shape and arrangement of the leaves, some specimens are somewhat similar to *P. mauiensis,* but the short peduncles serve to distinguish it from that species.

The specimen of Faurie's no. 109 in the Bernice P. Bishop Museum herbarium, which I take to represent a duplicate type of Léveillé's *P. Helleri,* has suborbicular leaves with subacute bases and on moderate petioles. Descriptive notes and sketches made of a specimen of the same collection number in the deCandolle herbarium by Professor Trelease, however, show some leaves similar in shape to those on the other specimens here included. Léveillé's description also gives the leaves as suborbicular to spatulate.

24. Peperomia eekana C. deCandolle.

Peperomia eekana C. deCandolle, Bull. Coll. Hawaii no. 2, p. 16, 1913, in part.

Peperomia sarcostigma C. deCandolle, Bull. Coll. Hawaii no. 2, p. 33, 1913.

Peperomia hypoleuca variety *montis-eeka* Hillebrand, Fl. Hawaiian Is., p. 422, 1888.

Stems up to 30 cm. long, ascending from a repent substoloniferous base, with ascending branches above, densely hirsute above, hairs up to 1 mm. long, mostly erect, glabrate below, internodes up to 9 cm. long, mostly 2 to 4 cm. long.

Leaves commonly in whorls of 3 to 5, rarely opposite, lower surface moderately hirsute and often with red intercostal areas, upper surface glabrous, sparingly hirsute when young, or with a few hairs at the base, impressed along the nerves, oval-obovate or elliptic or rarely orbicular, coriaceous and commonly with revolute edges when dry, 0.6 to 1.2 cm. broad, 1 to 2 cm. long, rarely some leaves slightly smaller, palmately 3-nerved, the midrib prominent and generally with prominent lateral nerves above, apex rounded or more or less attenuately subacute, base cuneate or acute; petiole 2 to 4 mm. long, or up to 1 cm. long in some lower leaves, hirsute, leaf scars semicircular, bundle scars 3, small.

Spikes terminal and axillary, up to 2.5 cm. long and 1.5 mm. thick, moderately flowered; peduncle up to 1 cm. long, hirsute or glabrescent; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments about equal to or longer than the ovoid anthers; ovary ovoid-turbinate, stigmas 2, apical or slightly subapical, penicillate; fruit about 1 mm. long, ovoid to obovoid, verrucose, viscid, on pseudopedicels.

Type, west Maui, Mount Eeka [Mauna Eke], Hillebrand, in the Berlin herbarium.

Known only from the island of Maui.

Maui: west Maui, Mount Eeka [Mauna Eke], Hillebrand, the type of *P. hypoleuca* variety *montis-eeka,* mixed with a plant of *P. ellipticibacca* (Berlin); Kaanapali, Hillebrand, Aug., 1870, in part (Berlin); back of Lahaina,

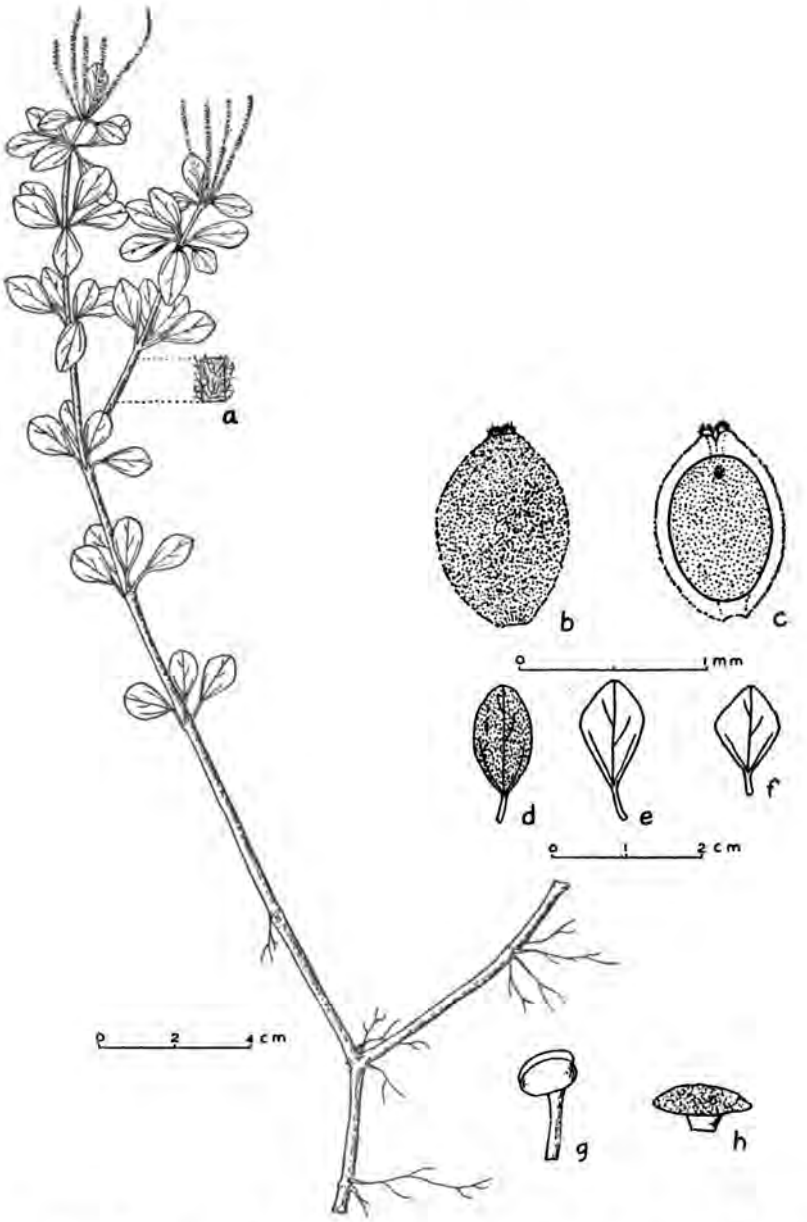

FIGURE 24.—*Peperomia eekana* C. deCandolle: *a*, section of stem, enlarged; *b*, fruit; *c*, section of fruit; *d-f*, leaves; *g*, stamen, enlarged; *h*, bract, enlarged.

Hillebrand, July, 1858 (Berlin); Eeka [Mauna Eke], Hillebrand and Lydgate (B. P. Bishop Museum); Puu Kukui, Rock no. 10384, duplicate type of *P. sarcostigma* (Gray, B. P. Bishop Museum); along the trail to Puu Kukui, in rain forest, altitude 3000 to 5780 feet, Yuncker nos. 3534, 3535, 3536, 3537 (B. P. Bishop Museum); Honokahau Drainage Basin, Forbes nos. 471-M, 681-M (B. P. Bishop Museum); Mauna Hooma, Forbes and Cooke no. 5-M (B. P. Bishop Museum); Haelaau, on mossy tree trunks, wooded ridge, altitude 3700 feet, St. John nos. 10216, 10217 (B. P. Bishop Museum); east Maui, along pipe line trail above Olinda, Yuncker nos. 3542, 3547 (B. P. Bishop Museum). The east Maui plants appear somewhat different from those from west Maui in the texture of the leaves and with more appressed hairs. The leaves on no. 3542, also, are more nearly orbicular than is common for the species. However, some leaves of the more typical shape are also present.

This species was apparently confused by both Hillebrand and deCandolle with *P. elliptibacca*. A specimen of this species in the herbarium at Berlin collected by Hillebrand on Mauna Eke, and which I believe represents the type of his *P. hypoleuca* variety *montis-eeka,* is mounted on the same sheet with a specimen of what I take to be *P. elliptibacca.* It would appear also that Hillebrand included both specimens in his description. DeCandolle later raised Hillebrand's variety *montis-eeka* to specific rank as *P. eekana* citing Hillebrand's specimen but also citing specimens from the island of Oahu which more properly belong to *P. elliptibacca.* At the same time he described his *P. sarcostigma,* which is the same as the Hillebrand specimen taken as the type of his variety *montis-eeka.* He also described his *P. elliptibacca* which agrees with the second specimen mounted with the type of *P. eekana* in the Berlin herbarium.

The present species, *P. eekana,* is known only from the island of Maui, and I believe that *P. elliptibacca* is restricted to the island of Oahu.

Distinguished from *P. elliptibacca* with its more obovate, coriaceous, and revolute leaves. The stigmas are also more apically located and more abundantly penicillated.

25. Peperomia maunakeana C. deCandolle.

Peperomia maunakeana C. deCandolle, Bull. Coll. Hawaii no. 2, p. 17, 1913.

Stem erect, up to 30 cm. (?) tall and 6 mm. thick in dry specimens, branching above, appressed hirtellous above, glabrate below, internodes up to 7 cm. long.

Leaves opposite or ternate, hirtellous on the lower surface and at the base and more or less along the nerves above, ovate to ovate-lanceolate, about 2 cm. broad and up to 3.5 cm. long, 5-plinerved or obscurely 7-plinerved, the midrib forking in the lowermost 3 to 5 mm., apex obtuse or subattenuate and more or less acute, base obtuse or shortly

acute; petioles up to 1 cm. long, appressed hirtellous, leaf scars semicircular, bundle scars 3.

Spikes axillary and terminal, up to 3 cm. long, moderately flowered; peduncle up to 1 cm. long, hirtellous or glabrate; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments longer than the ellipsoidal anthers; ovary obovate or turbinate, stigma terminal, divided, shortly penicillate; fruit not seen.

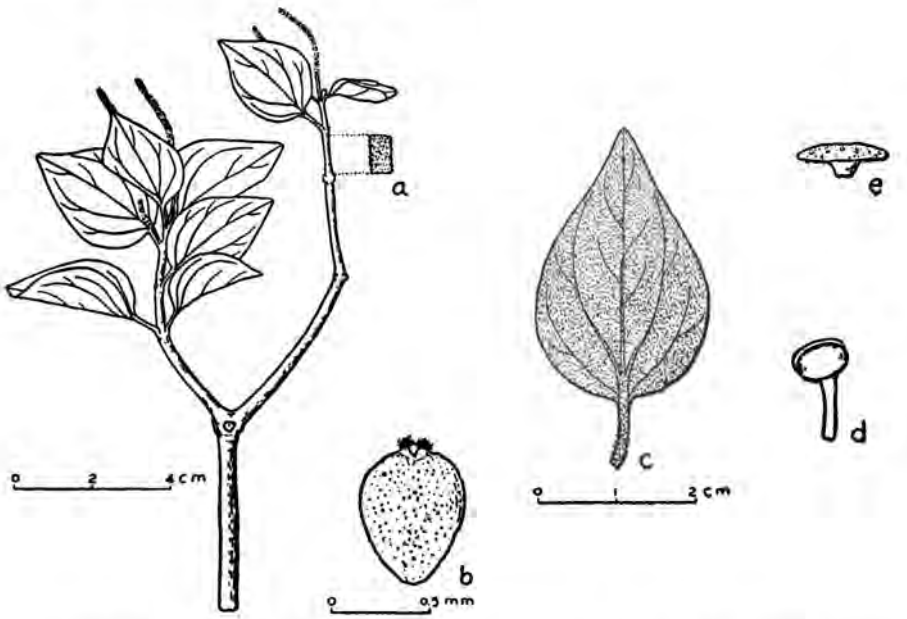

FIGURE 25.—*Peperomia maunakeana* C. deCandolle: *a*, section of stem; *b*, ovary; *c*, leaf; *d*, stamen, enlarged; *e*, bract, enlarged.

Type, Hawaii, Mauna Kea, altitude 1500 meters, Faurie no. 127, in the deCandolle herbarium.

Known only from the type locality.

The type specimen of this species is fragmentary with only the upper leaves present. DeCandolle describes the upper leaves as being 5-4 cm. long (3 to 4 cm. ?). I find none to exceed 3.5 cm. No matured fruits are present on the type specimen, but examination of the ovaries shows them to be of the divided, apical type.

This species differs from *P. Macraeana,* with which it appears to be closely related, in the smaller, more ovate and obtuse based, and 5-plinerved leaves. From *P. lilifolia* it differs in the more obtuse base and ovate leaves, and appressed hirtellous stems.

26. Peperomia Macraeana C. deCandolle.

Peperomia Macraeana C. deCandolle, Jour. Bot. (British), vol. 4, p. 145, 1866.

Peperomia pachycaulis C. deCandolle, Bull. Coll. Hawaii no. 2, p. 20, 1913.

Stems erect or ascending from a shortly decumbent and rooting base, commonly 5 to 10 dcm. long and up to 2.5 cm. thick at the base in fresh specimens, drying to 5 to 10 mm. thick, generally branching, densely appressed hirtellous above, glabrate below, hairs rusty-brown and mostly less than 0.5 mm. long, internodes 5 to 15 cm. long, rarely somewhat longer below.

Leaves opposite or whorled, densely hirtellous beneath with rusty-brown hairs especially along the nerves, sparingly hirtellous above or only at base and along the nerves, elliptic-lanceolate, 2 to 6 cm. broad, 5 to 9 cm. long, rarely longer, commonly 2 to 3 cm. broad and 6 to 8 cm. long, 7-plinerved or more rarely 5-plinerved, the midrib forking between 1 and 2 cm. from the base, nerves prominent and with numerous conspicuous, anastomosing nervelets, apex attenuately acute to acuminate, base acute; petiole up to 4 cm. long, mostly 1 to 2 cm. long, densely appressed hirtellous.

Spikes axillary and terminal, commonly clustered, up to 7 cm. long, moderately to densely flowered; peduncle about 1 cm. long, appressed hirtellous or subglabrate; rachis glabrous; bracts round, peltate, about 0.5 mm. broad, filaments equaling or somewhat longer than the ellipsoidal anthers; ovary ovoid, stigmas 2, apical, penicillate; fruit about 1 mm. long, elongated-subobovoid, shortly beaked, verrucose, viscid, on pseudopedicels.

Type, "Ins. Owhyhee, ad montem Kaah" (Island of Hawaii on Mauna Kea), Macrae, June, 1825, in the British Museum. Photograph of the type (B. P. Bishop Museum) examined.

Known from the islands of Hawaii, Maui, and perhaps Molokai.

Hawaii: Hilo, Hillebrand, April, 1871 (Berlin); near Glenwood, Rock, Aug., 1918 (B. P. Bishop Museum); between Glenwood and 29-Miles, wet jungle, Wiebke no. 3715 (Degener, Illinois); Wiebke and Lee no. 3786 (Degener, Illinois); Olaa flume, Forbes no. 657-H (B. P. Bishop Museum); Kipukas in 1855 flow between Olaa flume and Haleloulu, Forbes no. 681-H (B. P. Bishop Museum); mountains behind Pahala, Kau, Forbes no. 416-H, in part (B. P. Bishop Museum); between eastern Fern Forest trail and Aunumea [Anuhea] golf course, Kilauea, Degener no. 3808 (Degener, Illinois); Fern Forest, between Glenwood and Kilauea, Yuncker no. 3468 (B. P. Bishop Museum). Also Wiebke no. 3784, between Glenwood and 29-Miles (Degener, Illinois).

Maui: between Hana and Olinda, Wiebke and Topping no. 2617 (Degener, Illinois).

Molokai?: Pukoo?, Faurie no. 130, type of *P. pachycaulis* (deCandolle).

This species is closely related to *P. lilifolia* but appears to be sufficiently distinct with its densely hirtellous stems and leaves, and mostly 7-plinerved leaves. It differs from *P. cornifolia* in the more appressed hirtellous than hirsute stems and the elliptic-lanceolate shape of the leaves which are more

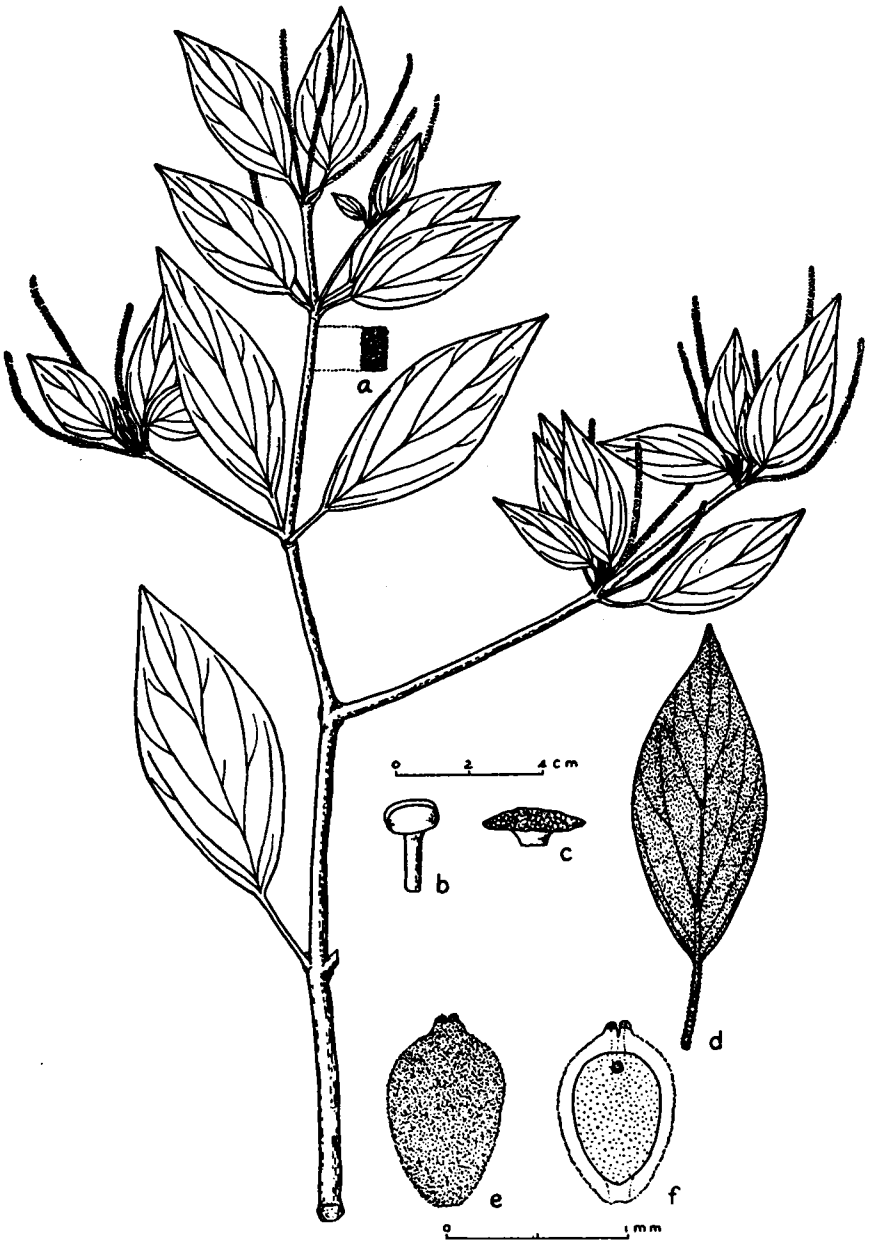

FIGURE 26.—*Peperomia Macraeana* C. deCandolle: *a*, section of stem, enlarged; *b*, stamen, enlarged; *c*, bract, enlarged; *d*, leaf; *e*, fruit; *f*, section of fruit.

or less hirtellous above at the base, and along the nerves, while the leaves of *P. cornifolia* are glabrous above.

