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Tales of Two Cultures: Traditional Historical and Archaeological Interpretations of Hawaiian Prehistory

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ABSTRACT

The relationships of archaeological and traditional historical evidence to accounts of Hawaiian prehistory are explored. The history of archaeological research in Hawai'i is divided into 4 periods: the Traditional Survey period (1900–20); the Empirical Survey period (1920–50); the Traditional Excavation period (1950–66); and the Empirical Excavation period (1966–present). Periods are defined by the dominant type of archaeological data collected and the accepted source, either archaeological or traditional historical, for the prehistoric sequence. Sources of tension between archaeological and traditional historical approaches to reconstructing Hawaiian prehistory in the Empirical Excavation period are traced to methodological problems that archaeologists of the Traditional Excavation period were unable to solve. It is concluded that there is no scientific reason to reject the use of traditional historical evidence in either the formation of archaeological hypotheses or accounts of Hawaiian prehistory.

INTRODUCTION

Questions concerning the proper relationships of archaeology[2] and traditional history[3] to prehistory[4] divide the community of scholars who study the past of Hawai'i. This division—expressed most clearly in opinions on the importance of culture contact in social and cultural change—is greatest between traditional historical and recent archaeological interpretations of Hawaiian prehistory, but splits the archaeological community as well.

The traditional historical case for the importance of culture contact revolves around a period of 2-way voyaging between Hawai'i and Kahiki in the early centuries of this millennium and the arrival in Hawai'i of Pa'ao, a priest, chief, navigator, and magician from the Society Islands, who became the progenitor of the priestly line that presided over Hawaiian religion until 1819 (Stokes 1928). Though Pa'ao's accomplishments in Hawai'i are variously interpreted, he is generally credited with establishing, through Pili Ka'ai'ea, the line of chiefs that ruled the island of Hawai'i until 1893, and with introducing a new religion, thus altering the evolution of social and political institutions in a decisive and revolutionary way.

The positions of contemporary archaeologists on the nature and effects of culture contact

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[2] *Archaeology* refers to the study of human and cultural material remains, excluding written records (cf. Rouse 1972; Dunnell 1971).

[3] *Traditional history* refers to the culture-bound oral record of earlier generations. In Hawai'i, as in much of the rest of the world, traditional historical records are set in a genealogical framework. The challenges faced by scholars who attempt to interpret traditional historical materials in a chronological framework are detailed by Vansina (1965).

[4] *Prehistory* refers to the study of social and cultural change before the advent of written records.

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Table 1. Periods of archaeological research in Hawai'i.

Period	Sequence Source	Data Collection	Dates
Traditional Survey	Tradition	Site survey	1900–20*
Empirical Survey	Archaeology	Site survey	1920–50**
Traditional Excavation	Tradition	Excavation	1950–66***
Empirical Excavation	Archaeology	Excavation	1966–present†

* Major sources for this period include Stokes (in press) and Thrum (1906–08).

** Results of the Empirical Survey period are published in Emory (1921, 1924, 1928), Bennett (1931) and McAllister (1933a, b).

*** The primary published works from this period are Emory and Sinoto (1961), Emory, Bonk and Sinoto (1968 [1959]), and Wallace and Wallace (1969).

† Most of the information yielded by research during the Empirical Excavation period is contained in unpublished reports prepared under contract to private and public land developers (see Spriggs & Tanaka 1988). The best review of this research is Kirch (1985).

run the gamut. At one extreme are archaeologists who reject the idea that culture contact took place in Hawai'i's past (Tuggle 1979, Cordy 1974a, 1981: 206). In this view, the "theme of Hawaiian prehistory [is] the human use of an *isolated* and bounded environment, which resulted in the culture encountered by Europeans in 1778" (Tuggle 1979: 167, italics mine). Hawaiian traditions, with their claims for significant change resulting from culture contact, are not historical records at all, but "external justification for internal consolidation of elite power" (Tuggle 1979: 189). The major changes in Hawaiian prehistory are "viewed as adaptation in *isolation*, an elaboration of a cultural pattern through *local* social group interaction within a particular environment" (Tuggle 1979: 195, italics mine). A somewhat more moderate position accepts linguistic, archaeological, and traditional historical data for culture contact, but discounts the influence that Pa'ao and other southern immigrants may have had on Hawaiian culture. Acknowledging that "the new arrivals might have been well received by the local population, and even accorded the status of chiefs," this position concludes that "their influence on the course of Hawaiian cultural development was unlikely to have been great" (Kirch 1985: 305). At the other extreme, the paucity of archaeological data that bear on the problem of culture contact and its effects on Hawaiian culture is acknowledged, and the traditional historical record is accepted as a hypothesis to guide future archaeological research (Hommon, ms.).

This paper presents a short history of the relationship between traditional history—especially accounts of 2-way voyaging and its effects on Hawaiian society—and archaeological practice in Hawai'i. Its goal is to outline the historical background for a possible synthesis, in which archaeological research and traditional historical interpretations of prehistoric social change would ask questions of and enrich each other. Four periods of archaeological research in Hawai'i are distinguished on the basis of the dominant type of archaeological data collected and the accepted or prescribed source for the prehistoric sequence (Table 1).

The Traditional Survey Period

A research design for Hawaiian archaeology was first formulated at Bishop Museum near the end of the 19th century. William T. Brigham, Bishop Museum's first director, and Thomas G. Thrum, a Honolulu publisher with a strong interest in Hawai'i's past, were convinced by the accounts of Hawaiian traditional historians that Hawaiian prehistory could be divided into 2 great epochs, each characterized by its own peculiar form of temple foundation. The primary source for this sequence was Abraham Fornander's *An account of the Polynesian race*, published in 3 volumes between 1878 and 1885.[5] Fornander, who had been a resident of the Hawaiian Islands since 1847 and was married to Pinao Alanakapu, an *ali'i* of Moloka'i Island, spoke the Hawaiian language fluently and was a forceful spokesman for native rights throughout his life. He wrote the *Polynesian Race* to show "that the Hawaiians had a history of their past, and a history worth preserving," for he believed that "no nation can go forward that has no past at its back" (1969 [1878–85], II: 349).

In the 1st and 3rd volumes of *The Polynesian Race* Fornander explores the backdrop to Hawaiian history by using ethnographic and linguistic data to reconstruct the history of the Polynesian peoples. Rife with speculation and modeled on Old Testament historiography, the conclusions offered in the 2 volumes are mostly of no more than passing historical interest.

The 2nd volume presents a detailed history of the Hawaiian Islands from the time of their first settlement, during the 5th century A.D., to Kamehameha's victory at Nu'uanu in 1795. It was based on an extensive collection of oral historical material[6] and is altogether different from the 1st and 3rd volumes. Since Hawaiian traditions were kept by "five or more equally independent rival factions," Fornander reasoned that sufficient cross-checking would ensure reliability (cf. Vansina 1965: 114ff.). In his view, the "critical canon which refuses to build up history from tradition, and receives nothing but contemporary writers or monumental records as evidences of fact seems . . . more nice than wise under certain circumstances." (Fornander 1919–20: 239)

Fornander could learn little of Hawai'i's first settlers, whose works Fornander referred to the Nanaulu period of Hawaiian history (Fig. 1). The "din and stir" of the 2-way voyaging period, when the traditions and genealogies of Hawai'i's first settlers were supplanted by those of the southern immigrants, left Fornander with little to study from the Nanaulu period. From scattered references he concluded that Nanaulu period society was fairly simple, with a system of government that "was more of a patriarchal than of a royal nature." The people were not burdened by excessive *kapu*, and religious activities centered on worship of the god Kane at various *pohaku a Kane* and in relatively "easy" ceremonies at a "truncated pyramidal form" of temple. Human sacrifice was unknown.

The 11th century[7] saw the start of a period of intensive 2-way voyaging between Hawai'i and Polynesian island groups to the south. The southern immigrants worshipped an expanded pantheon of deities (1969 [1878–85], II: 59ff.) and sacrificed humans inside walled temples where complex ceremonies were shielded from public view. Society became divided into classes whose genealogical bonds were ruptured through endogamy of the chiefly class. Fornander believed that the idea of an island sovereign, or *mo'i*, grew up at this time, and that as the body of the chief became increasingly sacred the *kapu* multiplied and transgressions against them were punished with increasing severity.

Brigham's and Thrum's archaeological research program was designed to gather data on the history of the transition from the Nanaulu-period "truncated pyramidal" temple form to the walled temple form introduced by Pa'ao, and thus to gain perspective on the social change that swept through the islands many centuries ago and to add detail to the traditional historical record. At the turn of the century Brigham took Bishop Museum assistant John F.G. Stokes to Wahaula Heiau at Puna on Hawai'i Island, the traditional site of the first walled temple established in Hawai'i by Pa'ao. In one of the first detailed archaeological investigations in Hawai'i, they measured the ruins, recorded construction techniques, and collected pebbles from the site with which to build a scale model of the *heiau* for display in Hawaiian Hall at Bishop Museum.

In 1906 Hawai'i's first major archaeological project began when Brigham sent Stokes to Hawai'i Island in search of temple remains from the Nanaulu period. Stokes's task was to make

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[5] Fornander's *An account of the Polynesian race* was reprinted in a single volume by Tuttle in 1969. References here are to this widely available edition.

[6] This material was eventually published by Brigham and Thrum (see Fornander 1916–17, 1918–19, 1919–20).

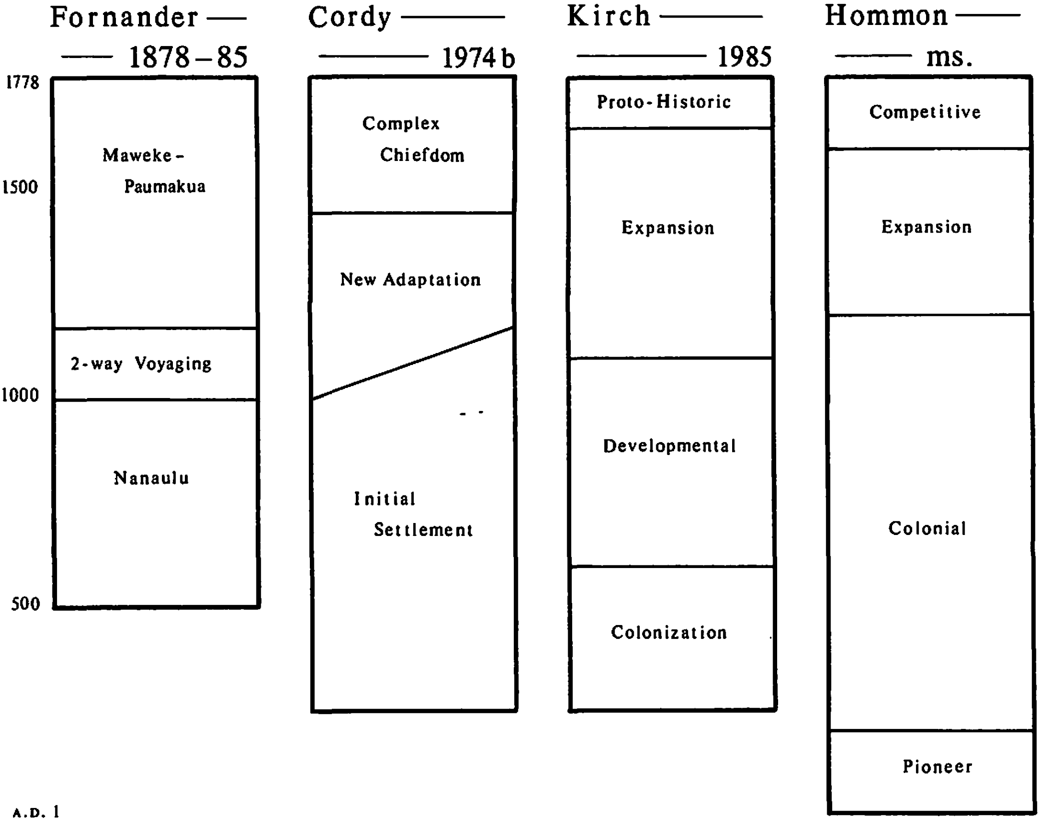

Fig. 1. Some important sequences of prehistoric Hawaiian social and cultural change. Refer to the original sources for full descriptions of periods and their precise chronological implications.

plans of extant temple foundations and collect information on their construction history from elderly Hawaiians (Stokes in press). Brigham, Thrum, and Stokes apparently reasoned that, with traditional historical data on temple construction and a reasonably accurate series of genealogies, they could trace the spread of Pa'ao's new religion through the islands. Stokes spent 5 months in the field on Hawai'i Island, recording 150 temple foundations and making plan drawings of over 40 of those best preserved. In 1909 and 1910 he travelled to Moloka'i to record temple foundations and the reportedly Nanaulu-period fish ponds along the island's southern coast. In 1912 he sailed to Ni'ihau to record temple foundations there.

By 1912 Stokes, along with Thrum (1906–08), had compiled a large catalogue of Hawai'i's temple foundations and had amassed sufficient descriptive detail to begin the task of historical interpretation of the evidence. Fornander's description of Nanaulu-period temples led others to see pyramidal forms in the ruins of Hawaiian temple foundations (e.g., Smith 1898: 163). But Stokes found no evidence in his extensive surveys to support the idea that Hawaiians had ever attempted to build pyramids. Instead, he found that Hawaiian temples ranged in form from an open platform to the enclosed, walled form supposedly introduced to the islands by Pa'ao. In Stokes's view the so-called "truncated pyramidal" temple form was actually a raised platform, whose heavily battered walls were a response to the need to produce a stable face with rounded waterworn boulders.

If they were not truncated pyramids, were Nanaulu-period temple foundations constructed as open platforms? This idea followed logically enough from Stokes's revision of Fornander's classification, and it left room for the traditionally recorded transition to walled forms introduced by Pa'ao. But Stokes found that the great diversity of temple foundation plans made it impossible to distinguish clearly between walled and platform types. The pure walled enclosure or open platform was a rare specimen. Instead, temple foundations incorporated features of enclosures and platforms in a bewildering variety of combinations. Stokes attributed this state of affairs to the creativity of the Hawaiian *kuhikuhipu'uone*, a class of *kahuna* responsible for temple design, whose task it was to study ancient temple architecture to design efficacious structures for their *ali'i*. This practice produced such a profusion of temple foundation designs that Stokes gave up hope of being able to use archaeological data to refine traditional accounts of the 2-way voyaging period and its effects on early Hawaiian society.

These negative results were a meager harvest for more than a decade of investigation. Stokes and Brigham had little with which to defend themselves when, in 1920, Herbert E. Gregory, Brigham's successor as director of Bishop Museum, began to reorganize the priorities of Hawaiian archaeology. In 1920 the Museum hosted Gerard Fowke of the Federal Bureau of Ethnology for 4 months as he toured the islands to survey existing Hawaiian ruins. This brief acquaintance with the Hawaiian archaeological landscape and a quick review of published and manuscript material were all that Fowke needed to condemn the current state of Hawaiian archaeology. In his Annual Report of the Director for 1920 Gregory wrote that

> Mr. Fowke's large experience as an archaeologist enables him to speak with authority, and for this reason his report to the Museum is somewhat discouraging. He recommends detailed mapping and description of all ancient structures, including such features of their surroundings as may have influenced their location. In his opinion *none of the ruins in the islands has been surveyed and described with sufficient accuracy for scientific purposes.* (Gregory 1921: 11, emphasis added)

With Fowke's counsel, Gregory apparently concluded that Brigham's and Stokes's search for data relating archaeological remains to traditional histories blinded them to the need for collecting a body of sound scientific data. Gregory began to bring in young scholars with solid training in scientific methods of data collection and analysis but—much to Brigham's dismay (Bryan 1980: xiv)—with little or no knowledge of Hawai'i, its people, and its traditions.

The Empirical Survey Period

Ironically, the first archaeological results that could be related to Pa'ao and the spread of the new religion through the Hawaiian Islands were the product of the ambitious archaeological survey program initiated by Gregory. This program had its official origin in 1920 at the 1st Pan-Pacific Scientific Conference in Honolulu. Presided over by Gregory, the conference was attended by a wide range of local and U.S. mainland scholars. The anthropology section, chaired by Clark Wissler of New York's American Museum of Natural History, included Brigham, Thrum, and Fowke; Kenneth Emory, fresh out of college and just beginning his long career at Bishop Museum; the famous Berkeley anthropologist A.L. Kroeber; R.T. Aitken, an archaeologist with the Milwaukee Public Museum; and Harvard University's Mayanist Alfred Tozzer, among others. Stokes was named secretary of the section. The anthropologists were charged with designing a program for research in the entire Pacific that would encompass all branches of anthropology. Competing as this task did with automobile tours of O'ahu, a trip to Hawai'i Island to see Kilauea crater, and the numerous social functions that go

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7. Traditional historians often disagreed in the dates assigned to past events. This variability derives from the difficulties of translating from a genealogical to a chronological framework.

with meetings of this type, it is not surprising that the anthropologists' work was incomplete when the conference came to a close. The partial research design was passed on for completion to the National Research Council, which included Fowke, Kroeber, Thrum, Tozzer, and several other well-known scholars but excluded Brigham and Stokes. The Research Council concluded that the central problems for archaeological research in the Pacific were "the origins, migrations, and external contacts" of the Polynesian peoples, and that "the fundamental objective of this research is chronology, or relative time-relations," whose "ultimate proof" was evidence of superposition in archaeological features. On a practical level the council recommended that "since Polynesian archaeology is in most respects a virgin field, the first problem is to make island surveys" (National Research Council 1921: 117).

This stress on survey work rather than excavations was the result of a widely held belief, based partially on Fowke's testimony, that excavation in Hawai'i's tropical soils would yield little information. Fowke claimed that there were no "indications whatever of underground remains" and that "so far as can be ascertained, excavations would not result in the discovery of any prehistoric objects or of anything essentially different from what can be seen on the surface or found slightly covered by very recent natural accumulation" (Fowke 1922). This rather grim assessment of Hawai'i's archaeological record was based on Fowke's assumption that Hawaiian prehistory had seen no major changes, so that the best course of action was to suspend further research and "take measures for the restoration and care of the principal structures" (ibid.). The National Research Council was more cautious, adopting Fowke's assumption of no change as a working hypothesis to be accepted or rejected on the basis of further survey work.

The first data that could call into question Fowke's assertion that Hawai'i's past was free of major change surfaced in 1923 and 1924, when Emory and Bruce Cartwright explored the remote and uninhabited leeward islands of Nihoa and Necker. There they were amazed to find numerous terraces and platforms studded with upright stones that looked little like any other Hawaiian architectural form. Instead, they resembled temple foundations from the Society and Tuamotu islands. The similarities were so strong that Emory and Cartwright referred to the Necker Island structures and 2 of the Nihoa Island structures by the Tahitian name, *marae*. Had Hawaiians built these shrines? Or were they the work of Tahitians and Tuamotuans who had shipwrecked there in the distant past? If Hawaiians had built them, why weren't similar structures found elsewhere in the islands?

Emory published a full report on the Nihoa and Necker findings in 1928 (Emory 1928). On the basis of artifact forms, especially the stone adzes and cowrie shell octopus lures found on the islands, Emory concluded that the Nihoa Island remains and the Necker Island *marae* had been built by Hawaiians. He explained the presence of *marae* in Hawai'i by postulating that they were erected in the era before Pa'ao had arrived, when Hawaiian temple foundations were more modest in scale and would have shown a greater resemblance to those of the East Polynesian homeland. This evidence seemed to support the traditional historical account of 2 separate migrations to Hawai'i, bolstered Stokes's rejection of a posited truncated pyramidal form for Nanaulu-period religious temples, and apparently solved the problem of discriminating Nanaulu-period temple forms. The crux of the problem now was the "relative time-relations" (National Research Council 1921: 117) of the different kinds of temple foundations. How could the *marae* be dated? Traditional histories were silent on the ruins of Nihoa and Necker, and the islands lacked typical Hawaiian temple foundations, so it was impossible to test for superposition.

The only hope was to search for survivals of the *marae* temple form on other islands where evidence of superposition could be collected, or to argue that the distribution of the *marae* type of temple foundation throughout the Hawaiian Islands corresponded to what might be expected if it were indeed an early temple form that subsequently was replaced by a new design.

These types of data proved hard to come by. The only other trace of the tantalizing *marae* was recognized on Maui Island by Winslow Walker, who noted that his site 230 at Hanakauhi, which had been recorded previously by Aitken (Emory 1921: 246, Plate XXIII A), was the only shrine on Maui that resembled the Necker Island type (Walker n.d.: 294). This was meager evidence, and Walker did not attempt to explain the distribution of such *marae* in cultural or historical terms.

Wendell Bennett, while a graduate student at the University of Chicago, tried to relate the unique cultural features of Kaua'i to the Nihoa and Necker remains. He cited the dressed stone of the Menehune Ditch, an upright stone at Poliahu Heiau near the Waialua River, stirrup pounders, and block rubbers as unusual features of the island's archaeological landscape, but he couldn't reject the possibility that these were "purely local developments of no great significance" (Bennett 1931: 96). Bennett, who later gained an international reputation for his archaeological work in Peru, was chary of arguing from negative data. He concluded that

> improbable as it may seem that such a standard form [of temple foundation] as that represented on the Nihoa and Necker islands if once established on the Hawaiian islands could have completely disappeared, it is not impossible. At a later time the Hawaiians so completely destroyed their thousands of idols that to-day scarcely a dozen are to be found. It is conceivable that the old temple form may have been destroyed under some similar stimulus. (Bennett 1931: 53)

J. Gilbert McAllister, who surveyed for sites on both O'ahu and Kaho'olawe islands, did not share Bennett's reluctance to argue from negative data; he took a position against the idea that there had been 2 separate migrations to the Hawaiian Islands and for the hypothesis that the unusual archaeological features of Kaua'i, Nihoa, and Necker islands were purely local developments. He argued that the lack of the *marae* type of temple platform on Kaho'olawe indicated that the early culture posited by Emory on archaeological grounds and recorded in traditional histories had not been widely distributed in Hawai'i. If it had been, he reasoned, "it should have been found on Kahoolawe, for the desolation and isolation [of the island] would have been important factors tending toward the preservation of materials." (McAllister 1933b: 60)

Bishop Museum's scientific archaeological surveys in the 1920s and 1930s failed to turn up any substantial archaeological evidence for change in Hawai'i's prehistoric past. The ultimate proof of relative time-relations provided by superposition of archaeological features was difficult, if not impossible, to recover with survey techniques. Only the enigmatic and isolated *marae* seemed likely to prove chronologically important, but these could not be dated. Thus, the scientific data needed to replace traditional historical materials as the main source of evidence for a sequence of prehistoric change could not be found. Instead, the discovery of the *marae* type of temple foundation fueled speculation about the course of Polynesian prehistory in Hawai'i.

Speculative history gained popularity in the late 1920s through the publications of E.S.C. Handy, a Harvard-trained anthropologist and proponent of an ethnographic theory known as *kulturkreis*. The central tenet of this theory held that present day cultures were derived from a very limited number of hypothetical cultural hearths through a process of culture trait mixing brought on by diffusion of peoples and ideas. The central problem in *kulturkreis* analyses was to determine which of the original cultural hearths had contributed to the formation of a contemporary culture and to establish the order of their influence. The usual method involved drawing up a list of traits from the culture under consideration and then searching for analogous traits in one or more of the hypothetical cultural hearths. Based on the correspondences between traits of the extant culture and those of the cultural hearths, proponents of the *kulturkreis* theory drew up quasi-historical scenarios, largely dominated by migrations of peoples, to account for the genesis of modern cultures. In Handy's (1930: 7) scheme the Nihoa Island shrines and the Necker Island *marae*, referred to as "temples with terrace," are classified as traits of "Old Tahitian worship."

Using traditional Tahitian history as a model, Handy proposed that the original Hawaiian people were the *menehune* of Hawaiian legends, since the cognate Tahitian term, *manahune*, referred to the commoner class of Tahitian society. Handy believed that the Hawaiian *menehune* and the Old Tahitian *manahune* both derived from a Brahmanistic cultural hearth in Southeast Asia and that during the course of their migration through Melanesia they had been influenced by what he termed a "barbaric neolithic phase of culture" (Handy 1930: 13). The Tahitian *manahune* and the Hawaiian *menehune* were later overrun by an *ali'i* cultural group that had also migrated out of Southeast Asia and had been influenced by a later Buddhistic cultural tradition. Thus, in Handy's view, there were 2 radically different cultures in prehistoric Hawai'i, whose differing cultural traits, mostly acquired in the Southeast Asian homeland, explained many features of the stratified contact-era Hawaiian social structure.

Handy's influence on later generations of scholars is slight compared to that of Peter H. Buck. His popular book, *Vikings of the Sunrise*, published 2 years after he had taken over from Gregory as director of Bishop Museum, told Polynesian history from the perspective of a half-Maori scholar whose breadth of experience as a Polynesian ethnographer was second to none. Like Handy, Buck believed that the differences between Hawaiian chiefs and commoners did not develop locally, but resulted from the immigration to Hawai'i of 2 culturally distinct peoples. But unlike Handy, Buck believed that the short, dark-skinned, curly-haired peoples of Melanesia were so different from the Polynesians in their physical features that they surely would have left their mark on the Polynesian peoples had the Polynesians' route of migration out of island Southeast Asia taken them through Melanesia. Therefore, he argued that the ancestors of the Polynesian peoples had migrated through the atolls of Micronesia, whose tall, fair-skinned, straight-haired peoples more closely resembled Polynesians.

This northern route, with its few high islands and ubiquitous atolls, also helped explain the motive behind the Polynesian peoples' journeys to the most remote corners of Oceania. Buck surmised that Hawai'i's first settlers were a weak, socially inferior group of Micronesians who had been driven from their atoll home during a period of famine and social strife. In their haste to flee, they brought no food plants or animals with them, and after landfall in Hawai'i they managed to eke out a rude existence by fishing and foraging. Several centuries later they were followed into Polynesia by the descendants of their socially superior kinsfolk, who landed first at Tahiti and then, as traditional historians implied, voyaged north to Hawai'i. There the new immigrants quickly and easily subjugated the first settlers, establishing themselves as a ruling class.

The proposed migration route through Micronesia had its weak points, and Buck was fully aware of at least one of these. Buck followed Emory and Handy in assigning the *marae* type of temple platform to Hawai'i's initial immigrants. The marginal distribution of this temple type in the Hawaiian Islands was due to the fact that

> the later invaders pushed Hawai'i's first settlers gradually out of the other islands so that they congregated in Kauai, the last of the large islands, at the northwest end of the chain. From there they apparently withdrew to the barren and rocky islets of Nihoa and Necker, as evidenced by numerous terraces, stone implements and stone images. (Buck 1938: 250)

The absence of fully developed *marae* in Micronesia meant either that the temple form was developed independently in Hawai'i and the Society Islands—an unlikely possibility given the close similarities in the forms of *marae* from the 2 island groups—or that Hawai'i's first settlers had both the means and the motivation to voyage between Tahiti and Hawai'i—another unlikely possibility given the few positive cultural traits that Buck assigned them. Of the 2 possibilities, Buck favored the idea that Hawai'i's first settlers arrived from Micronesia after stopping first in the Society Islands.

Through the period of Handy's grandiose theorizing and Buck's forceful summary of Polynesian prehistory, Kenneth Emory attempted no synthesis of his own. But as his familiarity with Polynesian archaeology grew, he found little need to look beyond Polynesia to explain the features of Hawaiian culture. In the tradition of Stokes, Emory set out to use archaeological data to debunk speculative histories of Hawai'i's past.

In a paper on Polynesian stone remains, Emory (1943) summarized archaeological data to refute the diffusionist theories promulgated by Handy (cf. Piddington 1939; Burrows 1938). He wrote that archaeologists

> do not find ruins or artifacts which represent a true break with the historic Polynesian cultures. No Melanesian culture underlying the Polynesian has yet been unearthed. It is unlikely that a dominant group of migrants of different culture would everywhere have taken over bodily a previous culture. . . . Changes we do find, but in the important things they are changes away from widespread and typical Polynesian features toward some local development which often can be laid to a peculiarity of the physical environment. (Emory 1943: 9)

Emory also took up the loose threads of Buck's argument, using the evidence of the distribution of stone back-rest slabs to argue that the first Polynesian settlers out of Micronesia established themselves in Tahiti and later migrated to Hawai'i:

> The use of [back-rest slabs] was evidently carried across Polynesia to the eastern Tuamotus, up to Hawaii, and down to New Zealand. I say up to Hawaii and not from Micronesia to Hawaii because what Hawaii and [the other island groups of Eastern Polynesia] shared in common . . . developed in the Marquesas and Tahiti, and not in Hawaii. (Emory 1943: 20)

At Yale University, where he used the evidence of Polynesian language vocabularies to investigate the relationships of Eastern Polynesian cultures, Emory (1946b) developed his thesis on the unity of Polynesian culture. Though his analyses do not conform to modern linguistic procedures, they led Emory to the conclusion that Polynesian culture had developed in Western Polynesia and had spread east from there to the other Polynesian island groups.[8]

However, for all the progress Emory was making toward working out the archaeological implications of an *in situ* development of Polynesian culture, the problems of origins, migrations, and external contacts that had been identified as important areas of archaeological research by the National Research Council, as well as the diffusionist doctrines of Handy and Buck, were still powerful forces that guided prehistoric investigation. The lack of any explicitly chronological archaeological data meant that the theoretical apparatus needed to build a sequence from archaeological materials was not developed in Hawai'i. When physicists in Chicago figured out a way to determine the age of ancient organic matter, precipitating a revolution in the interpretation of archaeological materials, Hawaiian archaeology was ill prepared to interpret the flood of new data that resulted.

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[8] This account of Emory's arguments against a diffusionist approach to Polynesian prehistory should be contrasted with Cordy (1974a), who claims that Emory subscribed to a diffusionism based on traditional historical sources.

The Traditional Excavation Period

In the spring of 1950 Kenneth Emory was preparing to teach a course in archaeological field methods at the University of Hawaii. He wasn't expecting a particularly exciting field season. Scholars had long assumed that conditions for artifact preservation were poor in tropical soils and that Hawai'i lacked stratified cultural deposits that were both deep and old. Aside from Emory's and Aitken's shovel excavations of 18 sites in Haleakala in 1920, and Emory's and Cartwright's shovel excavations of sites on Nihoa and Necker in 1923, only Stokes had attempted serious excavations; the deposits at Kamohio shelter on Kaho'olawe, though deep, were so filled with organic material that it seemed they could not have been ancient.

A cave site in Kuli'ou'ou valley, conveniently close to the University of Hawaii Manoa campus and not too far off the road, had been partially excavated by an amateur archaeologist in 1938, and was known to contain cultural deposits of sufficient extent for Emory's class to work on. Between 25 February and 19 May 1950, Emory, 11 students, and 2 volunteers excavated just over 30 m^2 of the cave floor in arbitrary 6-inch levels. On the advice of 1 of the volunteers, a series of charcoal samples was collected from the many firepits unearthed, and 1, from the deepest portion of the cave's cultural deposit, was sent to W. F. Libby in Chicago for age determination by the newly invented radiocarbon method. The result was published the following year in *Science*, as follows:

> 540 *Hawaii*: Charcoal from earliest Polynesian culture in Hawaii. 946 +/− 180 Found in Kiliouou Bluff Shelter, Kuliauaw, Oahu Island, by Kenneth P. Emory, Bernice P. Bishop Museum, Honolulu. Submitted by K.P. Emory. (Libby 1951: 295)

No one seems to have minded the misspellings of Hawaiian names; the results were revolutionary! The idea that archaeological excavations in the islands would yield little of interest was clearly mistaken. Not only were there deep deposits to be found, but scientific age determination techniques proved that the deepest of these dated back to a distant era whose history was only lightly touched upon by traditional data. Suddenly, it looked as though the origins and external contacts of Hawai'i's earliest settlers could be investigated with precision, fulfilling one of the National Research Council's research goals and putting Handy's and Buck's diffusionist theories to a scientific test.

The possibility that the new age determination techniques could provide data that would help solve the mystery of Hawai'i's supposedly Nanaulu-period temples was quickly appreciated, and Ivan Rainwater, an archaeology enthusiast with the U.S. Department of Agriculture in Hawai'i, was dispatched to Nihoa and Necker islands to collect charcoal from cave deposits for dating. Despite its great potential, the radiocarbon dating technique quickly proved difficult to use. Portions of a single sample (HRC-42) from a hearth on Nihoa were sent to the University of Michigan and Gakshuin University for independent age determinations. Michigan (M-480) returned an age estimate of 520 +/− 200 years before 1950, while Gakshuin (GaK-754) reported one twice as old (1060 +/− 90 B.P.). Two samples from a cave on Necker Island both returned estimates of modern age and were thought to have been somehow contaminated.

Emory continued to excavate caves on O'ahu's south coast with the University of Hawaii field school (Emory & Sinoto 1961). Kuli'ou'ou, Makani'olu, and Kawekiu shelters were all dry enough to preserve perishable organic materials in their upper layers, and the artifact yield was exceptional. Among the organic finds were fire sticks; a *kapa* cloth wick; fragments of gourd and coconut containers; fishing nets of *olona* cord; wooden net floats; netting needles; mesh gauges; javelin and arrow heads; *kapa* stamps and beaters; *hau*, *olona*, and coconut fiber cordage; and a fragment of what Emory believed to be the leg of a wooden image. More important, though, was the discovery of bone tattooing needles, wood and bone fish gorges, and bone toggles from cowrie shell octopus lures that were either rare or nonexistent in Bishop Museum and private collections. Were these remnants of Hawai'i's earliest culture? Unfortunately, the unusual artifact types were not numerous enough to rule out the possibility that they merely represented some rare types that had been manufactured in small numbers. In fact, Emory had good reason to suspect that this was the case, at least with the tattooing needles, since a few years before he had investigated a dry cave burial on Hawai'i Island in which clear traces of tattoo marks were preserved on pieces of desiccated skin (Emory 1946a).

Early in 1953 Emory's attention was drawn to 2 sites: an open sand dune and a cave at Ka Lae, Hawai'i Island. Miss Amy Greenwell had recovered several fishhooks of previously unknown forms from the eroding face of the dune, and the large cave appeared to offer the same preservation conditions as did the O'ahu cave sites. The proficiency of Hawaiian fishermen was well known, and it seemed likely to Emory that the two sites might yield enough fishhooks and other types of artifact to prove the existence of an early Hawaiian culture that could be dated with the radiocarbon method. With the aid of a generous grant from the McInerny Foundation and active support from Bishop Museum's new director, Alexander Spoehr, Emory put his student William Bonk in charge of work at the 2 Ka Lae sites. Excavations by a team of volunteers, many of them trained by Emory at the University of Hawaii, began in August and continued throughout the year with breaks for artifact analysis.

The large number and varied forms of fishhooks obtained in the 1st season's excavations convinced Emory that Hawai'i's early culture was well represented at the South Point sites. The 1953 field season, which Emory (Emory et al. 1968 [1959]: vii) referred to as a period of "experimental excavation," had yielded the most encouraging results, and the prospects for further excavation were bright. In 1954, with the financial backing of the McInerny Foundation, the Charles M. and Anna Cooke Trust, and the Wenner-Gren Foundation for Anthropological Research, Emory announced the beginning of a 5-year program in Hawaiian archaeology designed to collect "a body of data adequate for a reliable reconstruction of the pre-history of Hawaiian culture in the Hawaiian Islands." (Emory n.d.)

Additional surveys of the Ka Lae area by Bonk and Ivan Rainwater in 1954 resulted in the discovery of a cave site rich in artifacts near the base of the Pali-o-Kulani at Waiahukini, thus filling out the roster of sites to be excavated at Ka Lae.[9] The field team was joined in December by Yosihiko Sinoto, then a young archaeology student from Japan. Sinoto recognized that the wide variety of fishhooks recovered from the Ka Lae sites might make it possible to establish an artifact sequence—thus, change could be measured by archaeological, rather than traditional historical, criteria. To accomplish this task it was necessary to excavate within cultural stratigraphic layers rather than digging in arbitrary 6-inch levels, and Sinoto set about instituting the new procedures. The following 2 field seasons at Ka Lae were directed jointly by Emory, Bonk, and Sinoto.