27. Peperomia kulensis, new species.

Caules sat hirsuti. Folia verticillata, subtus moderate ad sparse hirsuta, supra glabra vel solum secus venas atque basi hirsuta, 3-4 cm. lata, 10-13 cm. longa, 9-11-penninervia vel subplinervia, apice parum attenuato-acuminata, basi cuneata; petiolus usque ad 1 cm. longus, plus minusve a basi decurrenti laminis aleatus aut fastigatus, sparse hirsutus. Spicae axillares vel terminales, usque ad 10 cm. longae; ovarium obovato-turbinatum; stigmata 2, apicalia, penicillata. Fructus non visus.

Stems erect (?), up to 3 mm. thick in upper part of only specimen available, with short, slender branches, moderately hirsute, hairs up to 1.5 mm. long, internodes up to 9 cm. long.

Leaves whorled, lower surface moderately hirsute along the nerves, sparingly hirsute on intercostal areas, upper surface glabrous or with a few hairs at the base or along the nerves, elliptic-lanceolate, 3 to 4 cm. broad, 10 to 13 cm. long, 9 to 11-penninerved or subplinerved, the innermost pair of prominent nerves forking off the midrib about 3 cm. from the base, apex somewhat attenuately acuminate, base cuneate; petiole 0.5 to 1 cm. long, more or less laterally winged or ridged by the decurrent leaf base, sparingly hirsute, leaf scar semicircular, bundle scars 3.

Spikes axillary and terminal, more or less clustered, up to 10 cm. long and 2.5 mm. thick, moderately to densely flowered, peduncle up to 2 cm. long, sparingly hirsute; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; anthers ellipsoidal, filaments stout; ovary obovate-turbinate, stigmas 2, apical, shortly penicillate; fruit not seen.

Type, east Maui, below Kula pipe line, Munro no. 800, in Bernice P. Bishop Museum. Specimen fragmentary.

Known only from the type locality.

The large 9- to 11-penninerved leaves, with short and more or less laterally winged or ridged petioles serve to distinguish this species. It is closely related to *P. Rockii* and to *P. hirtipetiola* but differs from those species in its long, elliptic-lanceolate leaves with acute to cuneate bases, and in the form of the petioles. The type is represented only by the upper part of a plant, but the characters which are present seem to be sufficiently distinct to warrant its designation as a new species.

28. Peperomia lilifolia C. deCandolle.

Peperomia lilifolia C. deCandolle, Bull. Coll. Hawaii no. 2, p. 35, pl. 7, 1913.

Peperomia longirama C. deCandolle, Bull. Coll. Hawaii no. 2, p. 18, 1913.

Peperomia astigmata C. deCandolle, Bull. Coll. Hawaii no. 2, p. 18, pl. 1, 1913.

Peperomia subnudipetiola C. deCandolle, Bull. Coll. Hawaii no. 2, p. 24, 1913.

Stems erect or ascending from a short, decumbent, rooting base, up to 60 cm. or more tall and 1.5 cm. thick at the base when fresh, up to 6 mm. thick when dry, simple or more commonly branching, sparingly to densely hairy above, glabrate below, hairs mostly 0.5 to 1 mm. long, internodes up to 10 cm. long.

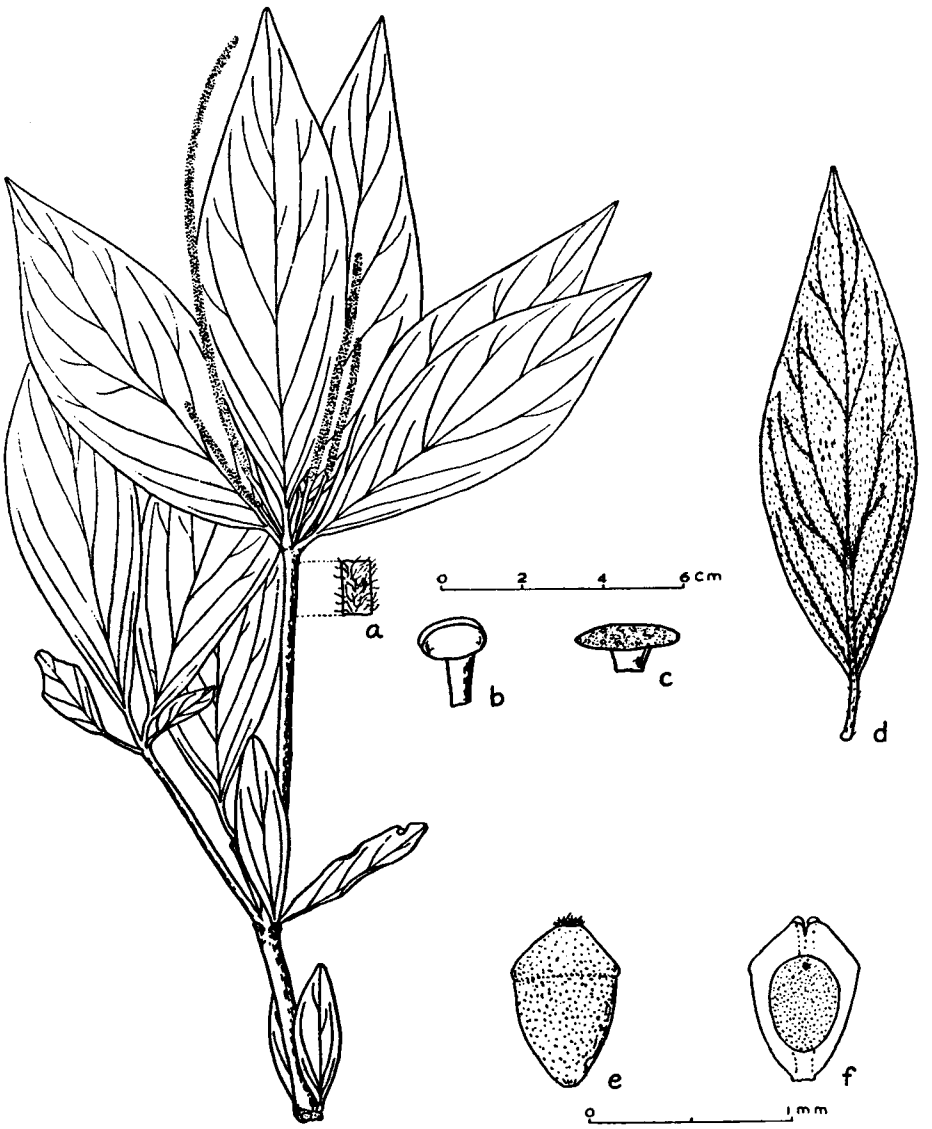

FIGURE 27.—*Peperomia kulensis* Yuncker (reconstructed from pieces of the type specimen): *a*, section of stem, enlarged; *b*, stamen, enlarged; *c*, bract, enlarged; *d*, leaf; *e*, ovary; *f*, section of ovary.

Leaves opposite or more commonly whorled, sparingly to moderately hirsute beneath, sparingly so above at the base and along the nerves, elliptic-lanceolate, 2 to 4.5 cm. broad, 4 to 7 cm. long, mostly 5-plinerved, the midrib commonly forking in the lowermost 1 cm., apex acute to acuminate, base acute to subcuneate; petiole mostly 1 to 2 cm., rarely up to 5 cm. long, hirsute or subglabrate, leaf scars semicircular, bundle scars 3.

Spikes terminal and axillary, up to 6.5 cm. long, moderately to densely flowered; peduncle mostly 1 to 1.5 cm. long, hirsute or subglabrate; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments about as long as the ellipsoidal anthers; ovary turbinate or obovate, stigmas 2, apical, penicillate; fruit about 1 mm. long, subobovoid, more or less beaked, verrucose, viscid, on pseudopedicels.

Type, Molokai, forest of Kaluaha [Kaluaaha], Rock no. 7012, in the deCandolle herbarium.

Found on the islands of Oahu, Molokai, Maui, Lanai, and Hawaii, mostly above an altitude of 2000 feet in wet forests.

Oahu: Hillebrand (Berlin); Koolau Range, Punaluu mountains, Rock nos. 414 duplicate type of *P. longirama*, 458 (B. P. Bishop Museum); Punaluu, altitude 800 meters, Faurie no 129, in part, cotype of *P. subglabricaulis*, also in part the type of *P. subnudipetiola* (deCandolle); wet slope, Nitta, Nov., 1929 (B. P. Bishop Museum); Koolauloa mountains between Punaluu and Kaipaupau [Kaipapau], Forbes, March, 1909 (B. P. Bishop Museum); Kipapa Gulch, Yuncker no. 3095 (B. P. Bishop Museum); Waianae range, Kalena mountain [Puu Kalena], Topping no. 2861 (Degener, Illinois); Mt. Kaala, Hillebrand (Berlin); altitude 2000 feet, Nitta no. 39 (B. P. Bishop Museum); just above stream, altitude 2000 feet, Hume no. 38 (B. P. Bishop Museum); east slope in moist woods, altitude 3900 feet, St. John no. 10052 (B. P. Bishop Museum); in wet woods at summit, altitude 4030 feet, St. John no. 10057 (B. P. Bishop Museum); Yuncker no. 3378 (B. P. Bishop Museum); along trail, altitude 3000 feet, Yuncker no. 3379 (B. P. Bishop Museum); in moist woods on northeast slope, altitude 3200 feet, Yuncker no. 3380 (B. P. Bishop Museum).

Molokai: Maunahui, Hillebrand (Berlin); Kaluaha [Kaluaaha], Rock no. 7012, duplicate type of *P. lilifolia* (B. P. Bishop Museum); Pukoo, Forbes no. 275-Mo (B. P. Bishop Museum); near Pepeopae, on ground in mossy rain forest, Degener and Wiebke no 2846 (Degener, Illinois).

Maui: west Maui, Lydgate (Berlin); along the trail to Puu Kukui, in wet forest, altitude 3000 to 5750 feet, Yuncker no. 3541—has leaves somewhat smaller than is typical, but agrees with this species in other respects (B. P. Bishop Museum); east Maui, along pipe line trail above Olinda, Yuncker no. 3469 (B. P. Bishop Museum).

Lanai: Lanaihale, Munro no. 227 (B. P. Bishop Museum).

Hawaii: Kohala, Rock no. 10366 (B. P. Bishop Museum); a specimen without collector's data labeled *P. astigmata* by C. deCandolle and from

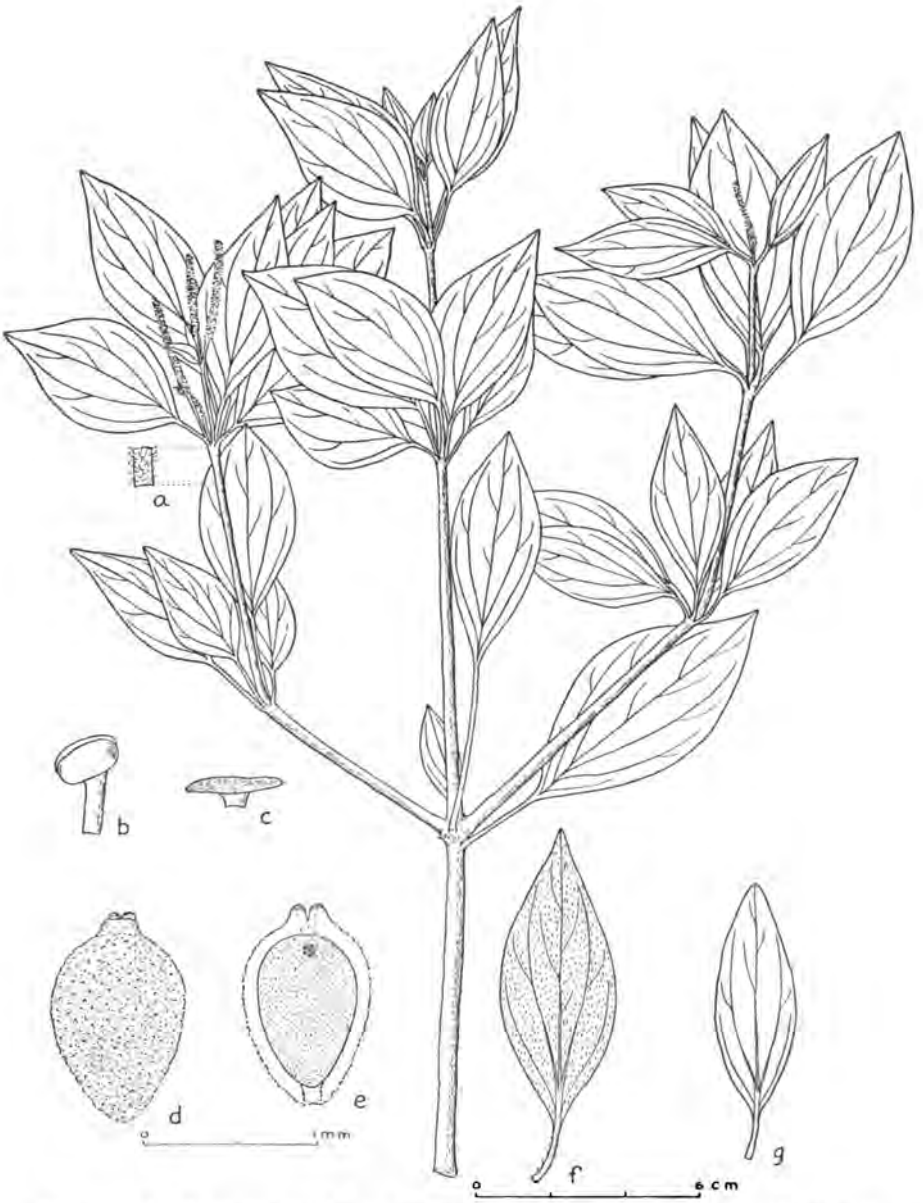

FIGURE 28.—*Peperomia lilifolia* C. deCandolle: *a*, section of stem, enlarged; *b*, stamen, enlarged; *c*, bract, enlarged; *d*, fruit; *e*, section of fruit; *f*, leaf; *g*, leaf of variety *obtusata*.

which the plate for that species was obtained (pl. 1, Bull. Coll. Hawaii no. 2). I take this specimen to be a duplicate type of *P. astigmata* which deCandolle cites as being collected by Rock in the Kohala Mountains of Hawaii (B. P. Bishop Museum).

Key to Varieties

1. Leaves acute to acuminate
 2. Plants ± hairy
  3. Stems hairy ..... **P. lilifolia**
  3. Stems glabrous
   4. Leaves hirsute on lower surface..... variety **nudilimba**
   4. Leaves glabrous beneath, ± hirsute on upper surface..... variety **psilostigma**
 2. Plants glabrous ..... variety **honokahauana**
1. Leaves obtuse ..... variety **obtusata**

Peperomia lilifolia variety **nudilimba,** new combination.

Peperomia nudilimba C. deCandolle, Bull. Coll. Hawaii no. 2, p. 15, 1913.

Peperomia molokaiensis C. deCandolle, Bull. Coll. Hawaii no. 2, p. 19, 1913.

Peperomia nudipetiola C. deCandolle, Bull. Coll. Hawaii no. 2, p. 26, 1913.

Peperomia nudipetiola variety *microtricha* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 27, 1913.

Peperomia disparifolia C. deCandolle, Bull. Coll. Hawaii no. 2, p. 29, 1913.

Peperomia lilifolia forma *b* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 36, 1913.

Peperomia lilifolia forma *c* C. deCandolle, Bull. Coll. Hawaii, no. 2, p. 36, 1913.

Stems essentially glabrous, leaves hirsute beneath, glabrate or hirsute at base and more or less along the nerves above, petioles and peduncles sparingly hirsute or glabrate.

Type, Molokai, Pukoo, Faurie no. 128, in the deCandolle herbarium.

Found on the islands of Oahu, Molokai, Maui, and Hawaii.

Oahu: Hillebrand (Berlin); Koolauloa mountains between Punaluu and Kaipaupau [Kaipapau], Forbes, Nov., 1908 (B. P. Bishop Museum); Forbes and Rock, Nov., 1909 (B. P. Bishop Museum); Forbes and Thompson, May, 1909 (B. P. Bishop Museum); on mossy ground, moist woods, Laie, Malaekahana ridge, Koolau mountains, altitude 2000 feet, St. John no. 13072 (B. P. Bishop Museum); Koolauloa mountains, Forbes, May, 1909 (B. P. Bishop Museum); Koolau mountains, Kahana, Waikane-Schofield trail, altitude 2400 feet, open grassy divide, St. John no. 10171 (B. P. Bishop Museum); Waikane-Schofield trail, near summit, Yuncker no. 3165 (B. P. Bishop Museum); Waikane-Schofield trail, in rain forest,

Degener, Park, and Hirai no. 4036 (Degener, Illinois); Koolau m Rock nos. 11, 413—duplicate type of *P. disparifolia* (B. P. Bishop M altitude 2000 feet, Hosaka no. 50 (B. P. Bishop Museum); Waiana Mt. Kaala, Hillebrand (Berlin); altitude 2500 feet, Nitta no. 28 Bishop Museum); at summit, in bog, altitude 4030 feet, Yuncker n (B. P. Bishop Museum).

Molokai: Mapulehu, Hillebrand (Berlin); Rock nos. 17193, 17195, 17197 (B. P. Bishop Museum); ridge between Hanalilolilo and Pep Waikolu, Kawela, St. John, Baker, Coulter, Fosberg, and Yuncker no. (B. P. Bishop Museum); Wailau Pali, altitude 4500 feet, Rock no. type of *P. lilifolia* forma *b* (B. P. Bishop Museum); Waikolu, Rock 16031 (B. P. Bishop Museum); mountains above Puu Kolekole, Forbes 159-Mo (B. P. Bishop Museum); ridge east of Mapulehu Valley overlc ing Wailau Valley, on ground in extreme rain forest, Degener and Wie no. 2897 (Degener, Illinois); near Pepeopae, on damp ground in dense sha Degener and Wiebke no. 2733 (Degener, Illinois); Kawela, Puu o Kael St. John, Baker, Coulter, Fosberg, and Yuncker no. 12500 (B. P. Bish Museum); at the end of Hanaliioliio [Hanalilolilo] pipe line, about 4½ fe long, hanging over cliff, Degener and Wiebke no. 2842 (Degener, Illinois).

Maui: west Maui, Kaanapali, Hillebrand, Aug., 1870 (Berlin); Puu Kukui, altitude 3000-5000 feet, Hitchcock nos. 14671, 14857 (B. P. Bishop Museum); along trail to Puu Kukui, altitude 3000 to 5780 feet, Yuncker nos. 3418, 3422, 3423 (B. P. Bishop Museum); altitude 5800 feet, Rock nos. 10378, 10379 (B. P. Bishop Museum); near Mt. Eke by way of Waihee, in damp woods, Degener and Wiebke no. 2627 (Degener, Illinois); east Maui, Papaea [Papaaea], north slope of Haleakala, Forbes no. 2507-M (B. P. Bishop Museum).

Hawaii: forest of Honokanenui, Rock no. 8365, duplicate type of *P. lilifolia* forma *c* (B. P. Bishop Museum); woods above Waimea, Rock no. 4422 (B. P. Bishop Museum); Holokaiea Gulch, Rock no. 4423, duplicate type of *P. nudipetiola* (B. P. Bishop Museum); Kohala Mountains, Rock nos. 10365 in part, 10367 duplicate type of *P. nudipetiola* variety *microtricha;* 10368, duplicate type of *P. nudilimba* (B. P. Bishop Museum).

Peperomia lilifolia variety **psilostigma,** new combination.

Peperomia psilostigma C. deCandolle, Bull. Coll. Hawaii no. 2, p. 20, 1913.

Peperomia psilostigma forma *b* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 21, 1913.

Peperomia lilifolia forma *d* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 36, 1913.

Stems glabrous, leaves glabrous beneath, hirsute above at the base and along the nerves, peduncles and petioles glabrous.

Type, "Maui, on the high swampy plateau and along the trail leading to Puu Kukui, 7540 ft. (5740 ft.) J. F. Rock," in the deCandolle herbarium.

Found on the islands of Maui and Hawaii.

Maui: west Maui, Puu Kukui, Rock nos. 10382 duplicate type of *P. psilostigma,* 10383 duplicate type of *P. psilostigma* forma *b* (B. P. Bishop Museum).

Hawaii: Kohala Mountains, altitude 4000 feet, in dense rain forest, Rock no. 10365, in part, duplicate type of *P. lilifolia* forma *d* (B. P. Bishop Museum).

Peperomia lilifolia variety **honokahauana,** new variety.

Herba omnino glabra.

Plant entirely glabrous.

Type, Maui, Honokahau Drainage Basin, Forbes no. 451-M, in Bernice P. Bishop Museum.

Found on the island of Maui.

"Sandwich Islands," Remy no. 187 (Gray).

Maui: along the trail to Puu Kukui, altitude 5600 feet, Yuncker no. 3426 (B. P. Bishop Museum); Honokahau Drainage Basin, Forbes nos. 451-M—the type, 452-M (B. P. Bishop Museum).

Peperomia lilifolia variety **obtusata,** new variety.

Rami superiores usque ad 50 cm. longi, flexuosi, superne sparse hirsuta. Folia elliptico-oblonga ad subovata, 3-5-verticillata, apice subattenuata, obtusa, basi breviter acuta.

Upper branches long (up to 50 cm. long), flexuous, sparingly hirsute above, glabrous below, internodes 3 to 12 cm. long. Leaves elliptic-oblong to subovate, in whorls of 3 to 5, somewhat coriaceous when dry, apex subattenuate, obtuse, base shortly acute.

Type, Molokai, Waikolu Valley, Rock no. 16032, in Bernice P. Bishop Museum.

Known from the islands of Molokai and Hawaii.

Molokai: Waikolu Valley, Rock no. 16032, the type (B. P. Bishop Museum).

Hawaii: Kilauea Volcano region, Rock no. 17174 (B. P. Bishop Museum).

In this, as well as in other species which have divided and apically placed stigmas, the appearance of the stigmatic area differs greatly at different stages in the development of the ovary and the fruit. In the young ovaries there is commonly a small, rounded, undivided, and more or less depressed area at the summit. As the ovary matures two short projections develop. These become penicillated and are formed on the anterior and posterior sides of the apical depression. These projections are commonly loosely attached to the ovary and are often deciduous. Observation of fresh specimens has revealed all stages in the development of the stigmatic area on the

same plant and not uncommonly in the same spike. The several species established by deCandolle and here relegated to synonymy were differentiated by him principally on differences in the appearance of the stigmas which I now believe only represent stages in the development of the fruit. I am also unable to discover any other constant characters by which the species here included are to be maintained.

There is considerable variation in the size of the leaves and in the degree and character of hirsuteness of the stems and leaves. The stems vary from a densely hirsute to an entirely glabrous condition. Some specimens from the Waianae Mountains on Oahu have stems which are more densely hirsute than is common for the species, and some specimens from the islands of Lanai and Hawaii with shorter, subappressed hairs approach *P. Macraeana* in this respect. The densely hirtellous condition of the leaves and stems as well as the type of venation serves, however, to distinguish *P. Macraeana* from this species.

DeCandolle established forms *b* and *c* of his *P. lilifolia* on the difference in hirsuteness of the upper surface of the leaves. I have commonly observed plants, however, bearing both forms of leaves as described by him. Variety *obtusata* is seemingly very distinct in some of its leaf characters. After careful comparison with specimens of *P. lilifolia,* however, I do not believe that the differences warrant its establishment as a separate species.

29. Peperomia Rockii C. deCandolle.

Peperomia Rockii C. deCandolle, Bull. Coll. Hawaii no. 2, p. 34, pl. 6, 1913.

Peperomia subglabricaulis C. deCandolle, Bull. Coll. Hawaii no. 2, p. 29, 1913.

Peperomia parvanthera C. deCandolle, Bull. Coll. Hawaii, no. 2, p. 35, 1913.

Stems erect or ascending from a short, decumbent, rooting base, up to 10 dcm. long and 1.5 cm. thick at the base when fresh, up to 7 mm. thick when dry, branching, densely subappressed hirsute above, glabrate below, hairs less than 1 mm. long, internodes up to 15 cm. long below, shorter above.

Leaves opposite below, whorled above, lower surface yellowish hirsute, upper surface marginally ciliated and sparsely hairy, especially at the base, ovate to elliptic-ovate, 2.5 to 5.5 cm. broad, 5 to 10 cm. long, 7- to 9-plinerved, the midrib forking mostly within the lowermost 1 cm., apex attenuately acute to acuminate, base rounded, subcordate, or shortly acute; petioles mostly 1 to 2 cm. long, up to 6 cm. long in lower leaves, subappressed hirsute, leaf scars semicircular, bundle scars 3.

Spikes axillary or terminal, single or in clusters of 3 to 5, up to 7 cm. long and 4 mm. thick, densely flowered; peduncle about 1 cm. long, hirsute; rachis glabrous; bracts about 0.5 mm. broad, irregularly rounded, peltate; anthers small, globose-ellipsoidal, filaments short; ovary emersed, ovoid, stigmas 2, apical, penicillate; fruit 1 to 1.25 mm. long, subobovoid, briefly beaked, verrucose, viscid.

Type, Molokai, Kahuaha [Kaluaaha] Forest, Rock no. 7013, in the deCandolle herbarium.

Known only from the island of Molokai.

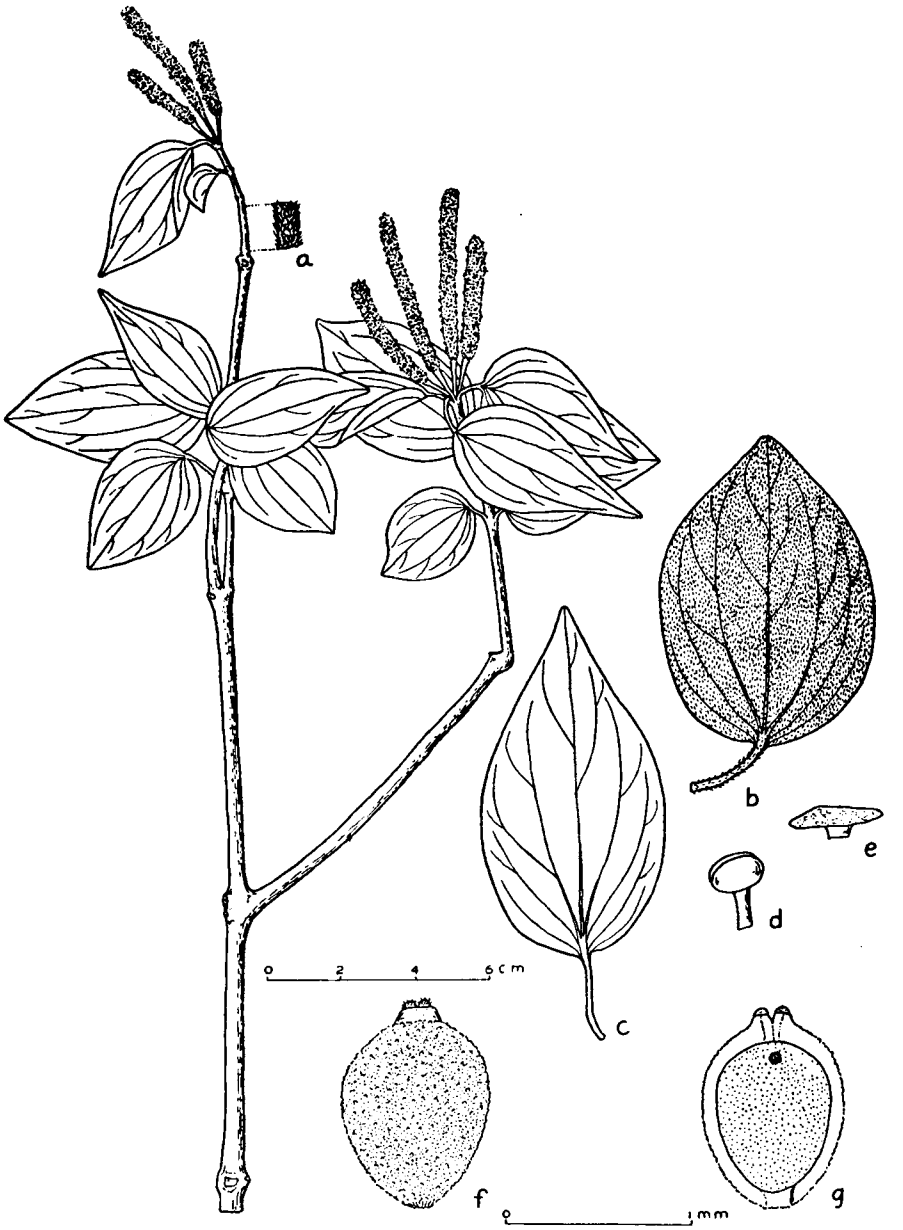

FIGURE 29.—*Peperomia Rockii* C. deCandolle: *a*, section of stem, enlarged; *b*, *c*, leaves; *d*, stamen, enlarged; *e*, bract, enlarged; *f*, fruit; *g*, section of fruit.

Molokai: Remy no. 189, type of *P. subglabricaulis* (deCandoll men of this same number in the Gray herbarium is apparently variety *nudilimba*); Kahuaha Forest, Rock no. 7013, duplicate t *Rockii* B. P. Bishop Museum); Pukoo, Faurie no. 164, type of *P. thera* (deCandolle); Forbes no. 273-Mo (B. P. Bishop Museum); ridge east of Mapulehu Valley in rain forest, altitude 2200 feet, St. J Fosberg no. 12899 (B. P. Bishop Museum); altitude 2600 feet, S and Fosberg no. 12910 (B. P. Bishop Museum).

Remy's no. 189, the type specimen of *P. subglabricaulis* in the c dolle herbarium, is fragmentary and sterile, but on the basis of its vege characteristics it appears quite conclusively to be the same species a other specimens included here. Faurie's no. 129, the cotype of *P. subgl caulis,* is likewise a poor specimen but one which I consider more prop to be a specimen of *P. lilifolia,* to which species I have now referred it.

In his key deCandolle separates *P. Rockii* and *P. parvanthera* on basis of differences in the stigmas which he describes as glabrous for *Rockii* and long-ciliated for *P. parvanthera.* Upon examination I find th both have ciliated (penicillated) stigmas. Nor do I agree with his venatio and leaf-size contrasts which I find to be similar in the specimens examined

This species differs from *P. Macraeana* and *P. lilifolia* principally in the rounded base and shape of the leaves, and from *P. hirtipetiola* in the type of venation and the glabrous upper leaf surface.

30. Peperomia hirtipetiola C. deCandolle.

Peperomia hirtipetiola C. deCandolle, Bull. Coll. Hawaii no. 2, p. 31, 1913.

Peperomia gracilescens C. deCandolle, Bull. Coll. Hawaii no. 2, p. 38, 1913.

Stems erect or ascending from a short decumbent, rooting base, 5 to 10 dcm. long, up to 6 mm. thick in dry specimens, branching above, moderately pilose above, glabrate below, hairs mostly about 1 mm. long, internodes up to 15 cm. long below, mostly shorter above.

Leaves mostly opposite, less commonly whorled above, pilose on the lower surface, moderately to sparingly so above, hairs up to 1 mm. long, ovate-lanceolate to elliptic-lanceolate, 2.5 to 7 cm. broad, 7 to 16 cm. long, mostly 3 to 4.5 cm. broad and 8 to 12 cm. long, pinnately nerved or 9- to 11-subplinerved, apex attenuately acute to acuminate, base rounded to shortly acute; petioles mostly 1.5 to 2 cm. long, up to 6 cm. long in lower leaves, pilose.

Spikes terminal and axillary, up to 9 cm. long, about 2 mm. thick, not uncommonly branching, moderately flowered; peduncle 1 to 2 cm. long, pilose, rachis glabrous; bracts round, peltate, about 0.5 mm. broad; ovary turbinate or obovoid, stigma single in young ovaries but becoming divided, terminal; fruit obovoid, more or less beaked, about 1 mm. long, verrucose, viscid, on pseudopedicels.

Type, east Maui along Wakamoi [Waikamoi] ditch trail, Rock, in the deCandolle herbarium.

Found on the island of Maui.

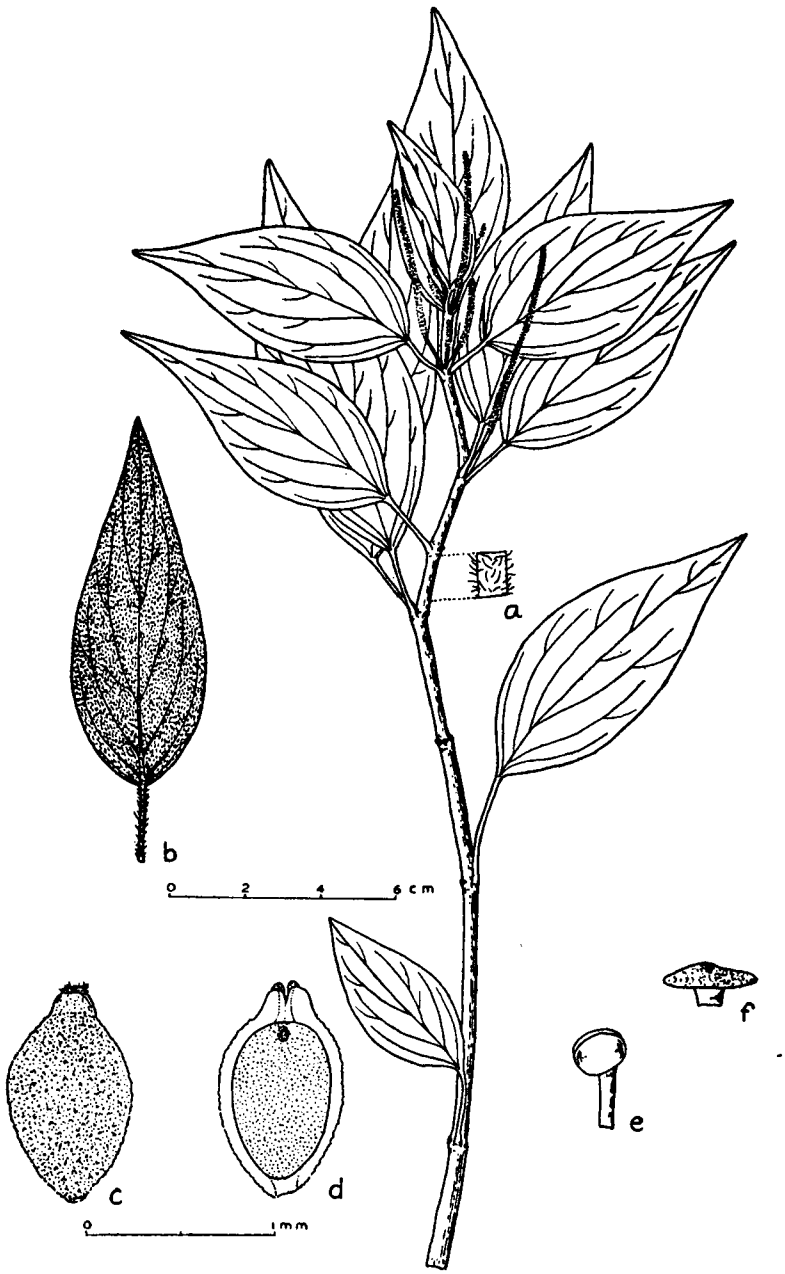

FIGURE 30.—*Peperomia hirtipetiola* C. deCandolle: *a*, section of stem, enlarged; *b*, leaf; *c*, fruit; *d*, section of fruit; *e*, stamen, enlarged; *f*, bract, enlarged.