The 3 Ka Lae sites yielded more than 3,000 fishhooks (Sinoto 1967: 342) from deposits that initial radiocarbon age estimates dated to the 1st millennium A.D. Sinoto's careful analyses of fishhook forms and statistical tests of the distribution of fishhook types through the layers of the 3 sites proved that the lashing devices at the base of early 2-piece fishhook points were formed by a series of notches, while those of later 2-piece hooks were formed by a single knob (Emory et al. 1968 [1959]). At the urging of Green (1961), Sinoto was able to demonstrate that a similar evolution had affected the heads of 1-piece fishhooks (Sinoto 1962). After nearly 50

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[9] Through the years these sites have received several names and are referred to in the literature in a variety of ways. The sand dune site was originally designated H1, but was often called Pu'u Ali'i. Today the site is designated 50-Ha-B20-1. The cave site immediately inland of the sand dune, known as Lua Makalei, was originally designated site H2, and is now designated 50-Ha-B20-2. The cave at Waiahukini, often referred to as Waiahukini shelter, was originally designated site H8, and is now known as 50-Ha-B21-6.

years of effort, beginning with Brigham, Thrum, and Stokes's attempt to chart changes in the form of temple foundations, archaeologists were able to demonstrate a prehistoric Hawaiian cultural change.

These new chronologically ordered data soon spurred efforts to rewrite the prehistory of Hawai'i. The sparseness of excavation data, along with considerable uncertainty as to how various kinds of data, especially radiocarbon dates, should be interpreted, led to a rapid succession of ideas about Hawai'i's past. The first of these was published by Emory (1959) in a short paper that—true to the National Research Council's research design—was entitled "Origin of the Hawaiians." The paper's goal was to re-explore the implications of the idea that internal developments, and not a series of migrations from outside Polynesia, could account for the characteristics of modern Polynesian cultures and societies. Emory began by suggesting that the Hawaiian chiefly genealogies that Fornander had cited as evidence for a 2nd period of migration to Hawai'i actually referred to the initial colonization of the islands. He placed this event at about A.D. 900, citing as evidence a recalculated genealogical dating of the Hawaiian chiefly lineages; lexicostatistical analyses of the Eastern Polynesian languages by University of Hawaii linguist Samuel Elbert (1953); and 2 radiocarbon dates—the initial date of A.D. 1004 from the Kuli'ou'ou shelter, and, from the bottom layer of the Waiahukini shelter, the date of A.D. 957 +/− 200. To support this shift from a 2-migration sequence to a single migration, Emory argued against the idea, popularized in the anthropological literature by Handy, that a race of *menehune* was established in the islands before the arrival of the *ali'i*. He traced the origin of the *menehune* idea to writings of the Hawaiian historian Samuel Kamakau that blended Hawaiian legends with biblical accounts of the Deluge. To prove that Kamakau's "neo-myth" was not a widely held Hawaiian tradition, Emory cited Malo (1951) as a Hawaiian authority who considered Kahiki to have been the homeland of the Hawaiian peoples.

This bold reinterpretation of Hawaiian prehistory soon had competition from Robert C. Suggs (1960), an ambitious young Ph.D. out of Columbia University who had just completed a pioneering series of excavations in the Marquesas Islands. Many of Suggs's ideas had their genesis in a selective list of 12 "important" radiocarbon dates that Emory presented in his introduction to *Hawaiian Archaeology: Fishhooks* (Emory, Bonk & Sinoto 1968 [1959]). Two features of the list stood out. First, the estimated age of a campfire under the earliest house-yard floor of the Ka Lae sand dune site was given as A.D. 124, more than 800 years older than any previous estimate. Second, there was a clear geographic pattern to the age estimates, with the oldest dated sites confined to Hawai'i Island in the south, followed by progressively younger dates as one moved north through the archipelago.

Suggs agreed with Emory that the islands were first settled by Tahitians and pointed to the presence of the *marae* form of temple foundation in Hawai'i as proof. On the basis of the earliest Ka Lae radiocarbon date, Suggs reckoned that initial colonization took place sometime in the 1st century A.D.; the new immigrants landed at Ka Lae, where they established successful colonies. Over the course of many generations, he believed, they founded new settlements, first in other areas of Hawai'i Island and then on the other major islands, reaching Nihoa at the extreme northern end of the chain sometime in the 15th century A.D. Suggs followed Emory (1928) in interpreting the *marae* type of temple as evidence of Hawai'i's early culture, and he used the archaeological remains from Nihoa and Necker islands to draw a portrait of early Hawaiian life.

The 15th century, according to Suggs, was a time of great change in Hawai'i, during which an elaboration of religious temples led to the development of large *heiau*, similar to those in use at the time of European contact. These architectural developments indicated to Suggs that Hawaiians of the time were able to produce a substantial food surplus and to organize large groups of workers for communal tasks. Social stratification brought on by population growth and expansion of food production capabilities was a theme that Suggs saw repeated in the prehistoric sequences of nearly all the major Polynesian islands.

Having accepted the earliest date from Ka Lae, Suggs was undecided about following Emory's suggestion that Hawai'i had been settled only once. He thought that traditional histories offered evidence for contact between Tahiti and Hawai'i in the 15th century and that such contact, if it did indeed occur, might have influenced change. Unable to cite persuasive archaeological evidence for the proposed 2nd migration, and influenced by the ethnological writings of Sahlins (1958), he noted the possibility that purely internal developments could account for change as well.

The ink was barely dry on Suggs's book when Emory and Sinoto found a distinctly Hawaiian-looking fishhook on the sandy surface of a site on Maupiti at the western end of the Society Islands. This hook, and the fact that some early Hawaiian hooks with strongly curved shanks resembled specimens recovered by Suggs from early sites in the Marquesas Islands, led Emory to reject his earlier notion of a single settlement of Hawai'i. Instead, he and Sinoto argued that Hawai'i's first settlers had arrived from the Marquesas Islands around the middle of the 1st millennium A.D. and that traditional historical accounts of a subsequent migration from Tahiti were historically correct (Emory & Sinoto 1964: 148–49). Using yet another recalculated genealogical date, Emory placed the migration period at A.D. 1200–1400, some 200 years later than Fornander's estimate but more closely approximating the age estimates for changes in Hawaiian fishhook lashing devices. A spate of comparative studies of other artifact types followed (e.g., Sinoto 1967, 1968; Emory 1968), designed to explore the prehistoric ties between Hawai'i, the Society Islands, and the Marquesas Islands.

The successful establishment of a sequence of prehistoric change based on archaeological materials led Emory, in 1964, to seek funds from the U.S. National Science Foundation (NSF) for a 3-year program of research in Hawaiian archaeology. The primary goal of Emory's research was to excavate additional deep, stratified sites to uncover more evidence of Hawai'i's most ancient culture. Excavations once again centered on the southern part of Hawai'i Island, where Hawai'i's original settlers were believed to have established their first colonies. In 1964 the Wallaces excavated a small coastal site at Pinao Bay within view of the sand dune site, but the site proved to be relatively young and yielded no early artifact types (Wallace & Wallace 1969). The following year Lloyd Soehren excavated 6 cave sites in the South Kona and Ka'u districts of Hawai'i Island, including the artifact-rich H66 site in Ka'u, but none of the sites were particularly old and added little to the artifact inventory of early Hawaiian culture (Soehren 1966). When no other promising coastal or cave sites could be located, the project sputtered to a halt. Emory's focus on the issues of origins and migrations, a legacy of the National Research Council's research design and the diffusionist theories of Handy and Buck, left him without a theoretical framework that could be used to generate hypotheses to test with the NSF-funded excavations. With no new early artifacts the project ended as a failure in the eyes of its investigators.

The Empirical Excavation Period

Emory's Hawaiian archaeology project reached its dead end just as the discipline of archaeology entered the throes of a long and critical self-examination. The body of method and theory developed by culture historians to work out the spatio-temporal patterning of the prehistoric record had been partially eclipsed by the emergence of radiocarbon dating (Renfrew 1979). The intricate webs of hypotheses and tests based on superposition and intersite comparison once necessary to determine the relative age of a site could seemingly be replaced by an absolute age estimate worked out with scientific precision in a laboratory. Freed from the difficult and time-consuming comparative work required by the old culture historical techniques, archaeologists turned their attention to the archaeological site, to see if it could yield anthropological as well as historical information.

A new approach was formally introduced to Pacific archaeologists by Roger Green in a paper delivered to the Divisional Meeting on Ethnology at the 11th Pacific Science Congress in Tokyo (Green 1967). Green's classification and review of previous archaeological work in the Pacific made clear the ways in which the modern approach differed from its predecessors. Large-scale island surveys of the kind undertaken in Hawai'i during the Traditional and Empirical Survey periods (1900–50) were characterized as *extensive* in nature, with a pronounced tendency to concentrate on the larger, more impressive field monuments. In contrast, modern surveys would be *intensive*, their goal to record all material traces of past human activity within circumscribed local areas. No site would be considered insignificant, no matter how small and informal. Archaeological excavation projects carried out in the Traditional Excavation period (1950–66) were criticized for regarding the site as merely a container for portable artifacts, with most analyses limited to the portable artifacts alone. Green proposed that archaeologists treat sites as artifacts whose types and distribution on the landscape could be analyzed: ecologically, in relation to features of the natural environment; functionally, in relation to the activities that were carried out in them; and socially, in relation to one another.

Green brought the settlement pattern approach to Hawai'i through his participation in 3 major projects: the Makaha Valley Historical Project on O'ahu, carried out by Bishop Museum under contract to the Makaha Historical Society; the Halawa Valley Project on Moloka'i, a cooperative research venture sponsored jointly by Bishop Museum, University of Hawaii, and Harvard University; and the Lapakahi project on Hawai'i Island, a University of Hawaii project co-directed by Green and Richard Pearson. The new directions that archaeologists would follow all show up clearly in the publications resulting from the Makaha Valley project (Green 1969, 1970; Ladd & Yen 1972; Ladd 1973; Green 1980).

The techniques and goals of an ecological approach were clearly set out by Doug Yen (Yen et al. 1972), an ethnobotanist at Bishop Museum, who assembled an interdisciplinary team to investigate the history of irrigated agricultural terracing in the back of Makaha Valley. With the assistance of Patrick Kirch, Thomas Riley, and Paul Rosendahl, 3 students in a graduate course in Oceanic prehistory that Yen taught at the University of Hawaii, Yen dug several trenches. With their total yield of 5 unimpressive portable artifacts, these trenches would have been considered a waste of time a few years earlier. But the sequence of construction, flooding, erosion, and destruction documented in the walls of the pits made possible a detailed look at the way Hawaiian planters had exploited the agricultural opportunities of the wet upper-valleys in the 14th and 15th centuries, and how, when flooding and landslides destroyed the gardens in the early 16th century, field and ditch designs were modified. This convincing demonstration that the interplay of prehistoric man and the Hawaiian environment could be investigated with archaeological techniques spawned a large literature. Today, the ecological approach is the most popular interpretive framework for archaeological data in Hawai'i (Kirch 1985: 17ff.).

Investigations of site function centered on several feature types that had been ignored by previous researchers. The most gratifying results came from the excavation of rude C-shaped structures in the *kula* lands of the middle valley (Takayama 1969, Takayama & Green 1970). The association of formal fireplaces and stone tools that would have been useful for garden work led to the conclusion that the C-shaped structures had served as temporary field shelters, occupied during breaks in the work day and for extended periods during the heavy labor of the planting season.

Once the functions of C-shaped shelters and other site types had been reliably inferred from excavation data, the stage was set for a social interpretation of the survey data. Green's (1980) summary of the Makaha Valley Historical Project culminates in a detailed 3-stage culture history that traces Hawaiian use of the valley from the initial coastal settlement documented by traditional historians, through the emergence of the valley as a separate *ahupua'a* with regular inland expansion of agriculture and settlement in the 12th to 17th centuries, to its contact-era endpoint as a somewhat marginal, but internally stratified, unit within a larger politically stratified society.

The wealth of evidential detail required by the new approach effectively limited the geographical scope of archaeological interpretation. Emory's goal in excavating the 3 Ka Lae sites was to recover data that would allow him to reconstruct the prehistoric cultural sequence of the Hawaiian archipelago. The project yielded 3 slim reports. The interpretive goal of the entire Makaha Valley Historical Project, which excavated 30 sites and produced nearly 500 pages of reports, was the detailed history of a single, rather marginal, *ahupua'a*. Hawaiian archaeology had clearly been rescued from the interpretive impasse of the Traditional Excavation period.

In the decade and a half since the Makaha Valley Historical Project the great bulk of archaeological work has been directed at the solution of local problems; only scattered consideration has been given to the larger issues that once dominated the field. Much of the impetus for this has come from the growing field of *cultural resources management*, or *contract archaeology*, which draws on private and public funds to produce studies that satisfy technical laws governing the protection of ancient sites in areas proposed for development (Rosendahl 1976). Since the land parcels chosen for development often bear no logical relation to prehistoric political, social, or cultural land divisions, the task of comparing and interpreting data yielded by these projects is enormously complicated. In addition, the competitive world of cultural resources management, in which independent archaeological consulting firms vie for a limited number of contracts, tends to discount the value of prehistoric interpretation in favor of a no-frills report that meets legal requirements at minimum cost.

The amount of data collection funded by public and private contract sources is staggering (Kirch 1985). The last 20 years of field research have given Hawaiian archaeologists a data base rivalled in the Pacific only by New Zealand, where archaeological excavations began in the mid-19th century (Davidson 1984). Despite this surge in available data, archaeological remains that can be confidently dated to the traditional Nanaulu and migration periods of Hawaiian prehistory are relatively rare. However, in the last 5 years, sufficient evidence has accumulated to convince most scholars that settlement began in the 3rd to 4th centuries A.D.

The first result of the realization that the early portion of the Hawaiian sequence was not well represented in the archaeological record was a demonstration of the fragile evidential basis for Emory and Sinoto's theory of Hawaiian origins and external contacts. Cordy (1974a) and Green (1971, 1974) both reanalyzed the Ka Lae excavations to develop arguments,—based on the limited occurrence of HT4 hooks in the lowest layers of Waiahukini shelter (H8)—against Emory and Sinoto's claims for archaeological evidence of contact between the Society Islands and Hawai'i. Yet none of these authors considered the possibility that the Hawaiian-style hook found in Maupiti might be a tangible result of voyages south to the Society Islands from Hawai'i during a period of 2-way voyaging. Similarly, Kirch (1986) argues that Hawai'i may have been settled initially from central East Polynesia before distinctive Tahitian and Marquesan cultures developed there, thus making a moot point of claims for an initial settlement of Hawai'i from the Marquesas Islands rather than the Society Islands. Because of the nascent state of archaeology in the Society Islands, firm conclusions on either of these issues would be premature, though the absence of Hawaiian-style fishhooks in Society Islands sites earlier than the traditional period of 2-way voyaging (Y.H. Sinoto, pers. comm. 1986) keeps alive the possibility that the design of the Maupiti hook is a product of prehistoric culture contact with Hawai'i.

The paucity of evidence from the early portion of Hawaiian prehistory has also influenced archaeologically formulated sequences of prehistoric social change—an effect that shows in the length of, and largely theoretical justifications for, early periods (Fig. 1). Hommon (ms.) presents a theoretically sophisticated and well-documented 4-stage sequence for the rise of social complexity in prehistoric Hawai'i. Hommon's early Pioneer phase is not supported by archaeological data, but is based on the theoretical proposition that the "lives of the first successful settlers were substantially different from those of their descendants" (Hommon ms.). This is followed by the millennium-long Colonial phase, during which 37 coastal communities were founded near the "salubrious cores" of the contact era island districts (*moku* or *kalana*). Only with the onset of the Expansion phase in the 13th century do archaeological data, in this case a rise in the number of inland sites, begin to play a dominant role in the sequence. Cordy (1974b) proposed a 3-stage adaptational sequence based on the spread of settlement through the islands and estimates of the degree of social stratification (Fig. 1). His first 2 periods were distinguished on the basis of the expansion of settlement into dry leeward areas, a trend to which he assigned no great sociological import. Given the variety of environmental conditions present in Hawai'i, Cordy argued that the transition from the Initial Settlement to the New Adaptation period would have taken place at different times in different regions. Cordy's (1981) most recent research along these lines failed to yield further evidence for this early transition. Kirch (1985) draws explicitly on comparative linguistics and ethnology, in addition to archaeological data, to outline a detailed prehistoric sequence (Fig. 1). As with Hommon's Pioneer phase, Kirch's Colonization period is largely a theoretical construct with tentative chronological boundaries (Kirch 1985: 298). The transition from the Developmental to the Expansion period, which dates to the traditional 2-way voyaging era, introduces a time when "social and political organization was radically altered," "new forms of religious belief and ritual" arose, and "more changes occurred . . . than throughout any other time in Hawaiian prehistory" (Kirch 1985: 303). Aside from the expansion of settlement into leeward areas first noted by Cordy (1974b) and the later inland expansion documented by Hommon (1976, 1986), the archaeological evidence for such radical changes is surprisingly slim. One is left to wonder at Kirch's assertion that the influence of southern immigrants "on the course of Hawaiian cultural development was unlikely to have been great" (Kirch 1985: 305).

DISCUSSION

Much of the tension between traditional history and archaeology expressed by Tuggle (1979), Kirch (1985), and Cordy (1974a, 1981) results from confusing archaeological sequences with prehistories. This confusion began in the Traditional Excavation period with Emory's theoretically uninformed efforts to wring the traditional historical sequence from archaeological data using the new and largely unexplored techniques of archaeological excavation. The shifting interpretations of archaeological and traditional historical data during this period are legion and generally unsupported by careful arguments, since the tacit assumption was that the 2 data sources ought to be congruent. Archaeologists of the Empirical Excavation period correctly insist that formation of archaeological sequences should be a scientific enterprise in which hypotheses about material variation through time or across space are tested against patterns of temporal and spatial variability yielded by the archaeological record. They err, however, when they insist that hypotheses about material variation must be derived from scientific investigation and not from sources such as traditional history.

The archaeological research program designed by Brigham, Thrum, and Stokes is a fine example of how traditional history can contribute to the process of establishing an archaeological sequence. The traditional historical claim that the form of temple foundations changed significantly during the period of 2-way voyaging is directly testable with the tools of modern archaeology. That Brigham's, Thrum's, and Stokes's archaeological labors failed to establish chronologically significant temple platform types was the fault of neither the hypotheses that guided them nor the source from which they drew their ideas about Hawai'i's past. Instead, their failure may be traced to the loss of detailed knowledge about the ancient works of Hawai'i's Polynesian people during a century of rapid social change and to the lack of a reliable means of dating archaeological remains. There is no scientific reason to reject the use of traditional historical accounts in the formation of archaeological hypotheses.

The question, then, is whether hypotheses drawn from traditional history are worthy of investigation. A common criticism of traditional historical accounts of migrations is that their poetic presentation makes it seem as if immigrants came in numbers great enough to swamp earlier populations, when no evidence exists of such a mass spectacle. Current archaeological techniques may be useful in establishing the historical reality behind the poetry. Irving Rouse (1986) recently distinguished 2 types of migration on archaeological grounds. The 1st, which he calls "population movements," involves the spread of peoples into areas where they manage, through successful colonization or conquest, to establish the culture of their homeland. This type of migration leads eventually to cultural differentiation, as the new daughter communities grow apart from communities in the homeland. A 2nd process, called "immigration," involves the movement of people into already populated areas, where they eventually adopt most features of their host culture. This type of migration leads to the emergence of similarities in specific aspects of culture between the parent communities of the immigrants and their new hosts. Could Rouse's immigration process help prehistorians explain the restricted distribution in Polynesia of feather girdles (Stokes 1928, Rose 1978), the term *heiau* and its cognates (Emory 1943), or the Maupiti fishhook?

Another criticism of traditional accounts is that they attribute an incredible amount of influence to one or a few individuals. Pa'ao's Hawaiian exploits are a prime example, and modern sensibilities resist the thought that a single individual could have so radically altered the developmental course of an entire society (e.g. Kirch 1985: 305). Yet Sahlins's (1985) structural analyses of the histories of "heroic" societies point to 2 contingencies that temper conclusions based solely on common sense. The 1st he terms the "heroic I" (Sahlins 1985: 47ff.). Here the accumulated accomplishments of some long-term corporate group are attributed to an individual, thus confounding Western notions of history by expressing processes in terms of events. In other words, the many influences attributed to Pa'ao by traditional historians may record the accumulated accomplishments of the line of priests that he founded. The 2nd is simply that massive changes in heroic society are often predicated on the decision of a single powerful individual and occur relatively rapidly as the members of a society follow the direction of their leader (Sahlins 1985: 37ff.). This may have been the case with Pa'ao the "stranger king." Archaeology's real challenge is to develop a research program that is able to discriminate between these 2 hypothetical processes of change (see Hommon ms.).

One unexpected effect of archaeologists' concentration in the last 20 years on the scientific interpretation of archaeological data is that questions of potential importance to Hawaiian prehistory have quietly slipped out of focus. Nearly a century after Brigham, Thrum, and Stokes founded modern Hawaiian archaeology by investigating temple foundations, the problem of a change in the form of Hawaiian religious temples remains unsolved. There is no dated archaeological evidence for the temples built by Nanaulu-period Hawaiians. Could it be that the Hawaiian form of *marae* is the key to learning about the spread of a new religion through the islands? The technical means to date with precision the small amounts of charcoal that one might expect to find among the stones and soil at the base of a *marae* are now widely available at a moderate cost. Enough is now known of variations in form between individual *marae* and of their distribution over the landscape to begin the process of sharpening chronological hypotheses for a meaningful test. Yet, this mystery of the Hawaiian form of *marae*, tainted by its association with traditional history and the diffusionist theories of Handy and Buck, generates little interest among modern archaeologists.

The wealth of archaeological detail now available gives the prehistorian of Hawai'i a rich resource on which to draw. To describe the past in terms of everyday life relieves the mythlike quality of much traditional history. The past is more than the heroic deeds of priests and kings.

The genius of a craftsman who looks at an outcrop of blue-gray rock and sees there the raw material for a finished adze, of a farmer who recognizes in a patch of alluvium next to a mountain stream a place to grow food for an extended family, or of a community elder who sees in the well-being of kin a reason to maintain the local agricultural shrine—archaeological analyses assure all of these a place in Hawaiian prehistory.

Archaeologists and anthropologists long ago laid to rest the notion that 2 different cultural migrations were sufficient to explain Hawai'i's contact-era social organization. The importance of *in situ* development is fully appreciated, and the archaeological techniques with which to explore it have been well developed. The time has now come to renew analyses of traditional history with the sophisticated tools at hand and to synthesize the results with the scientific data of archaeology, linguistics, and ethnography. The product will be enriched by exposure to the full diversity of views on Hawai'i's distant past, and will be meaningful to the various cultural traditions that now draw inspiration from an understanding of that past.

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Gametophyte Development in Adenophorus (Grammitidaceae)

L. Earl Bishop[1]

ABSTRACT

Gametophytes of 5 species of *Adenophorus* (Grammitidaceae) were raised from spores in sterile culture. Three species represented the subgen. *Adenophorus*, the other 2 subgen. *Oligadenus*. Most of the salient developmental details conform to those found previously to be characteristic of the family. The species of subgen. *Oligadenus* are exceptional in lacking an initial, prolonged filamentous growth phase. Therefore, the individual gametophytes normally result in a single gametophytic plate. The consequence of this difference is considered in view of the overall reproductive strategies of the 2 subgenera.

INTRODUCTION

Although the taxonomy of ferns has by long tradition been based primarily on the characters of the sporophyte, there is no special reason why the gametophyte should not also display characteristics of value in systematic syntheses. Various investigators have found such characters helpful in delimiting supraspecific categories (Atkinson & Stokey 1964, Atkinson 1973). Because the taxonomy and interspecific relationships of the Hawaiian genus *Adenophorus* have been worked out in some detail on the bases of morphology and anatomy (Bishop 1974), it seemed of value to study the gametophytes of several available species and to compare the results with previous observations in the family.

MATERIALS AND METHODS

Spores of 5 species of *Adenophorus* were cultured: *A. tamariscinus*, *A. tripinnatifidus*, and *A. hymenophylloides* of the subgenus *Adenophorus*; *A. pinnatifidus* and *A. oahuensis* of the subgenus *Oligadenus*. Also, wild gametophytes of *A. tamariscinus* were found and studied. Spores were sown on agar plates (Klekowski 1969) and maintained under continuous, fluorescent illumination (ca. 140 foot-candles) at room temperature (ca. 22° C.). The cultures were observed microscopically at various time intervals, and representative specimens were mounted on slides for further study. The cultures were continued for 10 months.

OBSERVATIONS

For this discussion *A. tripinnatifidus* has been selected as representative of the subgenus *Adenophorus*, *A. pinnatifidus* of *Oligadenus*. *Adenophorus tamariscinus* was found to be essentially identical in gametophyte development to the former, *A. oahuensis* to the latter. Details of *A. hymenophylloides* differential to those of *A. tripinnatifidus* will be mentioned where appropriate. The most typical (i.e., most frequent) developmental series has been used in either case for the illustrations (Figs. 1–2). Aberrations are explained in the text.

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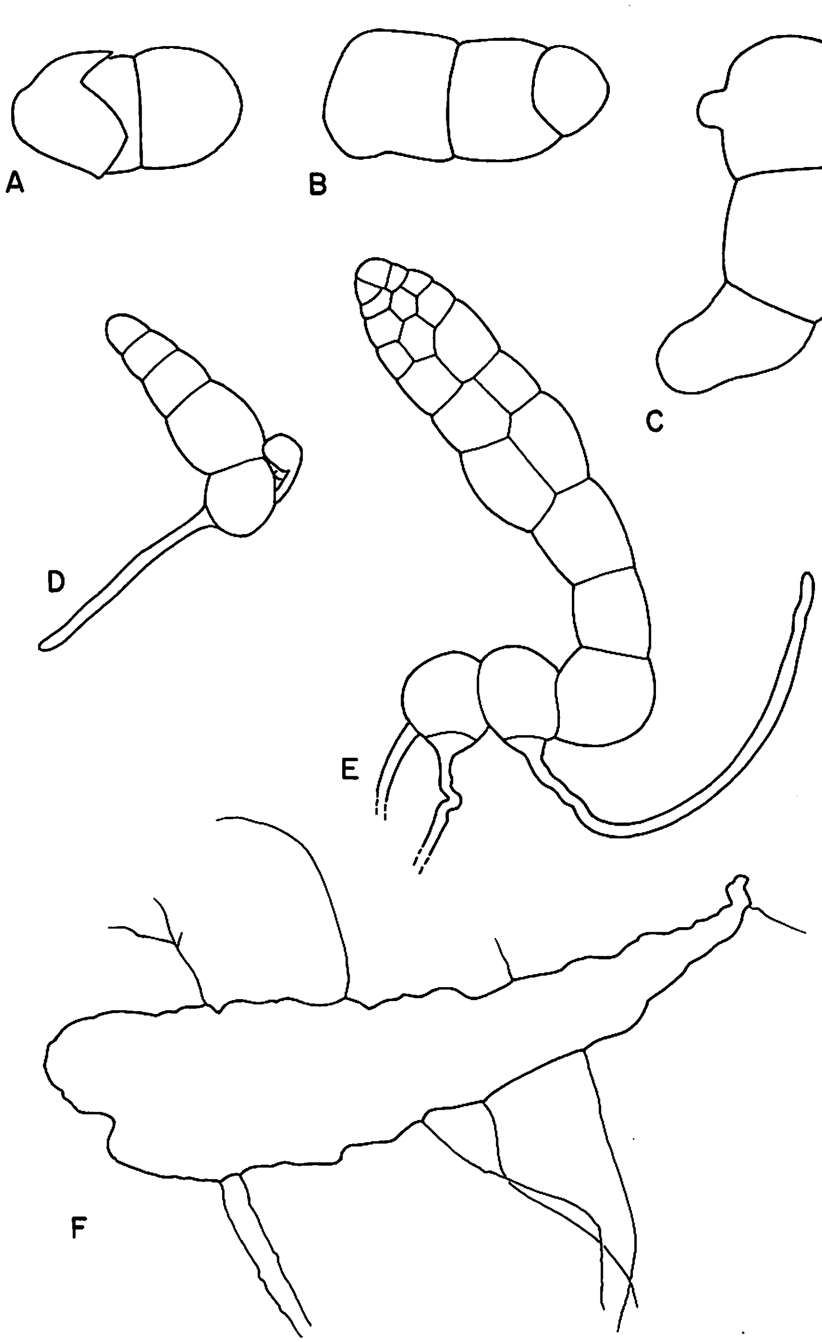

Fig. 1. Gametophyte development of *Adenophorus pinnatifidus*. **A,** 3 days. X385. **B,** 7 days. X385. **C,** 10 days. X385. **D,** 15 days. X210. **E,** 30 days. X210. **F,** 150 days. X50.

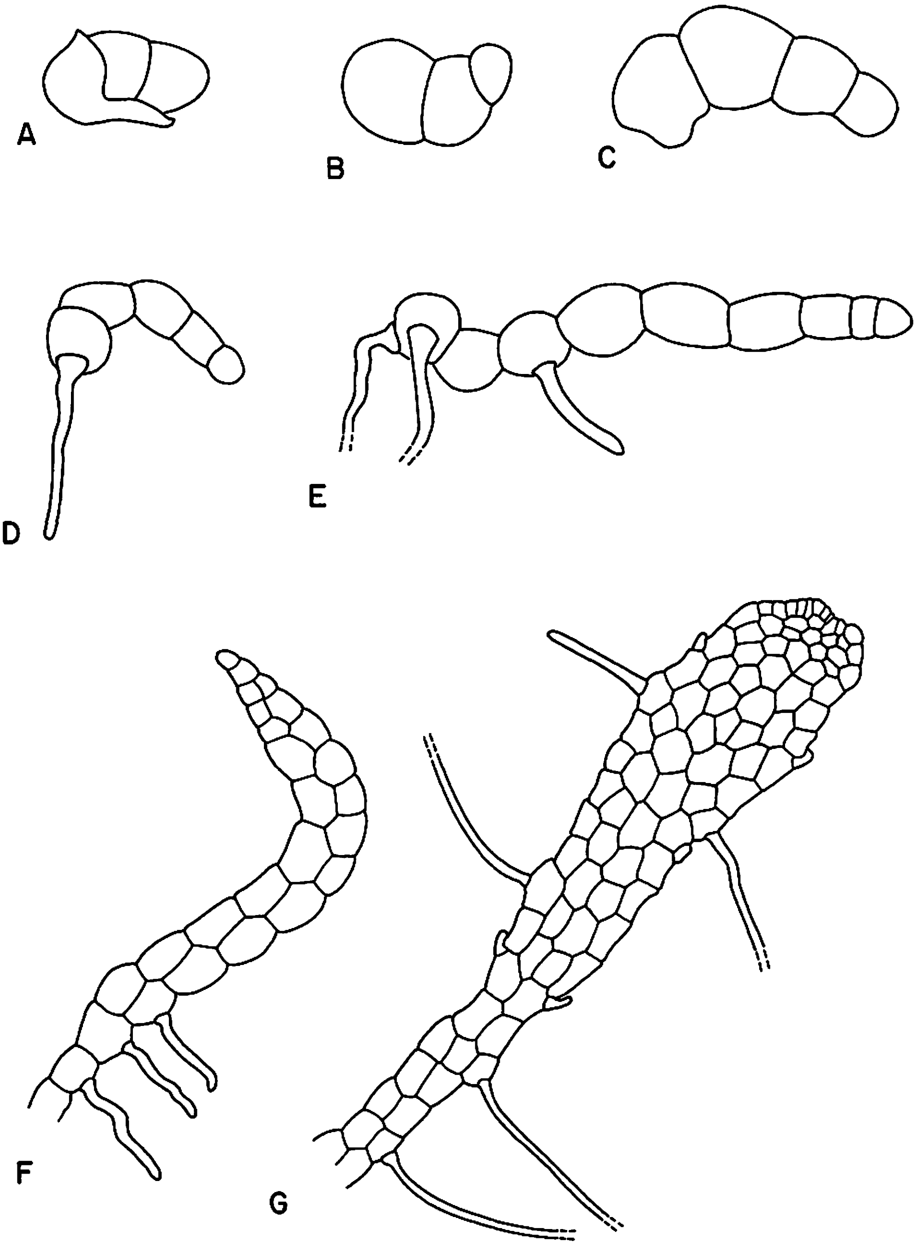

Fig. 2. Gametophyte development of *Adenophorus tripinnatifidus*. **A,** 3 days. X385. **B,** 7 days. X385. **C,** 10 days. X385. **D,** 15 days. X210. **E,** 30 days. X210. **F,** 80 days. X93. **G,** 110 days. X93.

The spores of *Adenophorus* are green, trilete, globose, and minutely sculptured. Germination begins on the 2nd day after sowing and is essentially complete by the 4th day. Immediately upon germination cell division occurs, resulting in 2 equal, green daughter cells, 1 of which—still partially retained within the spore wall—may be termed the basal cell. By the 7th day cell division has usually occurred again, normally by the unequal division (budding) of the apical cell only. Occasionally both cells divide, producing a young gametophyte with 2 growing points. In normal development the 4th cell is added apically by the 10th or 11th day, the 5th cell at the end of 2 weeks. The new cells formed by these divisions are usually not added rectilinearly but at slight angles to the more proximal cells, so that the young filament becomes distinctly arcuate. The initial cells of *A. pinnatifidus* are appreciably larger than those of *A. tripinnatifidus*. Species of subgenus *Oligadenus* exhibit larger spores than those of subgenus *Adenophorus*, so that these larger initial cells possibly reflect the larger spore size.

Plate Development: Subgenus *Oligadenus*

The subsequent development of most gametophytes differs markedly in the 2 subgenera. Plate formation is usually evident in *A. pinnatifidus* by the 4th week. The 1st longitudinal divisions normally occur in the 1 or 2 subapical cells. As apical growth continues, the apical region also becomes longitudinally divided and at length constitutes a zone of meristematic cells. The gametophytic plate is at first spathulate with a rounded apex. Later the apex is truncate or emarginate. Lateral, unicellular trichomes are not present, but some of the older gametophytes exhibit conspicuous digitate, multicellular, uniseriate or biseriate projections from the margin (Figs. 3C, 3D). With the exception of the small percentage of spores that produce 2 (rarely 3) filaments from the basal cell, 1 spore results in a single gametophytic plate and therefore, presumably, a single sporophyte.

Plate Development: Subgenus *Adenophorus*

At the end of 1 month most of the gametophytes of *A. tripinnatifidus* consist of a single filament of 8–12 cells. Some have initiated branch filaments by this time. A few show longitudinal cell divisions and thus plate initiation. Most, however, continue in a wholly filamentous stage for some time. Five-month-old gametophytes of *A. hymenophylloides* are small dense mats of much-branched, beadlike filaments (Fig. 3A). Comparable stages of *A. tripinnatifidus* are similar but somewhat less densely branched. Plate formation is evident in *A. tripinnatifidus* in some distal filaments of most gametophytes by the end of the 3rd month. The sequence of plate development is similar to that of *A. pinnatifidus* except that initially in many cases more cells of the uniseriate filament divide longitudinally, forming a longer biseriate plate stalk. The older plates exhibit marginal, unicellular trichomes that are distally directed. These are particularly conspicuous in *A. hymenophylloides* (Fig. 3B). The cells of the gametophytic plate are of approximately the same size in each subgenus (Figs. 4C, D). The filaments are fragile and easily fragmented. They appear collectively to undergo indeterminate growth, with individual filaments differentiating into plates from time to time.

Wild gametophytes of *A. tamariscinus* have been seen at 3 localities in the Ko'olau Mountains of O'ahu: Poamoho, Kipapa Gulch, and Kahana Valley. Those at Poamoho and Kipapa Gulch were growing on the introduced *Leptospermum scoparium*, those at Kahana Valley on a necrotic trunk of *Metrosideros polymorpha*. These gametophytes were colonial and quite elongate (Fig. 4E). Many exhibited platelike outgrowths either on the lateral margin or apically (Fig. 4F). Very little cushion development was apparent around the young sporophytes, and none showed evidence of a midrib.