Maui: east Maui, Wakamoi [Waikamoi] ditch trail, Rock nos. 10386 duplicate type of *P. gracilescens,* 10388 duplicate type of *P. hirtipetiola,* 10395 (B. P. Bishop Museum); west Maui, Iao Valley, Forbes no. 101-M (B. P. Bishop Museum); Pualaia [Pualaea], Forbes nos. 1745-M, 1749-M (B. P. Bishop Museum); ridge left side Kipahulu, Forbes nos. 1683-M, 1691-M (B. P. Bishop Museum).

Peperomia hirtipetiola variety **longilimba,** new combination.

Peperomia longilimba C. deCandolle, Bull. Coll. Hawaii no. 2, p. 36, pl. 8, 1913.

Stems and leaves densely pilose. Hairs mostly 1 to 2 mm. long. Otherwise similar to the typical form.

Type, Maui, along Wakamoi [Waikamoi] ditch trail, Rock, in the deCandolle herbarium.

Known from the islands of Maui and Lanai.

Maui: Waikamoi ditch trail, Rock nos. 10391—duplicate type of *P. longilimba,* 10399 (B. P. Bishop Museum); Honokahau Drainage Basin, Forbes no. 515-M (B. P. Bishop Museum); west Maui, along trail to Puu Kukui, Yuncker no. 3424 (B. P. Bishop Museum); Kula pipe line, Waikamoi, Forbes no. 1279-M (B. P. Bishop Museum); east Maui, below Kula pipe line, Munro no. 799, this specimen is hairy above only along the midrib (B. P. Bishop Museum); Haelaau, wooded ridge, altitude 3400 feet, St. John no. 10185 (B. P. Bishop Museum); wet forest of Hamakua, north slope of Haleakala, altitude 4000 feet, Rock no. 8506 (B. P. Bishop Museum); east Maui, Olinda, along shaded wet ditch trail, Degener and Wiebke no. 2410 (Degener, Illinois); along pipe line trail above Olinda, Yuncker nos. 3427, 3429, 3430, 3471, 3472 (B. P. Bishop Museum); west ridge of Haipuaena, Forbes no. 2645-M (B. P. Bishop Museum).

Lanai: Mahana, Rock no. 8094, cotype of *P. longilimba* (B. P. Bishop Museum).

This species is to be distinguished from *P. lilifolia* chiefly by the mostly larger and more ovate than elliptic leaves as well as by the venation, commonly rounded base, and pilose upper surface. From *P. Macraeana* it differs in the size and shape of the leaves and in the longer and mostly erect hairs, less prominent veinlets, and pilose upper surface of the leaves. It is also closely related to *P. Rockii* but differs from that species principally in the more pinnate type of venation, pilose upper surface, and more elongated leaves.

DeCandolle described his *P. hirtipetiola* as having single stigmas. As in other species with apical stigmas, the divided condition is not always evident in the very young ovaries. Microscopic examination of the ovaries of the specimens here included not uncommonly shows young ovaries with what

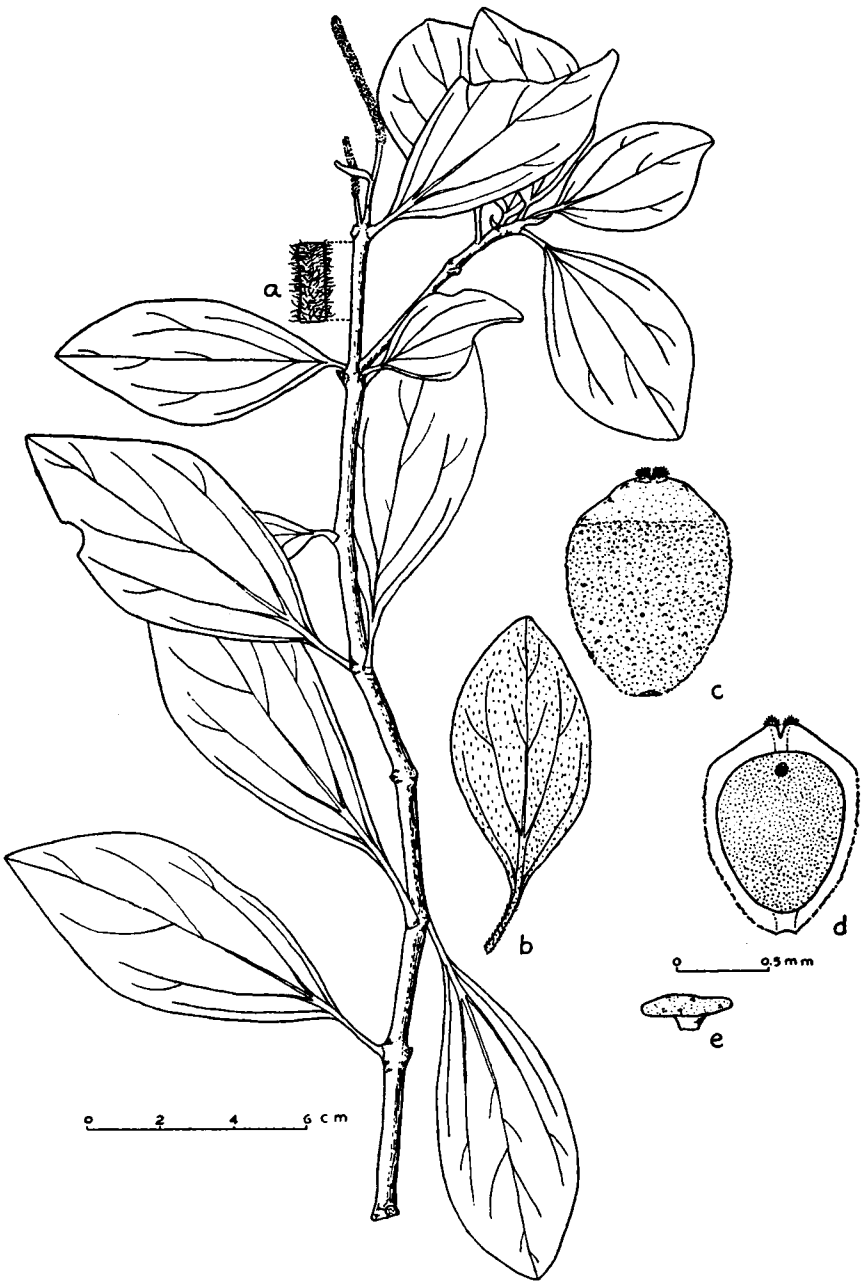

FIGURE 31.—*Peperomia cornifolia* C. deCandolle: *a*, section of stem, enlarged; *b*, leaf; *c*, fruit; *d*, section of fruit; *e*, bract, enlarged.

appears to be a single stigma together with others that have them definitely divided.

Some specimens of this species have larger leaves, and some of variety *longilimba* are more densely hirsute than has been observed in any other Hawaiian species.

31. Peperomia cornifolia C. deCandolle.

Peperomia cornifolia C. deCandolle, Bull. Coll. Hawaii no. 2, p. 30, 1913.

Stems ascending from a semiprostrate, rooting base, up to 40 cm. long and 6 mm. thick at the base in dry specimens, simple or with a few short branches above, densely hirsute above, hairs mostly 0.5 to 1 mm. long, glabrate below, internodes up to 7 cm. long.

Leaves mostly opposite, less commonly ternate, lower surface moderately hirsute, intercostal areas red, glabrous above, elliptic-subobovate, mostly 3.5 to 4.5 cm. broad and 7 to 10 cm. long, 5- to 7-plinerved, the midrib forking within the lowermost 2 cm., apex attenuately subacute or obtuse, base cuneate, petiole up to 1.5 cm. long, moderately hirsute, leaf scars semicircular, bundle scars 3.

Spikes axillary and terminal, up to 5 cm. long and 4 mm. thick, densely flowered; peduncle up to 1 cm. long, glabrate; rachis glabrous; bracts round, peltate, edges irregular, yellow glandular, up to 0.7 mm. broad; filaments about as long as the ellipsoidal anthers; ovary globose-ovoid, stigmas 2, apical, penicillate; fruit subobovoid; about 1.25 mm. long, verrucose, viscid, with a prominent umbonate apical area, on pseudopedicels.

Type, island of Hawaii, in dense forest of Kohala Mountains, altitude 4000 feet, Rock, in the deCandolle herbarium.

Known only from the region of the Kohala Mountains on the island of Hawaii.

Hawaii: Kohala Mountains, Rock nos. 10363, 10366 (B. P. Bishop Museum).

This species is to be distinguished from *P. lilifolia,* with which it is closely related, by its subobovate leaves, and from *P. rigidolimba,* to which it also bears some resemblance, by its larger, more pointed, and mostly opposite leaves, and with the midrib commonly forking somewhat higher.

32. Peperomia rigidolimba C. deCandolle.

Peperomia rigidolimba C. deCandolle, Bull. Coll. Hawaii no. 2, p. 34, pl. 4, 1913.

Stems ascending from a short, decumbent, rooting base, up to 40 cm. long and 5 mm. thick at the base in dry specimens, simple or with a few short branches above, densely hirsute above, moderately so below, hairs mostly 1 mm. or more long, internodes from 2 cm. long above to 6 cm. long below.

Leaves rigid, subcoriaceous, with revolute margins, mostly ternate, less commonly opposite, lower surface with red intercostal areas, densely hirsute, upper surface glabrous or sparingly hirsute at the base, veins more or less impressed, oblong-obovate, 1.5 to 3 cm. broad, 3 to 7 cm. long, 5-plinerved, the midvein forking in the lower 5 mm., apex obtuse, rounded or subattenuate and acutish, base cuneate; petiole up to 1 cm. long, densely hirsute, leaf scar semicircular, bundle scars 3.

Spikes axillary; 1 to 3 at a node, up to 5 cm. long, mostly 3 to 4 cm. long, densely flowered; peduncle up to 1 cm. long, hirsute or glabrate; rachis glabrous; bracts irregu-

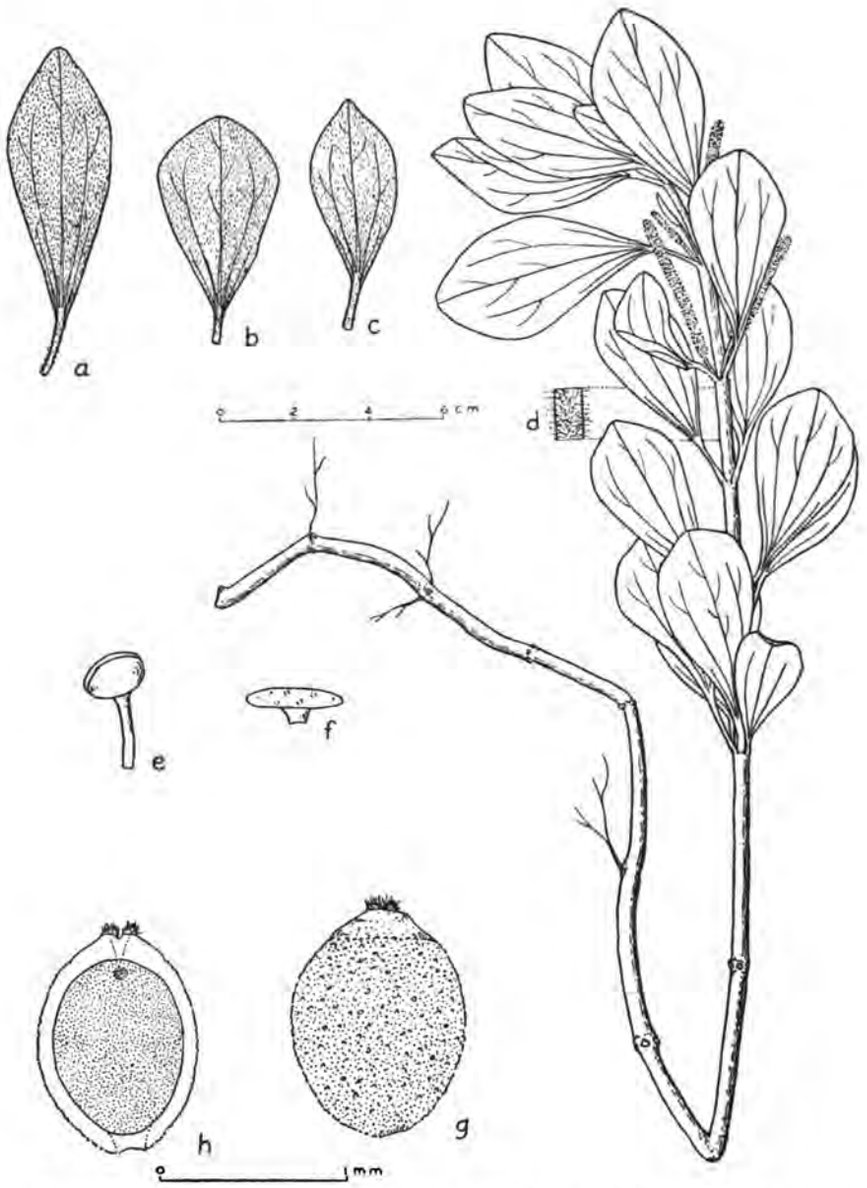

FIGURE 32.—*Peperomia rigidolimba* C. deCandolle: *a-c*, leaves; *d*, section of stem, enlarged; *e*, stamen, enlarged; *f*, bract, enlarged; *g*, fruit; *h*, section of fruit.

larly suborbicular, peltate, about 0.5 mm. broad; filaments about equaling the ellipsoidal anthers; ovary globose or subturbinate, stigmas 2, apical, penicillate; fruit globose-ovoid, about 1.2 mm. long, verrucose, viscid, with an umbonate apical area.

Type, island of Hawaii, Kohala Mountains, Rock, in the deCandolle herbarium.

Known only from the type locality.

Hawaii: Kohala Mountains, altitude 4000 feet, in dense rain forest, Rock no. 10369, duplicate type? (B. P. Bishop Museum).

This species is characterized chiefly by its rigid stems and leaves, short internodes, cuneate leaf base, and long hairs. From *P. cornifolia* it differs in the shape, smaller size, more rounded apex of the leaves, and generally lower forking of the midrib. However, further study of more abundant materials of these two species may show that they represent only variations of a single species.

33. Peperomia expallescens C. deCandolle.

Peperomia expallescens C. deCandolle, Bull. Coll. Hawaii no. 2, p. 23, 1913.

Stems ascending from a repent, substoloniferous base, up to 30 cm. long and 3 mm. thick in dry specimens, abundantly and divaricately branching from the base upward, glabrate below, densely hirsute above, hairs fuscous, spreading, 1 to 1.5 mm. long, internodes mostly 2 to 6 cm. long, or up to 8 cm. long below.

Leaves in whorls of 3 to 5 or less commonly opposite, coriaceous when dry, impressed along the nerves above, edges commonly more or less revolute, lower surface densely hirsute with fuscous hairs, upper surface sparsely hirsute all over, or only at the base and along the nerves, or subglabrate when older, oval to orbicular, obovate or subrhombic, 1.3 to 3.5 cm. broad, 2 to 4 cm. long, mostly 1.4 to 2 cm. broad and 2 to 2.5 cm. long, palmately 3-nerved, the midrib usually with two prominent branches arising near the middle, or 5-plinerved with the inner pair of lateral nerves arising about 4 mm. from the base, apex obtuse, rounded or very briefly atteunated, base shortly acute; petioles 0.5 cm. long above to 3 cm. long below in some large leaves, mostly about 1 cm. long, densely hirsute, leaf scars semicircular, bundle scars 3.

Spikes mostly terminal, single or more commonly clustered, up to 3.5 cm. long less hirsute than the petioles to glabrate; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments longer than the ellipsoidal anthers; ovary obovoid or turbinate, emersed, stigmas 2, apical or slightly subapical, penicillate; fruit 1.2 to 1.5 mm. long, narrowly obovoid or subturbinate, somewhat lop-sided, verrucose, viscid.

Type, Maui, on the high swampy plateau and along the trail leading to Puu Kukui, altitude 5780 feet, Rock, July, 1910, in the deCandolle herbarium.

Found on the islands of Molokai, Maui, and Hawaii.

Maui: on the high swampy plateau and along the trail leading to Puu Kukui, altitude 5780 feet, Rock, July, 1910, type (deCandolle); duplicate type (B. P. Bishop Museum); Kaeanae [Keanae] Gap, Haleakala crater, Forbes no. 1046-M (B. P. Bishop Museum).