Rhizoids, Gametangia, Leaf Development

In both subgenera, the 1st rhizoid of the young gametophyte regularly develops from the basal cell at about the 4-celled stage. Initially colorless, the rhizoid soon becomes dark brown

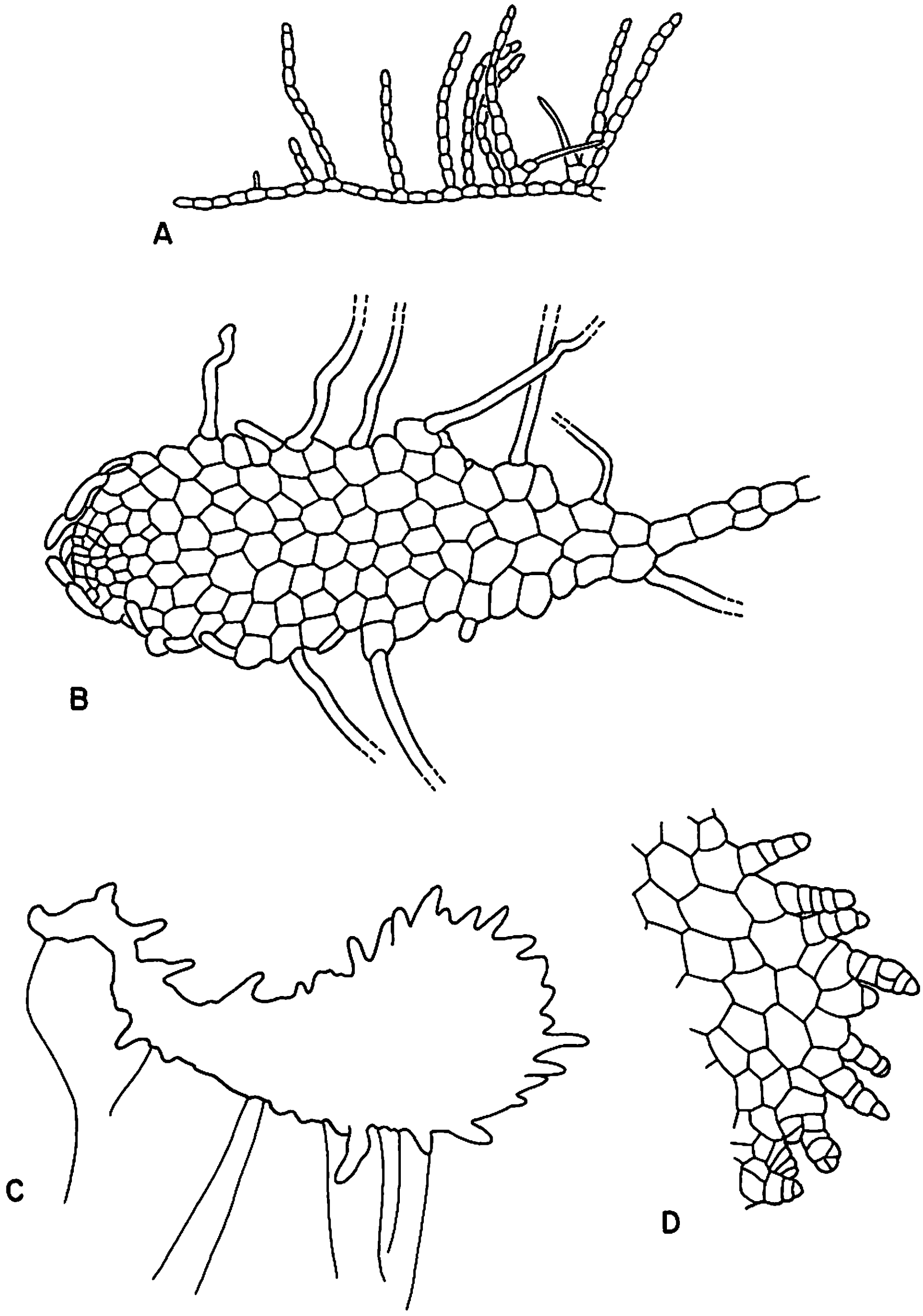

Fig. 3. Details of *Adenophorus* gametophytes. **A,** *A. hymenophylloides.* 150 days. X50. Portion of branched filament. **B,** *A. hymenophylloides.* 150 days. X93. Developed gametophyte plate. **C,** *A. pinnatifidus.* 150 days. X50. Gametophyte with digitate projections. **D,** detail of Fig. 3C. X93.

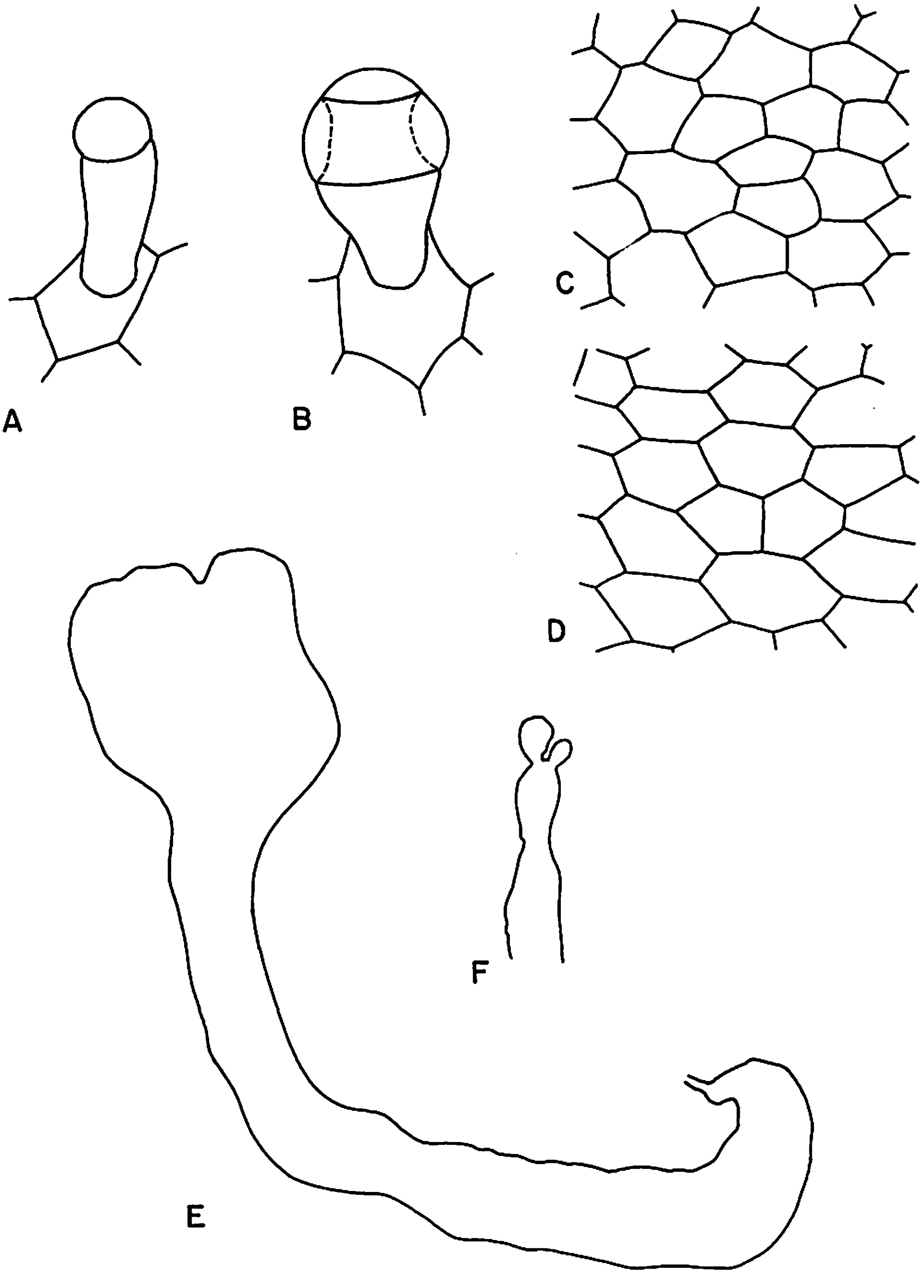

Fig. 4. Details of *Adenophorus* gametophytes. **A,** *A. pinnatifidus*. X385. Young antheridium. **B,** *A. pinnatifidus*. X385. Mature antheridium. **C,** *A. tripinnatifidus*. X210. Cells of gametophyte plate. **D,** *A. pinnatifidus*. X210. Cells of gametophyte plate. **E, F,** *A. tamariscinus*. X25. Wild gametophytes (rhizoids not shown).

and sharply delimited from the green subtending cell. Similar rhizoids later develop elsewhere on the filaments or marginally on the plate. Rarely they may be present on the ventral side of the plate. The rhizoids are usually simple, but occasionally are variously branched.

Antheridia appeared on cultured gametophytes of *A. pinnatifidus* after 4 months (Figs. 4A, B). These occur ventro-medially and are basally directed. The mature antheridium consists of an elongate stalk cell, a ring cell, a single cap cell, and the androgametic tissue. No antheridia were found in equally aged cultures of species of subgenus *Adenophorus*; however, wild gametophytes of *A. tamariscinus* bore antheridia that, although badly distorted by fixation, appeared to be essentially like those of *A. pinnatifidus*. Archegonia were not present on cultured gametophytes, nor were they discernible on the wild material.

The sequential events of frond development in *A. tamariscinus* were observed in the young sporophytes from Kipapa Gulch. The 1st leaf is simple, entire, spathulate, and 1.5–2.0 mm long. It is provided with laminar glands as in the adult leaf. The costa is simple or slightly forked apically. Usually the 2nd and sometimes the 3rd leaves are similar to, but slightly larger than, the 1st. Occasionally the 2nd or more generally the 3rd leaf is obliquely bilobed, and the vascular supply is similarly furcated. This leaf is ca. 3 mm long. Successive leaves are increasingly larger and have a progressively greater number of lateral lobes. The costa of the young, simply pinnatifid leaves is conspicuously flexuous. Three to 5 such leaves are developed. When a leaf attains a length of ca. 15 mm, some evidence of secondary lobing is displayed. The next leaf after this one is essentially bipinnatifid and successive fronds merely exhibit an increase in size and development.

DISCUSSION

Stokey and Atkinson (1958) studied the gametophyte development in culture of 27 Jamaican species of the Grammitidaceae. Irregularities in details of growth were frequent in their work, both interspecifically and intraspecifically, but certain features were found to occur in all species and were considered characteristic of the family. These included: equal or subequal division of the spore cell; slow development of the gametophyte; a prolonged phase of filamentous growth; belated appearance of the 1st rhizoid; brown rhizoids, which on the plate are generally marginal; elongate-cordate gametophyte plate; and the long basal cell of the antheridia. All these characters are found in *Adenophorus*. However, the usual absence of an indeterminate filamentous growth phase found in the subgenus *Oligadenus* was not explicitly reported in any of the species studied by Stokey and Atkinson (1958). Moreover, the growth rate of *Adenophorus* species, although very slow in comparison to most ferns, was generally faster than in their material. This could be attributable to the continuous light under which my cultures were grown; Stokey and Atkinson do not state the culture conditions employed in their work.

At least with respect to the species studied, the gametophytes of the subgenera of *Adenophorus* differ in 2 major respects. (1) The plate of subgenus *Adenophorus* bears unicellular, usually marginal trichomes, which are absent in subgenus *Oligadenus*. These trichomes are reminiscent of the sessile, laminar glands characteristic of the sporophyte of the former subgenus. (2) Gametophytes of subgenus *Oligadenus* usually produce a single gametophytic plate; those of subgenus *Adenophorus*, by virtue of their indeterminate filamentous phase, may produce many. On considering the reproductive biology of the various species, this latter difference seems to be correlated with the presence of vegetative root buds in subgenus *Oligadenus* and their absence in subgenus *Adenophorus*. Green spores have a significantly curtailed period of viability when compared to nongreen spores (Lloyd & Klekowski 1970), so that whatever the adaptive advantage of chlorophyllous spores may be, the incidence of successful diasporal dispersal must be reduced. The production of several to many sporophytes from a single instance of successful spore germination could be interpreted as providing a means of reproductive compensation, especially in species whose individual plants—and therefore spore output—are small. I find it remarkable that such compensatory mechanisms are exhibited in the genus *Adenophorus* in 1 subgenus by the gametophyte and in the other by the sporophyte.

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Checklist of Native and Naturalized Flowering Plants of Hawai'i

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ABSTRACT

An up-to-date checklist of the 1,817 species of native and naturalized flowering plants of the Hawaiian Archipelago is presented. The nomenclature and taxonomy follow the soon-to-be-published *Manual of the Flowering Plants of Hawai'i.* The taxa are presented alphabetically by family and subsequently within each successive hierarchical level (genus, species, and infraspecific ranks). The list includes all taxa accepted in the *Manual,* and for each the distributional status, endangerment status, and distribution within Hawai'i are given. The flowering plant flora consists of 146 families (87 with native taxa), 649 genera (216 with native taxa—165 dicot and 51 monocot), and 1,817 species (956 native species—850 endemic, 106 also occurring outside Hawai'i—and 861 naturalized species, 25 of which were introduced by the Polynesians before the Western discovery of the Hawaiian Islands in 1778).

INTRODUCTION

It has been 100 years since the publication of *Flora of the Hawaiian Islands* (Hillebrand 1888), the last complete flora of Hawai'i. This flora has served its purpose admirably, but numerous new botanical discoveries have been made since its publication. Considerable advances also have been made in the refinement of the classification and understanding of evolution in many genera. Furthermore, only about 140 naturalized angiosperms were known in the 1870s, while now there are about 860 naturalized species.

Various publications have been utilized during the past 100 years by those interested in the Hawaiian flora, including: *The Indigenous Trees of the Hawaiian Islands* (Rock 1913); *In Gardens of Hawaii,* 2nd edition (Neal 1965); *Flora Hawaiiensis or New Illustrated Flora of the Hawaiian Islands* (Degener 1932–80); and, most recently, *List and Summary of the Flowering Plants in the Hawaiian Islands* (St. John 1973).

In 1982 a project was initiated to write a modern account of the native and naturalized angiosperms of Hawai'i. This book, *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst & Sohmer, in press), will fill the considerable need for a comprehensive treatment of the Hawaiian flowering plants.

This checklist is intended to serve as a quick access, concise reference to the native and naturalized flowering plants of Hawai'i, appropriate for use in the field, using the taxonomy and distributional information derived from the forthcoming *Manual.* In a sense, it also can be

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Table 1. Statistics summarizing the native flowering plants of Hawai'i.

	Dicots	Monocots	Total
Families	73	14	87
Total genera	165 (76%)	51 (24%)	216
Endemic genera	31 (19%)	1 (2%)	32 (15%)
Total species	822 (86%)	134 (14%)	956
Endemic species	759 (92%)	91 (68%)	850 (89%)
Indigenous species	63 (8%)	43 (32%)	106 (11%)
Total taxa	947 (87%)	147 (13%)	1,094
Total endemic taxa	888 (94%)	107 (73%)	995 (91%)
Total indigenous taxa	59 (6%)	40 (27%)	99 (9%)

Table 2. Numbers of species and total taxa of Hawaiian flowering plants.

	Dicots	Monocots	Total
Native species	822	134	956 (53%)
Total native taxa	947	147	1,094 (56%)
Naturalized species	672	189	861 (47%)
Total naturalized taxa	679	190	869 (44%)
Total species	1,494 (82%)	323 (18%)	1,817
Total taxa	1,626 (83%)	337 (17%)	1,963

viewed as an updating of the information in the 1973 St. John checklist (but excluding cultivated plants and synonyms of accepted taxa). We hope that this checklist will stimulate further study of species distributions, especially of the naturalized flora, for which the distributional information base is weak. Many naturalized species probably had become well established on one or more islands before they were first collected. Information in the *Manual* will provide a baseline for future, more critical assessments of the introduction and spread of naturalized species in the Hawaiian flora.

The following list includes all taxa accepted in the *Manual*, along with their distributional status (extent of geographical range and origin relative to Hawai'i), endangerment status (if any), and distribution within Hawai'i.

The families, and the species within each family, are listed alphabetically. A total of 146 families (87 with native taxa), 649 genera (216 with native taxa—165 dicot and 51 monocot), and 1,817 species are treated in the *Manual*. These include 956 native species (850 endemic, 106 also occurring outside Hawai'i) and 861 naturalized species. Twenty-five of the naturalized species are Polynesian introductions (see Tables 1 & 2).

Distributional status is given in parentheses following the scientific name. The categories are as follows:

end	*Endemic:* Species occurring only in the Hawaiian Archipelago, but not necessarily on a single island within the archipelago.
ind	*Indigenous:* Species that occur naturally in the archipelago but also have a wider distribution outside Hawai'i.
nat	*Naturalized:* Species that apparently have been introduced to the archipelago directly or indirectly by humans. These species are thoroughly established and are replacing their populations or spreading by vegetative or sexual means. As used here, this category

	excludes naturalized species that were originally introduced by the migrating Polynesians.
pol	*Polynesian introduction:* Species that apparently were introduced by the Polynesians migrating to Hawai'i, either intentionally or unintentionally, and are now naturalized.
end?	*Questionably endemic:* Species treated here as endemic species, although some evidence suggests that they in fact represent naturalized populations of as yet unidentified species. This category is used here for only a single species, *Festuca hawaiiensis.*
ind?	*Questionably indigenous:* Species for which dates of introduction or other information do not make a clear argument for their dispersal to Hawai'i by natural or human-related mechanisms, but for which the weight of evidence suggests that they are probably indigenous.
nat?	*Questionably naturalized:* Species that probably are naturalized, but for which the dates of introduction are very early, or for which the habitats are such that the species may well have dispersed to Hawai'i long ago by agents other than humans and thus should be considered indigenous. Some species in this category, if not indigenous, could be Polynesian introductions.
pol?	*Questionably a Polynesian introduction:* Species that may have been Polynesian introductions or that possibly were introduced in historical times (after 1778).

In some cases, an indigenous species with one or more endemic infraspecific taxa occurs in the Hawaiian flora (e.g. *Jacquemontia ovalifolia* subsp. *sandwicensis*); in such instances, the distributional status is indicated for each taxonomic level.

Endangerment status of native species follows the distribution status in parentheses. The categories devised by the International Union for Conservation of Nature and Natural Resources (IUCN) for indicating degrees of threat were used for the *Manual* (*IUCN Plant Red Data Book*, Lucas & Synge 1978). The definitions of the four categories used are:

EX	*Extinct:* Species for which we have evidence that they are no longer extant. As many Hawaiian plants are very restricted in their distribution, some species presently placed in this category undoubtedly will be rediscovered. We do not include in this category species such as *Hibiscadelphus giffardianus* and *Kokia cookei,* which are extinct in the wild but survive in cultivation.
E	*Endangered:* Taxa in danger of becoming extinct throughout all or a significant portion of their range unless the threats jeopardizing their survival are alleviated.
V	*Vulnerable:* Taxa likely to become endangered in the near future unless the threats to their survival are removed or reduced. In Hawai'i, most species in this category are threatened by extensive habitat destruction or modification or by other environmental disturbances.
R	*Rare:* Species with small, localized populations that are not believed to be endangered or vulnerable at present but could be considered at risk.

These categories were assigned by the *Manual* authors on the basis of several factors: the number of collections of each taxon in the Herbarium Pacificum (BISH) collection at Bishop Museum and the date of the most recent collection; personal knowledge of the species and the condition of its habitat; geographical location or habitat type; distribution within the archipelago; and nature of and potential for threats. Of the 1,094 native flowering plant taxa included in the *Manual* (995 [91%] of which are endemic), 421 (38%) are considered to be extinct or threatened to some degree; of these, 107 are presumed extinct (10% of the native taxa), 138 endangered (12%), 39 vulnerable (4%), and 137 rare (12%). An asterisk (*) is used to indicate a federally listed endangered taxon (19 taxa formally designated at this time).

The geographic distribution follows the endangerment status, with the islands of occurrence listed according to their northwest-to-southeast (oldest to youngest) sequence in the archipelago: Ku, Mi, PH, Li, La, GP, FF, Ne, N, Ni (incl. Kl & Le), K, O (incl. Wa & Ko), Mo, L, M (incl. EM [incl. Ml] & WM), Ka, H. The complete alphabetical list is as follows:

EM	East Maui	L	Lāna‘i
FF	French Frigate Shoals (incl. Tern and other islands)	La	Laysan
		Le	Lehua
GP	Gardner Pinnacles	Li	Lisianski
H	Hawai‘i	M	Maui
HI	The eight main Hawaiian Islands (Ni‘ihau, Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, Kaho‘olawe, and Hawai‘i)	Mi	Midway Atoll (incl. Sand and Eastern islands)
		Ml	Molokini
		Mo	Moloka‘i
		N	Nihoa
		Ne	Necker
K	Kaua‘i	Ni	Ni‘ihau
Ka	Kaho‘olawe	O	O‘ahu (incl. Mokoli‘i Islet)
Kl	Ka‘ula		
Ko	Ko‘olau Mountains	PH	Pearl and Hermes Atoll
Ku	Kure Atoll (incl. Sand and Green islands)	WM	West Maui
		Wa	Wai‘anae Mountains

Ka‘ula, Lehua, and Molokini islands are mentioned specifically in the distribution list only if they harbor restricted native taxa or naturalized taxa not occurring on the adjacent main islands. Other offshore rocks and islets are included with the nearest large island and are not specifically mentioned unless they include restricted native taxa.

Information on geographical distribution was obtained primarily from label data on BISH collections, and was supplemented by records from other herbaria. In a few instances, other sources—such as references in the published literature or personal observations—are cited, but very few distributional records are included that are not documented by herbarium specimens.

When available, more specific distributional information is included (in parentheses), especially if a species has a localized distribution or is known from only a few collections. However, because of space constraints, in some cases a more generalized version of the *Manual* information is used. For the same reason, information from the *Manual* on elevational and ecological ranges is not included. No attempt was made to expand upon the level of detail provided by the *Manual.*

Question marks (?) indicate uncertainty about the island on which a specimen was collected (e.g., some David Nelson collections from Captain Cook's third voyage to the Pacific). Also, lower-case endangerment symbols refer to notes by the *Manual* authors indicating that the status of a taxon on a particular island is at variance with its status in the Hawaiian Islands. These symbols do not imply any formally designated endangerment status.

Thus, as an example of how to read the list, **Lipochaeta venosa** Sherff (**Asteraceae**) is an endemic species, federally listed as endangered, which occurs on Hawai‘i Island, specifically at Nohonaohae, Holoholokū, and Heihei cinder cones, and Pu‘upā, in South Kohala District.

An alphabetical listing of all genera treated in the *Manual*, cross-referenced by family, is included following the checklist as a locational aid for the user.

Additional abbreviations used in the checklist include the following:

Dist	*District*	Mts	*Mountains*
FR	*Forest Reserve*	NP	*National Park*
Hwy	*Highway*	Pt	*Point*
incl	*include*	Riv	*River*
Mt	*Mount*	Val	*Valley*

ACANTHACEAE

Asystasia gangetica (L.) T. Anderson (nat) Mi, K, O, Mo, M; probably HI
Barleria cristata L. (nat) K, O, H
Blechum brownei Juss. (nat) O (Ko: Mānoa Val)
Dicliptera chinensis (L.) Juss. (nat) K, O
Hemigraphis alternata (N.L. Burm.) T. Anderson (nat) O (Honolulu)
Hemigraphis reptans (G. Forster) T. Anderson (nat) K, O, H
Justicia betonica L. (nat) K, O, Mo, L, M, H
Ruellia brittoniana E. Leonard (nat) Mi, K, O
Ruellia graecizans Backer (nat) K, O
Ruellia prostrata Poir. (nat) O (Honolulu)
Thunbergia alata Bojer (nat) K, Mo, EM, H (Hilo; Volcano Village)
Thunbergia fragrans Roxb. (nat) K, O, M, H; probably HI
Thunbergia grandiflora Roxb. (nat) K, O, H
Thunbergia laurifolia Lindl. (nat) K, O

AGAVACEAE

Agave sisalana Perrine (nat) K, O, Mo, L, M, Ka, H
Cordyline fruticosa (L.) A. Chev. (pol) Ni, K, O, Mo, L, M, H
Furcraea foetida (L.) Haw. (nat) K, O, Mo, L, M, H
Phormium tenax J.R. Forster & G. Forster (nat) K, Mo
Pleomele aurea (H. Mann) N.E. Brown (end) K
Pleomele auwahiensis St. John (end) central Mo, leeward M
Pleomele fernaldii St. John (end) L
Pleomele forbesii Degener (end) O (Wa; Ko: Kawela; Wilhelmina Rise)
Pleomele halapepe St. John (end) O
Pleomele hawaiiensis Degener & I. Degener (1980), non Degener (1932) (end, R) leeward H (above Pōhue Bay, Kaʻū Dist; Holei Pali, Puna Dist)

AIZOACEAE

Sesuvium portulacastrum (L.) L. (ind) PH, Li, La, Ne, HI
Tetragonia tetragonioides (Pall.) Kuntze (nat) N, K, O, H
Trianthema portulacastrum L. (nat) O (Honolulu International Airport to Honouliuli)

ALISMATACEAE

Sagittaria latifolia Willd. (nat) K, O, M

AMARANTHACEAE

Achyranthes aspera L. (nat)
  var. **aspera** La (single collection), O, H
  var. **pubescens** (Moq.) C.C. Townsend (no locality data, probably no longer extant)
Achyranthes atollensis St. John (end, EX) Ku, Mi, PH, La
Achyranthes mutica A. Gray (end, EX) K, H?

Achyranthes splendens Mart. ex Moq. (end)
  var. **rotundata** Hillebr. (E*) O (west coast), Mo (Kalaupapa), L (Manele Gulch)
  var. **splendens** L (Maunalei Gulch), WM, EM (Kula)
Alternanthera brasiliana (L.) Kuntze (nat) Mo (Hālawa Val)
Alternanthera caracasana Kunth (nat) K, O, Mo, L, M
Alternanthera pungens Kunth (nat) O, Mo, H; probably HI
Alternanthera sessilis (L.) DC (nat) O, Mo, M, H
Alternanthera tenella Colla (nat) O
Amaranthus brownii Christoph. & Caum (end, E) N
Amaranthus dubius Mart. ex Thell. (nat) K, O, L, H
Amaranthus hybridus L. subsp. **hybridus** (nat) O, M
Amaranthus lividus L. subsp. **polygonoides** (Moq.) Probst (nat) K, O, H
Amaranthus spinosus L. (nat) Ku, K, O, Mo, M, Ka, H
Amaranthus viridis L. (nat) Ku, Kl, K, O, L, M, Ka, H
Charpentiera densiflora Sohmer (end, V) K (Ho‘olulu, Hanakāpī‘ai, and Hanakoa valleys, Nāpali Coast)
Charpentiera elliptica (Hillebr.) A. Heller (end) K
Charpentiera obovata Gaud. (end) K, O, Mo, L, M, H
Charpentiera ovata Gaud. (end)
  var. **niuensis** Sohmer O (Ko: Niu and Wailupe valleys)
  var. **ovata** O (south Ko), Mo, M, H
Charpentiera tomentosa Sohmer (end)
  var. **maakuaensis** Sohmer O (Ko: windward gulches)
  var. **tomentosa** O (Wa), Mo, L, M, H
Gomphrena celosioides Mart. (nat) O (Wa; central plain; Kalihi)
Gomphrena globosa L. (nat) O
Nototrichium humile Hillebr. (end, E) O (northwest Wa), EM (Luala‘ilua Hills)
Nototrichium sandwicense (A. Gray) Hillebr. (end) HI

ANACARDIACEAE

Mangifera indica L. (nat) HI
Rhus sandwicensis A. Gray (end) K (Kamali‘i Ridge, Makaweli), O (Ko: Nu‘uanu and Moanalua valleys; Ho‘omaluhia), Mo (Pelekunu Val), M, H
Schinus molle L. (nat) EM, H (Pu‘uwa‘awa‘a)
Schinus terebinthifolius Raddi (nat) Mi, K, O, Mo, L, M, H

APIACEAE

Anethum graveolens L. (nat) O, M
Centella asiatica (L.) Urb. (nat) K, O, Mo, L, M, H
Ciclospermum leptophyllum (Pers.) Sprague (nat) Mi, K, O, Mo, L, M, H
Coriandrum sativum L. (nat) O
Cryptotaenia canadensis (L.) DC (nat) K, O, H
Daucus pusillus Michx. (nat?) O, Mo, L, H
Foeniculum vulgare Mill. (nat) K, O, L, M, H
Hydrocotyle bowlesioides Mathias & Constance (nat) K, O, H
Hydrocotyle sibthorpioides Lam. (nat) K, O, M, H
Hydrocotyle verticillata Thunb. (nat?) Ni, K, O, Mo, M, H
Petroselinum crispum (Mill.) A.W. Hill (nat) K, O, M, H
Peucedanum sandwicense Hillebr. (end, E) K, Mo, WM, EM (Keōpuka Islet)
Sanicula kauaiensis St. John (end, E) K (Wai‘ale‘ale; Kalalau Val)
Sanicula mariversa Nagata & Gon (end, E) O (Wa: ‘Ōhikilolo)
Sanicula purpurea St. John & Hosaka (end, R) O (Ko), WM
Sanicula sandwicensis A. Gray (end) EM (slopes of Haleakalā), H (Mauna Kea; Mauna Loa; Hualālai)

Spermolepis hawaiiensis Wolff (end, E) K, O, Mo, M, H; only extant populations occur on Diamond Head, O'ahu, and WM
Torilis nodosa (L.) Gaertn. (nat) H (Kona; Pōhakuloa Training Area)

APOCYNACEAE

Alyxia oliviformis Gaud. (end) HI; no longer occurring on Ni and Ka
Cascabela thevetia (L.) Lippold (nat) K, O, M; probably HI
Catharanthus roseus (L.) G. Don (nat) Mi, Ni, O, Mo, M, Ka, H; probably HI
Ochrosia compta K. Schum. (end) O, Mo (Pelekunu Trail; Wailau Val; Kahanui)
Ochrosia haleakalae St. John (end, R) EM, H (Pololū Val; Kalōpā Gulch)
Ochrosia kauaiensis St. John (end, R) K (Nāpali Coast; Hi'i Mts)
Ochrosia kilaueaensis St. John (end, E) H (Pu'uwa'awa'a; Kīpukapuaulu)
Pteralyxia kauaiensis Caum (end, R) K (Ku'ia, Kalalau, and Mahanaloa valleys; Hi'i Mts; Hā'upu; Pāpa'a; Wai'oli-Waipā Ridge; Limahuli)
Pteralyxia macrocarpa (Hillebr.) K. Schum. (end) O
Rauvolfia sandwicensis A. DC (end) Ni, K, O, Mo, L, M, H

AQUIFOLIACEAE

Ilex anomala Hook. & Arnott (ind) K, O, Mo, L, M, H
Ilex aquifolium L. (nat) H (Pua'ākala Ranch, Mauna Kea)
Ilex paraguariensis St. Hil. (nat) O (Ko: Mānoa and Waiāhole valleys)

ARACEAE

Alocasia macrorrhiza (L.) Schott (pol) K, O, Mo, M; probably HI
Colocasia esculenta (L.) Schott (pol) Ni, K, O, Mo, L, M, H
Epipremnum pinnatum (L.) Engl. (nat) K, O, M, H; probably HI
Pistia stratiotes L. (nat) K, O, Mo, M
Zantedeschia aethiopica (L) Spreng. (nat) K, M

ARALIACEAE

Cheirodendron dominii Kraj. (end, R) K (Mt Wai'ale'ale)
Cheirodendron fauriei Hochr. (end) K (Kōke'e; Mt Kāhili; Hā'upu Ridge; Powerline Trail)
Cheirodendron forbesii (Sherff) Lowry (end) K (Mt Kāhili; Kamo'oloa Stream; Makaleha Mts; Powerline Trail)
Cheirodendron platyphyllum (Hook. & Arnott) Seem. (end)
  subsp. **kauaiense** (Kraj.) Lowry K
  subsp. **platyphyllum** O
Cheirodendron trigynum (Gaud.) A. Heller (end)
  subsp. **helleri** (Sherff) Lowry K
  subsp. **trigynum** Ni, O, Mo, L, M, H
Hedera helix L. (nat) K, O, H
Munroidendron racemosum (C. Forbes) Sherff (end, E) K (Nounou Mts; Nāpali Coast; Hā'upu Ridge)
Reynoldsia sandwicensis A. Gray (end) O, Mo, L, M, H
Schefflera actinophylla (Endl.) Harms (nat) K, O, M, H; probably HI
Tetraplasandra gymnocarpa (Hillebr.) Sherff (end, E) O (Ko)
Tetraplasandra hawaiensis A. Gray (end) Mo, L, M, H
Tetraplasandra kavaiensis (H. Mann) Sherff (end) K, O (north Wa), L, M, H
Tetraplasandra oahuensis (A. Gray) Harms (end) K, O, Mo, L, M, H
Tetraplasandra waialealae Rock (end) K
Tetraplasandra waimeae Wawra (end) K

ARECACEAE

Archontophoenix alexandrae (F.v. Muell.) H.A. Wendl. & Drude (nat) H
Cocos nucifera L. (pol) La, HI
Livistona chinensis (Jacq.) R. Br. ex Mart. (nat) O (Ko: Moanalua Val)
Pritchardia affinis Becc. (end, E) leeward H
Pritchardia arecina Becc. (end) EM (north slope, Haleakalā)
Pritchardia aylmer-robinsonii St. John (end, E) Ni (Ka‘ali Cliff)
Pritchardia beccariana Rock (end) H (Kīlauea)
Pritchardia forbesiana Rock (end) WM (Honokōhau drainage; Mt ‘Eke)
Pritchardia glabrata Becc. & Rock (end) WM (‘Īao Val)
Pritchardia hardyi Rock (end, R) K (Powerline Trail)
Pritchardia hillebrandii (Kuntze) Becc. (end) windward Mo
Pritchardia kaalae Rock (end) O (Wa: Mt Ka‘ala; Mākua-Mākaha ridge)
Pritchardia lanigera Becc. (end) H (Kohala Mts; above ‘Āwini, back of Waimea; south slope, Mauna Loa; Nā‘ālehu; windward slope, Mauna Kea, between Honoka‘a and Pa‘auhau)
Pritchardia lowreyana Rock (end) Mo
Pritchardia martii (Gaud.) H.A. Wendl. (end) O (Ko)
Pritchardia minor Becc. (end) K (Alaka‘i Swamp to Kōke‘e; Nāpali Coast)
Pritchardia munroi Rock (end, E) leeward Mo (Kamalō; Puako‘olau)
Pritchardia napaliensis St. John (end, R) K (Hanakāpī‘ai to Ho‘olulu valleys, Nāpali Coast)
Pritchardia remota (Kuntze) Becc. (end, V) N (East and West Palm valleys)
Pritchardia schattaueri Hodel (end, E) H (Ho‘omau Ranch, lands of Pāpā)
Pritchardia viscosa Rock (end, R) K (Powerline Trail)
Pritchardia waialealeana Read (end) K (Powerline Trail)

ARISTOLOCHIACEAE

Aristolochia littoralis Parodi (nat) O (Pearl Harbor)

ASCLEPIADACEAE

Asclepias curassavica L. (nat) HI
Asclepias physocarpa (E. Mey.) Schlechter (nat) K, O, L, M, Ka, H
Stapelia gigantea N.E. Brown (nat) O (Ko; Diamond Head)

ASTERACEAE

Acanthospermum australe (Loefl.) Kuntze (nat) HI
Acanthospermum hispidum DC (nat) Mo (Moloka‘i Ranch)
Achillea millefolium L. (nat) H
Adenostemma lavenia (L.) Kuntze (ind) K, O, Mo, L, M, H
Ageratina adenophora (Spreng.) R. King & H. Robinson (nat) O, Mo, L, M
Ageratina riparia (Regel) R. King & H. Robinson (nat) O, Mo, M, H
Ageratum conyzoides L. (nat) HI
Ageratum houstonianum Mill. (nat) K, O, H
Ambrosia artemisiifolia L. (nat) O, Mo, M, H
Anthemis cotula L. (nat) K, L, M, H
Arctium lappa L. (nat) O, L, H
Argyroxiphium caliginis C. Forbes (end) WM (‘Eke; Pu‘ukukui)
Argyroxiphium grayanum (Hillebr.) Degener (end) WM summit; EM (above Hāna Forest Reserve)
Argyroxiphium kauense (Rock & M. Neal) Degener & I. Degener (end, E) H (Kahuku Ranch, Mauna Kea; Hualālai, single collection)
Argyroxiphium sandwicense DC (end)
  subsp. **macrocephalum** (A. Gray) Meyrat (E) EM (Haleakalā)
  subsp. **sandwicense** (E*) H (Mauna Kea)
Argyroxiphium virescens Hillebr. (end, EX) EM (Ukulele; Pu‘unianiau; Ko‘olau Gap; Kuiki)