Molokai: heights near the pali of Pelekunu, Hillebrand, July, 1870 (Berlin); mountains above Puu Kolekole, Forbes nos. 160-Mo., 161-Mo. (B. P. Bishop Museum); upper forest, Munro no. 586 (B. P. Bishop Museum);

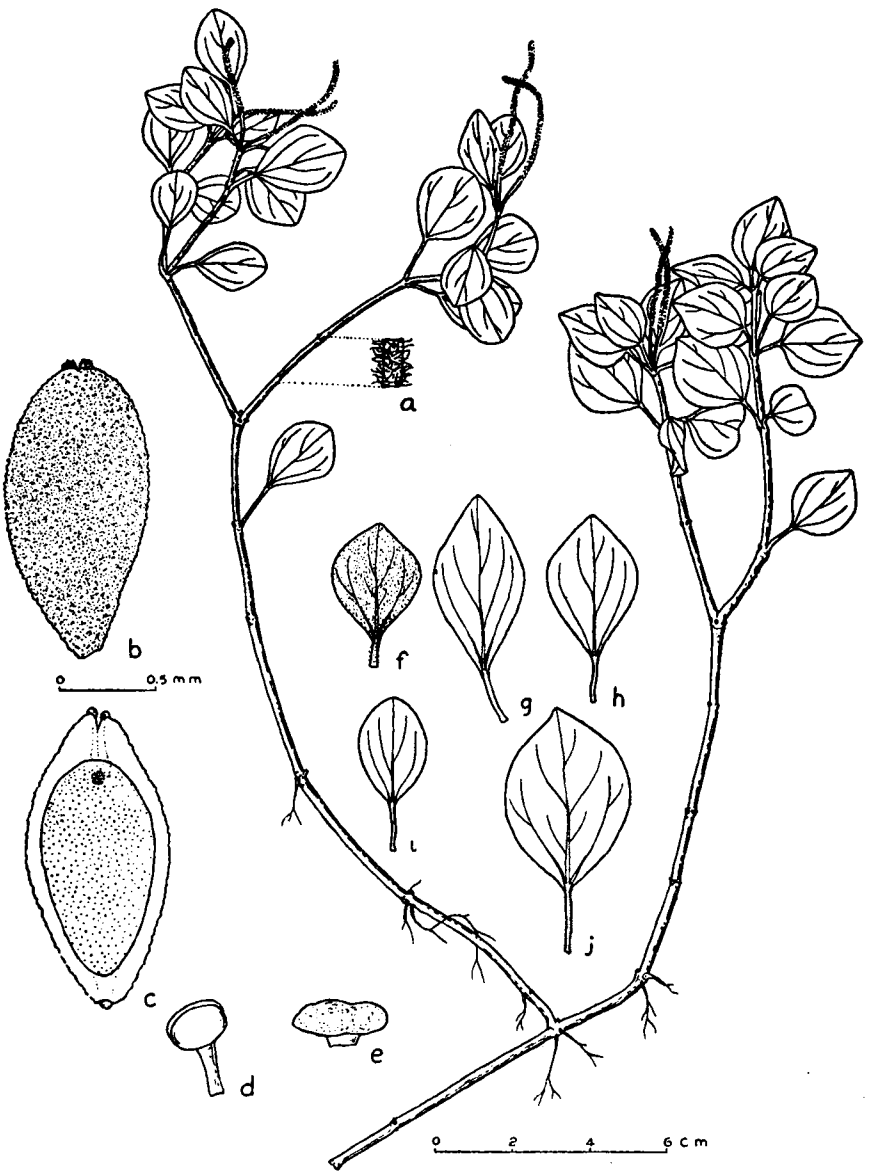

FIGURE 33.—*Peperomia expallescens* C. deCandolle: *a*, section of stem; *b*, fruit; *c*, section of fruit; *d*, stamen, enlarged; *e*, bract, enlarged; *f-j*, leaves.

near Puu o Wahaula, in mossy rain forest, Degener and Wiebke no. 2758 (Degener, Illinois); near Pepeopae, on ground and fallen logs in dense shade, Degener and Wiebke no. 2730 (Degener, Illinois); on moss-covered trunk of tree, Degener and Wiebke no. 2845 (Degener); between Waikolu Valley and probably northern base of Puu Alii, open rain forest, Degener and Wiebke no. 2761 (Degener, Illinois); dense wet woods, Puu o Kaeha, Kawela, altitude 4150 feet, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12463, 12492, 12494 (B. P. Bishop Museum); ridge between Hanalilolilo and Pepeopae, Waikolu Valley, Kawela, altitude 3800 to 3900 feet, St. John, Baker, Coulter, Fosberg, and Yuncker nos. 12566, 12572 (B. P. Bishop Museum); head of Waikolu Valley, Hanalilolilo, altitude 3800 feet, St. John, Baker, Coulter, Fosberg, and Yuncker no. 12409 (B. P. Bishop Museum).

Hawaii: Kilauea Volcano, Rock nos. 16028, 16029 (B. P. Bishop Museum).

Peperomia expallescens variety **brevipilosa,** new variety.

Pili breves, adpressi. Folia ovato-obovata, basi, acuta ad cuneata, palmatim 3-nervosa aut obscure 5-plinervia pagina superiore basi atque secus venas pilosa vel glabrata.

Hairs much shorter than in the typical form (mostly 0.5 mm. or less long) and appressed; leaves oval-obovate, base acute to cuneate, palmately 3-nerved or obscurely 5-plinerved, the midrib branching about 3 mm. above the base and with prominent lateral branches at about the middle, hairy above at the base and along the nerves, or glabrate.

Type, Maui, Forbes no. 1942-M, in Bernice P. Bishop Museum.

Known only from the island of Maui.

Maui: Forbes no. 1942-M (B. P. Bishop Museum); Ukulele, Forbes no. 956-M (B. P. Bishop Museum).

DeCandolle described *P. expallescens* from a very fragmentary specimen with young, immature spikes. It appears evident, however, from the leaf and stem characters that are present that his type belongs with the suite of specimens included here. I find the stigmas to be definitely bilobed and not single as originally described, although the immature ovaries of the type specimen do not show this character clearly.

The specimens from Kilauea Volcano on Hawaii have some leaves proportionately narrower and less coriaceous than those on the specimens from Molokai and Maui, but otherwise the plants from the different islands are similar.

This species differs from *P. eekana,* with which it is closely related, chiefly in the larger size of the plants and in the shape and size of the leaves, which also commonly have hairy upper surfaces. In Forbes no. 956-M, cited under variety *brevipilosa,* the more cuneate leaf base and glabrous upper surface indicate this relationship, but the size of the plant and the type of hairs serve to distinguish it from that species.

34. Peperomia erythroclada C. deCandolle.

Peperomia erythroclada C. deCandolle, Bull. Coll. Hawaii no. 2, p. 28, 1913.

Peperomia obovatilimba C. deCandolle, Bull. Coll. Hawaii no. 2, p. 29, 1913.

Peperomia astrostigma C. deCandolle, Bull. Coll. Hawaii no. 2, p. 30, 1913.

Peperomia acrostigma C. deCandolle, Candollea, vol. 1, p. 324, 1923 (a misprint for *astrostigma*).

Stems erect or ascending from a short, decumbent, rooting base, up to 45 cm. long and 5 mm. thick at the base in dry specimens, branching above, moderately to sparingly hirsute above, glabrate below, hairs up to 1 mm. long, mostly erect.

Leaves opposite or less commonly whorled, more or less coriaceous in dry specimens, glabrous on the upper surface or rarely sparingly hirsute at the base, hirsute beneath, intercostal areas commonly red, elliptic to elliptic-obovate or rarely some leaves elliptic-lanceolate, 1.7 to 4.2 cm. broad, 3 to 8 cm. long, mostly 2 to 3.5 cm. broad and 4 to 6 cm. long, 5-plinerved or rarely 7-plinerved, the midrib forking within the lowermost 1 cm., or rarely some leaves subpalmately nerved, apex rounded, obtuse or more rarely subattenuated and acutish, base acute to cuneate; petioles mostly 1 to 2 cm. long, hirsute, leaf scar semicircular, bundle scars 5.

Spikes terminal or less commonly axillary, single or more commonly in clusters of 3 to 5, up to 6 cm. long and 3 mm. thick, densely flowered; peduncle up to 1 cm. long, glabrous or more rarely sparingly hirsute, subclavate; rachis glabrous, bracts round, peltate, about 0.5 mm. broad; filaments somewhat longer than the ellipsoidal anthers; ovary obovoid-turbinate, stigma apical, divided, penicillated; fruit about 1.2 mm. long, obovoid, verrucose, viscid.

Type, Lanai, Mahana Valley, Rock no. 8001, in the deCandolle herbarium.

Found on the islands of Maui and Lanai.

Lanai: Mahana Valley, Rock no. 8001, duplicate type (B. P. Bishop Museum).

Maui: east Maui, along Waikamoi ditch trail, Rock nos. 10389—duplicate type of *P. obovatilimba,* 10387—duplicate type of *P. astrostigma,* 10394, 10398 (B. P. Bishop Museum); Nahiku, Forbes no. 251-M (B. P. Bishop Museum); Kaea, Forbes no. 2545-M (B. P. Bishop Museum); Papaaea, north slope of Haleakala, Forbes no. 2516-M (B. P. Bishop Museum); west ridge of Haipuaena, Forbes no. 2657-M (B. P. Bishop Museum); Puu Paki swamp, mountains above Hana, Forbes no. 2682-M (B. P. Bishop Museum).

Peperomia erythroclada variety **picta,** new combination.

Peperomia Macraeana variety *picta* Hillebrand, Fl. Hawaiian Is., p. 421, 1888.

Stems, lower surface of the leaves, and petioles densely appressed hirtellous, hairs much shorter than in the typical form. Peduncles hirtellous or more commonly glabrate. Otherwise similar to the typical form.

Type, Maui, Waihee, Hillebrand, in the Berlin Herbarium.

Found on the island of Maui.

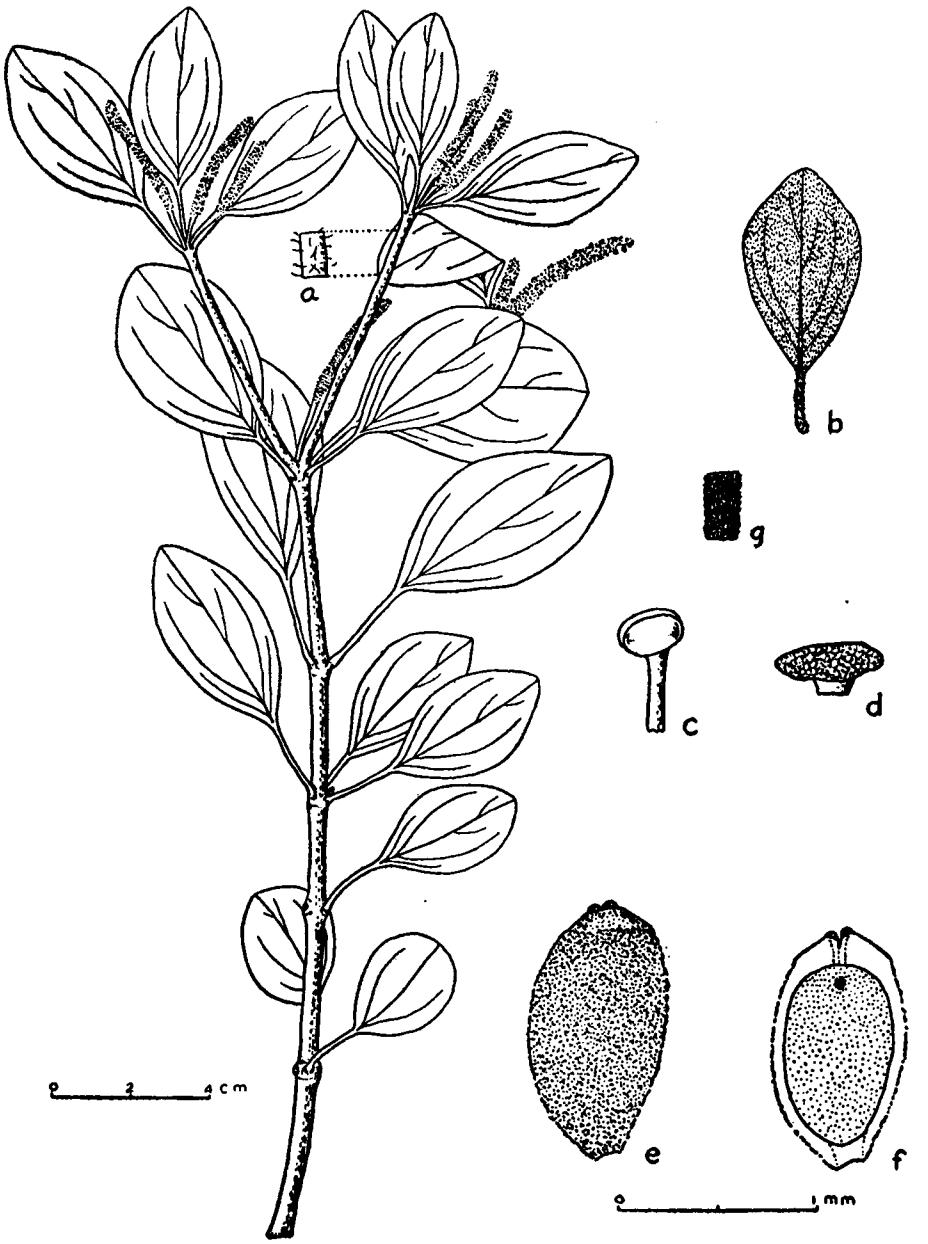

FIGURE 34.—*Peperomia erythroclada* C. deCandolle: *a*, section of stem, enlarged; *b*, leaf; *c*, stamen, enlarged; *d*, bract, enlarged; *e*, fruit; *f*, section of fruit; *g*, section of stem of variety *picta*.

Maui: Waihee, Hillebrand, type (Berlin); valley of Waihee, Hillebrand, Aug., 1870 (Berlin); Honokahau Drainage Basin, Forbes nos. 450-M, 514-M (B. P. Bishop Museum); along the trail to Puu Kukui, in wet forest, altitude 3000 to 5780 feet, Yuncker nos. 3539, 3540 (B. P. Bishop Museum); Haelaau, wooded ridge, altitude 3200 feet, St. John no. 10186 (B. P. Bishop Museum).

This species is distinguished by its commonly 5-plinerved, elliptic to obovate, and mostly opposite leaves. The short peduncles and mostly thick spikes are also noteworthy, although in variety *picta* these characters are not so conspicuous. It is closely related to *P. rigidolimba,* but differs from that species chiefly in the shape and arrangement of its leaves. The stem of what I take to represent a duplicate type of *P. obovatilimba* is more nearly glabrous than some of the other specimens included here. However, there is considerable variation in the degree of hirsuteness in the different specimens and inasmuch as *P. obovatilimba* agrees in other particulars with *P. erythroclada* I feel justified in including it here.

Hillebrand described the leaves of *P. Macraeana* variety *picta* as being "in young plants often alternate." This character has not been observed in any of the specimens examined. The appressed hirtellous condition of variety *picta* is in very marked contrast with the hirsute condition of the typical form.

35. Peperomia hypoleuca Miquel.

Peperomia hypoleuca Miquel, Syst. Pip., p. 136, 1845; Illustr. Pip., p. 21, pl. 17, 1844.

Stems erect or ascending from a decumbent, rooting base, up to 45 cm. long and 3 mm. thick at the base in dry specimens, simple or branching, glabrous to somewhat hirsute above, glabrous below, hairs up to 1 mm. long, internodes up to 8 cm. long, mostly 2 to 4 cm. long.

Leaves opposite or somewhat less commonly ternate, lower surface sparingly to moderately hirsute, light green or with red intercostal areas, upper surface glabrous excepting at the base or rarely along the nerves, darker green, elliptic-oblanceolate or obovate-spatulate, 1 to 3.5 cm. broad, 2 to 7 cm. long, mostly 2 to 2.5 cm. broad and 3 to 5 cm. long, 5-plinerved, the innermost pair of lateral nerves forking off the midrib within the lowermost 1 cm., apex more or less attenuate or rounded, acute or less commonly obtuse, base cuneate, petiole up to 2 cm. long, mostly about 1 cm. long, glabrous or somewhat hirsute, leaf scar semicircular, decurrent, forming longitudinal internodal ridges, bundle scars 3.

Spikes axillary and terminal, up to 9 cm. long, moderately to densely flowered; peduncle 1 to 2 cm. long, glabrous or less commonly somewhat hirsute; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments longer than the ellipsoidal anthers, ovary globose-ovoid, stigmas divided, essentially terminal, penicillate, fruit about 1 mm. long, globose-obovoid, stigmas divided and appearing slightly oblique, verrucose, viscid.

Type, "Sandwich Islands," Gaudichaud, October, in the Delessert herbarium.

Known from the islands of Hawaii and Oahu.

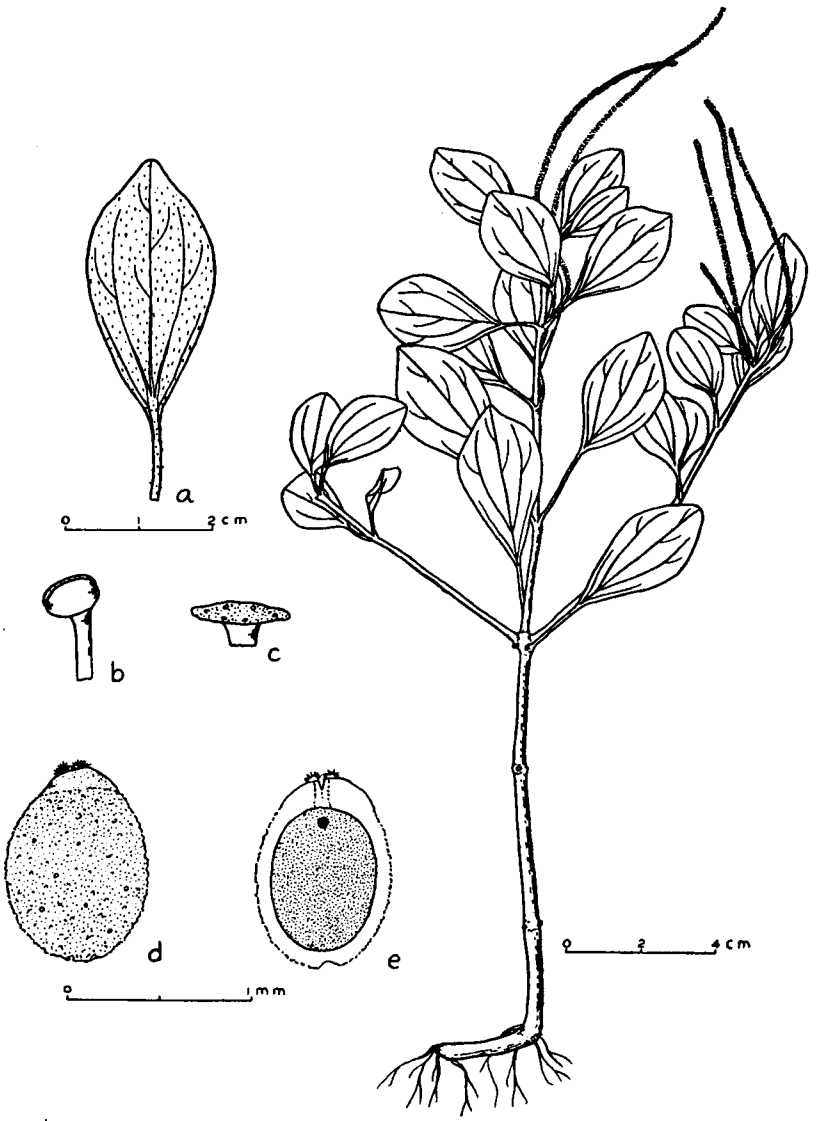

FIGURE 35.—*Peperomia hypoleuca* Miquel: *a*, leaf; *b*, stamen, enlarged; *c*, bract, enlarged; *d*, fruit; *e*, section of fruit.

Hawaii: forest of Kilauea Volcano, Rock, July, 1911 (B. P. Bishop Museum); Kilauea, Degener no. 2430 (Degener); between Glenwood and 29-Miles, Wiebke no. 3790 (Degener); near Thurston lava tube, Kilauea, Yuncker no. 3538 (B. P. Bishop Museum); Anuhea golf course, Kilauea, on ground in deep forest, Iwasaki no. 3883 (Degener); near Kalapana, on ground in moist woods, Degener no. 3785 (Degener, Illinois); between Ohia and Koa mills opposite road leading to Hoopuloa, on ground in damp forest, Degener, Pohina, and Iwasaki no. 3889 (Degener); along trail northwest of 27 milepost, Kilauea, on moss either on trees or ground in wet dark jungle, Degener and Iwasaki no. 3806 (Degener); near Napau Crater, on moss-covered trees and ground, Degener, Iwasaki, Bartram, and Brumaghim no. 3882 (Degener).

Oahu: Hillebrand's Glen, Forbes, September 24, 1908 (B. P. Bishop Museum).

Peperomia hypoleuca variety **pluvigaudens**, new combination.

? *Peperomia insularum* variety *glabrata* C. deCandolle, in DC Prodromus, vol. 16, pt. 1, p. 444, 1869.

Peperomia pluvigaudens C. deCandolle, Bull. Coll. Hawaii no. 2, p. 37, 1913.

Plants entirely glabrous. Otherwise as in the typical form.

Type, Hawaii, Mt. Kohala [Kohala Mountains], west of Honokanenui gulch, dense rain forest, altitude 4000 feet, Rock no. 8365, in the deCandolle herbarium.

Found in the region of the Kohala Mountains on the island of Hawaii, and perhaps also on the island of Oahu.

Hawaii: Kohala, mountains west of Honokanenui gulch, dense rain forest, altitude 4000 feet, Rock no. 8365-b, duplicate type (B. P. Bishop Museum); Holokaiea gulch, Waimea, Rock no. 4420—misprinted (?) as 4430 in Bull. Coll. Hawaii no. 2, p. 37—(B. P. Bishop Museum).

DeCandolle described *P. hypoleuca* with single subapical stigmas and *P. pluvigaudens* with two apical stigmas, a distinction which I have been unable to verify. I find the stigmas of all of the specimens examined to be terminal or slightly subterminal and commonly divided.

There is considerable variation in the degree of pubescence present in the specimens included under *P. hypoleuca*. As far as I can discover, *P. pluvigaudens* differs only in being entirely glabrous.

The type specimen of *P. insularum* variety *glabrata* C. deCandolle, in Kew herbarium, is mixed on the sheet with small specimens of some pubescent species. So far as can be determined from the meager material, however, it is the same as variety *pluvigaudens*. An immature specimen in Bernice P.

Bishop Museum collected on the ridge at Kalihi, Oahu, by Hume (no. 167) also appears to be this variety.

In its less hirsute stems, somewhat less coriaceous, and more generally opposite leaves *P. hypoleuca* differs from *P. rigidolimba.* The larger, plinerved leaves distinguish variety *pluvigaudens* from *P. hawaiensis.*

36. Peperomia hawaiensis C. deCandolle.

Peperomia hawaiensis C. deCandolle, Bull. Coll. Hawaii, no. 2, p. 14, 1913.

Peperomia nudipeduncula C. deCandolle, Bull. Coll. Hawaii, no. 2, p. 28, 1913.

Stems more or less flexuous, ascending from a repent base, up to 25 cm. long and 3 mm. thick in dry specimens, divaricately branching upwards, glabrous, internodes up to 8 cm. long, mostly 1 to 3 cm. long.

Leaves opposite or whorled, green above, light green beneath, ciliated towards the apex, otherwise glabrous, elliptic-obovate or oblanceolate, 1.2 to 2 cm. broad, 1.5 to 4 cm. long, palmately 3-nerved or 5-nerved, or rarely subplinerved, the outer pair of nerves slender and more or less obscure, apex somewhat attenuately acute, or rounded and obtuse, base cuneate; petiole up to 1 cm. long, glabrous, leaf scar semicircular or crescent shaped, bundle scars 3.

Spikes axillary and terminal up to 6 cm. long, moderately to loosely flowered; peduncle about 1 cm. long, glabrous; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; filaments longer than the ellipsoidal anthers; ovary globose-obovoid, apex slightly oblique, stigma single or divided, slightly subterminal; fruit 1 mm. long, ovoid or subobovoid, verrucose, viscid, on pseudopedicels.

Type, Hawaii, Holokaiea gulch, altitude 3200 feet, Rock no. 4424, in the deCandolle herbarium, duplicate type in Bernice P. Bishop Museum.

Found on the island of Hawaii.

Hawaii: Faurie no. 167, type of *P. nudipeduncula* (deCandolle); Holokaiea Gulch, rain forest, altitude 3200 feet, Rock nos. 4424—duplicate type, 4622 (B. P. Bishop Museum); near Glenwood, Rock and Hashimoto no. 17173 (B. P. Bishop Museum); Rock no. 16034 (B. P. Bishop Museum); Kipukas in 1855 flow below Halealoha, Forbes no. 760-H (B. P. Bishop Museum); Wahikalai, Forbes no. 417-H (B. P. Bishop Museum); mountains behind Pahala, Kau, Forbes no. 416-H, in part (B. P. Bishop Museum); Kohala Mountains, Waimea, Forbes no. 482-H (B. P. Bishop Museum); between Glenwood and Kau, Degener and Wiebke no. 3787 (Degener, Illinois).

Only a few spikes in poor condition were present on the specimens examined, and the description and sketch of the matured fruit was taken from one discovered on Faurie's no. 167, the type of *P. nudipeduncula.* DeCandolle separated *P. hawaiensis* from *P. nudipeduncula,* on the basis of leaf arrangement and size, but I find both opposite and whorled leaves on each of the types as well as a considerable variation in the leaf size, nor am I able to otherwise distinguish them.

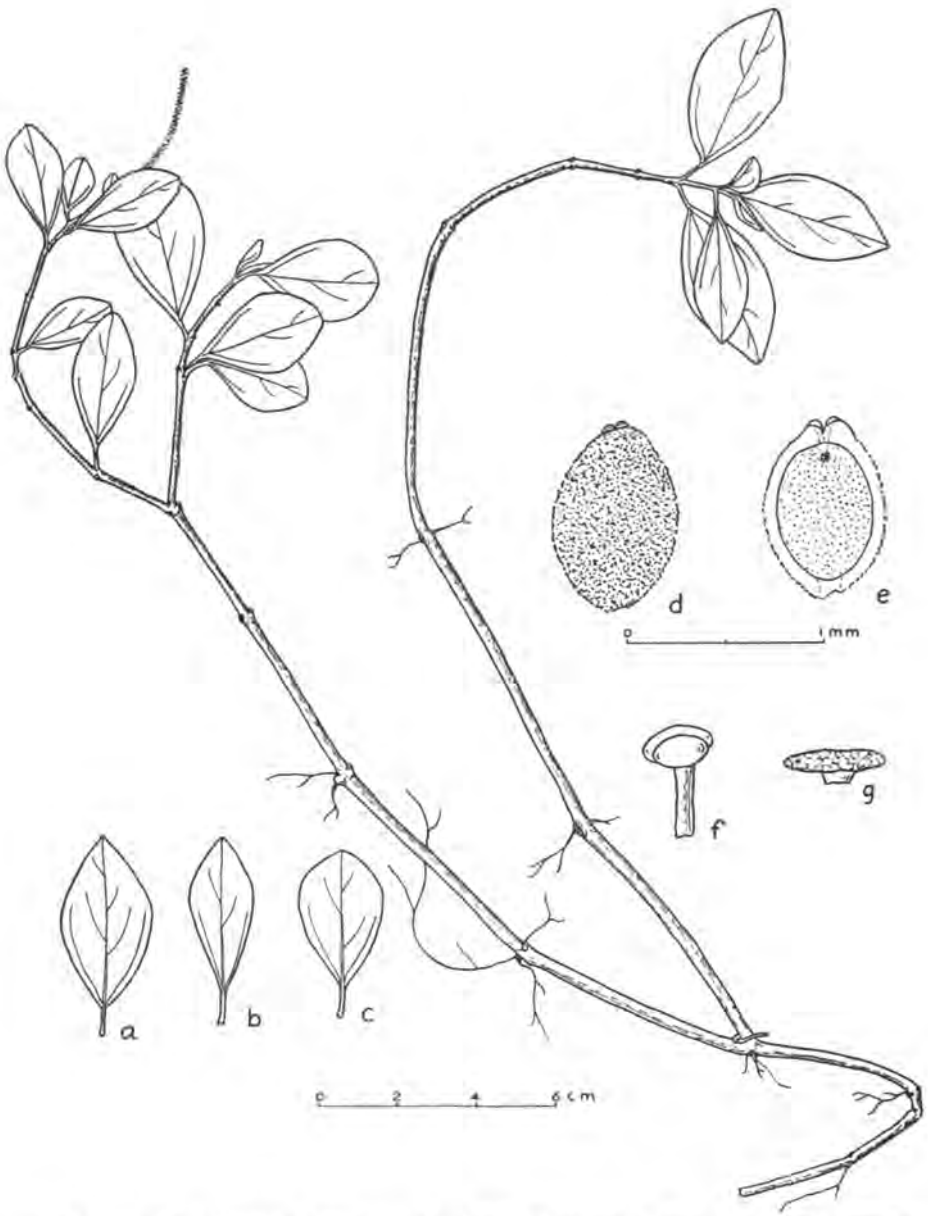

FIGURE 36.—*Peperomia hawaiensis* C. deCandolle: *a-c*, leaves; *d*, fruit; *e*, section of fruit; *f*, stamen, enlarged; *g*, bract, enlarged.

Rock's nos. 16034 and 17173 are more erect and 'twiggy" plants and with some leaves sub-plinerved, but in other respects they appear to belong here.

The species *P. hawaiensis* resembles *P. hypoleuca* variety *pluvigaudens,* but differs from it chiefly in the smaller size of the plants, smaller size and mostly palmate nerving of the leaves. From *P. hypoleuca,* to which it also bears some resemblance, it is to be distinguished by its entirely glabrous condition. More abundant fruiting materials may show that this species more properly belongs in the subgenus *Sphaerocarpidium.* However, from the materials which I have been able to examine, it appears to belong here.

37. **Peperomia Hesperomannii** Wawra.

Peperomia Hesperomannii Wawra, Flora, vol. 58, p. 227, 1875.

Peperomia Macraena variety *nervosa* Hillebrand, Fl. Hawaiian Is., p. 421, 1888.

Peperomia hypoleuca variety *kauaiensis* Hillebrand, Fl. Hawaiian Is., p. 422, 1888.

Peperomia Hochreutineri C. deCandolle, Ann. Cons. Bot. Genève, vols. 15, 16, p. 234, 1911 and 1912.

Peperomia kauaiensis C. deCandolle, Bull. Coll. Hawaii no. 2, p. 15, 1913.

Peperomia nervosa C. deCandolle, Bull. Coll. Hawaii no. 2, p. 34, pl. 5, 1913.

Peperomia dilobostigma C. deCandolle, Candollea, vol. 1, p. 385, 1923. As synonym only, in index.

Stems ascending from a repent base, more or less flexuous, up to 50 cm. long and 1 cm. thick at the base in fresh specimens, up to 0.5 cm. thick when dry, simple or divaricately branching, glabrous, internodes mostly 2 to 4 cm. long, rarely up to 8 cm. long.

Leaves opposite or more commonly whorled, marginally ciliated towards the apex, otherwise glabrous, green above, lighter colored beneath, not uncommonly with red intercostal areas on the lower surface, drying coriaceous and opaque, margins revolute, impressed along the nerves, elliptic-lanceolate or oblanceolate, rarely oval-obovate or elliptic, 0.6 to 2.3 cm. broad, 3 to 8 cm. long, mostly 1 to 1.5 cm. broad and 3.5 to 6 cm. long, 3-plinerved or large leaves 5-plinerved, the midrib forking in the lowermost 1 cm., apex subattenuate, acute, or more rarely rounded, base cuneate or acute; petiole 0.4 to 2 cm. long, mostly about 1 cm. long, glabrous, leaf scar semicircular, bundle scars 3, the middle one generally larger than the two lateral scars.

Spikes axillary and terminal, solitary or commonly several, up to 8 cm. long, but mostly somewhat shorter, moderately to loosely flowered; peduncles 1 to 2 cm. long, glabrous; rachis glabrous; bracts round, peltate, about 0.5 mm. broad; anthers ellipsoidal, filaments short; ovary globose-obovoid; stigmas 2, apical, penicillate; fruit about 1 mm. long, obovoid, somewhat pointed at the apex, verrucose, viscid, on pseudopedicels.

Type, "Kauai; am Waialeale bei 6000," (5080 feet), Wawra no. 2156, in the Museum of Natural History herbarium, Vienna.

Found in the wet forests of central Kauai, mostly above an altitude of 2000 feet.

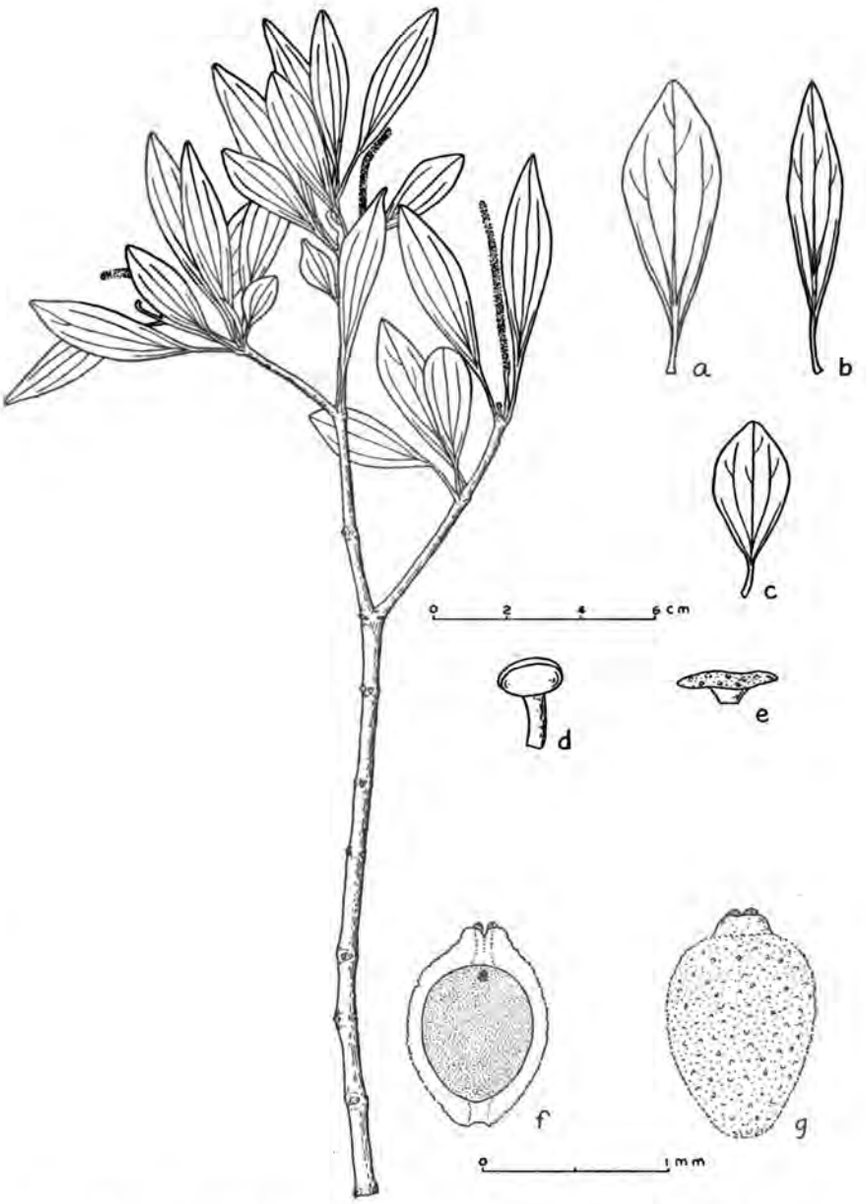

FIGURE 37.—*Peperomia Hesperomannii* Wawra: *a-b*, leaves; *c*, leaf of variety *brevifolia*; *d*, stamen, enlarged; *e*, bract, enlarged; *f*, section of fruit; *g*, fruit.

Kauai: Wawra no. 2156, type (Vienna); Knudsen, type? of *P. hypoleuca* variety *kauaiensis* (Berlin); Hanapepe, Faurie no. 100, type of *P. kauaiensis* (deCandolle); Na Pali-Kona Forest Reserve, Kumuweia Ridge, 3700 feet altitude, Yuncker no. 3372 (B. P. Bishop Museum); along trail near Kilohana lookout, altitude 3500 feet, Yuncker nos. 3373, 3396, 3602 (B. P. Bishop Museum); Alakai swamp, altitude 3700 to 4000 feet, Yuncker nos. 3374, 3375, 3376, 3377 (B. P. Bishop Museum); Forbes no. 1157-K (B. P. Bishop Museum); Halemanu, Rock, Jan., 1920 (B. P. Bishop Museum); mountains near Waimea, altitude 4000 feet, Seale, April, 1900 (B. P. Bishop Museum); Waimea Drainage Basin, Forbes nos. 957-K, 960-K, 1105-K, 1106-K, 1107-K (B. P. Bishop Museum); on Kaholuamano [Kaholuamanu] above Waimea, Heller no. 2826, duplicate type of *P. nervosa* (U. S. National); Kaholuamanu, Rock nos. 2502, 17181, 17186 (B. P. Bishop Museum); Forbes no. 413-K (B. P. Bishop Museum); Hanalei-Kalihikai, woods along power line trail, St. John, Hosaka, Hume, Inafuku, Lindsay, Masuhara, Mitchell, and Wong no. 10950 (B. P. Bishop Museum); power line trail between Hanalei and Lihue, Forbes no. 139-K (B. P. Bishop Museum); Waimea, Kaloluamano [Kaloluamanu], Hochreutiner no. 3531, the type of *P. Hochreutineri* (deCandolle).

Peperomia Hesperomannii variety **brevifolia,** new name.

Peperomia kauaiensis forma *b* C. deCandolle, Bull. Coll. Hawaii no. 2, p. 16, 1913.