Artemisia australis Less. (end) HI
Artemisia kauaiensis (Skottsb.) Skottsb. (end) K
Artemisia mauiensis (A. Gray) Skottsb. (end) EM (Haleakalā crater and south slope)
Artemisia vulgaris L. (nat) K, O, H
Aster subulatus Michx. var. **sandwicensis** (A. Gray) A.G. Jones (nat) Ni, K, O, Mo, M, H
Baltimora recta L. (nat) O (Makapu'u)
Bellis perennis L. (nat) K, H
Bidens alba (L.) DC var. **radiata** (Schultz-Bip.) Ballard ex Melchert (nat) Ku, Mi, K, O, M, Ka, H
Bidens amplectens Sherff (end) O (windward Wa: between Kawaihāpai and Ka'ena Pt)
Bidens asymmetrica (H. Lév.) Sherff (end) O (southeast, leeward Ko)
Bidens campylotheca Schultz-Bip. (end)
  subsp. **campylotheca** O, L (ex), H
  subsp. **pentamera** (Sherff) Ganders & Nagata (R) EM
  subsp. **waihoiensis** St. John (R) EM
Bidens cervicata Sherff (end) Ni, northwest K, O (northwest Wa)
Bidens conjuncta Sherff (end, R) WM
Bidens cosmoides (A. Gray) Sherff (end) K
Bidens cynapiifolia Kunth (nat) O, Mo, L, M, H
Bidens forbesii Sherff (end)
  subsp. **forbesii** K
  subsp. **kahiliensis** Ganders & Nagata K (Mt Kāhili; Kapalaoa)
Bidens gardneri Baker (nat) Mo (Honouli Wai)
Bidens hawaiensis A. Gray (end) H (Kohala; Puna Dist; Kīlauea)
Bidens hillebrandiana (Drake) Degener (end)
  subsp. **hillebrandiana** H (Kohala Coast)
  subsp. **polycephala** Nagata & Ganders Mo (windward coast), EM (windward coast)
Bidens macrocarpa (A. Gray) Sherff (end) O (Ko)
Bidens mauiensis (A. Gray) Sherff (end) L, M, Ka
Bidens menziesii (A. Gray) Sherff (end)
  subsp. **filiformis** (Sherff) Ganders & Nagata H (leeward sides of and in saddle between Mauna Loa and Mauna Kea)
  subsp. **menziesii** leeward Mo, leeward WM
Bidens micrantha Gaud. (end)
  subsp. **ctenophylla** (Sherff) Nagata & Ganders (V) H (leeward Hualālai)
  subsp. **kalealaha** Nagata & Ganders (E) L, WM (single locality), EM
  subsp. **micrantha** WM, EM (single collection)
Bidens molokaiensis (Hillebr.) Sherff (end) O (Diamond Head), windward Mo
Bidens pilosa L. (nat) Mi, HI
Bidens populifolia Sherff (end) O (windward Ko: between Kaipapa'u and Ka'a'awa)
Bidens sandvicensis Less. (end)
  subsp. **confusa** Nagata & Ganders (R) K (Waimea Canyon)
  subsp. **sandvicensis** K, O
Bidens torta Sherff (end) O (Wa; northwest Ko)
Bidens valida Sherff (end) K (Mt Kāhili; Hā'upu Ridge)
Bidens wiebkei Sherff (end, E) northeast Mo
Blumea laciniata (Roxb.) DC (nat) O, H
Blumea sessiliflora Decne. (nat) M (single collection; not known if species persists)
Calyptocarpus vialis Less. (nat) K, O, Mo, L, M
Carduus pycnocephalus L. (nat) M (west slope, Haleakalā; west Kaupō Gap)
Centaurea melitensis L. (nat) HI
Chrysanthemum leucanthemum L. (nat) M, H
Cirsium vulgare (Savi) Ten. (nat) K, O, Mo, L, M, Ka, H
Conyza bonariensis (L.) Cronq. (nat) Ku, Mi, La, FF, HI
Conyza canadensis (L.) Cronq. (nat)

  var. **canadensis** M, H (Pōhakuloa Training Area, Mauna Kea)
  var. **pusilla** (Nutt.) Cronq. Ni, K, O, Mo, L, M, H
Coreopsis lanceolata L. (nat) L, H (Hawai‘i Volcanoes NP)
Cotula australis (Sieber ex Spreng.) J.D. Hook. (nat) O, EM, H
Crassocephalum crepidioides (Benth.) S. Moore (nat) K, O, Mo, M, H
Crepis capillaris (L.) Wallr. (nat) H
Dubautia arborea (A. Gray) D. Keck (end, V) H
Dubautia ciliolata (DC) D. Keck (end)
  subsp. **ciliolata** H (Hualālai; Kīlauea; Mauna Loa)
  subsp. **glutinosa** G. Carr H (Mauna Kea)
Dubautia dolosa (Degener & Sherff) G. Carr (end) EM
Dubautia herbstobatae G. Carr (end, E) O (Wa: ‘Ōhikilolo; Kamaile‘unu Ridge)
Dubautia imbricata St. John & G. Carr (end, R)
  subsp. **acronaea** G. Carr K (Wai‘ale‘ale)
  subsp. **imbricata** K (Wahiawa Mts)
Dubautia knudsenii Hillebr. (end)
  subsp. **filiformis** G. Carr (R) K
  subsp. **knudsenii** K
  subsp. **nagatae** (St. John) G. Carr K
Dubautia laevigata A. Gray (end) K
Dubautia latifolia (A. Gray) D. Keck (end, E) K (Kōke‘e)
Dubautia laxa Hook. & Arnott (end)
  subsp. **bryanii** (Sherff) G. Carr O (Ko)
  subsp. **hirsuta** (Hillebr.) G. Carr K, O (primarily Wa), L
  subsp. **laxa** O, Mo, M
  subsp. **pseudoplantaginea** (Skottsb.) G. Carr O (Ko)
Dubautia linearis (Gaud.) D. Keck (end)
  subsp. **hillebrandii** (H. Mann) G. Carr H
  subsp. **linearis** L, M
  subsp. **opposita** (Sherff) G. Carr Mo, WM
Dubautia menziesii (A. Gray) D. Keck (end) EM
Dubautia microcephala Skottsb. (end, R) K
Dubautia paleata A. Gray (end) K
Dubautia pauciflorula St. John & G. Carr (end, E) K (Wahiawa Stream)
Dubautia plantaginea Gaud. (end)
  subsp. **humilis** G. Carr (V) WM (Black Gorge)
  subsp. **magnifolia** (Sherff) G. Carr K
  subsp. **plantaginea** O, Mo, L, M, H
Dubautia platyphylla (A. Gray) D. Keck (end) M
Dubautia raillardioides Hillebr. (end) K
Dubautia reticulata (Sherff) D. Keck (end) M
Dubautia scabra (DC) D. Keck (end)
  subsp. **leiophylla** (A. Gray) G. Carr Mo, L, M, H (Kohala Mts)
  subsp. **scabra** EM, H
Dubautia sherffiana Fosb. (end, V) O (Wa)
Dubautia waialealae Rock (end) K (Wai‘ale‘ale)
Eclipta alba (L.) Hassk. (nat) Ni, K, O, Mo, M, H; probably HI
Elephantopus mollis Kunth (nat) K, O, Mo, M, H
Elephantopus spicatus Juss. ex Aubl. (nat) K, O, M, H
Emilia coccinea (Sims) G. Don (nat) O, L
Emilia fosbergii Nicolson (nat) Ku, HI
Emilia sonchifolia (L.) DC (nat)
  var. **javanica** (N.L. Burm.) Mattf. K, O
  var. **sonchifolia** K, O, M

Encelia farinosa A. Gray (nat) M (Waikapū; Mā'alaea; Kēōkea; Wailea)
Erechtites hieracifolia (L.) Raf. ex DC (nat) K, O, Mo, L, M, H
Erechtites valerianifolia (Wolf) DC (nat) K, O, Mo, L, M, H
Erigeron bellioides DC (nat) O (Honolulu; Kāne'ohe), M (Kanahā Pond)
Erigeron karvinskianus DC (nat) K, O, M, H
Filago gallica L. (nat) H (Hawai'i Volcanoes NP)
Fitchia speciosa Cheeseman (nat) O (Ko: Roundtop-Tantalus)
Flaveria trinervia (Spreng.) C. Mohr (nat) O (Barber's Pt; Sand Island; Koko Head)
Gaillardia pulchella Foug. (nat) Ku, O, M
Galinsoga parviflora Cav. (nat) K, O, M, Ka, H
Galinsoga quadriradiata Ruiz & Pav. (nat) O, Mo, M, H
Gnaphalium japonicum Thunb. (nat) Mo, L, M, H
Gnaphalium purpureum L. (nat) K, O, Mo, L, M, Ka, H
Gnaphalium sandwicensium Gaud. (end)
  var. **hawaiiense** (Degener & Sherff) W.L. Wagner, Herbst & Sohmer EM (Auwahi), H
  var. **kilaueanum** Degener & Sherff H
  var. **molokaiense** Degener & Sherff (V) west Mo
  var. **sandwicensium** Ku, Mi, Ni, K, O, Mo, L, M, H
Helianthus annuus L. (nat) H (between Mauna Loa and Mauna Kea)
Helichrysum foetidum (L.) Cass. (nat) H (Mauna Loa; Mauna Kea; Pu'uwa'awa'a; Kamuela)
Hesperomannia arborescens A. Gray (end, E) O (Ko), Mo (Oloku'i, single collection; Pelekunu, single collection), L (ex)
Hesperomannia arbuscula Hillebr. (end, E) O (Wa), WM
Hesperomannia lydgatei C. Forbes (end, V) K (Wahiawa Stream)
Heterotheca grandiflora Nutt. (nat) K, O, L, M, Ka, H; probably HI
Hypochoeris glabra L. (nat) K, O, Mo, M, Ka, H
Hypochoeris radicata L. (nat) K, Mo, L, M, Ka, H
Lactuca serriola L. (nat) O, L, M, H
Lagenifera erici C. Forbes (end) K (Alaka'i Swamp; Mt Wai'ale'ale; Wainiha Val)
Lagenifera helenae C. Forbes & Lydgate (end, R) K (Alaka'i Swamp; Mt Wai'ale'ale; Kilohana; Kahōluamanu)
Lagenifera maviensis H. Mann (end, V) south Mo (Kalapamoa Ridge, single collection), WM (Mt 'Eke; Pu'ukukui), EM (Kuiki; Kaupō Gap; Kīpahulu and Waihoi valleys)
Lapsana communis L. (nat) M, H
Lipochaeta bryanii Sherff (end, EX) Ka
Lipochaeta connata (Gaud.) DC (end)
  var. **acris** (Sherff) Gardner Ni, K
  var. **connata** K, WM
Lipochaeta degeneri Sherff (end, EX?) southwest Mo
Lipochaeta fauriei H. Lév. (end, E) K (single collection each from Olokele Canyon, Hikimoe and Po'opo'oiki valleys)
Lipochaeta heterophylla A. Gray (end) Mo, L, M
Lipochaeta integrifolia (Nutt.) A. Gray (end) Ku, La, HI
Lipochaeta kamolensis Degener & Sherff (end, E) southeast EM (Kamole and Kepuni gulches)
Lipochaeta lavarum (Gaud.) DC (end) Mo, L, M, Ka, northwest H
Lipochaeta lobata (Gaud.) DC (end)
  var. **leptophylla** Degener & Sherff (R) O (Wa: Kolekole Pass; Kānehoa)
  var. **lobata** Ni, O, WM
Lipochaeta micrantha (Nutt.) A. Gray (end, E)
  var. **exigua** (Degener & Sherff) Gardner K (Hā'upu Ridge)
  var. **micrantha** K (Olokele and Hanapēpē valleys)
Lipochaeta ovata Gardner (end, EX) O
Lipochaeta perdita Sherff (end, EX) Ni (Kawaihoa Pt)
Lipochaeta remyi A. Gray (end) O (northwest Wa)

Lipochaeta rockii Sherff (end) Mo, M, Ka, H?

Lipochaeta subcordata A. Gray (end) K (Koai'e Val), L (Maunalei Val, ex), H (North Kona Dist; Pu'u Kanalopaka Nui, South Kohala Dist)

Lipochaeta succulenta (Hook. & Arnott) DC (end) Ni, K, O (r), Mo, M, Ka, H

Lipochaeta tenuifolia A. Gray (end, E) O (central Wa)

Lipochaeta tenuis Degener & Sherff (end, V) O (central Wa)

Lipochaeta venosa Sherff (end, E*) H (Nohonaohae, Holoholokū, and Heihei cinder cones; Pu'upā, South Kohala Dist)

Lipochaeta waimeaensis St. John (end, E) K (Waimea Canyon)

Madia sativa Molina var. **sativa** (nat) M (Haleakalā Crater)

Montanoa hibiscifolia Benth. (nat) K, O, L, M, H

Osteospermum calendulaceum L. fil. (nat) H (Puakō, North Kona Dist)

Palafoxia callosa (Nutt.) Torr. & A. Gray (nat) southwest Mo

Parthenium hysterophorus L. (nat) southwest K, Mo, M, H (Kona)

Pectis linifolia L. var. **linifolia** (nat) H (South Kona Dist)

Petasites japonicus (Siebold & Zucc.) Maxim. var. **japonicus** (nat) H ('Āwini Ridge, Kohala Mts)

Picris hieracioides L. (nat) L, H

Pluchea × fosbergii Cooperr. & Galang (nat) Mi, K, O, Mo, M

Pluchea indica (L.) Less. (nat) Mi, La, Ni, K, O, Mo, L, M, Ka; probably HI

Pluchea symphytifolia (Mill.) Gillis (nat) Ku, Mi, FF, HI

Reichardia picroides (L.) Roth (nat) O

Reichardia tingitana (L.) Roth (nat) O, Mo, H (Waimea)

Remya kauaiensis Hillebr. (end, E) K (Kōke'e)

Remya mauiensis Hillebr. (end, E) WM (Manawainui Gulch; Pāpalaua; formerly Olowalu Canyon, 'Īao Val, and behind Lahaina)

Remya montgomeryi W.L. Wagner & Herbst (end, E) K (Kalalau)

Senecio mikanioides Otto ex Walp. (nat) M, H (North and South Kona districts)

Senecio sylvaticus L. (nat) O, Mo, M, H

Senecio vulgaris L. (nat) EM (Haleakalā), H (Parker Ranch; Ahumoa)

Sigesbeckia orientalis L. (nat) K, O, Mo, M, Ka, H

Solidago canadensis L. var. **scabra** Torr. & A. Gray (nat) K, O, M, H

Sonchus asper (L.) J. Hill (nat) EM (Kula FR), H (Volcano; Keauhou Ranch)

Sonchus oleraceus L. (nat) Ku, Mi, PH, FF, Kl, Le, K, O, Mo, L, M, Ka, H

Synedrella nodiflora (L.) Gaertn. (nat) K, O, Mo, M, Ka, H

Tagetes minuta L. (nat) O (Honolulu, single collection), H (between Mauna Loa and Mauna Kea)

Taraxacum officinale W.W. Weber (nat) K, O, L, M, H

Tetramolopium arenarium (A. Gray) Hillebr. (end, EX)
- subsp. **arenarium**
  - var. **arenarium** EM, H
  - var. **confertum** Sherff H
- subsp. **laxum** Lowrey EM

Tetramolopium capillare (Gaud.) St. John (end, EX) WM (Lahaina Luna to Wailuku)

Tetramolopium consanguineum (A. Gray) Hillebr. (end)
- subsp. **consanguineum** (EX) K?
- subsp. **leptophyllum** (Sherff) Lowrey (V)
  - var. **kauense** Lowrey H (Ka'ū Dist)
  - var. **leptophyllum** H (between Mauna Loa and Mauna Kea)

Tetramolopium conyzoides (A. Gray) Hillebr. (end, EX) southwest Mo, L, WM (Waiehu?), EM (Kula), H

Tetramolopium filiforme Sherff (end, E)
- var. **filiforme** O (Wa: 'Ōhikilolo Ridge; Kea'au Val)
- var. **polyphyllum** (Sherff) Lowrey O (Wa: 'Ōhikilolo Ridge)

Tetramolopium humile (A. Gray) Hillebr. (end)
- subsp. **haleakalae** Lowrey EM

subsp. **humile**
var. **humile** EM (r), H (Mauna Loa; Mauna Kea; Hualālai; Kīlauea)
var. **sublaeve** Sherff H (between Mauna Loa and Mauna Kea)
Tetramolopium lepidotum (Less.) Sherff (end)
subsp. **arbusculum** (A. Gray) Lowrey (EX) EM (Haleakalā Crater)
subsp. **lepidotum** (E) O (Wa), L (ex)
Tetramolopium remyi (A. Gray) Hillebr. (end, E) L (Awalua Ridge, Lāna'ihale), WM (between Lahaina and Wailuku, ex)
Tetramolopium rockii Sherff (end, V)
var. **calcisabulorum** (St. John) Lowrey northwest Mo (Mo'omomi)
var. **rockii** northwest Mo (Mo'omomi)
Tetramolopium sylvae Lowrey (ind, R) windward Mo (Ho'olehua to Pelekunu Val), WM (Kahakuloa)
Tetramolopium tenerrimum (Less.) Nees (end, EX) O (Ko)
Tithonia diversifolia (Hemsl.) A. Gray (nat) K, O, M, H
Tragopogon porrifolius L. (nat) H (South Kohala Dist)
Tridax procumbens L. (nat) Mi, K, O, Mo, L, M, Ka, H; probably HI
Verbesina encelioides (Cav.) Benth. & Hook. (nat) Ku, Mi, K, O, Mo, L, M, Ka, H
Vernonia cinerea (L.) Less. var. **parviflora** (Reinw.) DC (nat) HI
Wedelia trilobata (L.) Hitchc. (nat) Mi, K, O; probably HI
Wilkesia gymnoxiphium A. Gray (end) K (Waimea Canyon)
Wilkesia hobdyi St. John (end, E) K (Polihale; Kā'aweiki)
Xanthium strumarium L. var. **canadense** (Mill.) Torr. & A. Gray (nat) Mi, HI
Youngia japonica (L.) DC (nat) K, O, Mo, L, M, H
Zinnia palmeri A. Gray (nat) O (Koko Crater)
Zinnia peruviana (L.) L. (nat) L, M, Ka

BALSAMINACEAE

Impatiens oliveri C.H. Wright ex Will. Wats. (nat) K (Kōke'e)
Impatiens walleriana J.D. Hook. (nat) K, O, Mo, L, M, H

BASELLACEAE

Anredera cordifolia (Ten.) Steenis (nat) K, O, Mo, M, H; probably HI

BATACEAE

Batis maritima L. (nat) HI

BEGONIACEAE

Begonia foliosa Kunth var. **miniata** (Planch.) L.B. Sm. & B.G. Schubert (nat) H (Kīlauea Settlement lots, Puna Dist)
Begonia hirtella Link (nat) O, EM, H
Begonia reniformis Dryander (nat) H (North and South Kona districts)
Hillebrandia sandwicensis Oliver (end) K, O (Wa: Mt Ka'ala, ex), Mo, M

BIGNONIACEAE

Jacaranda mimosifolia D. Don (nat) O, M, H; probably HI
Macfadyena unguis-cati (L.) A. Gentry (nat) K, O, L
Spathodea campanulata P. Beauv. (nat) K, O, Mo, M, H
Tecoma stans (L.) Juss. ex Kunth (nat) O, M, H (Ocean View Estates)

BIXACEAE

Bixa orellana L. (nat) K, O, Mo, M

BORAGINACEAE

Amsinckia intermedia Fisch. & C.A. Mey. (nat) H (single collection; not known if species persists)
Bothriospermum tenellum (Hornem.) Fisch. & C.A. Mey. (nat) O (Wa: Kolekole Pass), H
Cordia subcordata Lam. (pol) Ni, K, O, L, M, H
Cynoglossum amabile Stapf. & J.R. Drumm. (nat) H
Heliotropium amplexicaule Vahl (nat) O, Mo, M, H
Heliotropium anomalum Hook. & Arnott (ind)
  var. **argenteum** A. Gray (end) Ni, K, O, Mo, M (r), H (r); perhaps formerly on L and Ka
Heliotropium curassavicum L. (ind) La, FF, N, HI
Heliotropium procumbens Mill. var. **depressum** (Cham.) Fosb. (nat) Mi, FF (Tern Island), O, M
Myosotis discolor Pers. (nat) windward H
Tournefortia argentea L. fil. (nat) Ku, Mi, PH, Li, La, FF, Ni, K, O, Mo, L, M, H

BRASSICACEAE

Brassica campestris L. (nat) PH, K, O, Mo, L, H
Brassica juncea (L.) Czernj. (nat) H (Volcano House; Laupāhoehoe; Pu‘u‘ula‘ula)
Brassica nigra (L.) W. Koch (nat) O, M, H
Capsella rubella Reut. (nat) O, L, M, H
Cardamine flexuosa With. (nat) K, O, M, H
Cardamine hirsuta L. (nat) K, H
Coronopus didymus (L.) Sm. (nat) Mi, PH, HI
Descurainia sophia (L.) Webb (nat) EM (Haleakalā), H (Saddle Rd)
Lepidium arbuscula Hillebr. (end, R) O (leeward Wa)
Lepidium bidentatum Montin (ind)
  var. **o-waihiense** (Cham. & Schlechtend.) Fosb. (end) Ku, Mi, PH, La (ex), K, O, Mo, L, M
  var. **remyi** (Drake) Fosb. (end, EX) H
Lepidium bonariense L. (nat) H (Pōhakuloa State Park)
Lepidium densiflorum Schrad. (nat) north, leeward H
Lepidium hyssopifolium Desv. (nat) H (Ahumoa; Halepōhaku)
Lepidium oblongum Small (nat) Ni, O, Mo, L, Ka
Lepidium serra H. Mann (end, R) K
Lepidium virginicum L. (nat) Mi, O, Mo, M, H
Lobularia maritima (L.) Desv. (nat) Ku, Mi, M
Nasturtium microphyllum Boenn. ex Rchb. (nat) K, O, M, H
Nasturtium sarmentosum (G. Forster ex DC) Schinz & Guillaumin (pol?) K, O, Mo, M, H
Raphanus sativus L. (nat) K, O, Mo, M, Ka, H
Sisymbrium altissimum L. (nat) K, M, Ka, H
Sisymbrium irio L. (nat) H (between Mauna Loa and Mauna Kea)
Sisymbrium officinale (L.) Scop. (nat)
  var. **leiocarpum** DC L, H
  var. **officinale** K, Mo, L, M, H

BUDDLEJACEAE

Buddleia asiatica Lour. (nat) O, Mo, M, H
Buddleia madagascariensis Lam. (nat) H (Volcano transfer dump)

CACTACEAE

Cereus uruguayanus Ritter ex R. Kiesling (nat) south K
Harrisia martinii (Labour.) Britton (nat) south K
Hylocereus undatus (Haw.) Britton & Rose (nat) HI
Opuntia cochenillifera (L.) Mill. (nat) K, O
Opuntia ficus-indica (L.) Mill. (nat) K, O, M, Ka, H
Opuntia vulgaris Mill. (nat) O (Punchbowl; Kamehameha Schools)

CAMPANULACEAE

Brighamia insignis A. Gray (end, V) Ni (Ka‘ali Cliff), K (Nāpali Coast; Hā‘upu Ridge)

Brighamia rockii St. John (end, V) windward Mo (Kalaupapa to Hālawa), L (Maunalei Val, single observation), M (single collection)

Clermontia arborescens (H. Mann) Hillebr. (end)

subsp. **arborescens** south WM

subsp. **waihiae** (Wawra) Lammers Mo, L, north WM, EM

Clermontia calophylla F. Wimmer (end) H (Kohala Mts)

Clermontia clermontioides (Gaud.) A. Heller (end)

subsp. **clermontioides** H (Pāhala to Kealakekua)

subsp. **rockiana** (F. Wimmer) Lammers H (Keālia to Hualālai)

Clermontia drepanomorpha Rock (end) H (Kohala Mts)

Clermontia fauriei H. Lév. (end) K, O (Wa: Makaleha Val, single collection; Ko: Koloa Gulch, single collection)

Clermontia grandiflora Gaud. (end)

subsp. **grandiflora** M

subsp. **munroi** (St. John) Lammers Mo, L, M

Clermontia hawaiiensis (Hillebr.) Rock (end) H (Puna and Ka‘ū districts)

Clermontia kakeana Meyen (end) O, Mo, M

Clermontia kohalae Rock (end) H (Kohala and Hāmākua districts)

Clermontia lindseyana Rock (end, E) EM (leeward slope, Haleakalā), H (Hilo, Ka‘ū, and South Kona districts)

Clermontia micrantha (Hillebr.) Rock (end) L (Kumoa Gulch), WM (Pu‘ukukui; Mt ‘Eke; Lanilili)

Clermontia montis-loa Rock (end) H (Hilo, Puna, and Ka‘ū districts)

Clermontia multiflora Hillebr. (end, EX) O, WM

Clermontia oblongifolia Gaud. (end)

subsp. **brevipes** (F. Wimmer) Lammers (R) Mo

subsp. **mauiensis** (Rock) Lammers (R) L, M

subsp. **oblongifolia** O

Clermontia pallida Hillebr. (end) Mo

Clermontia parviflora Gaud. ex A. Gray (end) H (Kohala Mts; windward slopes of Mauna Kea and Mauna Loa)

Clermontia peleana Rock (end, E) EM, H (windward slopes of Mauna Kea and Mauna Loa)

Clermontia persicifolia Gaud. (end) O

Clermontia pyrularia Hillebr. (end, E) H (windward Mauna Kea; leeward Mauna Loa)

Clermontia samuelii C. Forbes (end)

subsp. **hanaensis** (St. John) Lammers EM (Kūhiwa Gulch to Pu‘uiki)

subsp. **samuelii** EM (Kīpahulu to Wai‘ānapanapa)

Clermontia tuberculata C. Forbes (end) EM

Clermontia waimeae Rock (end) H (Kohala Mts)

Cyanea aculeatiflora Rock (end) EM (windward slope, Haleakalā)

Cyanea acuminata (Gaud.) Hillebr. (end) O (Ko)

Cyanea angustifolia (Cham.) Hillebr. (end) O, east Mo, L, north WM

Cyanea arborea Hillebr. (end, EX) EM (leeward slope, Haleakalā)

Cyanea asarifolia St. John (end, E) northeast K (Anahola Stream)

Cyanea asplenifolia (H. Mann) Hillebr. (end, EX) north WM

Cyanea comata Hillebr. (end, EX) EM (leeward slope, Haleakalā)

Cyanea copelandii Rock (end)

subsp. **copelandii** (E) H (windward slope, Mauna Loa)

subsp. **haleakalaensis** (St. John) Lammers EM (windward slope, Haleakalā)

Cyanea coriacea (A. Gray) Hillebr. (end) north K

Cyanea degeneriana F. Wimmer (end) H (Kohala Mts; windward Mauna Kea and Mauna Loa)

Cyanea dunbarii Rock (end, EX) Mo (Waihānau)

Cyanea elliptica (Rock) Lammers (end) L, M

Cyanea fauriei H. Lév. (end) east, south K
Cyanea fissa (H. Mann) Hillebr. (end)
  subsp. **fissa** north K (Wainiha to Keālia)
  subsp. **gayana** (Rock) Lammers south K (Koai‘e Stream to Hanahanapuni; Hā‘upu Ridge)
Cyanea giffardii Rock (end, EX) H (Glenwood)
Cyanea glabra (F. Wimmer) St. John (end, EX) EM (windward slope, Haleakalā)
Cyanea grimesiana Gaud. (end)
  subsp. **cylindrocalyx** (Rock) Lammers (EX) H (Waipi‘o Val)
  subsp. **grimesiana** (V) O (north Wa: Mt Ka‘ala; Ko), Mo, L, M
  subsp. **obatae** (St. John) Lammers (V) O (south Wa: Pu‘uhāpapa to Ka‘aikukui)
Cyanea hamatiflora Rock (end)
  subsp. **carlsonii** (Rock) Lammers (R) H (Kona Dist)
  subsp. **hamatiflora** EM (windward slope, Haleakalā)
Cyanea hardyi Rock (end) south K
Cyanea hirtella (H. Mann) Hillebr. (end) west K
Cyanea horrida (Rock) Degener & Hosaka (end) EM (windward slope, Haleakalā)
Cyanea kunthiana Hillebr. (end) M
Cyanea leptostegia A. Gray (end) west K
Cyanea linearifolia Rock (end, EX) K (Wahiawa Mts)
Cyanea lobata H. Mann (end, E) L, north WM
Cyanea longissima (Rock) St. John (end, EX) EM (windward slope, Haleakalā)
Cyanea macrostegia Hillebr. (end)
  subsp. **gibsonii** (Hillebr.) Lammers (R) L
  subsp. **macrostegia** M
Cyanea mannii (Brigham) Hillebr. (end, E) central Mo
Cyanea marksii Rock (end) H (Kona Dist)
Cyanea mceldowneyi Rock (end, E) EM (windward slope, Haleakalā)
Cyanea membranacea Rock (end) O (Wa)
Cyanea obtusa (A. Gray) Hillebr. (end, EX) M
Cyanea pilosa A. Gray (end)
  subsp. **longipedunculata** (Rock) Lammers H (windward Mauna Kea and Mauna Loa)
  subsp. **pilosa** H (Kohala Mts; windward Mauna Kea)
Cyanea pinnatifida (Cham.) F. Wimmer (end, R) O (central Wa)
Cyanea platyphylla (A. Gray) Hillebr. (end) H (Waipi‘o Val; Puna Dist; windward Mauna Kea and Mauna Loa)
Cyanea pohaku Lammers (end, EX) EM (Pu‘unianiau, northwest Haleakalā)
Cyanea procera Hillebr. (end, EX) east Mo
Cyanea profuga C. Forbes (end, EX) east Mo (Mapulehu; Pelekunu)
Cyanea pycnocarpa (Hillebr.) F. Wimmer (end, EX) H (Kohala Mts)
Cyanea quercifolia (Hillebr.) F. Wimmer (end, EX) EM (leeward slope, Haleakalā)
Cyanea recta (Wawra) Hillebr. (end, EX) northeast K
Cyanea scabra Hillebr. (end) WM
Cyanea shipmanii Rock (end, E) H (windward slope, Mauna Kea)
Cyanea solanacea Hillebr. (end) Mo, M? (WM)
Cyanea solenocalyx Hillebr. (end) east Mo
Cyanea spathulata (Hillebr.) A. Heller (end)
  subsp. **longipetiolata** Lammers south-central K (Mt Kāhili)
  subsp. **spathulata** west K (‘Ōpaewela; Kahōluamanu; Kōke‘e; Kalalau)
Cyanea stictophylla Rock (end, E) H (Kona Coast; Ka‘ū Dist)
Cyanea superba (Cham.) A. Gray (end, E)
  subsp. **regina** (Wawra) Lammers O (south Ko)
  subsp. **superba** O (north Wa)
Cyanea sylvestris A. Heller (end) K
Cyanea tritomantha A. Gray (end, V) H (Waipi‘o Val; windward Mauna Kea and Mauna Loa)

Cyanea truncata (Rock) Rock (end, E) O (windward Ko)
Cyanea undulata C. Forbes (end, EX) south-central K (Wahiawa Bog)
Delissea fallax Hillebr. (end, EX) H (Hāmākua and Hilo districts)
Delissea laciniata Hillebr. (end, EX) O (Ko: Wailupe)
Delissea lauliiana Lammers (end, EX) O (Ko: Wailupe)
Delissea parviflora Hillebr. (end, EX) H (Kohala Mts; Mauna Kea)
Delissea rhytidosperma H. Mann (end, E) K
Delissea rivularis (Rock) F. Wimmer (end, EX) K
Delissea sinuata Hillebr. (end, EX)
  subsp. **lanaiensis** (Rock) Lammers L
  subsp. **sinuata** O (Wa)
Delissea subcordata Gaud. (end) K?, O
Delissea undulata Gaud. (end, EX)
  subsp. **kauaiensis** Lammers K (Hanapēpē Falls)
  subsp. **niihauensis** (St. John) Lammers Ni
  subsp. **undulata** WM, H (west and southwest Hualālai; Pu'ulehua, south Mauna Loa)
Hippobroma longiflora (L.) G. Don (nat) K, O, M, H
Lobelia dunbarii Rock (end, R)
  subsp. **dunbarii** Mo (Waihānau Stream)
  subsp. **paniculata** (Rock) Lammers Mo (Kawela; Waialea; Waikolu)
Lobelia erinus L. (nat) H
Lobelia gaudichaudii A. DC (end)
  subsp. **gaudichaudii** O (central, south Ko)
  subsp. **koolauensis** (Hosaka & Fosb.) Lammers O (north Ko)
Lobelia gloria-montis Rock (end) Mo (Pāpa'alā Pali), M
Lobelia grayana F. Wimmer (end) EM (Haleakalā)
Lobelia hillebrandii Rock (end) M
Lobelia hypoleuca Hillebr. (end) K, O, Mo, L, M, H
Lobelia kauaensis (A. Gray) A. Heller (end) K (Wahiawa Bog; Wai'ale'ale)
Lobelia monostachya (Rock) Lammers (end, EX) O (south Ko)
Lobelia niihauensis St. John (end, R) Ni, K, O (north Wa)
Lobelia oahuensis Rock (end, E) O (Ko)
Lobelia remyi Rock (end, EX) O
Lobelia villosa (Rock) St. John & Hosaka (end) K (Alaka'i Swamp; Wai'ale'ale)
Lobelia yuccoides Hillebr. (end) K, O (Wa)
Rollandia angustifolia (Hillebr.) Rock (end) O (Ko)
Rollandia crispa Gaud. (end, R) O (Ko)
Rollandia humboldtiana Gaud. (end) O (Ko)
Rollandia lanceolata Gaud. (end)
  subsp. **calycina** (Cham.) Lammers O
  subsp. **lanceolata** O (Ko)
Rollandia longiflora Wawra (end) O
Rollandia parvifolia C. Forbes (end, EX) K (Wai'oli Val)
Rollandia purpurellifolia Rock (end, EX) O (Ko: Kaluanui Val)
Rollandia st.-johnii Hosaka (end) O (central Ko)
Trematolobelia grandifolia (Rock) Degener (end) H (Kohala Mts; between Mauna Loa and Mauna Kea; Hawai'i Volcanoes NP)
Trematolobelia kauaiensis (Rock) Skottsb. (end) K
Trematolobelia macrostachys (Hook. & Arnott) A. Zahlbr. (end) O, Mo, L, M, H (single collection)
Trematolobelia singularis St. John (end, R) O (Ko: Kōnāhuanui; Hālawa)
Triodanis biflora (Ruiz & Pav.) Greene (nat) H (Hawai'i Volcanoes NP)
Wahlenbergia gracilis (G. Forster) A. DC (nat) Mo, L, M, H

CANNABACEAE

Cannabis sativa L. subsp. **indica** (Lam.) E. Small & Cronq. (nat) HI (widely cultivated)

CANNACEAE

Canna indica L. (nat) K, O, Mo, L, M, H

CAPPARACEAE

Capparis sandwichiana DC (end, V) Mi, PH, La, HI
Cleome gynandra L. (nat) K, O, Mo, L, M, H
Cleome spinosa Jacq. (ind?) Ni, O, M

CAPRIFOLIACEAE

Lonicera japonica Thunb. (nat) K (Kōke‘e State Park), H (Volcano; slopes of Hualālai)
Sambucus mexicana K. Presl ex A. DC (nat) K (Kōke‘e State Park), O, EM, H

CARICACEAE

Carica papaya L. (nat) K, Mo, H

CARYOPHYLLACEAE

Alsinidendron lychnoides (Hillebr.) Sherff (end, R) K (Alaka‘i Swamp, from Keaku Cave to Kahōluamanu)
Alsinidendron obovatum Sherff (end, E) O (Wa)
Alsinidendron trinerve H. Mann (end, E) O (north Wa: Mt Ka‘ala, from Pu‘ukalena, Pu‘ukawiwi, and Mākaha Val)
Alsinidendron viscosum (H. Mann) Sherff (end, EX) K (Waimea; Kahōluamanu; west of Alaka‘i Swamp)
Arenaria serpyllifolia L. (nat) M, H
Cerastium fontanum Baumg. subsp. **triviale** (Link) Jalas (nat) K, O, Mo, L, M, H
Dianthus armeria L. subsp. **armeria** (nat) H (Pu‘uhuluhulu to northwest slope, Mauna Kea)
Drymaria cordata (L.) Willd. ex Roem. & Schult. var. **pacifica** Mizush. (nat) K, O, Mo, M, H
Petrorhagia velutina (Guss.) P. Ball & Heyw. (nat) M, H (Pōhakuloa to South Kohala and Waimea)
Polycarpon tetraphyllum (L.) L. (nat) K, Mo, L, M, Ka, H
Sagina decumbens (Elliott) Torr. & A. Gray subsp. **occidentalis** (S. Wats.) Crow (nat) H (Hawai‘i Volcanoes NP)
Schiedea adamantis St. John (end, E*) O (Diamond Head)
Schiedea amplexicaulis H. Mann (end, EX) Ni?, K
Schiedea apokremnos St. John (end, E) K (Nu‘alolo Kai, Miloli‘i and Kalalau valleys, Nāpali Coast)
Schiedea diffusa A. Gray (end) east Mo (Kawela to Waikolu valleys), EM, H (Kohala Mts; ‘Ōla‘a Tract, Hawai‘i Volcanoes NP)
Schiedea globosa H. Mann (end) southeast O, Mo (north and northwest coasts), M (east and west coasts)
Schiedea haleakalensis Degener & Sherff (end, E) EM (Kaupō Gap; Hōlua near Ko‘olau Gap)
Schiedea helleri Sherff (end, EX?) K (Kahōluamanu)
Schiedea hookeri A. Gray (end, R) O (north and central Wa), EM (Haleakalā)
Schiedea implexa (Hillebr.) Sherff (end, EX) EM (Auwahi to Kaupō Gap)
Schiedea kaalae Wawra (end, E) O (Wa: Makaleha; Pahole Gulch; Mokulē‘ia; Pu‘uhāpapa; Huliwai)
Schiedea kealiae Caum & Hosaka (end) O (north Wa)
Schiedea ligustrina Cham. & Schlechtend. (end) O (Wa: Pālehua; Pu‘ukaua; Keawapilau Gulch; Mokulē‘ia)
Schiedea lydgatei Hillebr. (end, R) Mo (Kamalō, Makakupa‘ia, and Popohua gulches; O‘oa)
Schiedea mannii St. John (end) O (Wa: Pu‘uhapapa; Pu‘ukawiwi; Mākua Val; Mākua–Kea‘au Ridge; Kamaile‘unu Ridge)

Schiedea membranacea St. John (end, V) K (Mahanaloa and Ku‘ia valleys; Kalalau rim)
Schiedea menziesii Hook. (end, R) Mo (Pu‘ukolekole; Kamalō and Kawela gulches), L (Maunalei Val), WM (Mā‘alaea; Lahaina; Lahaina Luna Gulch)
Schiedea nuttallii Hook. (end, R) K, O (Wa: ‘Ēkahanui Gulch to Mokulē‘ia)
Schiedea pubescens Hillebr. (end)
  var. **pubescens** Mo (Pelekunu to Kala‘e), L (Lāna‘ihale), M (Makawao; Hāmākua; Olowalu Val; Kā‘anapali)
  var. **purpurascens** Sherff O (Wa: Maunakapu to Mt Ka‘ala)
Schiedea salicaria Hillebr. (end, V) WM (Waikapū; Kaunohua; Mā‘alaea; Olowalu; Lahaina)
Schiedea spergulina A. Gray (end)
  var. **leiopoda** Sherff (EX?) K (Hanapāpē; Wahiawa)
  var. **spergulina** (E) K (Olokele and Waimea canyons)
Schiedea stellarioides H. Mann (end, EX) K (Waimea; ‘Ōpaewela; Kahōluamanu; Hā‘upu Ridge; Hanakāpī‘ai)
Schiedea verticillata F. Brown (end, E) N (West Palm Val; Devil's Slide)
Silene alexandri Hillebr. (end, E) east Mo (Pu‘ukolekole; Kamalō Gulch)
Silene cryptopetala Hillebr. (end, EX) EM (Haleakalā)
Silene degeneri Sherff (end, EX) EM (Ko‘olau Gap, Haleakalā)
Silene gallica L. (nat) K, O, Mo, L, M, H
Silene hawaiiensis Sherff (end, R) H (Kīlauea; North Kona and Hāmākua districts; Saddle Rd)
Silene lanceolata A. Gray (end, E) K, Mo (Pu‘ukolekole), L (Maunalei Val), H (Pu‘uahi, Mauna Kea)
Silene perlmanii W.L. Wagner, Herbst & Sohmer (end, E) O (south Wa: between Palikea and Pōhākea Pass)
Silene struthioloides A. Gray (end) EM (Haleakalā), H (Mauna Kea; single collections at Pu‘uke‘eke‘e and Hualālai)
Spergula arvensis L. (nat) K, O, M, H
Spergularia marina (L.) Griseb. (nat) Ku, Mi, FF, K, O, Mo, M
Stellaria media (L.) Vill. (nat) Ku, K, O, L, M, H

CASUARINACEAE

Casuarina equisetifolia L. (nat) Ku, Mi, PH, Li, La, FF, HI
Casuarina glauca Siebold ex Spreng. (nat) O, L (Kō‘ele)

CECROPIACEAE

Cecropia obtusifolia Bertol. (nat) K, O, H

CELASTRACEAE

Perrottetia sandwicensis A. Gray (end) K, O, Mo, L, M, H

CERATOPHYLLACEAE

Ceratophyllum demersum L. (nat) M (Kanahā Pond), H (Hilo; Waipi‘o Val)

CHENOPODIACEAE

Atriplex eardleyae Aellen (nat) H (Pu‘uhonua o Hōnaunau National Historical Park)
Atriplex lentiformis (Torr.) S. Wats. (nat) Mo (Kaunakakai)
Atriplex semibaccata R. Br. (nat) HI
Atriplex suberecta Verd. (nat) FF, O, Mo, L, M, H
Bassia hyssopifolia (Pall.) Kuntze (nat) O (Kuapā Pond), M (Kanahā Pond)
Chenopodium album L. (nat) EM (Kula)
Chenopodium ambrosioides L. (nat) O, L, M, H
Chenopodium carinatum R. Br. (nat) Ni, Mo, L, M, Ka, H
Chenopodium hircinum Schrad. (nat) EM (Haleakalā Crater), H (Parker Ranch)
Chenopodium murale L. (nat) Ku, Mi, FF, HI

Chenopodium oahuense (Meyen) Aellen (end) Li, La, FF, Ne, N, Ni, K, O, Mo, L, M, H
Salicornia virginica L. (nat) FF (Tern Island)
Salsola kali L. (nat) H (Waimea)

CLUSIACEAE

Calophyllum inophyllum L. (pol) K, O, Mo, M, H
Clusia rosea Jacq. (nat) K, O, H (Hilo; Kona)
Hypericum canariense L. (nat) EM (Kula)
Hypericum gramineum G. Forster (nat) H (North Kona Dist)
Hypericum mutilum L. (nat) east Mo, M, H
Hypericum parvulum Greene (nat) H (Kīlauea; Kūlani)
Hypericum perforatum L. (nat) H (Hualālai)

COMBRETACEAE

Conocarpus erectus L. (nat) O, L, M
Terminalia catappa L. (nat) K, O, M, H
Terminalia myriocarpa Van Heurck & Müll. Arg. (nat) K, M, H

COMMELINACEAE

Callisia fragrans (Lindl.) Woodson (nat) K, O
Commelina benghalensis L. (nat) K, O, M, H
Commelina diffusa N.L. Burm. (nat) Mi, K, O, Mo, L, M, H
Murdannia nudiflora (L.) Brenan (nat) windward H

CONVOLVULACEAE

Bonamia menziesii A. Gray (end, E) K, O, Mo, L, M, H
Convolvulus arvensis L. (nat) O, M
Cressa truxillensis Kunth (ind) O, Mo, Ka
Ipomoea alba L. (nat) K, O, Mo, L, M, H
Ipomoea aquatica Forssk. (nat) O, M
Ipomoea batatas (L.) Lam. (pol) K, O, H; probably HI
Ipomoea cairica (L.) Sweet (nat?) Ni, K, O, Mo, L, Ka, H; probably HI
Ipomoea hederifolia L. (nat) H (Kealakekua to Nāpō‘opo‘o)
Ipomoea imperati (Vahl) Griseb. (ind) Ni, K, O, Mo, M
Ipomoea indica (J. Burm.) Merr. (ind) Ku, Mi, Li, La, N, HI
Ipomoea littoralis Blume (ind?) O, Mo, M, H?
Ipomoea obscura (L.) Ker-Gawl. (nat) K, O, M, H
Ipomoea ochracea (Lindl.) G. Don (nat) K, O, M, H
Ipomoea pes-caprae (L.) R. Br. subsp. **brasiliensis** (L.) Ooststr. (ind) Mi, Li, La, FF, N, HI
Ipomoea triloba L. (nat) Mi, K, O, M
Ipomoea tuboides Degener & Ooststr. (end) HI
Ipomoea violacea L. (nat) O, Mo, M, H
Jacquemontia ovalifolia (Choisy) H. Hallier (ind)
  subsp. **sandwicensis** (A. Gray) K. Robertson (end) HI
Jacquemontia pentantha (Jacq.) G. Don (nat) O
Merremia aegyptia (L.) Urb. (nat?) K, O, Mo, L, M, Ka, H
Merremia tuberosa (L.) Rendle (nat) K, O, M, H
Stictocardia tiliifolia (Desr.) H. Hallier (nat) K, O, Mo, M, H

CORYNOCARPACEAE

Corynocarpus laevigatus J.R. Forster & G. Forster (nat) K, O, Mo, H

COSTACEAE

Costus speciosus (J. König) Sm. (nat) L

CRASSULACEAE

Crassula sieberiana (Schult.) Druce (nat) H (Pōhakuloa Training Area)
Kalanchoë pinnata (Lam.) Pers. (nat) K, O, Mo, L, M, H
Kalanchoë tubiflora (Harv.) Raym.-Hamet (nat) K, O, L, M, H

CUCURBITACEAE

Coccinia grandis (L.) Voigt (nat) O (Mānoa Val to Punchbowl; Kailua), H (Kailua-Kona)
Cucumis dipsaceus Ehrenb. ex Spach (nat) Ni, K, O, L, M, Ka, H
Momordica charantia L. (nat) HI
Sechium edule (Jacq.) Sw. (nat) K, O, M, H
Sicyos alba (St. John) Telford (end, R) H (windward slopes of Mauna Kea, Mauna Loa, and Kīlauea)
Sicyos anunu (St. John) Telford (end) L, H (southwest slope, Kohala Mts; northeast and southwest slope, Mauna Kea; southeast slope, Mauna Loa)
Sicyos cucumerinus A. Gray (end, R) Mo, M, H
Sicyos erostratus St. John (end) O (Wa: Kealia Gulch), Mo
Sicyos herbstii (St. John) Telford (end) leeward K (Makaweli to Barking Sands and Polihale), Mo?
Sicyos hillebrandii St. John (end, EX) EM (Kula)
Sicyos hispidus Hillebr. (end) Mo, L, M (Kahului to Kihei), H (North Kona)
Sicyos lasiocephalus Skottsb. (end) H (north slope, Hualālai; leeward slope, Kohala Mts)
Sicyos macrophyllus A. Gray (end, R?) H (windward slope, Kohala Mts; Mauna Kea; Mauna Loa-Mauna Kea saddle)
Sicyos maximowiczii Cogn. (end) Ku, PH, Li, La, Ni, O (ex)
Sicyos pachycarpus Hook. & Arnott (end) La, N, HI
Sicyos semitonsus St. John (end) La
Sicyos waimanaloensis St. John (end) K (Waimea Canyon), O (Ka'ena Pt; Diamond Head; Waimānalo; Makapu'u; Koko Crater), Mo
Sicyos sp. A (end) K (Kalalau Val; Waimea Canyon), O (Wa)

CUSCUTACEAE

Cuscuta campestris Yuncker (nat) O, H
Cuscuta sandwichiana Choisy (end) Ni, O, Mo, L, M, H

CYPERACEAE

Bolboschoenus maritimus (L.) Palla subsp. **paludosus** (A. Nels.) T. Koyama (ind) Ni, K, O, Mo, M
Bulbostylis capillaris (L.) C.B. Clarke (nat) H
Carex alligata Boott (end) K, O, Mo, M, H
Carex echinata J.A. Murray (ind) K, M, H
Carex kauaiensis R. Krauss (end) K
Carex macloviana Dum. D'Urv. subsp. **subfusca** (W. Boott) T. Koyama (ind) M, H
Carex meyenii Nees (ind) HI (Ka [ex])
Carex montis-eeka Hillebr. (end) K, Mo, M
Carex thunbergii Steud. (ind?) M, H
Carex wahuensis C.A. Mey. (end)
  subsp. **herbstii** T. Koyama (R) O (Ko: Moanalua Val, single collection)
  subsp. **rubiginosa** (R. Krauss) T. Koyama K, O, L, M, H
  subsp. **wahuensis** K, O, Mo, L, M, H
Cladium jamaicense Crantz (ind) K, O, Mo, M, H
Cyperus alternifolius L. subsp. **flabelliformis** (Rottb.) Kükenth. (nat) Mi, K, O, M

Cyperus compressus L. (nat) H
Cyperus difformis L. (nat) K, O
Cyperus esculentus L. (nat) H (Onomea, single collection; not known if species persists)
Cyperus gracilis R. Br. (nat) K, O, M
Cyperus halpan L. (nat) K, M, H
Cyperus laevigatus L. (ind) La, Ni, O, Mo, M, H
Cyperus papyrus L. (nat) K
Cyperus pilosus Vahl (nat) K (Līhu‘e, single collection; not known if species persists)
Cyperus rotundus L. (nat) Ku, Mi, Ni, K, O, L, M, H
Cyperus trachysanthos Hook. & Arnott (end, R?) Ni, K, O, Mo, L
Cyperus trinervis R. Br. (nat) H (Hawai‘i Volcanoes NP)
Cyperus virens Michx. (nat) H (Waiākea FR; Hilo FR)
Eleocharis calva Torr. (ind?) Ni, O, Ka
Eleocharis geniculata (L.) Roem. & Schult. (nat) K, O, Mo
Eleocharis obtusa (Willd.) Schult. (ind) K, O, Mo, M, H
Eleocharis radicans (Poir.) Kunth (nat) K, O, M
Fimbristylis aestivalis (Retz.) Vahl (nat) K (Hanalei and Lāwa‘i valleys)
Fimbristylis cymosa R. Br.
  subsp. **spathacea** (Roth) T. Koyama (ind) Mi, La, FF, Ni, K, O, WM, H
  subsp. **umbellato-capitata** (Hillebr.) T. Koyama (ind) Ku, Mi, La, Ni, K, O, Mo, L, M, H
Fimbristylis dichotoma (L.) Vahl (ind) K, O, Mo, M, H
Fimbristylis hawaiiensis Hillebr. (end, R) H (Ka‘ū Desert, Chain of Craters Rd, Hawai‘i Volcanoes NP)
Fimbristylis schoenoides (Retz.) Vahl (nat) H (Hilo Airport)
Gahnia aspera Spreng. (ind)
  subsp. **globosa** (H. Mann) J. Kern (end) O
Gahnia beecheyi H. Mann (end) K, O, L, M, H
Gahnia gahniiformis (Gaud.) A. Heller (ind) Mo, L, M, H
Gahnia lanaiensis Degener, I. Degener & J. Kern (end, E) L (Lāna‘ihale)
Gahnia vitiensis Rendle (ind)
  subsp. **kauaiensis** (Benl) T. Koyama (end) K (Alaka‘i Swamp to Mt. Wai‘ale‘ale)
Kyllinga brevifolia Rottb. (nat) K, O, Mo, L, M, H
Kyllinga nemoralis (J.R. Forster & G. Forster) Dandy ex Hutchinson & Dalziel (nat) K, O, M, H
Machaerina angustifolia (Gaud.) T. Koyama (ind) K, O, Mo, L, M, H
Machaerina mariscoides (Gaud.) J. Kern (ind)
  subsp. **meyenii** (Kunth) T. Koyama (end) K, O, Mo, L, M, H
Mariscus congestus (Vahl) C.B. Clarke (nat) O (‘Ewa Plains, 2 collections; not known if species persists)
Mariscus cyperinus (Retz.) Vahl (ind) K, O, Mo
Mariscus fauriei (Kükenth.) T. Koyama (end, E) Mo, L, H
Mariscus hillebrandii (Boeck.) T. Koyama (end)
  subsp. **decipiens** (Hillebr.) T. Koyama K, O (Wa), L, WM
  subsp. **hillebrandii** O, L, EM, H
Mariscus hypochlorus (Hillebr.) C.B. Clarke (end)
  subsp. **brevior** (Kükenth.) T. Koyama K, O, Mo, M
  subsp. **hypochlorus** K, O, Mo, M, H
Mariscus javanicus (Houtt.) Merr. & Metcalfe (ind) Mi, Ni, K, O, Mo, L, M, H
Mariscus kunthianus Gaud. (end, R) WM
Mariscus meyenianus (Kunth) Nees (nat) K, O (Wa: Mākua Val, single collection)
Mariscus pennatiformis (Kükenth.) T. Koyama (end, E)
  subsp. **bryanii** (Kükenth.) T. Koyama northeast La
  subsp. **pennatiformis** K, O, M, H
Mariscus phleoides Nees ex Kunth (end)

subsp. **hawaiiensis** (H. Mann) T. Koyama Ni, K, O, Mo, L, M
subsp. **phleoides** K, Mo, L, M, H
Mariscus rockii (Kükenth.) T. Koyama (end, EX?) K (Waiʻalae Val)
Mariscus sandwicensis (Kükenth.) T. Koyama (end) K, O, Mo, M
Oreobolus furcatus H. Mann (end) K, O, Mo, M
Pycreus polystachyos (Rottb.) P. Beauv.
subsp. **holosericeus** (Link) T. Koyama (ind) Ni, O, Mo, L, M, H
subsp. **polystachyos** (ind) Mi, K, O, Mo, M, H
Pycreus sanguinolentus (Vahl) Nees (nat) H
Rhynchospora caduca Elliott (nat) M, H
Rhynchospora chinensis Nees & Meyen subsp. **spiciformis** (Hillebr.) T. Koyama (ind) K, Mo, M, H
Rhynchospora globularis (Chapm.) Small (nat) H (Kaūmana; along Saddle Rd)
Rhynchospora rugosa (Vahl) Gale subsp. **lavarum** (Gaud.) T. Koyama (ind) K, O, Mo, M, H
Rhynchospora sclerioides Hook. & Arnott (ind) K, O, Mo, L, M, H
Schoenoplectus californicus (C.A. Mey.) Palla (nat?) Ni, K, O, Mo, L, M, H
Schoenoplectus juncoides (Roxb.) Palla (ind) K, H (Kohala Mts)
Schoenoplectus lacustris (L.) Palla subsp. **validus** (Vahl) T. Koyama (ind) Ni, K, O, Mo, H
Scleria testacea Nees (ind) M (WM: Puʻukukui), H (Hilo; Kīlauea)
Torulinium odoratum (L.) S. Hooper (ind)
subsp. **auriculatum** (Nees & Meyen) T. Koyama (end) K, O, Mo, M, H
Uncinia brevicaulis Thouars (ind) EM (Keʻanae to Pōhakupālaha)
Uncinia uncinata (L. fil.) Kükenth. (ind) K, Mo, M, H

DIOSCOREACEAE

Dioscorea bulbifera L. (pol) K, O, Mo, M, H
Dioscorea pentaphylla L. (pol) K, O, Mo, M, H; probably HI

DROSERACEAE

Drosera anglica Huds. (ind) K

EBENACEAE

Diospyros hillebrandii (Seem.) Fosb. (end) K, O
Diospyros sandwicensis (A. DC) Fosb. (end) K, O, Mo, L, M, H

ELAEAGNACEAE

Elaeagnus umbellata Thunb. (nat) H (Volcano Village; Kīlauea)

ELAEOCARPACEAE

Elaeocarpus bifidus Hook. & Arnott (end) K, O

EPACRIDACEAE

Styphelia tameiameiae (Cham. & Schlechtend.) F.v. Muell. (ind) K, O, Mo, L, M, H (perhaps on Ni and Ka in the past)

ERICACEAE

Vaccinium calycinum Sm. (end) K, O, Mo, L, M, H
Vaccinium dentatum Sm. (end) K, O, Mo, L, M, H
Vaccinium reticulatum Sm. (end) K (r), O (r), Mo (r), M, H

ERIOCAULACEAE

Eriocaulon sp. A (nat) H (Mountain View)

EUPHORBIACEAE

Aleurites moluccana (L.) Willd. (pol) Ni, K, O, Mo, L, M, H
Antidesma platyphyllum H. Mann (end)
  var. **hillebrandii** Pax & K. Hoffm. K
  var. **platyphyllum** O, Mo, L, M, H
Antidesma pulvinatum Hillebr. (end) O, Mo, M, H
Bischofia javanica Blume (nat) O (Ko: Roundtop-Tantalus; Lanipō)
Chamaesyce albomarginata (Torr. & A. Gray) Small (nat) K (Māhā'ulepū), O (Pearl Harbor)
Chamaesyce arnottiana (Endl.) Degener & I. Degener (end, R) O (south Ko)
Chamaesyce atrococca (A. Heller) Croizat & Degener (end, R) west K
Chamaesyce celastroides (Boiss.) Croizat & Degener (end)
  var. **amplectens** (Sherff) Degener & I. Degener HI
  var. **celastroides** N, Ni, K
  var. **hanapepensis** (Sherff) Degener & I. Degener K
  var. **kaenana** (Sherff) Degener & I. Degener (E) O
  var. **laehiensis** (Degener, I. Degener & Sherff) Koutnik L, EM (Manawainui)
  var. **lorifolia** (A. Gray) Degener & I. Degener L (r), M
  var. **stokesii** (C. Forbes) Degener & I. Degener Ni, K, Mo, Ka
  var. **tomentella** (Boiss.) Koutnik (EX?) O
Chamaesyce clusiifolia (Hook. & Arnott) Arth. (end) O (Ko: west slopes)
Chamaesyce degeneri (Sherff) Croizat & Degener (end) Ni, K, O, Mo, M, H
Chamaesyce deppeana (Boiss.) Millsp. (end, E) O (Ko: Nu'uanu Pali; south O)
Chamaesyce halemanui (Sherff) Croizat & Degener (end, E) northwest K
Chamaesyce herbstii W.L. Wagner (end) O (Wa)
Chamaesyce hirta (L.) Millsp. (nat) Ku, Mi, FF, HI
Chamaesyce hypericifolia (L.) Millsp. (nat) Ku, Mi, FF, K, O, M, H
Chamaesyce hyssopifolia (L.) Small (nat) K, O, M, H
Chamaesyce kuwaleana (Degener & Sherff) Degener & I. Degener (end, E) O (Wa; single collections from Mokumanu and Kāne'ohe)
Chamaesyce maculata (L.) Small (nat) Ku, Mi (Sand Island)
Chamaesyce multiformis (Hook. & Arnott) Croizat & Degener (end)
  var. **microphylla** (Boiss.) Degener & I. Degener O, Mo, WM (r), leeward H (r)
  var. **multiformis** O, M
Chamaesyce olowaluana (Sherff) Croizat & Degener (end, V) WM, H
Chamaesyce prostrata (Aiton) Small (nat) Mi, K, O, L, M, Ka, H
Chamaesyce remyi (A. Gray ex Boiss.) Croizat & Degener (end, R)
  var. **hanaleiensis** (Sherff) Degener & I. Degener K (Hanalei)
  var. **kauaiensis** (Degener & Sherff) Degener & I. Degener K (Kahōluamanu)
  var. **remyi** K
Chamaesyce rockii (C. Forbes) Croizat & Degener (end) O (Ko)
Chamaesyce skottsbergii (Sherff) Croizat & Degener (end)
  var. **skottsbergii** (E*) southwest O, northwest Mo
  var. **vaccinioides** (Sherff) Koutnik (V) Mo, south M (single collection), Ka
Chamaesyce sparsiflora (A. Heller) Koutnik (end, R) K (Wahiawa Bog)
Chamaesyce thymifolia (L.) Millsp. (nat) O, H
Claoxylon sandwicense Müll. Arg. (end) K, O, Mo (Kala'e, r), L (Lāna'ihale), WM (Honokōwai), EM (Haleakalā), H (Pu'uwa'awa'a; Kohala; Hilo)
Euphorbia cyathophora J.A. Murray (nat) Mi, K, O, Mo, M
Euphorbia graminea Jacq. (nat) O (Barber's Pt)
Euphorbia haeleeleana Herbst (end) K (Ku'ia, Mahanaloa, and Hā'ele'ele valleys; ridge between Pa'aiki and Mahanaloa valleys; Waimea Canyon), O (Wa: Kaluakauila Gulch)
Euphorbia heterophylla L. (nat) Mi, Ni, K, O, L, M, Ka, H
Euphorbia peplus L. (nat) Mi, M, H

Flueggea neowawraea W. Hayden (end, E) northwest K, O (Wa), Mo (ex), EM (southwest slope, Haleakalā), H (Kona Coast)
Jatropha curcas L. (nat) EM (Kahikinui, south slope of Haleakalā)
Jatropha gossypiifolia L. (nat) O (Diamond Head)
Macaranga mappa (L.) Müll. Arg. (nat) O, H
Macaranga tanarius (L.) Müll. Arg. (nat) K, O
Mallotus philippensis (Lam.) Müll. Arg. (nat) O (Wa: Lualualei)
Manihot glaziovii Müll. Arg. (nat) K, O, M, H
Phyllanthus debilis Klein ex Willd. (nat) K, O, M, H
Phyllanthus distichus Hook. & Arnott (end) K, O, Mo, L, WM, EM (r)
Phyllanthus tenellus Roxb. (nat) K, O
Ricinus communis L. (nat) HI

FABACEAE

Abrus precatorius L. (nat) Ni, K, Mo, M, H
Acacia confusa Merr. (nat) K, O, Mo, L, M, Ka, H
Acacia farnesiana (L.) Willd. (nat) Mi, K, O, Mo, M, Ka, H
Acacia koa A. Gray (end) K, O, Mo, L, M, H
Acacia mearnsii De Wild. (nat) K, O, L, M, H
Acacia parramattensis Tind. (nat) O (Ko: Tantalus), Mo (Kamakou Preserve)
Albizia chinensis (Osbeck) Merr. (nat) O
Albizia lebbeck (L.) Benth. (nat) Mi, Ni, K, O, H
Alysicarpus vaginalis (L.) DC (nat) K, O, M, H
Caesalpinia bonduc (L.) Roxb. (ind) Ni, K, O, Mo, EM, H
Caesalpinia decapetala (Roth) Alston (nat) Ni, K, O, EM, H
Caesalpinia kavaiensis H. Mann (end, E*) K, O (Wa), WM, H (North Kona Dist)
Caesalpinia major (Medik.) Dandy & Exell (nat?) Ni, O, Mo, L, H
Cajanus cajan (L.) Millsp. (nat) K, O, M, H; probably HI
Canavalia cathartica Thouars (nat) K, O, Mo, M, H
Canavalia galeata (Gaud.) Vogel (end) O
Canavalia hawaiiensis Degener, I. Degener & J. Sauer (end) L, M, H (South Pt; Hualālai; Mauna Loa; Ka'ū Desert)
Canavalia kauaiensis J. Sauer (end) K
Canavalia molokaiensis Degener, I. Degener & J. Sauer (end, V) east Mo
Canavalia napaliensis St. John (end, R?) K (Mākaha to Waiahuakua valleys)
Canavalia pubescens Hook. & Arnott (end, V) Ni, K (Nāpali Coast), L, leeward EM
Canavalia sericea A. Gray (nat) O (Kahuku to Pounders Beach), M (Waihe'e to Kahului)
Chamaecrista nictitans (L.) Moench subsp. **patellaria** (DC ex Collad.) H. Irwin & Barneby var. **glabrata** (Vogel) H. Irwin & Barneby (nat) Ni, K, O, L, M, Ka, H
Clitoria ternata L. (nat) O
Crotalaria assamica Benth. (nat) O, H
Crotalaria berteroana DC (nat) O, M
Crotalaria brevidens Benth. (nat) EM (Ulumalu; Makawao FR)
Crotalaria incana L. (nat) Mi, Ni, K, O, L, M, Ka, H
Crotalaria lanceolata E. Mey. (nat) H (Kona Coast; Kapoho, Puna Dist)
Crotalaria longirostrata Hook. & Arnott (nat) O, Mo, EM, H
Crotalaria micans Link (nat) O, M, H
Crotalaria pallida Aiton (nat) Mi, K, O, Mo, L, M, H
Crotalaria pumila Ort. (nat) O (Mokulē'ia), EM (Makawao; Pukalani)
Crotalaria retusa L. (nat) K, O, Mo, M, H
Crotalaria spectabilis Roth (nat) Ni, K, O, Mo, H
Cytisus palmensis (Christ) Hutch. (nat) M
Cytisus scoparius (L.) Link (nat) H

Delonix regia (Bojer ex Hook.) Raf. (nat) Mo
Desmanthus virgatus (L.) Willd. (nat) Mi, K, O, Mo, M, Ka, H; probably HI
Desmodium cajanifolium (Kunth) DC (nat) H (Pāhoa; Kīlauea Dist)
Desmodium heterocarpon (L.) DC var. **strigosum** van Meeuwen (nat) O (Ko: Kalihi Val; not known if species persists)
Desmodium incanum DC (nat) K, O, M, H
Desmodium intortum (Mill.) Urb. (nat) H (Kona, Ka‘ū, Hilo, and Puna districts)
Desmodium sandwicense E. Mey. (nat) Mi, HI
Desmodium tortuosum (Sw.) DC (nat) K, O, M, Ka, H
Desmodium triflorum (L.) DC (nat) K, O, Mo, L, M, Ka, H
Dioclea wilsonii Standl. (nat?) K, H
Entada phaseoloides (L.) Merr. (ind?) K (Powerline Trail)
Erythrina sandwicensis Degener (end) HI
Glycine wightii (Wight & Arnott) Verdc. (nat) O, M, Ka, H
Haematoxylum campechianum L. (nat) O, H
Indigofera spicata Forssk. (nat) K, O, M
Indigofera suffruticosa Mill. (nat) Ni, K, O, L, M, Ka, H; probably HI
Lablab purpureus (L.) Sweet (nat?) K, O, Mo, M, H; probably HI
Lathyrus latifolius L. (nat) EM (Olinda)
Lathyrus tingitanus L. (nat) EM (Olinda)
Lespedeza cuneata (Dum. Cours.) G. Don (nat) O
Leucaena leucocephala (Lam.) de Wit (nat) Mi, HI
Lotus subbiflorus Lag. (nat) M, H
Lotus uliginosus Schkuhr (nat) Mo, M, H
Lupinus hybridus Lem. (nat) H (Volcano)
Macroptilium atropurpureum (DC) Urb. (nat) O, M, H
Macroptilium lathyroides (L.) Urb. (nat) Ni, K, O, L, M, Ka, H; probably HI
Medicago lupulina L. (nat) Mi, O, M, H
Medicago minima (L.) Bartal. (nat) L, M, H
Medicago polymorpha L. (nat) K, O, L, M, H
Medicago rugosa Desr. (nat) O, H
Medicago sativa L. (nat) Mi, K, O, L, H
Melilotus alba Medik. (nat) Mi, H
Melilotus indica (L.) All. (nat) Mi, K, O, M, H
Mimosa pudica L. var. **unijuga** (Duchass. & Walp.) Griseb. (nat) K, O, L, M, H
Mucuna gigantea (Willd.) DC (ind) K, O, Mo, M, H
Mucuna urens (L.) Medik. (nat?) O, M, H
Pachyrhizus erosus (L.) Urb. (nat) H (Ho‘okena, Kona)
Paraserianthes falcataria (L.) I. Nielsen (nat) K, O, Mo, H
Parkinsonia aculeata L. (nat) K, O, M
Pithecellobium dulce (Roxb.) Benth. (nat) Ni, K, O, Mo, M, H
Prosopis juliflora (Sw.) DC (nat) O (Sand Island)
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth (nat) Mi, K, O, L, M, Ka, H; probably HI
Pueraria lobata (Willd.) Ohwi (nat)
  var. **lobata** K, O, M, H
  var. **thomsoni** (Benth.) Maesen K
Rhynchosia minima (L.) DC (nat) K
Samanea saman (Jacq.) Merr. (nat) O, H; probably HI
Senna alata (L.) Roxb. (nat) K, O
Senna didymobotrya (Fresen.) H. Irwin & Barneby (nat) east K, EM (Kula)
Senna gaudichaudii (Hook. & Arnott) H. Irwin & Barneby (ind) K, O, Mo, L, M, H
Senna obtusifolia (L.) H. Irwin & Barneby (nat) H (Greenwell Ranch)
Senna occidentalis (L.) Link (nat) Ni, K, O, EM, H

Senna pendula (Humb. & Bonpl. ex Willd.) H. Irwin & Barneby var. **advena** (Vogel) H. Irwin & Barneby (nat) K, O, Mo, L, M, H
Senna septemtrionalis (Viv.) H. Irwin & Barneby (nat) K, O, Mo, M
Senna surattensis (N.L. Burm.) H. Irwin & Barneby (nat) K, O, M
Sesbania sesban (L.) Merr. (nat) K, O
Sesbania tomentosa Hook. & Arnott (end, V) Ne, N, HI
Sophora chrysophylla (Salisb.) Seem. (end) K, O, Mo, L, M, H
Spartium junceum L. (nat) K (Kōke'e)
Strongylodon ruber Vogel (end) K, O, Mo, M, H
Stylosanthes fruticosa (Retz.) Alston (nat) K, O, Mo (Waiahewahewa Gulch), L (Mahana)
Tephrosia purpurea (L.) Pers. var. **purpurea** (pol) HI
Trifolium arvense L. var. **arvense** (nat) M, H
Trifolium dubium Sibth. (nat) EM, H
Trifolium glomeratum L. (nat) M (Makawao Intermediate School)
Trifolium hybridum L. var. **hybridum** (nat) H (Kapāpala, single collection)
Trifolium incarnatum L. var. **incarnatum** (nat) EM (upper Kula)
Trifolium pratense L. var. **sativum** Schreb. (nat) M, H
Trifolium repens L. var. **repens** (nat) K, M, H
Trifolium resupinatum L. (nat) H (Kūka'iau Ranch)
Trifolium subterraneum L. (nat) H
Ulex europaeus L. (nat) M, H
Vicia menziesii Spreng. (end, E*) H (Keauhou-Kīlauea; Pu'uwa'awa'a)
Vicia sativa L. subsp. **nigra** (L.) Ehrh. (nat) EM, H
Vicia tenuifolia Roth (nat) M, H
Vicia villosa Roth (nat) H (Pōhakuloa Training Area)
Vigna adenantha (G. Mey.) Maréchal, Mascherpa & Stainier (ind) O (Diamond Head; not known if species persists), H
Vigna marina (J. Burm.) Merr. (ind) K, O, Mo, M, H
Vigna o-wahuensis Vogel (end, E) Ni, O, Mo, L, M, Ka, H

FLACOURTIACEAE

Xylosma crenatum (St. John) St. John (end, E) K (Mōhihi Stream; Nualolo Trail)
Xylosma hawaiiense Seem. (end) K, O, Mo, L, M, H

FRANKENIACEAE

Frankenia salina (Molina) I.M. Johnst. (nat) FF (Tern Island)

GENTIANACEAE

Centaurium erythraea Raf. subsp. **erythraea** (nat) Mi, K, O, Mo, L, M, Ka, H
Centaurium sebaeoides (Griseb.) Druce (end, E) K, O, Mo, WM

GERANIACEAE

Erodium cicutarium (L.) L'Hér. (nat) K, O, Mo, L, M, H
Geranium arboreum A. Gray (end, E) EM (north and west Haleakalā; Luala'ilua Hills, south slope of Haleakalā, single collection)
Geranium cuneatum Hook. (end)
  subsp. **cuneatum** H (Humu'ula; Mauna Kea; Hualālai; South Kona)
  subsp. **hololeucum** (A. Gray) Carlq. & Bissing H (Mauna Kea; Kahuku, 'Ainahou, and above Kūlani Prison, Mauna Loa)
  subsp. **hypoleucum** (A. Gray) Carlq. & Bissing H (above Kūlani Prison to Kahuku, Mauna Loa)
  subsp. **tridens** (Hillebr.) Carlq. & Bissing EM (Haleakalā)

Geranium dissectum L. (nat) K (Kōke'e State Park), EM (Haleakalā), H (Waimea; Hawai'i Volcanoes NP)
Geranium hanaense Medeiros & St. John (end) EM (Hāna FR)
Geranium homeanum Turcz. (nat) K, M, H
Geranium humile Hillebr. (end, R) WM (Pu'ukukui; Mt 'Eke)
Geranium kauaiense (Rock) St. John (end, R) K (Alaka'i Swamp to Mt Wai'ale'ale)
Geranium molle L. (nat) H (upper Pa'auhau, Hāmākua, single collection; not known if species persists)
Geranium multiflorum A. Gray (end, V) EM (Haleakalā)
Geranium pusillum N.L. Burm. (nat) H (Mauna Kea, single collection; not known if species persists)
Geranium retrorsum L'Hér. ex DC (nat) L, M, H