Leaves up to 1.5 cm. broad and 3.5 cm. long, mostly 1 to 1.5 cm. broad and 1.5 to 3 cm. long, elliptic, or oblanceolate to subobovate, rarely sublanceolate.

Type, Kauai, Kauhao, altitude 800 meters, Faurie no. 101, in the deCandolle herbarium.

Found in the Waimea Drainage Basin, Kauai.

Kauai: Kauhao, altitude 800 meters, Faurie no. 101, type of *P. kauiensis* forma *b* (deCandolle); Waimea Drainage Basin, Forbes nos. 957-K, 959-K, 1117-K, 1118-K, 1693-K (B. P. Bishop Museum); Kaholuamano [Kaholuamanu], Rock no. 17178 (B. P. Bishop Museum).

This species varies considerably in the size of the leaves and length of petioles and internodes. Wawra's no. 2156, the type, has very short petioles and leaves less than 1 cm. broad. Observation of a large number of plants in the field shows that the larger leaves predominate, although all intergradations in width from those more than 2 cm. wide down to the narrowest forms are not uncommon. I have been unable to discover any other difference which would distinguish Wawra's plant from the others included here.

DeCandolle described his *P. nervosa* from exceptionally large specimens and separated his *P. kauaiensis* and *P. Hochreutineri* from it on the basis of

stigma characters. Examination of the types of these species, however, shows that this distinction is untenable because all have divided stigmas, a character which he ascribed only to *P. nervosa.* A specimen in the herbarium at Berlin, collected by Knudsen and originally identified as *P. hypoleuca,* agrees in most particulars with Hillebrand's description of his *P. hypoleuca* variety *kauaiensis.* This specimen, however, is entirely glabrous, as are all the other specimens included here, and is not "almost glabrate, at most only faintly puberulous" as Hillebrand described it.

Faurie's no. 101, the type specimen of variety *brevifolia,* is similar to the typical form except for the shorter leaves. There is some question as to the advisability of distinguishing as different the specimens listed under this variety, inasmuch as specimens with leaves of intermediate size are not uncommon. However, some of the specimens with short and more or less elliptical leaves are considerably different in appearance from the typical form.

This species is limited to the island of Kauai in its distribution, where it is to be found forming clumps 6 to 10 or more feet across in the wet forests mostly above an altitude of 2000 feet. It is to be distinguished from other species by its entirely glabrous condition, the shape, venation and arrangement of the leaves, and the divided and apically placed stigmas.

38. Peperomia subpetiolata, new species.

Caules e basi breviter decumbente erecti adscentesve, usque ad 8 cm. longi, glabri. Folia 5-8-verticillata, glabra, lineari-lanceolata, usque ad 35 cm. lata, atque 16 cm. longa, 5-plinervia, apice sensim acuminata, basi cuneata, sessilia vel subsessilia, petiolis brevissimis latisque. Spicae terminalis axillaresque, usque ad 10 cm. longae; ovarium turbinatum; stigma apicale. Fructus non visus.

Stems erect, or ascending from a briefly decumbent and rooting base, up to 8 dcm. long and 7 mm. thick in dry specimens, unbranched, glabrous, internodes, 3 to 4 cm. long above, up to 12 cm. long below.

Leaves in whorls of 5 to 8, glabrous, linear-lanceolate, up to 3.5 cm. broad and 16 cm. long, 5-plinerved, the midrib forking in the lowermost 2 to 4 cm., apex attenuately acuminate, base cuneate, leaves essentially sessile or the blade forming wings along a very short petiole, leaf scar semi-elliptic, bundle scars 3.

Spikes terminal and axillary, up to 10 cm. long and 3 mm. thick, densely flowered; peduncle up to 3.5 cm. long, glabrous; rachis glabrous; bracts round, peltate, about 6 mm. broad; filaments longer than the ellipsoidal anthers; ovary turbinate, stigma apical, inconspicuous, (?) divided; fruit not seen.

Type, Maui, Kula pipe line, Waikamoi, Forbes no. 1283-M, in Bernice P. Bishop Museum.

Known only from eastern Maui.

Maui: Kula pipe line, Waikamoi, Forbes no. 1283-M, type (B. P. Bishop Museum); east Maui, Olinda, Kula pipe line, woods, altitude 4500 feet, St. John no. 10299 (B. P. Bishop Museum).

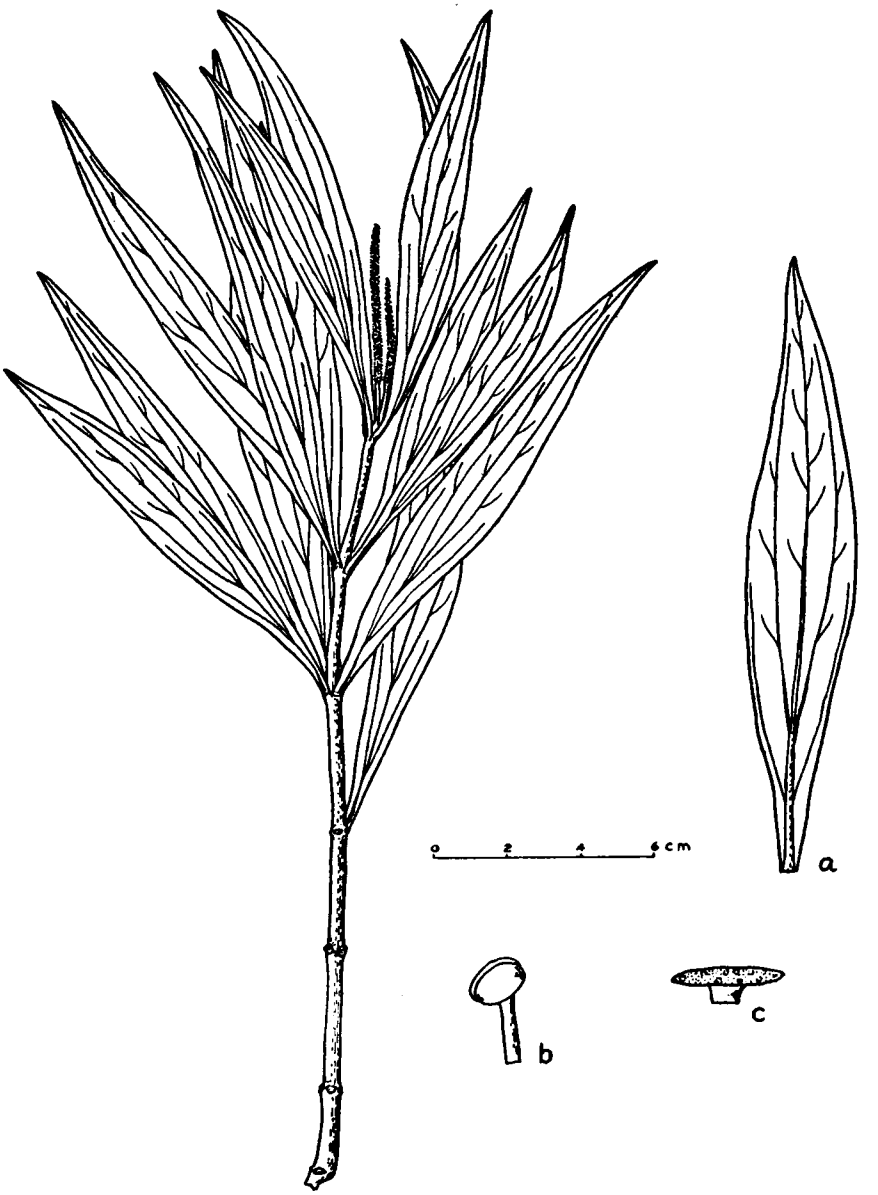

FIGURE 38.—*Peperomia subpetiolata* Yuncker: *a*, leaf; *b*, stamen, enlarged; *c*, bract, enlarged.

This is a very well marked species with the exceptionally elongated, whorled, and sessile or subsessile leaves. Neither of the two specimens examined bears matured spikes, but from dissections of those available it is evident that the stigma is terminal and appears to be divided.

Doubtful and Excluded Species

Peperomia parvula Hillebrand, Fl. Hawaiian Is., p. 426, 1888.

Hillebrand described this species as with small opposite to quaternate, orbicular to ovate-obtuse leaves and with short, whorled, and puberulous spikes. He says "only two specimens without label, mixed with *P. reflexa,* probably collected on the high ridge of Waiolani to the left of the pali of Nuuanu, Oahu."

I have been unable to locate these type specimens nor have I seen any other specimens with the combination of characters as described by Hillebrand. None of the Hawaiian species seen, excepting the pantropic *P. reflexa,* have rachides otherwise than entirely glabrous. It is possible that the specimens seen by Hillebrand represent a form of *P. reflexa.*

Peperomia fernandeziana Miquel, *P. blanda* Kunth, and *P. pallida* Dietrich, it is believed, do not occur in Hawaii.

KEYS TO SPECIES BY ISLANDS

Because it is often difficult or impossible to determine fruit characters on immature specimens it is believed that the following keys, which are based in the main on vegetative characters, will prove useful. A separate key is presented for the species as found on each island. It is to be expected, of course, that additional species may be discovered on any of the islands which will then necessitate the use of other keys.

Key to the Kauai Species

1. Rachis pubescent, leaves in whorls of 3 or 4, mostly fleshy, less than 2 cm. long ..... **1. P. reflexa**
1. Rachis glabrous
 2. Leaves commonly alternate below, mostly opposite or whorled above, rounded, obtuse, plants mostly 5 to 10 cm. tall ..... **5. P. latifolia**
 2. Leaves opposite or whorled
  3. Peduncles 2.5 to 6 cm. long, leaves mostly obovate, apex rounded, obtuse ..... **20. P. sandwicensis**
  3. Peduncles mostly less than 2 cm. long
   4. Plants entirely glabrous (leaves may be ciliated)
    5. Leaves 3- to 5-plinerved, stigmas apical, divided ..... **37. P. Hesperomanni**
    5. Leaves palmately 3- to 5-nerved, stigmas subapical, mostly single ..... **9. P. membranacea**
   4. Plants more or less hairy
    5. Plants finely hirtellous, hairs mostly less than 1 mm. long
     6. Plants mostly less than 20 cm. tall, leaves commonly opposite, articulate, apex obtuse or acutish, internodes mostly 1 to 2 cm. long... **16. P. leptostachya**
     6. Plants mostly much larger, leaves with acute to acuminate apex
      7. Leaves mostly 2 to 5 cm. broad ..... **15. P. Remyi**
      7. Leaves mostly less than 2 cm. broad ..... **13. P. kokeana**
    5. Plants hirsute, hairs up to 1 mm. long
     6. Leaves mostly ovate to ovate-elliptic ..... **18. P. Cookiana**
     6. Leaves narrowly elliptic to elliptic-lanceolate ..... **12. P. Helleri**

Key to the Oahu Species

1. Rachis pubescent, leaves in whorls of 3 or 4, mostly fleshy, less than 2 cm. long ..... **1. P. reflexa**
1. Rachis glabrous
 2. Leaves alternate
  3. Plant entirely glabrous (leaves may be ciliated) ..... **2. P. oahuensis**
  3. Plant more or less hairy ..... **5. P. latifolia**
 2. Leaves opposite or whorled
  3. Peduncles 2.5 to 6 cm. long, leaves mostly obovate, apex rounded, obtuse ..... **20. P. sandwicensis**
  3. Peduncles mostly less than 2 cm. long
   4. Plants entirely glabrous (leaves may be ciliated)
    5. Leaves 7 to 13 mm. broad, base rounded or shortly acute, plants less than 20 cm. tall ..... **7. P. koolauana**

5. Leaves and plants mostly much larger.....**9. P. membranacea**
4. Plants more or less hairy
5. Plants more or less completely hirtellous, hairs mostly less than 1 mm. long.
6. Plants mostly less than 20 cm. tall, leaves commonly opposite, articulate, leaves obtuse or acutish, internodes mostly 1 to 2 cm. long.....**16. P. leptostachya**
6. Plants mostly much taller, leaves commonly whorled, acute to acuminate, internodes mostly 4 to 6 cm. long.....**15. P. Remyi**
5. Plants more or less hirsute, hairs mostly up to 1 mm. long
6. Leaves 5-plinerved, elliptic-lanceolate, apex acute to acuminate.....**28. P. lilifolia**
6. Leaves not entirely as above
7. Leaves more or less rounded, palmately-nerved, apex rounded, lower leaves often alternate.....**5. P. latifolia**
7. Leaves not as above
8. Leaves elliptic-ovate or oval.....**17. P. ellipticibacca**
8. Leaves elliptic-oblanceolate or obovate-spatulate.....**35. P. hypoleuca**

Key to the Molokai Species

1. Rachis pubescent, leaves in whorls of 3 or 4, mostly fleshy, less than 2 cm. long.....**1. P. reflexa**
1. Rachis glabrous
2. Leaves alternate
3. Plants glabrous (leaves may be ciliated).....**3. P. alternifolia**
3. Plants more or less hairy
4. Leaves more or less hairy on the upper surface, mostly less than 1 cm. broad, plants delicate.....**4. P. Degeneri**
4. Leaves glabrous above excepting at the base or along the nerves, mostly larger, upper leaves commonly opposite or whorled, plants more robust.....**5. P. latifolia**
2. Leaves mostly opposite or whorled (may be alternate below in *P. latifolia*, *P. sandwicensis*, or in young seedling plants)
3. Peduncles mostly 2.5 to 6 cm. long, often equaling or exceeding the rachis, leaves mostly obovate to spatulate, apex rounded, obtuse
4. Leaves 3- to 5-plinerved, mostly 1 to 2 cm. broad and 1.5 to 2.5 cm. long, plants mostly 10 to 25 cm. tall.....**20. P. sandwicensis**
4. Leaves 1- to 3-nerved, in whorls of 3 to 5, mostly less than 1 cm. broad and 1.8 cm. long, plants mostly smaller.....**21. P. maulensis**
3. Peduncles much shorter, mostly not exceeding 2 cm.
4. Plants glabrous
5. Leaves 5-plinerved, stigmas abundantly penicillated.....**10. P. Forbesii**
5. Leaves mostly 3- to 5-palmately-nerved, stigmas commonly not penicillated.....**9. P. membranacea**
4. Plants more or less hairy
5. Leaves mostly 2 to 6 cm. broad and 4 to 10 cm. long
6. Leaves palmately nerved
7. Plants hirsute, apex of leaves rounded.....**5. P. latifolia**
7. Plants hirtellous, apex of leaves acute to acuminate.....**15. P. Remyi**
6. Leaves 5- to 9-plinerved
7. Midrib forking 1 to 2 cm. above the base, plant densely hirtellous.....**26. P. Macraeana**
7. Midrib forking mostly within the lowermost 1 cm., plants more or less hirsute

8. Leaves 7- to 9-plinerved, base rounded.....**29. P. Rockii**
8. Leaves 5- to 7-plinerved, base acute.....**28. P. lilifolia**

5. Leaves mostly smaller
6. Leaves less than 1 cm. wide, elliptic-oblong to elliptic-lanceolate, or oblanceolate, petioles mostly less than 3 mm. long
7. Leaves glabrous, stem sparingly hirtellous above.....**22. P. Fauriei**
7. Leaves more or less hairy
8. Leaves mostly less than 2 cm. long, hirtellous .....**6. P. ligustrina variety oopuolana**
8. Leaves mostly 2 to 4 cm. long, mostly hirsute.....**12. P. Helleri**

6. Leaves mostly wider, or if small not of above shape
7. Plants hirtellous, hairs mostly less than 1 mm. long
8. Leaves mostly opposite, oval-obovate, articulated, internodes mostly 1 to 2 cm. long.....**16. P. leptostachya**
8. Leaves mostly whorled, elliptic
9. Leaves less than 1 cm. broad, plants up to 15 cm. tall.....**11. P. Treleasei**
9. Leaves and plants much larger.....**18. P. cookiana variety pukooana**
7. Plants hirsute, hairs mostly up to 1 mm. long
8. Stigma subterminal, mostly single.....**18. P. Cookiana**
8. Stigma apical or but slightly subapical, commonly divided and more or less penicillate
9. Leaves mostly less than 2 cm. long, mostly 1-nerved.....**23. P. mapulehuana**
9. Leaves mostly exceeding 2 cm. in length, 3 to 5-nerved.....**33. P. expallescens**

Key to the Maui Species

1. Rachis pubescent, leaves in whorls of 3 or 4, mostly fleshy, less than 2 cm. long.....**1. P. reflexa**
1. Rachis glabrous
2. Leaves alternate
3. Plants glabrous.....**3. P. alternifolia**
3. Plants more or less hairy.....**5. P. latifolia**
2. Leaves opposite or whorled (may be alternate below in *P. latifolia*, *P. sandwicensis* or in young seedling plants)
3. Peduncles mostly 2.5 to 6 cm. long, often equaling or exceeding the rachis, leaves mostly obovate to spatulate, apex rounded, obtuse
4. Leaves 3- to 5-nerved, mostly 1 to 2 cm. broad and 1.5 to 2.5 cm. long, plants mostly 10 to 25 cm. tall.....**20. P. sandwicensis**
4. Leaves 1- to 3-nerved, in whorls of 3 to 5, mostly less than 1 cm. broad and 1.8 cm. long, plants mostly smaller.....**21. P. maulensis**
3. Peduncles much shorter, mostly not exceeding 2 cm. in length
4. Plants glabrous
5. Leaves less than 1 cm. broad, oblong to elliptic-lanceolate, or oblanceolate.....**6. P. ligustrina**
5. Leaves more than 1 cm. broad
6. Leaves mostly 5-plinerved
7. Leaves up to 16 cm. long, lanceolate, sessile or subsessile.....**38. P. subpetiolata**
7. Leaves much shorter, with petioles.....**28. P. lilifolia variety honokahauana**
6. Leaves palmately 3- to 5-nerved
7. Leaves up to 3.5 cm. broad and 5 cm. long, 3- to 5-nerved...**9. P. membranacea**
7. Leaves mostly about 1 to 2 cm. broad and 2 to 3 cm. long, palmately 3-nerved.....**8. P. globulanthera**
4. Plants more or less hairy
5. Leaves mostly more than 3.5 cm. long