GESNERIACEAE

Cyrtandra biserrata Hillebr. (end, R) east Mo (Wailau, Pūko'o, and Mapulehu valleys; Oloku'i)
Cyrtandra calpidicarpa (Rock) St. John & Storey (end) O (Ko: Lā'ie to Kahalu'u on windward side, Kipapa Gulch on leeward side)
Cyrtandra confertiflora (Wawra) C.B. Clarke (end)
  var. **confertiflora** K (Nāpali Coast; Kīlauea-Anahola; Wahiawa-Hanapēpē)
  var. **obovata** (Wawra) C.B. Clarke K (base of Wai'ale'ale)
Cyrtandra cordifolia Gaud. (end) O (Ko: Waikāne, Kahana, and Konahuanui on windward side, Halemano to Wailupe on leeward side)
Cyrtandra crenata St. John & Storey (end, R) O (Ko: Kahana Val; Waikāne-Schofield Trail)
Cyrtandra cyaneoides Rock (end, EX?) K (Wai'alae Val)
Cyrtandra dentata St. John & Storey (end) O (north Wa; leeward, north Ko: Pa'ala'a, Kawailoa divide, to 'Ōpae'ula)
Cyrtandra filipes Hillebr. (end, R) Mo (Mapulehu and Kalua'aha valleys), WM (Honokōwai; Ka'anapali; Olowalu)
Cyrtandra garnotiana Gaud. (end) O (Wa; leeward Ko: Wahiawā to Niu Val)
Cyrtandra giffardii Rock (end, E) H (Kīlauea; Kūlani; Laupāhoehoe)
Cyrtandra gracilis Hillebr. ex C.B. Clarke (end, EX) O (Ko: Pālolo Val; Kōnāhuanui Gulch)
Cyrtandra grandiflora Gaud. (end) O (Ko: He'eia to Kōnāhuanui on windward side; Kipapa Gulch to Wailupe on leeward side)
Cyrtandra grayana Hillebr. (end) east Mo, L (Lāna'ihale), WM
Cyrtandra grayi C.B. Clarke (end) Mo, WM, EM (Kīpahulu; Kahikinui; Pu'u'alaea)
Cyrtandra halawensis Rock (end, R) east Mo
Cyrtandra hashimotoi Rock (end) M
Cyrtandra hawaiensis C.B. Clarke (end) O (Wa: Pu'ukalena; Ko: Kawailoa to Wailupe Val), east Mo, M, H
Cyrtandra hematos St. John (end, R) Mo (Oloku'i Plateau; Kawela; Kahuoahu Val)
Cyrtandra kalihii Wawra (end) O (Wa: Mt Ka'ala; Ko)
Cyrtandra kauaiensis Wawra (end) K (Kōke'e; Waimea drainage basin to northeast K)
Cyrtandra kaulantha St. John & Storey (end) O (Ko: Waiāhole)
Cyrtandra kealiae Wawra (end, R) K (Hanapēpē and Olokele valleys; Wahiawa Mts; Hā'upu Ridge)
Cyrtandra kohalae Rock (end, EX) H (Kohala Mts)
Cyrtandra laxiflora H. Mann (end) O (windward, north Ko)
Cyrtandra lessoniana Gaud. (end) O
Cyrtandra limahuliensis St. John (end, R) K (Mt Kāhili)
Cyrtandra longifolia (Wawra) Hillebr. ex C.B. Clarke (end) K
Cyrtandra lydgatei Hillebr. (end, R) east Mo, L (Maunalei Gulch), WM (Honokōhau drainage basin to Honokōwai)
Cyrtandra lysiosepala (A. Gray) C.B. Clarke (end) H (Kūlani; 'Ōla'a Tract)
Cyrtandra macraei A. Gray (end) O (Wa: Makaleha to Mākaha valleys; Ko: Punalu'u to Kaluanui, Kahana Iki Stream to Niu)
Cyrtandra macrocalyx Hillebr. (end, R) Mo (Waikolu to Wailau valleys; Kaunakakai Gulch)

Cyrtandra menziesii Hook. & Arnott (end) H (South Kona, Ka'ū, and North Kona districts)
Cyrtandra munroi C. Forbes (end, R) L (Lāna'ihale)
Cyrtandra oenobarba H. Mann (end, R) K (Kīlauea-Ha'ena; Wahiawa-Hanapēpē; Olokele Canyon)
Cyrtandra olona C. Forbes (end, EX) K (Wahiawa Mts)
Cyrtandra oxybapha W.L. Wagner & Herbst (end, R) WM (upper Pōhākea Gulch, Hana'ula)
Cyrtandra paludosa Gaud. (end)
  var. **microcarpa** Wawra K
  var. **paludosa** K (Kōke'e State Park; Hā'upu Ridge; Wai'ale'ale), O (Wa: Palikea; Ko), M, H
Cyrtandra pickeringii A. Gray (end, R) K (Wahiawa Mts; Hanalei; Kīlauea), O?
Cyrtandra platyphylla A. Gray (end) M, H
Cyrtandra polyantha C.B. Clarke (end, R) O (east Ko: Niu and Kuli'ou'ou valleys)
Cyrtandra procera Hillebr. (end) Mo (Waikolu to Pelekunu valleys; Pēpē'ōpae Bog)
Cyrtandra propinqua C. Forbes (end) O (north Ko: Kaunala to Kīpapa and Waiāhole gulches)
Cyrtandra pruinosa St. John & Storey (end, R) O (Ko: Kalauao Val)
Cyrtandra rivularis St. John & Storey (end) O (windward Ko: Kaluanui to Waikāne valleys)
Cyrtandra sandwicensis (H. Lév.) St. John & Storey (end, V) O (leeward Ko: Pauoa to Mānoa valleys)
Cyrtandra sessilis St. John & Storey (end, R) O (windward Ko: Waikāne-Schofield Trail)
Cyrtandra spathulata St. John (end) M
Cyrtandra subumbellata (Hillebr.) St. John & Storey (end, R) O (north-central Ko: Kaluanui to Waiāhole valleys)
Cyrtandra tintinnabula Rock (end, E) H (Laupāhoehoe)
Cyrtandra viridiflora St. John & Storey (end, R) O (Ko: Lanihuli; Waikāne-Waipi'o; Punalu'u; Kawailoa)
Cyrtandra waianaeensis St. John & Storey (end) O (Wa: Mākua Val to Palikea)
Cyrtandra waiolani Wawra (end, EX) O (Ko: Kalihi to Kaipapa'u valleys)
Cyrtandra wawrae C.B. Clarke (end) K

GOODENIACEAE

Scaevola chamissoniana Gaud. (end) Mo, L, M, H
Scaevola coriacea Nutt. (end, E*) Ni (ex), K (ex), O (ex), Mo (Mokuho'oniki Islet), L (ex), M (Waiehu; Kaupō; Mōke'ehia Islet), H (ex)
Scaevola gaudichaudiana Cham. (end) K, O
Scaevola gaudichaudii Hook. & Arnott (end) K, O, Mo, L, M, H
Scaevola glabra Hook. & Arnott (end) K, O (Ko)
Scaevola kilaueae Degener (end) H (Ocean View Estates; Ka'ū Dist; Kīlauea)
Scaevola mollis Hook. & Arnott (end) K, O, Mo (r)
Scaevola procera Hillebr. (end) K, Mo
Scaevola sericea Vahl (ind) Ku, Mi, PH, Li, La, FF, HI

GUNNERACEAE

Gunnera kauaiensis Rock (end) K (Alaka'i Swamp; Mt Kāhili; Mt Wai'ale'ale)
Gunnera petaloïdea Gaud. (end) O, east Mo, M, H (Kohala Mts)

HALORAGACEAE

Gonocarpus chinensis (Lour.) Orch. subsp. **verrucosus** (Maiden & E. Betcke) Orch. (nat) H (Hawai'i Volcanoes NP)
Myriophyllum aquaticum (Vell.) Verdc. (nat) K, O, H

HELICONIACEAE

Heliconia bihai (L.) L. (nat) EM (Hāna Hwy)
Heliconia latispatha Benth. (nat) EM (Hāna Hwy), H
Heliconia metallica Planch. & Linden ex Hook. (nat) O (Ko: Mānoa Val)

HYDRANGEACEAE

Broussaisia arguta Gaud. (end) K, O, Mo, L, M, H

HYDROCHARITACEAE

Egeria densa Planch. (nat) K, O, Mo, H
Halophila hawaiiana Doty & B. Stone (end) K, O, Mo, M

HYDROPHYLLACEAE

Nama sandwicensis A. Gray (end, V) Li, La, Ni, K, O, Mo, L, M, H

IRIDACEAE

Aristea gerrardii Weim. (nat) H (Volcano)
Crocosmia × crocosmiiflora (Lemoine ex E. Morr.) N.E. Brown (nat) K, O, M, H
Sisyrinchium acre H. Mann (end) EM, H
Sisyrinchium exile E.P. Bicknell (nat) EM (Kokomo), H (Kīlauea, Hawai'i Volcanoes NP; Waimea, Kohala Mts)
Sisyrinchium rosulatum E.P. Bicknell (nat) H (Waimea, single collection)
Trimezia martinicensis (Jacq.) Herb. (nat) O
Watsonia borbonica (Pourr.) Goldblatt (nat) EM (Olinda)

JOINVILLEACEAE

Joinvillea ascendens Gaud. ex Brongn. & Gris (ind)
  subsp. **ascendens** (end) K, O, Mo, M, H

JUNCACEAE

Juncus acuminatus Michx. (nat) M, H
Juncus bufonius L. (nat) K, Mo, M, H
Juncus effusus L. (nat) Mo, M, H
Juncus ensifolius Wikström (nat) M, H
Juncus planifolius R. Br. (nat) K, O, Mo, M, H
Juncus polyanthemos Buchenau (nat) O, M
Juncus tenuis Willd. (nat) K, Mo, EM, H
Luzula hawaiiensis Buchenau (end)
  var. **glabrata** (Hillebr.) Degener & I. Degener K, Mo, M
  var. **hawaiiensis** K, L, M, H
  var. **oahuensis** (Degener & Fosb.) Degener & I. Degener O (Wa)

LAMIACEAE

Haplostachys bryanii Sherff (end, EX) central-southwest Mo
Haplostachys haplostachya (A. Gray) St. John (end, E*) K (ex), M (ex), H (Kīpukakālawamauna; formerly from Nohonaohae, Pu'ukapele, and Waiki'i)
Haplostachys linearifolia (Drake) Sherff (end, EX) Mo (Mauna Loa; Kawela Gulch; Kamalō; Pu'ukolekole), M
Haplostachys munroi C. Forbes (end, EX) west L (Ahupua'a Ka'ā; Paoma'i)
Haplostachys truncata (A. Gray) Hillebr. (end, EX) M
Hyptis pectinata (L.) Poit. (nat) K, O, M, H
Hyptis suaveolens (L.) Poit. (nat) H
Lamium amplexicaule L. (nat) EM (Haleakalā NP Headquarters)
Leonotis nepetifolia (L.) R. Br. (nat) K, O, M, H
Leonurus sibiricus L. (nat) K, O, M, H
Lepechinia hastata (A. Gray) Epling (ind?) EM (Haleakalā)
Marrubium vulgare L. (nat) L, H

Mentha pulegium L. (nat) M
Mentha spicata L. (nat) O, H
Mentha × villosa Huds. (nat) O, H
Ocimum basilicum L. (nat) Ni, O, Mo, M, H
Ocimum gratissimum L. (nat) Ni, O, Mo, M, H
Phyllostegia ambigua (A. Gray) Hillebr. (end) M, H (Mauna Loa)
Phyllostegia bracteata Sherff (end, R) M
Phyllostegia brevidens A. Gray (end, EX) H (Hilo; Mauna Kea)
Phyllostegia electra C. Forbes (end) K
Phyllostegia floribunda Benth. (end) H (Honokaia; Pāhala; Kohala Mts; Kīlauea to Laupāhoehoe)
Phyllostegia glabra (Gaud.) Benth. (end)
  var. **glabra** O (Wa: Mt Ka'ala; Ko), east Mo, L, EM
  var. **lanaiensis** Sherff (E) L (known from only two collections)
Phyllostegia grandiflora (Gaud.) Benth. (end) O (Wa: Mt Ka'ala; Ko)
Phyllostegia helleri Sherff (end, R) K (Kahōluamanu; Mt Kāhili)
Phyllostegia hillebrandii H. Mann ex Hillebr. (end, EX) EM (Kula; 'Ulupalakua)
Phyllostegia hirsuta Benth. (end) O (central Wa; Ko)
Phyllostegia hispida Hillebr. (end) east Mo
Phyllostegia imminuta (Sherff) St. John (end, EX?) L (Lāna'ihale), EM (Makawao)
Phyllostegia knudsenii Hillebr. (end, EX) K (Kōke'e)
Phyllostegia lantanoides Sherff (end) O
Phyllostegia macrophylla (Gaud.) Benth. (end) EM, east H
Phyllostegia mannii Sherff (end, E) east Mo (Hanalilolilo to 'Ōhi'alele), EM ('Ukulele, r)
Phyllostegia mollis Benth. (end, E) O (Wa; Ko: Honolulu area, ex), Mo, EM
Phyllostegia parviflora (Gaud.) Benth. (end)
  var. **glabriuscula** A. Gray H
  var. **parviflora** O, WM
Phyllostegia racemosa Benth. (end, R) H (windward slope of Mauna Kea and Mauna Loa)
Phyllostegia rockii Sherff (end, EX) EM ('Ukulele)
Phyllostegia stachyoides A. Gray (end) east Mo, WM, H (North and South Kona districts)
Phyllostegia variabilis Bitter (end, EX) Ku, Mi, La
Phyllostegia velutina (Sherff) St. John (end, R) H (Kīlauea to Pu'ukīpū; Nā'ālehu)
Phyllostegia vestita Benth. (end) H (Hīlea to Laupāhoehoe; Kohala Mts)
Phyllostegia waimeae Wawra (end, E) K
Phyllostegia warshaueri St. John (end, R) H (Laupāhoehoe; Kohala Ditch Trail)
Phyllostegia wawrana Sherff (end, EX) K (Hanalei; Kōke'e)
Plectranthus parviflorus Willd. (ind) Ni, K, O, Mo, L, M, H (may also have occurred on Ka in the past)
Plectranthus scutellarioides (L.) R. Br. (nat) K, O, M, H
Prunella vulgaris L. (nat) Mo, M, H
Salvia coccinea Juss. ex J.A. Murray (nat) O, Mo, L, M, H
Salvia occidentalis Sw. (nat) Ni, K, O, Mo, L, M, H
Stachys arvensis L. (nat) K, O, Mo, L, M, H; probably HI
Stenogyne angustifolia A. Gray (end, E*) Mo (ex), M (ex), H (Pōhakuloa Training Area)
Stenogyne bifida Hillebr. (end, E) Mo (Laianui; Pelekunu Trail)
Stenogyne calaminthoides A. Gray (end) H
Stenogyne calycosa Sherff (end) M
Stenogyne campanulata Weller & Sakai (end, E) K (Kalalau)
Stenogyne cinerea Hillebr. (end, EX) EM (Kula)
Stenogyne cranwelliae Sherff (end, E) H (Kohala Mts)
Stenogyne haliakalae Wawra (end, EX) EM (south slope, Haleakalā)
Stenogyne kaalae Wawra (end) O (Wa; Ko: single collections from Nu'uanu Pali and Pe'ahinā'a Trail)
Stenogyne kamehamehae Wawra (end) Mo, M
Stenogyne kanehoana Degener & Sherff (end, E) O (Wa: Pu'ukānehoa)

Stenogyne macrantha Benth. (end) H
Stenogyne microphylla Benth. (end) EM, H
Stenogyne oxygona Degener & Sherff (end, EX?) H (Kohala Mts)
Stenogyne purpurea H. Mann (end) K
Stenogyne rotundifolia A. Gray (end) EM (north slope, Haleakalā)
Stenogyne rugosa Benth. (end) EM, H
Stenogyne scrophularioides Benth. (end) H (Mauna Loa; Mauna Kea, single collection)
Stenogyne sessilis Benth. (end) L (ex), M, H
Stenogyne viridis Hillebr. (end, EX) WM (Ka'anapali)

LAURACEAE

Cassytha filiformis L. (ind) Ni, K, O, Mo, L, M, H
Cinnamomum burmannii (Nees) Blume (nat) O (Ko: Mānoa Val; Pauoa Flats)
Cinnamomum camphora (L.) J. Presl (nat) K, O, L, M
Cinnamomum verum J. Presl (nat) K, O, M
Cryptocarya mannii Hillebr. (end) K, O
Persea americana Mill. (nat) K, O, M, H

LEMNACEAE

Lemna perpusilla Torr. (nat?) K, O, Mo, M, H
Spirodela polyrrhiza (L.) Schleid. (nat?) O

LENTIBULARIACEAE

Utricularia gibba L. (nat) H (Stainback Hwy)

LILIACEAE

Astelia argyrocoma A. Heller ex Skottsb. (end) K
Astelia menziesiana Sm. (end) K, O, Mo, L, M, H
Astelia waialealae Wawra (end) K (Mt Wai'ale'ale; Alaka'i Swamp)
Dianella sandwicensis Hook. & Arnott (ind) K, O, Mo, L, M, H
Hippeastrum puniceum (Lam.) Voss (nat) K, H

LINACEAE

Linum bienne Mill. (nat) M (Wailaulau)
Linum trigynum L. (nat) O (Wa: 'Ōhikilolo Ridge; Mokulē'ia Val)

LOGANIACEAE

Labordia cyrtandrae (Baill.) St. John (end, R) O (Wa: Mākaha Val; Hale'au'au Gulch; Ko)
Labordia degeneri Sherff (end) K (Kōke'e; Pihea Trail)
Labordia fagraeoidea Gaud. (end) O (Ko)
Labordia hedyosmifolia Baill. (end) Mo, L, M, H
Labordia helleri Sherff (end, R) K (Nāpali Coast)
Labordia hirtella H. Mann (end) east K, O (Ko: Nu'uanu to Wailupe valleys), Mo, L, M, H
Labordia hosakana (Sherff) W.L. Wagner, Herbst & Sohmer (end) O (Ko: Kīpapa to Wa'ahila)
Labordia kaalae C. Forbes (end) O (Wa)
Labordia lydgatei C. Forbes (end, E) K (Wahiawa Mts)
Labordia pumila (Hillebr.) Skottsb. (end, R) K (Mt Wai'ale'ale; Alaka'i Swamp)
Labordia sessilis A. Gray (end) O (Ko)
Labordia tinifolia A. Gray (end)
  var. **lanaiensis** Sherff Mo (Mapulehu Val), L
  var. **tinifolia** K, O (Wa: Mākaha Val; Pu'upane; Ko), Mo, M, H
  var. **wahiawaensis** St. John K (Wahiawa Val)

Labordia venosa Sherff (end) EM
Labordia waialealae Wawra (end) K (Mt Wai‘ale‘ale; Alaka‘i Swamp; Pihea; Makaleha Mts)
Labordia waiolani Wawra (end) O, Mo, L (r)

LYTHRACEAE

Ammannia auriculata Willd. (nat) O, M
Ammannia coccinea Rottb. (nat) K (Hanalei)
Cuphea carthagenensis (Jacq.) Macbr. (nat) K, O, Mo, M, H
Cuphea hyssopifolia Kunth (nat) H
Cuphea ignea A. DC (nat) H (Honokāne Nui Val; Honoka‘a)
Lythrum maritimum Kunth (ind?) K, O, Mo, L, M, H

MALVACEAE

Abelmoschus moschatus Medik. (nat) K (Hanapēpē Riv, single collection)
Abutilon auritum (Wall ex Link) Sweet (nat) EM (Kahikinui, single collection; not known if species persists)
Abutilon eremitopetalum Caum (end, E) east L (Kalulu and Maunalei valleys; Kānepu‘u; Kehewai Gulch)
Abutilon grandifolium (Willd.) Sweet (nat) Mi, HI
Abutilon incanum (Link) Sweet (ind?) Ni, K, O, Mo, L, M, Ka
Abutilon indicum (L.) Sweet (nat) O (Honolulu, single collection)
Abutilon menziesii Seem. (end, E*) L, EM, H
Abutilon sandwicense (Degener) Christoph. (end, E) O (Wa: between Makaleha Val and Pu‘ukaua)
Gossypium barbadense L. (nat) Ni, K, O, Mo, L, H
Gossypium hirsutum L. (nat) O (Hale‘iwa)
Gossypium tomentosum Nutt. ex Seem. (end, V) Ni, K, O, Mo, L, M, Ka
Herissantia crispa (L.) Briz. (nat) M (Olowalu)
Hibiscadelphus bombycinus C. Forbes (end, EX) H (Kawaihae)
Hibiscadelphus crucibracteatus Hobdy (end, EX) L (Puhielelu Ridge)
Hibiscadelphus distans L. Bishop & Herbst (end, E*) K (Koai‘e Stream, Waimea Canyon)
Hibiscadelphus giffardianus Rock (end, E) H (Kīpukapuaulu)
Hibiscadelphus hualalaiensis Rock (end, E) H (Hualālai and Waihou, North Kona)
Hibiscadelphus wilderianus Rock (end, EX) EM (Auwahi, south slope, Haleakalā)
Hibiscus arnottianus A. Gray (end)
  subsp. **arnottianus** O (Wa; east Ko: Wahiawā to Niu Val)
  subsp. **immaculatus** (M. Roe) D. Bates (E) Mo (Wailau, Waihānau, and Pāpalaua valleys)
  subsp. **punaluuensis** (Skottsb.) D. Bates O (Ko: Kaipapa‘u to Waiāhole)
Hibiscus brackenridgei A. Gray (end, E)
  subsp. **brackenridgei** Mo, L, M, H
  subsp. **mokuleianus** (M. Roe) D. Bates K (Līhu‘e; Olokele Canyon), O (Wa: Kawaihāpai to Pu‘upane)
Hibiscus calyphyllus Cav. (nat) K
Hibiscus clayi Degener & I. Degener (end, E) east K (Nounou Mountain; Hāli‘i Val; Anahola Mts)
Hibiscus furcellatus Desr. (ind) K, O, M, H
Hibiscus kokio Hillebr. ex Wawra (end, R)
  subsp. **kokio** K, O, Mo, M, H?
  subsp. **saintjohnianus** (M. Roe) D. Bates northwest K
Hibiscus macrophyllus Roxb. ex Hornem. (nat) O (Pālama and Kaipapa‘u valleys), H (Kohala Mts)
Hibiscus mutabilis L. (nat) O (Ko: Hālawa; Poamoho)
Hibiscus tiliaceus L. (ind?) Mi, FF, K, O, Mo, L, M, H; probably HI
Hibiscus waimeae A. Heller (end)
  subsp. **hannerae** (Degener & I. Degener) D. Bates (R) northwest K (Hanakāpī‘ai; Limahuli; Kalihi Wai)
  subsp. **waimeae** K (Waimea Canyon; west and southwest valleys)

Kokia cookei Degener (end, E*) west Mo (Mauna Loa)
Kokia drynarioides (Seem.) Lewton (end, E*) H (Pu'uwa'awa'a and Hu'ehu'e, North Kona)
Kokia kauaiensis (Rock) Degener & Duvel (end, V) west K (Pa'aiki, Ku'ia, Mahanaloa, Kalalau, and Koai'e valleys)
Kokia lanceolata Lewton (end, EX) southeast O (Makaku; Koko Head; Wailupe Val)
Malachra alceifolia Jacq. (nat) K, O, M
Malva parviflora L. (nat) FF, HI
Malvastrum americanum (L.) Torr. (nat) O (Queen's Beach)
Malvastrum coromandelianum (L.) Garcke subsp. **coromandelianum** (nat) Mi, HI
Malvaviscus penduliflorus DC (nat) K, M, H
Modiola caroliniana (L.) G. Don (nat) M, H
Sida acuta N.L. Burm. subsp. **carpinifolia** (L. fil.) Borssum Waalkes (nat) K, O, M, H
Sida cordifolia L. (nat) EM (Kaupō), H (Kona Coast)
Sida fallax Walp. (ind) Mi, N, HI
Sida linifolia Cav. (nat) Mo (Honouli Wai)
Sida rhombifolia L. (nat?) HI
Sida spinosa L. (nat) O (Honolulu; Wa), H (Kohala Dist)
Sida urens L. (nat) H (North Kona)
Sidastrum micranthum (St. Hil.) Fryx. (nat) O (Wa: Makaleha Val), H (Ka'awaloa)
Sidastrum paniculatum (L.) Fryx. (nat) H (Hālawa)
Thespesia populnea (L.) Sol. ex Corrêa (ind?) Ni, K, O, Mo, M, H; probably HI
Urena lobata L. (nat) K, O, EM

MARANTACEAE

Calathea crotalifera S. Wats. (nat) O (Ko: Pu'ulanihuli)

MELASTOMATACEAE

Arthrostema ciliatum Pav. ex D. Don (nat) O (Ko: Mānoa; Tantalus; 'Ōpae'ula; Castle Trail), H (Kona Dist)
Clidemia hirta (L.) D. Don var. **hirta** (nat) K, O, Mo, M, H
Dissotis rotundifolia (Sm.) Triana (nat) O, M, H
Heterocentron subtriplinervium (Link & Otto) A. Braun & C. Bouché (nat) K, O, M, H
Medinilla venosa (Blume) Blume (nat) EM (Nāhiku to Hāna)
Melastoma candidum D. Don (nat) K, H
Melastoma sanguineum Sims (nat) H (Keaukaha; between Volcano and Hilo)
Oxyspora paniculata (D. Don) DC (nat) O (Ko: Tantalus)
Pterolepis glomerata (Rottb.) Miq. (nat) K, O, H
Tetrazygia bicolor (Mill.) Cogn. (nat) H (Hilo; Nānāwale FR, Puna Dist)
Tibouchina herbacea (DC) Cogn. (nat) WM (Maluhia Boy Scout Camp), EM (Lanilili and Ko'olau FR), H (Saddle Rd)
Tibouchina longifolia (Vahl) Baill. ex Cogn. (nat) H (Stainback Hwy)
Tibouchina urvilleana (DC) Cogn. var. **urvilleana** (nat) K, O, M, H
Trembleya phlogiformis DC var. **parvifolia** Cogn. (nat) K (Waipahe'e Trail, Kamalomalo'o)

MELIACEAE

Melia azedarach L. (nat) Ni, K, O, L, M, H
Toona ciliata M. Roem. var. **australis** (F.v. Muell.) C. DC (nat) K, O, L, M, H

MENISPERMACEAE

Cocculus trilobus (Thunb.) DC (ind) Ni, K, O, Mo, L, M, H

MOLLUGINACEAE

Mollugo cerviana (L.) Ser. (nat) H

MORACEAE

Broussonetia papyrifera (L.) Venten. (pol) HI
Ficus microcarpa L. fil. (nat) O, M, H; probably HI
Morus alba L. (nat) K, O, Mo, M, H
Streblus pendulinus (Endl.) F.v. Muell. (ind) K, O, Mo, L, M, H

MUSACEAE

Musa × paradisiaca L. (pol) K, O, Mo, L, M, H
Musa troglodytarum L. (pol) K, O, Mo, M, H

MYOPORACEAE

Myoporum sandwicense A. Gray (ind) Ni, K, O, Mo, L, M, H; probably HI

MYRICACEAE

Myrica faya Aiton (nat) K, O, L, M, H

MYRSINACEAE

Ardisia crenata Sims (nat) O (Ko: Waiāhole-Waikāne and Mānoa valleys), H (Hilo)
Ardisia elliptica Thunb. (nat) K, O, EM, H
Embelia pacifica Hillebr. (end) K, O, Mo, L, M, H
Myrsine alyxifolia Hosaka (end) K (Kōke'e; Hā'upu Ridge)
Myrsine degeneri Hosaka (end) O (Ko: Pu'ukeahiakahoe; Kawai Nui)
Myrsine denticulata (Wawra) Hosaka (end) K (Alaka'i Swamp to Mt Wai'ale'ale)
Myrsine emarginata (Rock) Hosaka (end) O (Wa: Mt Ka'ala), L (Lāna'ihale), EM (Waikamoi)
Myrsine fernseei (Mez) Hosaka (end) K (Wahiawa Bog; Powerline Trail; Hanalei Riv; Kaloko Reservoir)
Myrsine fosbergii Hosaka (end) O (Ko: southeast end to Castle Trail)
Myrsine helleri (Degener & I. Degener) St. John (end) K (Wahiawa Bog; Alaka'i Swamp to Mt Wai'ale'ale)
Myrsine juddii Hosaka (end, R) O (Ko: Kawai Iki and Poamoho gulches; Pe'ahināi'a Trail; Punalu'u Trail)
Myrsine kauaiensis Hillebr. (end) K (Kōke'e; Alaka'i Swamp; Hanapēpē Val)
Myrsine knudsenii (Rock) Hosaka (end) K (Kōke'e; Hanapēpē Val)
Myrsine lanaiensis Hillebr. (end) K, O, Mo, L, M, H
Myrsine lessertiana A. DC (end) K, O, Mo, L, M, H
Myrsine linearifolia Hosaka (end, R) K (west half to Pu'uokila)
Myrsine mezii Hosaka (end, EX) K (Hanapēpē)
Myrsine petiolata Hosaka (end) K (east half; Alaka'i Swamp Trail)
Myrsine pukooensis (H. Lév.) Hosaka (end) O, east Mo, L, WM
Myrsine punctata (H. Lév.) Wilbur (end) K (Kōke'e Plateau; Alaka'i Swamp; Mt Kāhili), O (Wa: Kuaokalā)
Myrsine sandwicensis A. DC (end) O, Mo, L, M, H
Myrsine vaccinioides W.L. Wagner, Herbst & Sohmer (end, R) WM (Violet Lake, Pu'ukukui)
Myrsine wawraea (Mez) Hosaka (end) K (Kōke'e; Alaka'i Swamp; Mt Kāhili; Kalalau Trail)

MYRTACEAE

Eucalyptus albens Benth. (nat) O, H
Eucalyptus amygdalina Labill. (nat) M, H
Eucalyptus botryoides Sm. (nat) K, H
Eucalyptus bridgesiana R. Baker (nat) K, O, Mo, H
Eucalyptus calophylla R. Br. (nat) O, H
Eucalyptus camaldulensis Dehnh. (nat) K, O, Mo, M, H

Eucalyptus cinerea F.v. Muell. ex Benth. (nat) K, H
Eucalyptus citriodora Hook. (nat) K, O, Mo, M, H
Eucalyptus cladocalyx F.v. Muell. (nat) H
Eucalyptus cornuta Labill. (nat) H
Eucalyptus crebra F.v. Muell. (nat) K, O, Mo
Eucalyptus deanei Maiden (nat) K, O, Mo, H
Eucalyptus deglupta Blume (nat) K, O, Mo, H
Eucalyptus ficifolia F.v. Muell. (nat) K, O, M, H
Eucalyptus globulus Labill. (nat)
  subsp. **globulus** K, O, M, H
  subsp. **maidenii** (F.v. Muell.) Kirkpatr. M, H
Eucalyptus gomphocephala DC (nat) O
Eucalyptus goniocalyx F.v. Muell. ex Miq. (nat) O, H
Eucalyptus gummifera (Sol. ex Gaertn.) Hochr. (nat) K, O
Eucalyptus marginata Donn ex Sm. (nat) K, O, Mo, M, H
Eucalyptus microcorys F.v. Muell. (nat) K, O, Mo, M, H
Eucalyptus paniculata Sm. (nat) K, O, Mo, M, H
Eucalyptus pilularis Sm. (nat) K, O, Mo, M, H
Eucalyptus raveretiana F.v. Muell. (nat) EM
Eucalyptus resinifera Sm. (nat) O, M, H
Eucalyptus robusta Sm. (nat) K, O, Mo, M, H
Eucalyptus rudis Endl. (nat) K, O, M, H
Eucalyptus saligna Sm. (nat) K, O, Mo, M, H
Eucalyptus sideroxylon A. Cunn. ex Woolls subsp. **sideroxylon** (nat) K, O, Mo, M
Eucalyptus tereticornis Sm. (nat) K, O, Mo, M, H
Eucalyptus viminalis Labill. subsp. **viminalis** (nat) O, H
Eugenia koolauensis Degener (end, E) O (north Ko: Pūpūkea to Kaipapa'u), Mo (Mauna Loa)
Eugenia reinwardtiana (Blume) DC (ind) K, O, Mo, M
Eugenia uniflora L. (nat) K, Mo
Leptospermum flavescens Sm. (nat) O (Ko: Wai'alae Nui Ridge)
Leptospermum laevigatum (Sol. ex Gaertn.) F.v. Muell. (nat) L
Leptospermum scoparium J.R. Forster & G. Forster (nat) K, O, L
Lophostemon confertus (R. Br.) Peter G. Wilson & Waterhouse (nat) O
Melaleuca quinquenervia (Cav.) S.T. Blake (nat) K, O, Mo, M, H
Metrosideros macropus Hook. & Arnott (end) O (Ko)
Metrosideros polymorpha Gaud. (end)
  var. **dieteri** J. Wyndham Dawson & Stemmermann K
  var. **glaberrima** (H. Lév.) St. John K, O, Mo, L, M, H
  var. **incana** (H. Lév.) St. John O, Mo, L, M, H
  var. **macrophylla** (Rock) St. John H
  var. **newellii** (Rock) St. John H
  var. **polymorpha** O, Mo, L, M, H
  var. **pseudorugosa** (Skottsb.) J. Wyndham Dawson & Stemmermann WM
  var. **pumila** (A. Heller) J. Wyndham Dawson & Stemmermann K, Mo, M
Metrosideros rugosa A. Gray (end) O (Ko)
Metrosideros tremuloides (A. Heller) P. Knuth (end) O
Metrosideros waialealae (Rock) Rock (end)
  var. **fauriei** (H. Lév.) J. Wyndham Dawson & Stemmermann Mo, L
  var. **waialealae** K
Psidium cattleianum Sabine (nat) K, O, Mo, L, M, H; probably HI
Psidium guajava L. (nat) K, O, Mo, L, M, H; probably HI
Rhodomyrtus tomentosa (Aiton) Hassk. (nat) K, O, H
Syzygium cumini (L.) Skeels (nat) K, O, Mo, L, M, H
Syzygium jambos (L.) Alston (nat) K, O, Mo, L, M, H

Syzygium malaccense (L.) Merr. & Perry (pol) K, O, Mo, M, H
Syzygium sandwicensis (A. Gray) Nied. (end) K, O, Mo, L, M

NYCTAGINACEAE

Boerhavia coccinea Mill. (nat) K, O, M, Ka, H
Boerhavia glabrata Blume (ind) Ni, O, Mo, L, M, Ka, H
Boerhavia herbstii Fosb. (end) PH, Li, O, L, M, Ka, H
Boerhavia repens L. (ind) Ku, Mi, PH, Li, La, FF, HI
Mirabilis jalapa L. (nat) Mi, K, O, L, M, H
Pisonia brunoniana Endl. (ind) O, Mo, L, M, H
Pisonia grandis R. Br. (ind) Li, M?
Pisonia sandwicensis Hillebr. (end) K, O, Mo, L, M, H
Pisonia umbellifera (G. Forster) Seem. (ind) K, O, Mo (single collection), L, M, H (single collection)
Pisonia wagneriana Fosb. (end, R) K (Powerline Trail to Maunahina-Wainiha drainage)

OCHNACEAE

Sauvagesia erecta L. (nat) Mo (Keōpuka Loa)

OLEACEAE

Fraxinus uhdei (Wenzig) Lingelsh. (nat) K, O, Mo, L, M, H
Nestegis sandwicensis (A. Gray) Degener, I. Degener & L. Johnson (end) K, O, Mo, L, M, H
Olea europaea L. (nat)
  subsp. **africana** (Mill.) P. Green H ('Āinahou Ranch)
  subsp. **europaea** H (Parker Ranch)

ONAGRACEAE

Epilobium billardierianum Ser. subsp. **cinereum** (A. Rich.) Raven & Engelhorn (nat) K (Kōke'e), O (Wa: Mt Ka'ala), M, H
Epilobium ciliatum Raf. (nat) H (Kīlauea; Kohala Mts)
Fuchsia boliviana Carrière (nat) K (Kōke'e)
Fuchsia magellanica Lam. (nat) K, M, H
Fuchsia paniculata Lindl. (nat) H (Kīlauea FR; Thurston Lava Tube)
Ludwigia octovalvis (Jacq.) Raven (pol?) K, O, Mo, L, M, H
Ludwigia palustris (L.) Elliott (nat) K, O, Mo, M, H
Oenothera affinis Cambess. (nat) H (between Mauna Loa and Mauna Kea; Makahālau)
Oenothera laciniata J. Hill (nat) Mi, M, H
Oenothera stricta Ledeb. ex Link subsp. **stricta** (nat) EM, H