6. Leaf apex obtuse to shortly acute, 3- to 7-plinerved within the lowermost 1 cm.
7. Apex of ovary oblique, stigma subapical, leaves elliptic, midrib forking about 5 mm. from the base....**14. P. trichostigma**
7. Apex of ovary not oblique, stigma terminal, divided
8. Leaves elliptic-oblong to subovate....**28. P. lilifolia variety obtusata**
8. Leaves elliptic to elliptic-obovate....**34. P. erythroclada**
6. Leaf apex acute to acuminate
7. Leaves palmately 3- to 5-nerved, hirtellous....**15. P. Remyi**
7. Leaves 5- to 11-plinerved
8. Plants densely hirtellous, leaves mostly 7-plinerved....**26. P. Macraeana**
8. Plants hirsute
9. Leaves 5- to 7-plinerved....**28. P. lilifolia**
9. Leaves 9- to 11-plinerved or subpinnately nerved
10. Leaf base rounded or shortly acute....**30. P. hirtipetiola**
10. Leaf base cuneate, leaves 10 to 13 cm. long....**27. P. kulensis**
5. Leaves mostly less than 4 cm. long
6. Leaves oval-orbicular, less than 1 cm. long, 4 to 5 cm. broad, spikes numerous, less than 1 cm. long....**19. P. waikamoiana**
6. Leaves mostly 1 cm. or more long, spikes mostly longer
7. Leaves 4 to 8 mm. broad, oblong to elliptic-lanceolate, or oblanceolate....**6. P. ligustrina variety oopuolana**
7. Leaves broader or not of above shape
8. Plants finely hirtellous, hairs less than 1 mm. long, leaves mostly opposite, articulated, internodes mostly 1 to 2 cm. long....**16. P. leptostachya**
8. Plants hirsute, leaves commonly whorled
9. Stigmas apical, divided, penicillate
10. Leaves mostly less than 2 cm. long....**24. P. oekana**
10. Leaves mostly exceeding 2 cm. in length....**33. P. expallescens**
9. Stigmas subterminal, apex of ovary oblique
10. Leaves mostly 3- to 5-plinerved, hairy above only at the base or along the nerves, spikes less than 4 cm. long....**17. P. ellipticibacca**
10. Leaves palmately 3- to 5-nerved, commonly hairy above, spikes commonly longer....**18. P. Cookiana**

Key to the Lanai Species

1. Rachis pubescent, leaves in whorls of 3 or 4, mostly fleshy, less than 2 cm. long....**1. P. reflexa**
1. Rachis glabrous
2. Leaves alternate
3. Plants entirely glabrous (leaves may be ciliated)....**3. P. alternifolia**
3. Plants more or less hairy....**5. P. latifolia**
2. Leaves opposite or whorled
3. Peduncles mostly 2 to 5 cm. long, leaves less than 1 cm. broad, more or less spatulate, apex rounded, obtuse....**21. P. mauiensis**
3. Peduncles mostly less than 2 cm. long, leaves much broader
4. Plants commonly less than 15 cm. tall, leaves more or less rounded, apex rounded, lower leaves often alternate....**5. P. latifolia**
4. Plants not as above
5. Leaves 9- to 11-pinnately or subplinerved, hirsute or pilose....**30. P. hirtipetiola**
5. Leaves palmately 3- to 7-nerved or plinerved
6. Leaves elliptic-lanceolate, apex acute to acuminate
7. Stems subappressed hirtellous, leaves palmately 3- to 5-nerved, hirtellous....**15. P. Remyi**

7. Stems hirsute or glabrous, leaves 5-plinerved, hirsute....**28. P. lillifolia**
6. Leaves mostly elliptic to elliptic-obovate, apex obtuse or acutish
7. Leaves elliptic, spikes about 1 mm. thick when dry, hairs on stem mostly less than 0.5 mm. long....**14. P. trichostigma**
7. Leaves elliptic to elliptic-obovate, spikes about 3 mm. thick when dry, hairs on stem up to 1 mm. long....**34. P. erythroclada**

Key to the Hawaii Species

1. Rachis pubescent, leaves in whorls of 3 or 4, mostly fleshy, less than 2 cm. long....**1. P. reflexa**
1. Rachis glabrous
2. Leaves commonly alternate below, mostly opposite or whorled above, rounded, obtuse....**5. P. latifolia**
2. Leaves opposite or whorled
3. Plants entirely glabrous (leaves may be ciliated)
4. Leaves 4 to 8 mm. broad....**6. P. ligustrina**
4. Leaves more than 1 cm. broad
5. Leaves 5-plinerved, 1.5 to 3 cm. broad, stems up to 50 cm. or more tall....**35. P. hypoleuca variety pluvigaudens**
5. Leaves palmately 3- to 5-nerved
6. Leaves elliptic-obovate or oblanceolate, apex obtuse to acutish, base cuneate....**36. P. hawaiensis**
6. Leaves oval to subovate or ovate-lanceolate, apex acute, base acute....**9. P. membranacea variety puukukuiana**
3. Plants more or less hairy
4. Plants finely hirtellous, hairs mostly less than 1 mm. long
5. Plants mostly less than 20 cm. tall, leaves commonly opposite, articulate, apex obtuse or acutish....**16. P. leptostachya**
5. Plants mostly much larger, leaves not as above
6. Leaves palmately 3- to 5-nerved, elliptic-lanceolate....**15. P. Remyi**
6. Leaves 5- to 7-plinerved
7. Leaves mostly 5-plinerved, the midrib forking within the lowermost 5 mm....**25. P. maunakeana**
7. Leaves mostly 7-plinerved, the midrib forking 1 to 2 cm. above the base....**26. P. Macraeana**
4. Plants hirsute, hairs mostly up to 1 mm. long
5. Leaves mostly less than 3.5 cm. long, plants mostly less than 30 cm. tall
6. Stigma 1, subapical, fruit globose-ovoid....**18. P. Cookiana**
6. Stigma divided, more or less apical, fruit narrowly obovoid or subturbinate....**33. P. expallescens**
5. Leaves mostly more than 3.5 cm. long, plants commonly much taller
6. Leaves 6 to 10 cm. long, 5- to 7-plinerved, elliptic subobovate....**31. P. cornifolia**
6. Leaves mostly less than 7 cm. long, 5-plinerved
7. Stems densely hirsute, especially above, leaves oblong-obovate...**32. P. rigidolimba**
7. Stems sparingly to moderately hirsute
8. Leaves elliptic-oblanceolate or obovate-spatulate, base cuneate....**35. P. hypoleuca**
8. Leaves elliptic to elliptic-lanceolate, base acute....**28. P. lillifolia**

LIST OF SPECIMENS OF PEPEROMIA STUDIED

Baker, R. J., Coulter, J. W., Yuncker, T. H.
12756: latifolia
12757: leptostachya
12760: latifolia
Bush, Wm.
4346: oahuensis
Christophersen, E.
3668: reflexa var. elongata
Christophersen, E., Hume, E. P.
1406: latifolia
Christophersen, E., Wilder, G. P., Hume, E. P.
1497: reflexa var. parvifolia
1498: latifolia
1530: reflexa
1535: reflexa
1589: sandwicensis var. robusta
Degener, O.
1569: leptostachya
2417: membranacea
2418: latifolia
2419: sandwicensis
2420: Cookiana
2429: leptostachya
2430: hypoleuca
2431: Cookiana
2432: leptostachya
2434: leptostachya
2435: reflexa var. parvifolia
2437: membranacea var. puukukuiana
2438: reflexa var. parvifolia
2439: reflexa var. parvifolia
2612: latifolia
2616: membranacea
2726: Cookiana var. pukooana
2727: Helleri
2895: Cookiana
2896: Cookiana var. pukooana
2955: Remyi
2989: reflexa var. parvifolia
2991: leptostachya
3539: membranacea
3782: Cookiana
3785: hypoleuca
3805: Cookiana
3807: membranacea var. puukukuiana
3808: Macraeana
4139: sandwicensis
4230: sandwicensis var. robusta
4231: leptostachya
4232: reflexa
4234: latifolia
4235: sandwicensis var. robusta
4267: leptostachya
4274: reflexa var. parvifolia
4275: oahuensis
4277: membranacea
4278: latifolia
4279: reflexa
4280: sandwicensis var. robusta
4282: reflexa
4283: latifolia
4285: latifolia
4287: latifolia
4288: leptostachya
4289: latifolia
4290: sandwicensis
4291: membranacea waimeana
4292: alternifolia
4293: Cookiana var. flavinerva
4294: sandwicensis var. robusta
4297: membranacea
4298, in part: leptostachya
4298, in part: sandwicensis
4356: reflexa
4844: membranacea
Degener, O., Brumaghim, E., Akau, E., Iwasaki, Y.
3899: reflexa var. parvifolia
Degener, O., Hirai, W.
4031: reflexa var. parvifolia
4032: latifolia
4033: membranacea
Degener, O., Iwasaki, Y.
3806: hypoleuca
3881: leptostachya
3884: leptostachya
Degener, O., Iwasaki, Y., Bartram, E., Brumaghim, E.
3882: hypoleuca
Degener, O., Kai, H.
4265: leptostachya
Degener, O., Krauss, N.
4296: membranacea
Degener, O., Kwon, M., Park, K. K.
4266: sandwicensis
Degener, O., Nitta, K.
3409: membranacea
3540: latifolia
Degener,O., Nitta, Y.
3897: Cookiana
Degener, O., Park, K. K.
4246: sandwicensis
4281: sandwicensis
4286: membranacea
4295: reflexa var. parvifolia
4354: latifolia
4355: reflexa
4357: latifolia
Degener, O., Park, K. K., Hirari, W.
4034: leptostachya
4035: oahuensis
4036: lilifolia var. nudilimba
4037: ellipticibacca
4039: leptostachya
Degener, O., Park, K. K. Nitta, Y.
4248: sandwicensis
4268: reflexa var. parvifolia
4272: membranacea
4273: reflexa
Degener, O., Park, K. K., Nitta, Y., Westgate, P.
4247: leptostachya
Degener, O., Pohina, O., Iwasaki, Y.
3887: latifolia
3889: hypoleuca
Degener, O., Rodrigues, H.
3536: membranacea
3538: sandwicensis
Degener, O., Rodrigues, H., Krauss, N.
3541: latifolia
3542: membranacea
3543: reflexa var. parvifolia
Degener, O., Swezey, O.
3803: Cookiana
3804: membranacea var. puukukuiana
Degener, O., Tam, A. A.
3545: latifolia
3546: leptostachya
Degener, O., Topping, D. L., Bush, W.
4233: reflexa
Degener, O., Westagte, P.
4270: latifolia
4271: oahuensis
Degener, O., Wiebke, H.
2390: Cookiana
2391: leptostachya
2392: Cookiana
2393: latifolia
2394: membranacea var. puukukuiana
2410: hirtipetiola var. longilimba
2411: latifolia
2412: mauiensis
2413: reflexa var. parvifolia
2415: Cookiana
2421: sandwicensis
2600: reflexa

2603: sandwicensis
2613: membranacea
2614: reflexa var. parvifolia
2615: latifolia
2618: Cookiana
2619: reflexa var. parvifolia
2620: Cookiana
2624: ligustrina
2625: mauiensis
2626: latifolia
2627: lilifolia var. nudilimba
2628: ligustrina var. oopuolana
2630: membranacea var. pu-ukukuiana
2631: reflexa
2632: reflexa var. parvifolia
2633: Cookiana
2634: reflexa
2635: leptostachya
2636: membranacea var. pu-ukukuiana
2638: Cookiana
2640: Cookiana
2641: reflexa
2642: Cookiana
2728: latifolia
2730: expallescens
2731: Cookiana
2732: Cookiana var. flavinerva
2733: lilifolia var. nudilimba
2734: Cookiana
2735: Cookiana
2736: Cookiana var. flavinerva
2737: Cookiana var. flavinerva
2738: reflexa var. parvifolia
2739: latifolia
2740: Cookiana
2741: Cookiana
2743: Cookiana
2757: leptostachya
2758: expallescens
2759: membrancea var. waimeana
2761: expallescens
2762: Cookiana var. flavinerva
2763: Cookiana
2764: Cookiana
2765: Cookiana var. flavinerva
2766: Cookiana
2841: leptostachya
2842: lilifolia var. nudilimba
2843: Treleasei
2845: expallescens
2846: lilifolia
2847: Cookiana
2848: latifolia
2849: Cookiana
2850: Cookiana
2873: Treleasei
2874: reflexa
2875: latifolia
2876: reflexa
2878: Cookiana var. ovatilimba
2879: Cookiana
2880: Helleri
2897: lilifolia var. nudilimba
2898-a: Cookiana var. flavinerva
2898-b: Cookiana var. flavinerva
2954: latifolia
2982: reflexa var. elongata
2984: leptostachya
2990: leptostachya
2993: Remyi
2996: reflexa
2997: leptostachya
3055: sandwicensis
3061: Degeneri
3062: mauiensis
3063: sandwicensis
3065: alternifolia
3066: ligustrina var. oopuolana
3067: leptostachya
3787: hawaiensis
Didrichsen, D.
3432: sandwicensis
Diell, J.
53: leptostachya
Faurie, U.
100. Hesperomannii
101: Hesperomannii var. brevifolia
102: mauiensis
103: mauiensis
108: Fauriei
109: mapulehuana
110: mauiensis
114: Remyi
115: Remyi
117: Helleri
119: Cookiana var. pukooana
120: Cookiana var. pukooana
121: Cookiana
124: Cookiana var. flavinerva
127: maunakeana
129, in part: lilifolia
130: Macraeana
133: Cookiana
134: reflexa
135: reflexa
151: leptostachya
152: leptostachya
154: leptostachya
156: leptostachya
158: Cookiana
159: latifolia
163: Remyi
164: Rockii
166: leptostachya
167: hawaiensis
169: Cookiana
Forbes, C. N.
1-H: Cookiana
50-Mo: latifolia
64-K: Helleri
76-L: reflexa
87-K: membranacea var. brevifolia
101-M: hirtipetiola
105-M: latifolia
110-K: latifolia
135-M: mauiensis
136-M: mauiensis
139-K: Hesperomannii
159-Mo: lilifolia var. nudilimba
160-Mo: expallescens
161-Mo: expallescens
174-Mo: reflexa var. parvifolia
198-M: Cookiana
216-H: Cookiana
230-K: Cookiana
251-M: erythroclada
247-M: latifolia
260-H: reflexa var. parvifolia
273-Mo: Rockii
274-Mo: Treleasei
275-Mo: lilifolia
276-Mo: Forbesii
299-Mo: mauiensis
301-Mo: latifolia
302-Mo, in part: ligustrina var. oopuolana
302-Mo, in part: alternifolia
318-L: latifolia
329-K: Helleri
333-L: reflexa
337-L: reflexa var. parvifolia
338-L: trichostigma
360-L: trichostigma
363-L: Remyi
367-Mo: Remyi
413-K: Hesperomanni
416-H, in part: Macraeana
416-H, in part: hawaiensis
417-H: hawaiensis
450-M: erythroclada var. picta
451-M: lilifolia var. honokahauana
452-M: lilifolia var. honokahauana
454-M: Cookiana var. flavinerva
455-M: mauiensis
471-M: eekana
482-H: hawaiensis
487-M: Remyi
514-M: erythroclada var. picta
515-M: hirtipetiola var. longilimba
580-Mo: sandwicensis

583-K: latifolia
586-K: latifolia
657-H: Macraeana
681-H: Macraeana
681-M: eekana
699-K: latifolia
716-K: leptostachya
717-H: Cookiana
734-M: Cookiana
760-H: hawaiiensis
766(a)-H: Cookiana var. minutilimba
779-M: reflexa var. pavifolia
858-M: globulanthera
952-K: Helleri
953-K: reflexa
954-K: Helleri
955-K: latifolia
956-K: Helleri var. grossa
956-M: expallescens var. brevipilosa
957-K: Hesperomannii var. brevifolia
958-K: Hesperomannii
959-K: Hesperomannii var. brevifolia
960-K: Hesperomannii
970-M: globulanthera
974-H: Cookiana
982-H: Cookiana
1044-M: globulanthera
1046-M: expallescens
1067-K: Helleri
1068-K: reflexa
1069-K: kokeana
1078-M: globulanthera
1105-K: Hesperomannii
1106-K: Hesperomannii
1107-K: Hesperomannii
1108-K: membranacea var. waimeana
1109-K: latifolia
1116-K: Helleri var. subovata
1116-M: Cookiana var. ovatilimba
1117-K: Hesperomannii var. brevifolia
1118-K: Hesperomannii brevifolia
1119-K: Helleri var. Knudsenii
1125-M: Cookiana var. ovatilimba
1157-K: Hesperomannii
1279-M: hirtipetiola var. longilimba
1280-M: waikamoiana
1283-M: subpetiolata
1417-O: koolauana
1441-O: latifolia
1683-M: hirtipetiola
1691-M: hirtipetiola
1693-K: Hesperomannii var. brevifolia
1694-K: Helleri var. Knudsenii
1704-M: ligustrina
1706-O: oahuensis
1727-M: latifolia
1745-M: hirtipetiola
1749-M: hirtipetiola
1767-M: leptostachya
1782-O: reflexa
1832-M: Cookiana
1854-O: membranacea
1891-M: Cookiana
1907-M: leptostachya
1942-M: expallescens var. brevipilosa
1950-M: leptostachya
1951-M: leptostachya
1952-O: leptostachya
1958-O: latifolia
1974-M: reflexa var. parvifolia
2027-O: reflexa
2106-O: sandwicensis
2108-O: sandwicensis
2109-O: membranacea
2140-M: Cookiana
2178-M: leptostachya
2209-O: oahuensis
2381-M: mauiensis
2408-M: Remyi
2461-M: Cookiana
2462-M: Remyi
2507-M: lilifolia var. nudilimba
2516-M: erythroclada
2526-O: sandwicensis
2545-M: erythroclada
2590-M: Cookiana
2645-M: hirtipetiola var. longilimba
2657-M: erythroclada
2682-M: erythroclada

Forbes, C. N., Cooke, C. M., Jr.
5-M: eekana
27-M: mauiensis

Fosberg, F. R.
8686: latifolia
8694: ellipticibacca
8760: latifolia
8764: latifolia
8956: ellipticibacca
8974: latifolia
8997: membranacea
9030: reflexa var. elongata
9117: reflexa var. parvifolia
9268: leptostachya
9294: leptostachya
9299: reflexa
9310: reflexa

Fosberg, F. R., Duker, K.
8781: latifolia
8870: leptostachya
8872: leptostachya
9029: leptostachya
9033: leptostachya
9040: leptostachya

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