ORCHIDACEAE

Anoectochilus sandvicensis Lindl. (end) K, O, Mo, L, M, H
Arundina graminifolia (D. Don) Hochr. (nat) K, O, M, H
Epidendrum × obrienianum Rolfe (nat) K (Wahiawa Bog), O, L, M, H
Liparis hawaiensis H. Mann (end) K, O, Mo, L, M, H
Phaius tankarvilleae (Banks ex L'Hér.) Blume (nat) K, O, L, H
Platanthera holochila (Hillebr.) Kraenzl. (end, R) K, O, Mo, M
Spathoglottis plicata Blume (nat) K, O, Mo, L, M, H

OXALIDACEAE

Oxalis corniculata L. (pol?) Mi, HI
Oxalis corymbosa DC (nat) K, O, Mo, L, M, H

PANDANACEAE

Freycinetia arborea Gaud. (ind) K, O, Mo, L, M, H; probably HI
Pandanus tectorius S. Parkinson ex Z. (ind?) Ni, K, O, Mo, L, M, H

PAPAVERACEAE

Argemone glauca (Nutt. ex Prain) Pope (end)
  var. **decipiens** Ownbey H (leeward side and between Mauna Loa and Mauna Kea)
  var. **glauca** Ni, O, Mo, L, M, Ka, H (South Pt)
Argemone mexicana L. (nat) K, O, M
Bocconia frutescens L. (nat) M, H
Eschscholzia californica Cham. (nat) EM (Kula Rd), H (Hale Pōhaku Ranger Station)
Hunnemannia fumariifolia Sweet (nat) EM (Pi'ilani Hwy)

PASSIFLORACEAE

Passiflora × caerulea L. (nat) K, O
Passiflora edulis Sims (nat) K, O, L, M, H
Passiflora foetida L. (nat) Ni, K, O, M, H
Passiflora laurifolia L. (nat) K, O, Mo, H
Passiflora ligularis Juss. (nat) K, O, L, H
Passiflora manicata (Juss.) Pers. (nat) K
Passiflora mollissima (Kunth) L.H. Bailey (nat) K, H
Passiflora pulchella Kunth (nat) O, H
Passiflora quadrangularis L. (nat) O (Ko: Waiāhole Val), H (Kona)
Passiflora suberosa L. (nat) O, M, H
Passiflora subpeltata Ort. (nat) K, O, M
Passiflora vitifolia Kunth (nat) O (Ko: Mānoa Falls Trail)

PHYTOLACCACEAE

Phytolacca octandra L. (nat) K, O, Mo, L, M
Phytolacca sandwicensis Endl. (end) K, O, Mo, M, H
Rivina humilis L. (nat) K, O, H

PIPERACEAE

Peperomia alternifolia Yuncker (end) Mo, L, M
Peperomia cookiana C. DC (end) K, Mo, M, H
Peperomia degeneri Yuncker (end, EX?) Mo (Kalua'aha Val)
Peperomia eekana C. DC (end) Mo, M
Peperomia ellipticibacca C. DC (end) O (Ko)
Peperomia expallescens C. DC (end) Mo, M
Peperomia globulanthera C. DC (end) M
Peperomia hesperomannii Wawra (end) K
Peperomia hirtipetiola C. DC (end) L (r), M
Peperomia hypoleuca Miq. (end) H
Peperomia kipahuluensis St. John & C. Lamour. (end) EM (Kīpahulu, Waiho'i, and Kūhiwa valleys)
Peperomia kokeana Yuncker (end) K (Kōke'e)
Peperomia latifolia Miq. (end) K, O, Mo, L, M, H
Peperomia leptostachya Hook. & Arnott (ind) Ni, K, O, Mo, L, M, H
Peperomia ligustrina Hillebr. (end) Mo, M, H
Peperomia macraeana C. DC (end) O, Mo, L, M, H
Peperomia mauiensis Wawra (end) Mo, L, WM
Peperomia membranacea Hook. & Arnott (end) K, O, Mo, M, H
Peperomia oahuensis C. DC (end) K (Hā'upu Ridge; Kamo'oloa Stream), O (Ko)

Peperomia obovatilimba C. DC (end) EM, H (Kohala Mts)
Peperomia pellucida (L.) Kunth (nat) O
Peperomia remyi C. DC (end) K, O, Mo, L, M, H
Peperomia rockii C. DC (end, R) east Mo
Peperomia sandwicensis Miq. (end) K, O, Mo
Peperomia subpetiolata Yuncker (end, R) EM (Kula Pipeline, lower Waikamoi)
Peperomia tetraphylla (G. Forster) Hook. & Arnott (ind) K, O, Mo, L, M, H
Piper methysticum G. Forster (pol) K, O, Mo, M, H; probably also on Ni and L

PITTOSPORACEAE

Pittosporum argentifolium Sherff (end) Mo, M
Pittosporum confertiflorum A. Gray (end) O, L, M, H
Pittosporum flocculosum (Hillebr.) Sherff (end) O (Wa; Ko: Kuli'ou'ou-Waimānalo Ridge to Hālawa Val)
Pittosporum gayanum Rock (end) K
Pittosporum glabrum Hook. & Arnott (end) K, O, Mo, L, M
Pittosporum hawaiiense Hillebr. (end) leeward H (Kohala Mts to Ka'ū Dist)
Pittosporum hosmeri Rock (end) H (Kohala Mts south to Mauna'anu, Ka'ū FR)
Pittosporum kauaiense Hillebr. (end) K
Pittosporum napaliense Sherff (end, R) northwest K (Limahuli to Hanakoa valleys)
Pittosporum terminalioides Planch. ex A. Gray (end) L, M, leeward H (Kīlauea to Kohala Mts)
Pittosporum undulatum Venten. (nat) L (Lāna'ihale), H
Pittosporum viridiflorum Sims (nat) L (Kapano Gulch), H (Pu'uwa'awa'a; Waimea)

PLANTAGINACEAE

Plantago aristata Michx. (nat) H (Kīlauea Military Camp, Hawai'i Volcanoes NP; Kapāpala)
Plantago australis Lam. subsp. **hirtella** (Kunth) Rahn (nat) EM, H
Plantago debilis R. Br. (nat) O (Honolulu)
Plantago hawaiensis (A. Gray) Pilg. (end, E) H
Plantago lanceolata L. (nat) Mi, FF, K, O, Mo, L, M, H
Plantago major L. (nat) Mi, K, O, Mo, L, M, H
Plantago pachyphylla A. Gray (end) K (Alaka'i Swamp; Mt Wai'ale'ale), O (Ko), Mo (Pēpē'ōpae Bog), M, H (Kohala Mts; Kahuku Ranch)
Plantago princeps Cham. & Schlechtend. (end, R)
  var. **anomala** Rock K (Hanapēpē and Kalalau valleys), O (Wa: Nāpepeiauolelo Gulch)
  var. **laxiflora** A. Gray Mo, M, H
  var. **longibracteata** H. Mann K (Hanalei and Hanapēpē valleys; Wahiawa Mts), O (Wa: Mt Ka'ala; Ko: Kaipapa'u to Pa'ala'a-Wahiawā)
  var. **princeps** O (Ko: Mānoa Cliffs Trail; Kalihi and Nu'uanu valleys)

PLUMBAGINACEAE

Plumbago zeylanica L. (ind) HI

POACEAE

Agrostis avenacea J.G. Gmelin (ind) K, O, Mo, L, M, H
Agrostis sandwicensis Hillebr. (end) O, M, H
Agrostis semiverticillata (Forssk.) C. Chr. (nat) K, H
Agrostis stolonifera L. (nat) K, O, Mo, M, H
Aira caryophyllea L. (nat) Mo, M, H
Andropogon virginicus L. (nat) O, H
Anthoxanthum odoratum L. (nat) Mo, M, H
Arundo donax L. (nat) K, O, M, H
Avena fatua L. (nat) K, O, L, M, H

Avena sativa L. (nat) O, M, H
Axonopus fissifolius (Raddi) Kuhlm. (nat) K, O, L, M, H
Bothriochloa barbinodis (Lag.) Herter (nat) Ni, O, Mo, M
Bothriochloa pertusa (L.) A. Camus (nat) HI
Brachiaria mutica (Forssk.) Stapf (nat) Mi, K, O, L, M, H
Briza maxima L. (nat) K, M, H
Briza minor L. (nat) K, O, Mo, L, M, H
Bromus mollis L. (nat) K, O, M, H
Bromus rigidus Roth (nat) K, H
Bromus willdenowii Kunth (nat) Mi, O, Mo, M, H
Calamagrostis expansa (Munro ex Hillebr.) Hitchc. (end, R) M
Calamagrostis hillebrandii (Munro ex Hillebr.) Hitchc. (end) central Mo (single collection), WM (Pu'ukukui)
Cenchrus agrimonioides Trin. (end)
  var. **agrimonioides** O, L, M
  var. **laysanensis** F. Brown (EX) Ku, Mi, La
Cenchrus ciliaris L. (nat) K, O, Mo, L, M, Ka, H
Cenchrus echinatus L. (nat) Ku, Mi, Li, La, FF, N, HI
Chloris barbata (L.) Sw. (nat) Ku, Mi, Ni, K, O, Mo, L, M, H
Chloris divaricata R. Br. (nat)
  var. **cynodontioides** (Balansa) Lazarides K, O
  var. **divaricata** Ni, L, M, Ka
Chloris gayana Kunth (nat) Ni, O, L, M, H
Chloris radiata (L.) Sw. (nat) K, O, L, M, H
Chloris virgata Sw. (nat) Ku, K, Mo, L, M, Ka, H
Chrysopogon aciculatus (Retz.) Trin. (ind?) K, O, Mo, L, H
Coix lachryma-jobi L. (nat) K, O, Mo, M, H
Cymbopogon refractus (R. Br.) A. Camus (nat) K, O, Mo, M, H
Cynodon dactylon (L.) Pers. (nat) Ku, Mi, PH, La, FF, K, O, L, M, Ka, H
Dactylis glomerata L. (nat) K, O, Mo, M, H
Dactyloctenium aegyptium (L.) Willd. (nat) O, Mo, M, Ka, H
Danthonia pilosa R. Br. (nat) H
Deschampsia nubigena Hillebr. (end) K, Mo, M, H
Dichanthelium cynodon (Reichardt) C.A. Clark & Gould (end) K, Mo, M
Dichanthelium hillebrandianum (Hitchc.) C.A. Clark & Gould (end) K, Mo, M, H
Dichanthelium isachnoides (Munro ex Hillebr.) C.A. Clark & Gould (end) K, Mo, M
Dichanthelium koolauense (St. John & Hosaka) C.A. Clark & Gould (end) O (Ko: Kaipapa'u to Moanalua)
Dichanthium annulatum (Forssk.) Stapf (nat) O
Dichanthium aristatum (Poir.) Hubb. (nat) K, O, L, M
Dichanthium sericeum (R. Br.) A. Camus (nat) Ni, O, L, M, Ka, H
Digitaria ciliaris (Retz.) Koeler (nat) Ku, Mi, FF, HI
Digitaria fuscescens (K. Presl) Henr. (nat) H
Digitaria insularis (L.) Mez ex Ekman (nat) Mi, K, O, Mo, L, M, Ka, H
Digitaria setigera Roth (ind) Ni, K, O, Mo, L, M, H
Digitaria violascens Link (nat) K, O, Mo, L, M, H
Dissochondrus biflorus (Hillebr.) Kuntze ex Hack. (end) K, O, Mo, L, M, H
Echinochloa colona (L.) Link (nat) HI
Echinochloa crus-galli (L.) P. Beauv. (nat) K, O, Mo, L, M, H
Ehrharta stipoides Labill. (nat) O, M, H
Eleusine indica (L.) Gaertn. (nat) Ku, Mi, FF, K, O, Mo, L, M, H
Eragrostis atropioides Hillebr. (end) O, Mo, L, M, H
Eragrostis brownei (Kunth) Nees ex Steud. (nat) Mo, M, H
Eragrostis cilianensis (All.) Link (nat) K, O, Mo, M, Ka, H

Eragrostis deflexa Hitchc. (end, EX) L, H
Eragrostis fosbergii Whitney (end, EX) O (Wa: Mt Ka'ala to Kolekole Pass)
Eragrostis grandis Hillebr. (end) K, O, Mo, L, M, H
Eragrostis hosakai Degener (end, EX) Mo (Mauna Loa)
Eragrostis leptophylla Hitchc. (end) L, M, H
Eragrostis mauiensis Hitchc. (end, EX) L, M (Wailuku)
Eragrostis monticola (Gaud.) Hillebr. (end) Mo, L, M, H
Eragrostis paupera Jedwabn. (ind) Ku, Mi, PH, FF, O (Barber's Pt, ex)
Eragrostis pectinacea (Michx.) Nees (nat) O, L, M, H
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult. (nat) Mi, Ni, O, M, Ka, H
Eragrostis variabilis (Gaud.) Steud. (end) Ku, Mi, PH, Li, La, N, HI
Eriochloa punctata (L.) Desv. ex W. Ham. (nat) Ni, O
Festuca hawaiiensis Hitchc. (end?) EM ('Ulupalakua, single collection), H (single collection each from Pu'uhuluhulu and Hualālai)
Festuca rubra L. (nat) M, H
Garnotia acutigluma (Steud.) Ohwi (nat?) Mo, M, H
Gastridium ventricosum (Gouan) Schinz & Thell. (nat) K, M, H
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult. (ind?) HI
Holcus lanatus L. (nat) K, O, Mo, M, H
Hordeum leporinum Link (nat) Mi, L, M, H
Hyparrhenia rufa (Nees) Stapf (nat) K, O, Mo, M, H
Isachne distichophylla Munro ex Hillebr. (end) K, O, Mo, L, M, H
Isachne pallens Hillebr. (end) K, O
Ischaemum byrone (Trin.) Hitchc. (end, V) Mo, M, H
Koeleria nitida Nutt. (nat) H
Leptochloa uninervia (K. Presl) Hitchc. & Chase (nat) K, O, Mo, M
Lepturus repens (G. Forster) R. Br. (ind) Ku, Mi, PH, Li, La, FF
Lolium multiflorum Lam. (nat) K, O, M, H
Lolium perenne L. (nat) H
Melinis minutiflora P. Beauv. (nat) K, O, Mo, L, M, Ka, H
Muhlenbergia microsperma (DC) Kunth (nat) O (Diamond Head), M (Wai'ale Reservoir)
Oplismenus compositus (L.) P. Beauv. (nat) K, O, Mo, H
Oplismenus hirtellus (L.) P. Beauv. (nat) K, O, Mo, L, M, H
Panicum antidotale Retz. (nat) O, Mo, H
Panicum beecheyi Hook. & Arnott (end) K, O, M
Panicum coloratum L. (nat) Mo, M
Panicum dichotomiflorum Michx. (nat) O, H
Panicum fauriei Hitchc. (end)
  var. **carteri** (Hosaka) Davidse (E*) O (Mokoli'i Islet)
  var. **fauriei** O, Mo, M, Ka, H
  var. **latius** (St. John) Davidse K, O, Mo, L, M, Ka, H
Panicum konaense Whitney & Hosaka (end) M, H
Panicum maximum Jacq. (nat) HI
Panicum miliaceum L. (nat) O, M, H
Panicum napaliense Davidse (end) K
Panicum nephelophilum Gaud. (end) K, O, Mo, L, M, H
Panicum niihauense St. John (end, R) Ni
Panicum pellitum Trin. (end) Ni, L, M, H
Panicum ramosius Hitchc. (end) Mo, L, Ka
Panicum repens L. (nat) O, L, H
Panicum tenuifolium Hook. & Arnott (end) O, Mo, L, M, H
Panicum torridum Gaud. (end) Ne, N, HI
Panicum virgatum L. (nat) O (single collection)
Panicum xerophilum (Hillebr.) Hitchc. (end) Ni, O, Mo, L, M, H

Paspalum conjugatum Bergius (nat) K, O, Mo, L, M, H
Paspalum dilatatum Poir. (nat) K, O, Mo, L, M, H
Paspalum fimbriatum Kunth (nat) Ku, K, O
Paspalum scrobiculatum L. (ind?) K, O, Mo, M, H
Paspalum urvillei Steud. (nat) Mi, K, O, Mo, L, M, H
Paspalum vaginatum Sw. (nat) K, O, H
Pennisetum clandestinum Chiov. (nat) O, L, M, H
Pennisetum polystachion (L.) Schult. (nat) O, L, H
Pennisetum purpureum Schumach. (nat) K, O, L, M, H
Pennisetum setaceum (Forssk.) Chiov. (nat) K, O, L, H
Phyllostachys nigra (Lodd.) Munro (nat) O, Mo, M
Poa annua L. (nat) Ku, Mi, K, O, Mo, L, M, H
Poa mannii Munro ex Hillebr. (end, EX) K (Waimea; Olokele Gulch)
Poa pratensis L. (nat) O, M, H
Poa sandvicensis (Reichart) Hitchc. (end, E) K
Poa siphonoglossa Hack. (end, E) K (Kōke‘e)
Polypogon interruptus Kunth (nat) Mi, K, O, M, H
Polypogon monspeliensis (L.) Desf. (nat) Mi, K, O, M, H
Rhynchelytrum repens (Willd.) Hubb. (nat) Mi, HI
Saccharum spontaneum L. (nat) O, Mo
Sacciolepis indica (L.) Chase (nat) K, O, Mo, M, H
Schizachyrium condensatum (Kunth) Nees (nat) H
Schizostachyum glaucifolium (Rupr.) Munro (pol?) K, O, Mo, M, H
Setaria gracilis Kunth (nat) K, O, Mo, L, M, H
Setaria palmifolia (J. König) Stapf (nat) O, L, M, H
Setaria verticillata (L.) P. Beauv. (nat) Ku, Mi, PH, FF, N, HI
Sorghum bicolor (L.) Moench (nat) K, O, H
Sorghum halpense (L.) Pers. (nat) K, O, L, M, H
Sporobolus africanus (Poir.) Robyns & Tournay (nat) K, O, Mo, L, M, H
Sporobolus diander (Retz.) P. Beauv. (nat) O, L, H
Sporobolus indicus (L.) R. Br. (nat) Mi, K, O, L, M, H
Sporobolus virginicus (L.) Kunth (ind) Mi, La, HI
Stenotaphrum secundatum (Walter) Kuntze (nat) Mi, K, O, Mo, L, H
Stipa cernua Stebb. & A. Löve (nat) H (Pōhakuloa)
Themeda villosa (Poir.) A. Camus (nat) K, O, H
Tragus berteronianus Schult. (nat) Mo, M, Ka
Trisetum glomeratum (Kunth) Trin. (end) L, M, H
Trisetum inaequale Whitney (end) L, M
Vulpia bromoides (L.) S.F. Gray (nat) K, O, Mo, L, M, H
Vulpia myuros (L.) C.C. Gmelin (nat) Mi, K, O, Mo, L, M, H

POLEMONIACEAE

Gilia capitata Sims (nat) EM (Haleakalā)

POLYGALACEAE

Polygala paniculata L. (nat) O, EM, H

POLYGONACEAE

Antigonon leptopus Hook. & Arnott (nat) K, O, L, M, H
Emex spinosa (L.) Campd. (nat) O, Mo, M, H
Polygonum argyrocoleon Steud. ex Kunze (nat) EM (‘Ulupalakua, single collection; not known if species persists)
Polygonum aviculare L. (nat) M, H

Polygonum capitatum F. Ham. (nat) H
Polygonum chinense L. (nat) windward H
Polygonum convolvulus L. (nat) EM (Haleakalā NP, single collection; not known if species persists)
Polygonum glabrum Willd. (nat?) K, O, Mo, M, H
Polygonum punctatum Elliot (nat) H
Rumex acetosella L. (nat) K, M, H
Rumex albescens Hillebr. (end) N, K, O (Wa)
Rumex brownei Campd. (nat) EM (‘Ulupalakua Ranch), H (North Kona Dist)
Rumex crispus L. (nat) K, O, L, M, H
Rumex giganteus W.T. Aiton (end) Mo, M, H
Rumex obtusifolius L. subsp. **obtusifolius** (nat) K (Kōke‘e), O, H (Kona)
Rumex skottsbergii Degener & I. Degener (end) H (North and South Kona, Puna, and south Ka‘ū districts)

PONTEDERIACEAE

Eichhornia crassipes (Mart.) Solms (nat) K, O, M, H
Monochoria vaginalis (N.L. Burm.) K. Presl (nat) K, O

PORTULACACEAE

Portulaca lutea Sol. ex G. Forster (ind) Mi, Li, La, GP, FF, Ne, N, O, Mo, L, M, H
Portulaca molokiniensis Hobdy (end, R) Ml, Ka (Kamōhio Bay; Pu‘ukoa‘e Islet)
Portulaca oleracea L. (nat) Mi, PH, La, FF, N, Ni, K, O, Mo, L, M, H
Portulaca pilosa L. (nat) Ni, K, O, Mo, M, H
Portulaca sclerocarpa A. Gray (end, V) L, H (Po‘opo‘o Islet)
Portulaca villosa Cham. (end, V) N, Kl, O, Mo, L, M, Ka, H
Portulaca sp. A (nat) EM (‘Ulupalakua Ranch)
Talinum paniculatum (Jacq.) Gaertn. (nat) K, O, H
Talinum triangulare (Jacq.) Willd. (nat) H (Keauhou, North Kona Dist)

POTAMOGETONACEAE

Potamogeton foliosus Raf. (ind?) K, O, M, H
Potamogeton nodosus Poir. (ind?) O, M
Potamogeton pectinatus L. (nat) Ni, K

PRIMULACEAE

Anagallis arvensis L. (nat) Mi, K, O, Mo, L, M, Ka, H
Lysimachia daphnoides (A. Gray) Hillebr. (end, R) K (Alaka‘i Swamp; Wahiawa Bog)
Lysimachia filifolia C. Forbes (end, E) K (Olokele Val; Wailua Riv, southeast side of Mt Wai‘ale‘ale), O (Ko: Waiāhole Ditch Trail)
Lysimachia forbesii Rock (end, EX) O (Ko: Castle Trail)
Lysimachia glutinosa Rock (end) K (Kōke‘e)
Lysimachia hillebrandii J.D. Hook. ex A. Gray (end) K (Hā‘upu to Limahuli), O, east Mo, L, M
Lysimachia kalalauensis Skottsb. (end, R) K (Kōke‘e, from Kalalau to Mākaha valleys; Hanapēpē Val)
Lysimachia lydgatei Hillebr. (end, E) WM (Līhau; Lahaina)
Lysimachia mauritiana Lam. (ind) Ni, K (Hanakāpī‘ai; Princeville), Mo (Kaholaiki Bay; Kalawao, Waikolu, and Wailau valleys), WM (Makamaka‘ole), EM (Hanawī), northwest H (Hilo; Honopue; Niuli‘i)
Lysimachia maxima (R. Knuth) St. John (end, R) east Mo (Pelekunu Trail)
Lysimachia remyi Hillebr. (end) Mo, M
Lysimachia venosa (Wawra) St. John (end, R) K (Mt Wai‘ale‘ale)

PROTEACEAE

Grevillea banksii R. Br. (nat) Ni, K, O, Mo, M, H
Grevillea robusta A. Cunn. ex R. Br. (nat) K, O, M, H; probably also naturalized on Ni, Mo, and L

RANUNCULACEAE

Anemone hupehensis Lemoine var. **japonica** (Thunb.) Bowles & W. Stern (nat) H (Hawai'i Volcanoes NP)
Ranunculus hawaiensis A. Gray (end, E) EM, H
Ranunculus mauiensis A. Gray (end, R) K, O (Wa: Mt Ka'ala), Mo, M, H
Ranunculus muricatus L. (nat) H (Hawai'i Volcanoes NP; South Kona Dist)
Ranunculus parviflorus L. (nat) H
Ranunculus plebeius R. Br. ex DC (nat) H
Ranunculus repens L. (nat) H

RHAMNACEAE

Alphitonia ponderosa Hillebr. (end) K, O (r), Mo (r), L (r), M (r), H (r)
Colubrina asiatica (L.) Brongn. (ind) Ni, K, O, Mo
Colubrina oppositifolia Brongn. ex H. Mann (end, E) O (Wa), leeward H
Gouania hillebrandii Oliver (end, E*) Mo (Kamalō; Waiakuilani Gulch; ex), L (ex), WM (Pa'upa'u and Līhau Mountain, Lahaina Dist), Ka (ex)
Gouania meyenii Steud. (end, E) O (Wa: Mākaha-Wai'anae Kai; Līhu'e)
Gouania vitifolia A. Gray (end, EX?) O (Wa), WM (Lahaina), H (Ka'ū)
Rhamnus californica Eschsch. var. **californica** (nat) H (Mauna Kea State Park; Pōhakuloa Training Area)

RHIZOPHORACEAE

Bruguiera gymnorrhiza (L.) Lam. (nat) O (He'eia)
Rhizophora mangle L. (nat) K, O, Mo, L, H

ROSACEAE

Acaena exigua A. Gray (end, E) K (Mt Wai'ale'ale), WM (Pu'ukukui)
Fragaria chiloensis (L.) Duchesne (ind)
  subsp. **sandwicensis** (Decne.) Staudt (end) EM, H
Fragaria vesca L. (nat) K (Kōke'e), H
Osteomeles anthyllidifolia (Sm.) Lindl. (ind) K, O, Mo, L, M, H
Pyracantha angustifolia (Franch.) C.K. Schneid. (nat) K (Kōke'e), H (Volcano transfer dump)
Rubus argutus Link (nat) K, O, M, H
Rubus ellipticus Sm. var. **obcordatus** Focke (nat) H (Volcano; Laupāhoehoe)
Rubus hawaiensis A. Gray (end) K, Mo, M, H
Rubus macraei A. Gray (end, R?) EM, H
Rubus niveus Thunb. (nat) EM (Kula), H (Volcano transfer dump)
Rubus rosifolius Sm. (nat) K, O, Mo, L, M, H
Rubus sieboldii Blume (nat) K (Lāwa'i Val; Kīlauea)

RUBIACEAE

Bobea brevipes A. Gray (end) K, O
Bobea elatior Gaud. (end) K (Nāpali Coast southeast to Hā'upu Ridge), O (Ko), Mo, L, M, H (Kohala Mts)
Bobea sandwicensis (A. Gray) Hillebr. (end) O (Wa; south Ko: Wailupe Val), Mo, L, M
Bobea timonioides (J.D. Hook.) Hillebr. (end, R) K (Hā'upu Ridge; Nāwiliwili), O (Wa: Mākua; Ko: Waimano Ditch), EM (south slope, Haleakalā), H (Puna and South Kona districts)
Canthium odoratum (G. Forster) Seem. (ind) K, O, Mo, L, M, H

Cinchona pubescens Vahl (nat) EM (Ko'olau FR), H (South Kona Dist)
Coffea arabica L. (nat) K, O, Mo, L, M, Ka, H
Coprosma cymosa Hillebr. (end) leeward H
Coprosma elliptica W. Oliver (end) K (Alaka'i Swamp to Mt Wai'ale'ale; Kahōluamanu, single collection; Kōke'e, single collection)
Coprosma ernodeoides A. Gray (end) WM (Mt 'Eke?), EM, H
Coprosma foliosa A. Gray (end) K (r), O, Mo, L, M
Coprosma kauensis (A. Gray) A. Heller (end) K
Coprosma longifolia A. Gray (end) O
Coprosma menziesii A. Gray (end) H
Coprosma montana Hillebr. (end) EM, H
Coprosma ochracea W. Oliver (end) O (Wa: Mt Ka'ala), east Mo, L, M, H
Coprosma pubens A. Gray (end) Mo, L, M, H
Coprosma rhynchocarpa A. Gray (end) H
Coprosma ternata W. Oliver (end) east Mo
Coprosma waimeae Wawra (end) K
Galium divaricatum Pourr. ex Lam. (nat) EM (Waihou Spring, Olinda)
Gardenia brighamii H. Mann (end, E*) O (Wa: Pu'uku'ua; Nānākuli), Mo (Mauna Loa, Mahana Flats), L (Kānepu'u), WM (Olowalu), H (Pu'uwa'awa'a)
Gardenia mannii St. John & Kuykendall (end) O
Gardenia remyi H. Mann (end, R) K, Mo, M, H (Hilo and Puna districts)
Hedyotis acuminata (Cham. & Schlechtend.) Steud. (end) K, O, Mo, L, M, H
Hedyotis callitrichoides (Griseb.) W. Lewis (nat) O (Honolulu International Airport; Kalihi; Mānoa; Kāne'ohe; Waipahu), M (Kahului)
Hedyotis centranthoides (Hook. & Arnott) Steud. (end) K, O, Mo, L, M, H
Hedyotis cookiana (Cham. & Schlechtend.) Steud. (end, E) K (Waiahuakua Val), H (Kealakekua)
Hedyotis coriacea Sm. (end, EX?) O (Wa; Nu'uanu; Pearl Harbor), M, leeward H (1859 Lava Flow)
Hedyotis corymbosa (L.) Lam. (nat) O (Honolulu), EM (Wai'ānapanapa State Park), H (Hilo to Volcano)
Hedyotis degeneri Fosb. (end, E)
  var. **coprosmifolia** Fosb. O (Wa: Kamaile'unu Ridge and Mokulē'ia, north and northwest slope, Mt Ka'ala)
  var. **degeneri** O (Wa: Ka'a'awa and Pu'uiki, north slope, Mt Ka'ala)
Hedyotis elatior (H. Mann) Fosb. (end, R?) K, O (Ko: upper Wahiawā), Mo, EM
Hedyotis fluviatilis (C. Forbes) Fosb. (end, R) K, O (Ko: Pūpūkea to Mānoa)
Hedyotis foggiana Fosb. (end) K (Mt Kāhili; Hanalei Val; Kōke'e)
Hedyotis foliosa (Hillebr.) Fosb. (end, EX) EM (southwest slope, Haleakalā)
Hedyotis formosa (Hillebr.) Fosb. (end, R) WM
Hedyotis fosbergii W.L. Wagner & Herbst (end) O (Ko: Castle Trail to Pālolo), L (Lāna'ihale)
Hedyotis hillebrandii (Fosb.) W.L. Wagner & Herbst (end) Mo, M, H
Hedyotis knudsenii (Hillebr.) Fosb. (end) K (Kōke'e)
Hedyotis littoralis (Hillebr.) Fosb. (end, V) K (Princeville), O (ex), Mo (Hālawa to Wailau valleys), EM (Ke'anae-Wailua; Hanawī; 'Ālau Island), H (Honopue Val)
Hedyotis mannii Fosb. (end, E) Mo (Kawela Gulch; Mapulehu Val), L, WM
Hedyotis parvula (A. Gray) Fosb. (end, E) O (Wa: Pālehua to Makaleha)
Hedyotis st.-johnii Stone & Lane (end, E) K (Honopū, Miloli'i, Kalalau, and Nualolo valleys, Nāpali Coast)
Hedyotis schlechtendahliana Steud. (end)
  var. **remyi** (Hillebr.) Fosb. L
  var. **schlechtendahliana** K, O, Mo, M
Hedyotis terminalis (Hook. & Arnott) W.L. Wagner & Herbst (end) K, O, Mo, L, M, H
Hedyotis tryblium Herbst & W.L. Wagner (end, R) K (Mt Kāhili; Wahiawa Stream; rim of Kalalau Val)
Mitracarpus hirtus (L.) DC (nat) H (Hilo)

Morinda citrifolia L. (pol) Ni, K, O, Mo, L, M, H; probably HI
Morinda trimera Hillebr. (end) K (single sterile collection), O (Wa; Ko: Kīpapa Gulch), L, M
Nertera granadensis (L. fil.) Druce (ind) K, O (Wa), Mo, WM (Pu‘ukukui), H
Paederia scandens (Lour.) Merr. (nat) K, O, H
Psychotria fauriei (H. Lév.) Fosb. (end) O (Ko)
Psychotria grandiflora H. Mann (end) K (Kōke‘e; Alaka‘i Swamp)
Psychotria greenwelliae Fosb. (end) K (Kōke‘e)
Psychotria hathewayi Fosb. (end)
  var. **brevipetiolata** Fosb. O (Wa)
  var. **hathewayi** O (Wa)
Psychotria hawaiiensis (A. Gray) Fosb. (end)
  var. **hawaiiensis** Mo, M, H
  var. **hillebrandii** (Rock) Fosb. Mo, M, H
  var. **scoriacea** (Rock) Fosb. M, H
Psychotria hexandra H. Mann (end)
  subsp. **hexandra**
    var. **hexandra** K
    var. **hirta** Wawra K
    var. **kealiae** Fosb. K
  subsp. **oahuensis** Degener & Fosb.
    var. **hosakana** Fosb. O (Ko)
    var. **oahuensis** O (Ko)
    var. **rockii** Fosb. O (Ko)
Psychotria hobdyi Sohmer (end, R) K (Miloli‘i-Kopiwai)
Psychotria kaduana (Cham. & Schlechtend.) Fosb. (end) K, O, Mo, L, M
Psychotria mariniana (Cham. & Schlechtend.) Fosb. (end) K, O, Mo, L, M
Psychotria mauiensis Fosb. (end) K, Mo, L, M, H
Psychotria wawrae Sohmer (end) east K
Richardia brasiliensis Gomes (nat) K, O, L, EM, H
Sherardia arvensis L. (nat) EM, H
Spermacoce assurgens Ruiz & Pav. (nat) K, O, M, H
Spermacoce mauritiana Gideon (nat) M, H

RUPPIACEAE

Ruppia maritima L. (ind) Ni, K, O, Mo, L, M, H

RUTACEAE

Flindersia brayleyana F. v. Muell. (nat) H (Waiākea FR)
Melicope adscendens (St. John & E. Hume) T. Hartley & B. Stone (end, EX) EM (Auwahi)
Melicope anisata (H. Mann) T. Hartley & B. Stone (end) K
Melicope balloui (Rock) T. Hartley & B. Stone (end, EX?) EM (between Olinda and ‘Ukulele)
Melicope barbigera A. Gray (end) K (Kōke‘e)
Melicope christophersenii (St. John) T. Hartley & B. Stone (end, R) O (Wa: Pu‘ukaua to Mt Ka‘ala)
Melicope cinerea A. Gray (end) O (Wa; Ko: Mānoa and Pālolo valleys, single collections), M (single collection)
Melicope clusiifolia (A. Gray) T. Hartley & B. Stone (end) K, O, Mo, L, M, H
Melicope cruciata (A. Heller) T. Hartley & B. Stone (end, R) K (Kahōluamanu; Mt Wai‘ale‘ale)
Melicope degeneri (B. Stone) T. Hartley & B. Stone (end, EX?) K (Kōke‘e Stream)
Melicope elliptica A. Gray (end) O (Wa), WM (Ōlowalu)
Melicope feddei (H. Lév.) T. Hartley & B. Stone (end) K
Melicope haleakalae (B. Stone) T. Hartley & B. Stone (end, R?) EM (Olinda Flume Trail; ‘Ukulele)
Melicope haupuensis (St. John) T. Hartley & B. Stone (end, E) K (Hā‘upu)
Melicope hawaiensis (Wawra) T. Hartley & B. Stone (end) Mo, L, M, H

Melicope honoluluensis (St. John) T. Hartley & B. Stone (end) O (Ko: Wiliwilinui to Pūpūkea)
Melicope kaalaensis (St. John) T. Hartley & B. Stone (end) O (Wa: Puʻukaua to Piko Trail)
Melicope kavaiensis (H. Mann) T. Hartley & B. Stone (end) K (Alakaʻi Swamp to Mt Waiʻaleʻale)
Melicope knudsenii (Hillebr.) T. Hartley & B. Stone (end, E) K (Olokele Val and Waimea, single collections), EM (Auwahi)
Melicope lydgatei (Hillebr.) T. Hartley & B. Stone (end, EX?) O (Ko: Hauʻula-Kahana; Mānana-Waimano; Pālolo-Wailupe)
Melicope macropus (Hillebr.) T. Hartley & B. Stone (end, R) K (Robinson's summer house; Kahōluamanu)
Melicope makahae (B. Stone) T. Hartley & B. Stone (end) O (Wa: Pālāwai to Mākaha Val ridges)
Melicope mauii T. Hartley & B. Stone (end) Mo (Waikolu to Kaunuohua), WM (Honokōwai to Puʻukukui), EM (Olinda to ʻŌpana Gulch)
Melicope molokaiensis (Hillebr.) T. Hartley & B. Stone (end) Mo (Hanalilolilo to Olokuʻi), southeast WM (Manawainui to Puʻukukui), northeast EM
Melicope mucronulata (St. John) T. Hartley & B. Stone (end, E) Mo (Kūpāʻia Gulch), EM (Pakiloi, south slope, Haleakalā)
Melicope munroi (St. John) T. Hartley & B. Stone (end, R) L (Lānaʻihale)
Melicope nealae (B. Stone) T. Hartley & B. Stone (end, R) K (Kumuwela and Kāholuamanu, single collections)
Melicope oahuensis (H. Lév.) T. Hartley & B. Stone (end) O
Melicope obovata (St. John) T. Hartley & B. Stone (end, EX) M (or possibly L)
Melicope orbicularis (Hillebr.) T. Hartley & B. Stone (end) WM (Pōhākea north to Honokahua), EM (Makawao to Koʻolau Gap)
Melicope ovalis (St. John) T. Hartley & B. Stone (end, EX?) EM (above Hāna)
Melicope ovata (St. John & E. Hume) T. Hartley & B. Stone (end) northwest K
Melicope pallida (Hillebr.) T. Hartley & B. Stone (end, EX?) K (Hanapēpē and rim of Kalalau Val, single collections), O (south-central Wa: below Palikea; ʻĒkahanui Gulch)
Melicope paniculata (St. John) T. Hartley & B. Stone (end, R) K (upper Līhuʻe Ditch Trail; Wahiawa Bog)
Melicope peduncularis (H. Lév.) T. Hartley & B. Stone (end) K (Kōkeʻe), O, east Mo (Kaʻaloa Peak), M
Melicope pseudoanisata (Rock) T. Hartley & B. Stone (end) H
Melicope puberula (St. John) T. Hartley & B. Stone (end, R) K (Kalalau Lookout to Puʻuokila Lookout)
Melicope quadrangularis (St. John & E. Hume) T. Hartley & B. Stone (end, EX?) K (Wahiawa Bog)
Melicope radiata (St. John) T. Hartley & B. Stone (end) H (Kohala Mts to Puna Dist, southwest to Ocean View Estates)
Melicope reflexa (St. John) T. Hartley & B. Stone (end, EX?) east Mo
Melicope rotundifolia (A. Gray) T. Hartley & B. Stone (end) O (Ko: ʻŌpaeʻula to Niu Val)
Melicope saint-johnii (E. Hume) T. Hartley & B. Stone (end) O
Melicope sandwicensis (Hook. & Arnott) T. Hartley & B. Stone (end) O (Wa; Ko: Kahana Iki to Waimalu)
Melicope volcanica (A. Gray) T. Hartley & B. Stone (end) L, EM, H
Melicope waialealae (Wawra) T. Hartley & B. Stone (end) K (Wahiawa Bog; Alakaʻi Swamp to Mt Waiʻaleʻale)
Melicope wailauensis (St. John) T. Hartley & B. Stone (end, EX?) Mo (Kukuinui Ridge, Wailau Val)
Melicope wawraeana (Rock) T. Hartley & B. Stone (end) K (Wahiawa Bog, single collection), O
Melicope zahlbruckneri (Rock) T. Hartley & B. Stone (end, R) H (Kīpukapuaulu; Moaʻula and near Glenwood, single collections)
Platydesma cornuta Hillebr. (end)
  var. **cornuta** O (Ko)
  var. **decurrens** B. Stone O (Wa)
Platydesma remyi (Sherff) Degener, I. Degener, Sherff & B. Stone (end, R) H (Hāmākua-Kohala)
Platydesma rostrata Hillebr. (end, R) K

Platydesma spathulata (A. Gray) B. Stone (end) K, O, M, H
Zanthoxylum dipetalum H. Mann (end)
  var. **dipetalum** K, O, Mo (Kamiloloa), H
  var. **tomentosum** Rock (R) H (Pu‘uwa‘awa‘a)
Zanthoxylum hawaiiense Hillebr. (end, V) Mo, L, M, H
Zanthoxylum kauaense A. Gray (end) K, O, Mo, L, M, H
Zanthoxylum oahuense Hillebr. (end) O (Ko)

SANTALACEAE

Exocarpos gaudichaudii A. DC (end, R) Ni, O, Mo, L, M, Ka, H
Exocarpos luteolus C. Forbes (end, R) K
Exocarpos menziesii Stauffer (end) L (Kaiholena Gulch, single collection), leeward H (Kahuku Ranch and Mauna Loa Strip north to Hualālai and Pu‘ukapele)
Santalum ellipticum Gaud. (end) La(ex), HI (K [r]; Ka [ex]; H [Kohala Mts; Pu‘uwa‘awa‘a; Pu‘upāpapa])
Santalum freycinetianum Gaud. (end)
  var. **freycinetianum** O, Mo
  var. **lanaiense** Rock (E*) L, M
  var. **pyrularium** (A. Gray) Stemmermann K
Santalum haleakalae Hillebr. (end) EM (Haleakalā)
Santalum paniculatum Hook. & Arnott (end)
  var. **paniculatum** H
  var. **pilgeri** (Rock) Stemmermann H

SAPINDACEAE

Alectryon macrococcus Radlk. (end, E)
  var. **auwahiensis** G. Linney EM
  var. **macrococcus** K, O (Wa; Ko: Kīpapa Gulch), Mo, WM (Honokōwai Ditch Trail)
Cardiospermum grandiflorum Sw. (nat) O (Ko: Mānoa Val; downtown Honolulu)
Cardiospermum halicacabum L. (nat?) Ni, K, O, Mo, M, H
Dodonaea viscosa Jacq. (ind) Ni, K, O, Mo, L, M, H
Sapindus oahuensis Hillebr. ex Radlk. (end) northwest K, O (Wa; Ko: Waimalu to Niu valleys)
Sapindus saponaria L. (ind) H (Hualālai; Mauna Loa; Kīlauea)

SAPOTACEAE

Nesoluma polynesicum (Hillebr.) Baill. (ind) K, O, Mo, L, M, H
Pouteria sandwicensis (A. Gray) Baehni & Degener (end) K, O, Mo, L, M, H

SCROPHULARIACEAE

Antirrhinum orontium L. (nat) O (Diamond Head), M (Pu‘uokali)
Bacopa monnieri (L.) Wettst. (ind) Mi, Ni, K, O, Mo, L, M, H
Buchnera pusilla Kunth (nat) H (Puna Dist)
Castilleja arvensis Cham. & Schlechtend. (nat) K, M, H
Cymbalaria muralis Gaertn. (nat) EM (Olinda)
Dopatrium junceum (Roxb.) F. Ham. ex Benth. (nat) K (Hanalei and Hanapēpē valleys)
Linaria canadensis (L.) Dum. Cours. var. **texana** (Scheele) Pennell (nat) O, H
Lindernia antipoda (L.) Alston (nat) H (Waipi‘o Val)
Lindernia crustacea (L.) F.v. Muell. (nat) O, H
Lophospermum erubescens D. Don (nat) O, H
Maurandya antirrhiniflora Humb. & Bonpl. ex Willd. subsp. **antirrhiniflora** (nat) O (single collection; not known if species persists)
Orthocarpus purpurascens Benth. (nat) H (Mauna Loa, single collection; not known if species persists)

Parentucellia viscosa (L.) Caruel (nat) H (Kahuku Ranch; Kūkaʻiau Ranch)
Torenia asiatica L. (nat) H (Hilo to Volcano)
Verbascum blattaria L. (nat) H (Humuʻula, single collection; not known if species persists)
Verbascum thapsus L. (nat) EM (Haleakalā NP), H (Hualālai)
Verbascum virgatum Stokes (nat) H (Hale Pōhaku Ranger Station; Kaʻū Dist)
Veronica arvensis L. (nat) Mo, M, H
Veronica peregrina L. subsp. **xalapensis** (Kunth) Pennell (nat) H (Hawaiʻi Volcanoes NP)
Veronica plebeia R. Br. (nat) M, H
Veronica serpyllifolia L. (nat) K, H

SMILACACEAE

Smilax melastomifolia Sm. (end) K, O, Mo, L, M, H

SOLANACEAE

Brugmansia candida Pers. (nat) K, O, M, H
Capsicum frutescens L. (nat) K, O, Mo, M; probably HI
Cestrum aurantiacum Lindl. (nat) O, M, H
Cestrum diurnum L. (nat) K, O, Mo
Cestrum nocturnum L. (nat) K (Hāʻena), O (Ko: Tantalus)
Datura metel L. (nat) O, Mo, M, H
Datura stramonium L. (nat) K, O, Mo, M, H
Lycium sandwicense A. Gray (ind) HI
Lycopersicon esculentum Mill. (nat) O, Ka, H; probably HI
Lycopersicon pimpinellifolium (Jusl.) Mill. (nat) HI
Nicandra physalodes (L.) Gaertn. (nat) K, O, Mo, M, H
Nicotiana glauca R.C. Graham (nat) O, L, M, Ka
Nicotiana tabacum L. (nat) La, HI
Nothocestrum breviflorum A. Gray (end, R) H (Kaʻū Dist north to Waimea)
Nothocestrum latifolium A. Gray (end) K, O, Mo, L, M
Nothocestrum longifolium A. Gray (end) K, O, Mo, L, M, H
Nothocestrum peltatum Skottsb. (end, E) K (Kalalau Lookout; Kumuwela; Nuʻalolo; Mākaha Val; west side of Waimea drainage)
Physalis angulata L. (nat) K (Hanalei)
Physalis peruviana L. (nat) K, O, Mo, L, M, H
Solanum americanum Mill. (ind?) Ku, Mi, PH, Li, La, N, HI
Solanum aviculare G. Forster (nat) L
Solanum capsicoides All. (nat) K, O, Mo, L, H
Solanum elaeagnifolium Cav. (nat) O, Mo, M
Solanum incompletum Dunal (end, E) K, Mo, L, M, H
Solanum linnaeanum Hepper & P. Jaeger (nat) O, Mo, L, M, H
Solanum mauritianum Scop. (nat) O (Ko: Waiāhole-Waikāne; Koʻolauloa Regional Park)
Solanum nelsonii Dunal (end) Ku, Mi, PH, La, N, Ni, K, O, Mo (Moʻomomi to ʻĪlio Pt), M, H
Solanum nigrescens Mart. & Galeotti (nat) H (between Mauna Loa and Mauna Kea)
Solanum pseudocapsicum L. (nat) O, Mo, M, H
Solanum robustum Wendl. (nat) EM (Kailua Gulch)
Solanum sandwicense Hook. & Arnott (end, E) K, O
Solanum seaforthianum Andr. (nat) K, O, Mo, M
Solanum torvum Sw. (nat) O (Ko: Kāneʻohe; Pālolo Val), WM (ʻĪao Stream)
Solanum tuberosum L. (nat) EM (Haleakalā Crater; not known if species persists)
Solanum viride G. Forster ex Spreng., non R. Br. (pol?) K (Hāʻupu)

STERCULIACEAE

Melochia umbellata (Houtt.) Stapf (nat) H (Hilo and Puna districts)
Waltheria indica L. (ind?) Mi, HI

TACCACEAE

Tacca leontopetaloides (L.) Kuntze (pol) K, O, Mo, M, H; probably HI

THEACEAE

Eurya sandwicensis A. Gray (end, R) K, O, Mo, M, H

THYMELAEACEAE

Wikstroemia bicornuta Hillebr. (end, R) L, WM (Mt 'Eke)
Wikstroemia forbesii Skottsb. (end) east Mo
Wikstroemia furcata (Hillebr.) Rock (end) K
Wikstroemia hanalei Wawra (end, EX?) north K (Wai'oli, Moloa'a, and Ho'olulu valleys)
Wikstroemia monticola Skottsb. (end) EM
Wikstroemia oahuensis (A. Gray) Rock (end)
  var. **oahuensis** K, O, Mo, L, M
  var. **palustris** (Hochr.) Peterson K
Wikstroemia phillyreifolia A. Gray (end) H
Wikstroemia pulcherrima Skottsb. (end) H (South Kohala and north Kona districts)
Wikstroemia sandwicensis Meisn. (end) H
Wikstroemia skottsbergiana Sparre (end, R) K (Wahiawa Mts; Hanalei and Kauhao valleys)
Wikstroemia uva-ursi A. Gray (end)
  var. **kauaiensis** Skottsb. K
  var. **uva-ursi** O, Mo, M
Wikstroemia villosa Hillebr. (end, R) WM (Wailuku Val)

TILIACEAE

Heliocarpus popayanensis Kunth (nat) K, O (Ko: Tantalus), H (Waiākea)
Triumfetta rhomboidea Jacq. (nat) O, Mo, H
Triumfetta semitriloba Jacq. (nat) K, O, M, H

TROPAEOLACEAE

Tropaeolum majus L. (nat) K, Mo, M, H

TURNERACEAE

Turnera ulmifolia L. (nat) K, Mo

TYPHACEAE

Typha domingensis Pers. (nat) O (Pearl Harbor)
Typha latifolia L. (nat) K (Wailua Riv), O (Salt Lake; Pearl Harbor), H

ULMACEAE

Trema orientalis (L.) Blume (nat) K, O, Mo, L, M, H

URTICACEAE

Boehmeria grandis (Hook. & Arnott) A. Heller (end) K, O, Mo, L, M, H
Hesperocnide sandwicensis (Wedd.) Wedd. (end, R) H (plateau between Hualālai, Mauna Loa, and Mauna Kea)
Neraudia angulata R. Cowan (end, R)
  var. **angulata** O (Wa)
  var. **dentata** Degener & R. Cowan O (Wa)
Neraudia kauaiensis (Hillebr.) R. Cowan (end) K
Neraudia melastomifolia Gaud. (end) K, O, Mo (Oloku'i, single collection), WM (Olowalu; 'Īao Val)

Neraudia ovata Gaud. (end, R) leeward H
Neraudia sericea Gaud. (end, R) Mo, L, M, Ka (ex)
Pilea microphylla (L.) Liebm. (nat) K, O, M, H; probably HI
Pilea peploides (Gaud.) Hook. & Arnott (ind) K, O, Mo, L, M, H
Pipturus albidus (Hook. & Arnott) A. Gray (end) K, O, Mo, L, M, H
Pipturus forbesii Kraj. (end) EM (Kaupō Gap east to Ko'olau Gap)
Pipturus kauaiensis A. Heller (end) K
Pipturus ruber A. Heller (end) K
Touchardia latifolia Gaud. (end) K, O, Mo, L, M, H
Urera glabra (Hook. & Arnott) Wedd. (end) K, O, Mo, L, M, H
Urera kaalae Wawra (end, E) O (Wa: Nāpepeiauolelo Gulch; 'Ēkahanui near Pu'ukaua; Kalua'a near Pu'uhāpapa)
Urtica urens L. (nat) H

VALERIANACEAE

Centranthus ruber (L.) DC subsp. **ruber** (nat) EM (Pōhaku o Ka Lā Gulch)

VERBENACEAE

Citharexylum caudatum L. (nat) O (Ko)
Clerodendrum philippinum Schauer (nat) K, O, Mo, L, M, H
Lantana camara L. (nat) Mi, HI
Lantana montevidensis (Spreng.) Briq. (nat) L (Lāna'i City)
Stachytarpheta dichotoma (Ruiz & Pav.) Vahl (nat) K, O, L, M, H
Stachytarpheta jamaicensis (L.) Vahl (nat) Mi, K, O, L, M, Ka, H
Stachytarpheta mutabilis (Jacq.) Vahl (nat) K (Hanalei Val; Powerline Trail)
Stachytarpheta urticifolia (Salisb.) Sims (nat) K, O, Mo, M, H
Verbena bonariensis L. (nat) Mo, L, EM (Makawao)
Verbena litoralis Kunth (nat) Mi, HI
Verbena rigida Spreng. (nat) H (Parker Ranch)
Vitex rotundifolia L. fil. (ind) Ni, K, O, Mo, L, M, H

VIOLACEAE

Isodendrion hosakae St. John (end, E) H (Nohonaohae and Pu'upāpapa, South Kohala Dist)
Isodendrion laurifolium A. Gray (end, V) K (Miloli'i to Ku'ia valleys; Kahōluamanu; Papa'alai; Hā'upu), O (Wa: Makaleha and upper Mākaha valleys; Ko: Wailupe and Mānoa valleys)
Isodendrion longifolium A. Gray (end, R?) K (Hanapēpē; Wahiawa Mts; Hā'upu; Limahuli, Wainiha, and Hanakāpī'ai valleys), O (Wa: Palikea Gulch; Pu'upane)
Isodendrion pyrifolium A. Gray (end, EX) Ni, O (Wa: Mt Ka'ala), Mo, L, M, H (Hualālai)
Viola chamissoniana Ging. (end)
  subsp. **chamissoniana** (R) O (Wa)
  subsp. **robusta** (Hillebr.) W.L. Wagner, Herbst & Sohmer Mo
  subsp. **tracheliifolia** (Ging.) W.L. Wagner, Herbst & Sohmer K, O, Mo, M
Viola helenae C. Forbes & Lydgate (end, E) K (Wahiawa Stream)
Viola kauaensis A. Gray (end)
  var. **kauaensis** K (Waineki to Mt Wai'ale'ale), O (Ko: Kaipapa'u)
  var. **wahiawaensis** C. Forbes K (Wahiawa Bog)
Viola lanaiensis W. Becker (end, V) L (Lāna'ihale)
Viola maviensis H. Mann (end) Mo (Pēpē'ōpae Bog), M, H (Kohala Mts)
Viola oahuensis C. Forbes (end) O (Ko: Kawailoa to Pālolo)
Viola wailenalenae (Rock) Skottsb. (end) K (Alaka'i Swamp)

VISCACEAE

Korthalsella complanata (Tiegh.) Engl. (ind) K, O, Mo, L, M, H
Korthalsella cylindrica (Tiegh.) Engl. (end) O, Mo, L, M, H

Korthalsella degeneri Danser (end, R) O (Wa: Piko Trail; Mākua Val)
Korthalsella latissima (Tiegh.) Danser (end) K, O (Wa: Mt Ka‘ala), H (Waiākea FR, Mauna Loa, single collection)
Korthalsella platycaula (Tiegh.) Engl. (ind) K, O, L (Kapua Gulch, single collection), EM (Waikamoi Trail, single collection)
Korthalsella remyana Tiegh. (end) K, O, Mo, L, M, H

VITACEAE

Cissus nodosa Blume (nat) K, O, H (Hilo)

XYRIDACEAE

Xyris complanata R. Br. (nat) K, H (Mountain View; Glenwood)
Xyris platylepis Chapm. (nat) H (Mountain View; Glenwood)

ZINGIBERACEAE

Alpinia mutica Roxb. (nat) O
Alpinia purpurata (Vieill.) K. Schum. (nat) K, Mo
Curcuma longa L. (pol) Mo, M, H
Etlingera cevuga (Seem.) R.M. Smith (nat) O (Ko: Pu‘ulanihuli)
Hedychium coronarium J. König (nat) O, Mo, L, M, H
Hedychium flavescens N. Carey ex Roscoe (nat) K, O, Mo, L, M, H
Hedychium gardnerianum Ker-Gawl. (nat) K (Kōke‘e), L (Kaiholena Val), EM (Waikamoi; Hāna-Kīpahulu), H
Zingiber zerumbet (L.) Sm. (pol) K, O, Mo, L, M

ZYGOPHYLLACEAE

Tribulus cistoides L. (ind) Ku, Mi, PH, Li, La, FF, N, HI
Tribulus terrestris L. (nat) K, O, M, H

ALPHABETICAL LISTING OF GENERA, WITH FAMILY DESIGNATIONS

Abelmoschus (Malvaceae)
Abrus (Fabaceae)
Abutilon (Malvaceae)
Acacia (Fabaceae)
Acaena (Rosaceae)
Acanthospermum (Asteraceae)
Achillea (Asteraceae)
Achyranthes (Amaranthaceae)
Adenostemma (Asteraceae)
Agave (Agavaceae)
Ageratina (Asteraceae)
Ageratum (Asteraceae)
Agrostis (Poaceae)
Aira (Poaceae)
Albizia (Fabaceae)
Alectryon (Sapindaceae)
Aleurites (Euphorbiaceae)
Alocasia (Araceae)
Alphitonia (Rhamnaceae)
Alpinia (Zingiberaceae)
Alsinidendron (Caryophyllaceae)
Alternanthera (Amaranthaceae)
Alysicarpus (Fabaceae)
Alyxia (Apocynaceae)
Amaranthus (Amaranthaceae)
Ambrosia (Asteraceae)
Ammannia (Lythraceae)
Amsinckia (Boraginaceae)
Anagallis (Primulaceae)
Andropogon (Poaceae)
Anemone (Ranunculaceae)
Anethum (Apiaceae)
Anoectochilus (Orchidaceae)
Anredera (Basellaceae)
Anthemis (Asteraceae)
Anthoxanthum (Poaceae)
Antidesma (Euphorbiaceae)
Antigonon (Polygonaceae)
Antirrhinum (Scrophulariaceae)
Archontophoenix (Arecaceae)
Arctium (Asteraceae)
Ardisia (Myrsinaceae)
Arenaria (Caryophyllaceae)
Argemone (Papaveraceae)
Argyroxiphium (Asteraceae)
Aristea (Iridaceae)
Aristolochia (Aristolochiaceae)
Artemisia (Asteraceae)
Arthrostema (Melastomataceae)
Arundina (Orchidaceae)
Arundo (Poaceae)
Asclepias (Asclepiadaceae)
Astelia (Liliaceae)
Aster (Asteraceae)
Asystasia (Acanthaceae)
Atriplex (Chenopodiaceae)
Avena (Poaceae)
Axonopus (Poaceae)

Bacopa (Scrophulariaceae)
Baltimora (Asteraceae)
Barleria (Acanthaceae)
Bassia (Chenopodiaceae)
Batis (Bataceae)
Begonia (Begoniaceae)
Bellis (Asteraceae)
Bidens (Asteraceae)
Bischofia (Euphorbiaceae)
Bixa (Bixaceae)
Blechum (Acanthaceae)
Blumea (Asteraceae)
Bobea (Rubiaceae)
Bocconia (Papaveraceae)
Boehmeria (Urticaceae)
Boerhavia (Nyctaginaceae)
Bolboschoenus (Cyperaceae)
Bonamia (Convolvulaceae)
Bothriochloa (Poaceae)
Bothriospermum (Boraginaceae)
Brachiaria (Poaceae)
Brassica (Brassicaceae)
Brighamia (Campanulaceae)
Briza (Poaceae)
Bromus (Poaceae)
Broussaisia (Hydrangeaceae)
Broussonetia (Moraceae)
Brugmansia (Solanaceae)
Bruguiera (Rhizophoraceae)
Buchnera (Scrophulariaceae)
Buddleia (Buddlejaceae)
Bulbostylis (Cyperaceae)

Caesalpinia (Fabaceae)
Cajanus (Fabaceae)
Calamagrostis (Poaceae)
Calathea (Marantaceae)
Callisia (Commelinaceae)
Calophyllum (Clusiaceae)
Calyptocarpus (Asteraceae)
Canavalia (Fabaceae)
Canna (Cannaceae)
Cannabis (Cannabaceae)
Canthium (Rubiaceae)
Capparis (Capparaceae)
Capsella (Brassicaceae)
Capsicum (Solanaceae)
Cardamine (Brassicaceae)
Cardiospermum (Sapindaceae)
Carduus (Asteraceae)
Carex (Cyperaceae)
Carica (Caricaceae)
Cascabela (Apocynaceae)
Cassytha (Lauraceae)
Castilleja (Scrophulariaceae)
Casuarina (Casuarinaceae)
Catharanthus (Apocynaceae)
Cecropia (Cecropiaceae)
Cenchrus (Poaceae)
Centaurea (Asteraceae)
Centaurium (Gentianaceae)
Centella (Apiaceae)
Centranthus (Valerianaceae)
Cerastium (Caryophyllaceae)
Ceratophyllum (Ceratophyllaceae)
Cereus (Cactaceae)
Cestrum (Solanaceae)
Chamaecrista (Fabaceae)
Chamaesyce (Euphorbiaceae)
Charpentiera (Amaranthaceae)
Cheirodendron (Araliaceae)
Chenopodium (Chenopodiaceae)
Chloris (Poaceae)
Chrysanthemum (Asteraceae)
Chrysopogon (Poaceae)
Ciclospermum (Apiaceae)
Cinchona (Rubiaceae)
Cinnamomum (Lauraceae)
Cirsium (Asteraceae)
Cissus (Vitaceae)
Citharexylum (Verbenaceae)
Cladium (Cyperaceae)
Claoxylon (Euphorbiaceae)
Cleome (Capparaceae)
Clermontia (Campanulaceae)
Clerodendrum (Verbenaceae)
Clidemia (Melastomataceae)
Clitoria (Fabaceae)
Clusia (Clusiaceae)
Coccinia (Cucurbitaceae)
Cocculus (Menispermaceae)
Cocos (Arecaceae)
Coffea (Rubiaceae)
Coix (Poaceae)
Colocasia (Araceae)
Colubrina (Rhamnaceae)
Commelina (Commelinaceae)
Conocarpus (Combretaceae)
Convolvulus (Convolvulaceae)
Conyza (Asteraceae)
Coprosma (Rubiaceae)
Cordia (Boraginaceae)
Cordyline (Agavaceae)
Coreopsis (Asteraceae)
Coriandrum (Apiaceae)
Coronopus (Brassicaceae)
Corynocarpus (Corynocarpaceae)
Costus (Costaceae)
Cotula (Asteraceae)
Crassocephalum (Asteraceae)
Crassula (Crassulaceae)
Crepis (Asteraceae)
Cressa (Convolvulaceae)
Crocosmia (Iridaceae)
Crotalaria (Fabaceae)
Cryptocarya (Lauraceae)
Cryptotaenia (Apiaceae)
Cucumis (Cucurbitaceae)
Cuphea (Lythraceae)
Curcuma (Zingiberaceae)
Cuscuta (Cuscutaceae)
Cyanea (Campanulaceae)
Cymbalaria (Scrophulariaceae)
Cymbopogon (Poaceae)
Cynodon (Poaceae)
Cynoglossum (Boraginaceae)
Cyperus (Cyperaceae)
Cyrtandra (Gesneriaceae)
Cytisus (Fabaceae)

Dactylis (Poaceae)
Dactyloctenium (Poaceae)
Danthonia (Poaceae)
Datura (Solanaceae)
Daucus (Apiaceae)
Delissea (Campanulaceae)
Delonix (Fabaceae)
Deschampsia (Poaceae)
Descurainia (Brassicaceae)
Desmanthus (Fabaceae)
Desmodium (Fabaceae)
Dianella (Liliaceae)
Dianthus (Caryophyllaceae)
Dichanthelium (Poaceae)
Dichanthium (Poaceae)
Dicliptera (Acanthaceae)
Digitaria (Poaceae)
Dioclea (Fabaceae)
Dioscorea (Dioscoreaceae)
Diospyros (Ebenaceae)
Dissochondrus (Poaceae)
Dissotis (Melastomataceae)
Dodonaea (Sapindaceae)
Dopatrium (Scrophulariaceae)
Drosera (Droseraceae)
Drymaria (Caryophyllaceae)
Dubautia (Asteraceae)

Echinochloa (Poaceae)
Eclipta (Asteraceae)
Egeria (Hydrocharitaceae)

Ehrharta (Poaceae)
Eichhornia (Pontederiaceae)
Elaeagnus (Elaeagnaceae)
Elaeocarpus (Elaeocarpaceae)
Eleocharis (Cyperaceae)
Elephantopus (Asteraceae)
Eleusine (Poaceae)
Embelia (Myrsinaceae)
Emex (Polygonaceae)
Emilia (Asteraceae)
Encelia (Asteraceae)
Entada (Fabaceae)
Epidendrum (Orchidaceae)
Epilobium (Onagraceae)
Epipremnum (Araceae)
Eragrostis (Poaceae)
Erechtites (Asteraceae)
Erigeron (Asteraceae)
Eriocaulon (Eriocaulaceae)
Eriochloa (Poaceae)
Erodium (Geraniaceae)
Erythrina (Fabaceae)
Eschscholzia (Papaveraceae)
Etlingera (Zingiberaceae)
Eucalyptus (Myrtaceae)
Eugenia (Myrtaceae)
Euphorbia (Euphorbiaceae)
Eurya (Theaceae)
Exocarpos (Santalaceae)

Festuca (Poaceae)
Ficus (Moraceae)
Filago (Asteraceae)
Fimbristylis (Cyperaceae)
Fitchia (Asteraceae)
Flaveria (Asteraceae)
Flindersia (Rutaceae)
Flueggea (Euphorbiaceae)
Foeniculum (Apiaceae)
Fragaria (Rosaceae)
Frankenia (Frankeniaceae)
Fraxinus (Oleaceae)
Freycinetia (Pandanaceae)
Fuchsia (Onagraceae)
Furcraea (Agavaceae)

Gahnia (Cyperaceae)
Gaillardia (Asteraceae)
Galinsoga (Asteraceae)
Galium (Rubiaceae)
Gardenia (Rubiaceae)
Garnotia (Poaceae)
Gastridium (Poaceae)
Geranium (Geraniaceae)
Gilia (Polemoniaceae)
Glycine (Fabaceae)
Gnaphalium (Asteraceae)
Gomphrena (Amaranthaceae)
Gonocarpus (Haloragaceae)
Gossypium (Malvaceae)
Gouania (Rhamnaceae)
Grevillea (Proteaceae)
Gunnera (Gunneraceae)

Haematoxylum (Fabaceae)
Halophila (Hydrocharitaceae)
Haplostachys (Lamiaceae)
Harrisia (Cactaceae)
Hedera (Araliaceae)
Hedychium (Zingiberaceae)
Hedyotis (Rubiaceae)
Helianthus (Asteraceae)
Helichrysum (Asteraceae)
Heliconia (Heliconiaceae)
Heliocarpus (Tiliaceae)
Heliotropium (Boraginaceae)
Hemigraphis (Acanthaceae)
Herissantia (Malvaceae)
Hesperocnide (Urticaceae)
Hesperomannia (Asteraceae)
Heterocentron (Melastomataceae)
Heteropogon (Poaceae)
Heterotheca (Asteraceae)
Hibiscadelphus (Malvaceae)
Hibiscus (Malvaceae)
Hillebrandia (Begoniaceae)
Hippeastrum (Liliaceae)
Hippobroma (Campanulaceae)
Holcus (Poaceae)
Hordeum (Poaceae)
Hunnemannia (Papaveraceae)
Hydrocotyle (Apiaceae)
Hylocereus (Cactaceae)
Hyparrhenia (Poaceae)
Hypericum (Clusiaceae)
Hypochoeris (Asteraceae)
Hyptis (Lamiaceae)

Ilex (Aquifoliaceae)
Impatiens (Balsaminaceae)
Indigofera (Fabaceae)
Ipomoea (Convolvulaceae)
Isachne (Poaceae)
Ischaemum (Poaceae)
Isodendrion (Violaceae)

Jacaranda (Bignoniaceae)
Jacquemontia (Convolvulaceae)
Jatropha (Euphorbiaceae)
Joinvillea (Joinvilleaceae)
Juncus (Juncaceae)
Justicia (Acanthaceae)

Kalanchoë (Crassulaceae)
Koeleria (Poaceae)
Kokia (Malvaceae)
Korthalsella (Viscaceae)
Kyllinga (Cyperaceae)

Lablab (Fabaceae)
Labordia (Loganiaceae)
Lactuca (Asteraceae)
Lagenifera (Asteraceae)
Lamium (Lamiaceae)
Lantana (Verbenaceae)
Lapsana (Asteraceae)
Lathyrus (Fabaceae)
Lemna (Lemnaceae)
Leonotis (Lamiaceae)
Leonurus (Lamiaceae)
Lepechinia (Lamiaceae)
Lepidium (Brassicaceae)
Leptochloa (Poaceae)
Leptospermum (Myrtaceae)
Lepturus (Poaceae)
Lespedeza (Fabaceae)
Leucaena (Fabaceae)
Linaria (Scrophulariaceae)
Lindernia (Scrophulariaceae)
Linum (Linaceae)
Liparis (Orchidaceae)
Lipochaeta (Asteraceae)
Livistona (Arecaceae)
Lobelia (Campanulaceae)
Lobularia (Brassicaceae)
Lolium (Poaceae)
Lonicera (Caprifoliaceae)
Lophospermum (Scrophulariaceae)
Lophostemon (Myrtaceae)
Lotus (Fabaceae)
Ludwigia (Onagraceae)
Lupinus (Fabaceae)
Luzula (Juncaceae)
Lycium (Solanaceae)
Lycopersicon (Solanaceae)
Lysimachia (Primulaceae)
Lythrum (Lythraceae)

Macaranga (Euphorbiaceae)
Macfadyena (Bignoniaceae)

Machaerina (Cyperaceae)
Macroptilium (Fabaceae)
Madia (Asteraceae)
Malachra (Malvaceae)
Mallotus (Euphorbiaceae)
Malva (Malvaceae)
Malvastrum (Malvaceae)
Malvaviscus (Malvaceae)
Mangifera (Anacardiaceae)
Manihot (Euphorbiaceae)
Mariscus (Cyperaceae)
Marrubium (Lamiaceae)
Maurandya (Scrophulariaceae)
Medicago (Fabaceae)
Medinilla (Melastomataceae)
Melaleuca (Myrtaceae)
Melastoma (Melastomataceae)
Melia (Meliaceae)
Melicope (Rutaceae)
Melilotus (Fabaceae)
Melinis (Poaceae)
Melochia (Sterculiaceae)
Mentha (Lamiaceae)
Merremia (Convolvulaceae)
Metrosideros (Myrtaceae)
Mimosa (Fabaceae)
Mirabilis (Nyctaginaceae)
Mitracarpus (Rubiaceae)
Modiola (Malvaceae)
Mollugo (Molluginaceae)
Momordica (Cucurbitaceae)
Monochoria (Pontederiaceae)
Montanoa (Asteraceae)
Morinda (Rubiaceae)
Morus (Moraceae)
Mucuna (Fabaceae)
Muhlenbergia (Poaceae)
Munroidendron (Araliaceae)
Murdannia (Commelinaceae)
Musa (Musaceae)
Myoporum (Myoporaceae)
Myosotis (Boraginaceae)
Myrica (Myricaceae)
Myriophyllum (Haloragaceae)
Myrsine (Myrsinaceae)

Nama (Hydrophyllaceae)
Nasturtium (Brassicaceae)
Neraudia (Urticaceae)
Nertera (Rubiaceae)
Nesoluma (Sapotaceae)
Nestegis (Oleaceae)
Nicandra (Solanaceae)
Nicotiana (Solanaceae)
Nothocestrum (Solanaceae)
Nototrichium (Amaranthaceae)

Ochrosia (Apocynaceae)
Ocimum (Lamiaceae)
Oenothera (Onagraceae)
Olea (Oleaceae)
Oplismenus (Poaceae)
Opuntia (Cactaceae)
Oreobolus (Cyperaceae)
Orthocarpus (Scrophulariaceae)
Osteomeles (Rosaceae)
Osteospermum (Asteraceae)
Oxalis (Oxalidaceae)
Oxyspora (Melastomataceae)

Pachyrhizus (Fabaceae)
Paederia (Rubiaceae)
Palafoxia (Asteraceae)
Pandanus (Pandanaceae)
Panicum (Poaceae)
Paraserianthes (Fabaceae)
Parentucellia (Scrophulariaceae)
Parkinsonia (Fabaceae)
Parthenium (Asteraceae)
Paspalum (Poaceae)
Passiflora (Passifloraceae)
Pectis (Asteraceae)
Pennisetum (Poaceae)
Peperomia (Piperaceae)
Perrottetia (Celastraceae)
Persea (Lauraceae)
Petasites (Asteraceae)
Petrorhagia (Caryophyllaceae)
Petroselinum (Apiaceae)
Peucedanum (Apiaceae)
Phaius (Orchidaceae)
Phormium (Agavaceae)
Phyllanthus (Euphorbiaceae)
Phyllostachys (Poaceae)
Phyllostegia (Lamiaceae)
Physalis (Solanaceae)
Phytolacca (Phytolaccaceae)
Picris (Asteraceae)
Pilea (Urticaceae)
Piper (Piperaceae)
Pipturus (Urticaceae)
Pisonia (Nyctaginaceae)
Pistia (Araceae)
Pithecellobium (Fabaceae)
Pittosporum (Pittosporaceae)
Plantago (Plantaginaceae)
Platanthera (Orchidaceae)
Platydesma (Rutaceae)
Plectranthus (Lamiaceae)
Pleomele (Agavaceae)
Pluchea (Asteraceae)
Plumbago (Plumbaginaceae)
Poa (Poaceae)
Polycarpon (Caryophyllaceae)
Polygala (Polygalaceae)
Polygonum (Polygonaceae)
Polypogon (Poaceae)
Portulaca (Portulacaceae)
Potamogeton (Potamogetonaceae)
Pouteria (Sapotaceae)
Pritchardia (Arecaceae)
Prosopis (Fabaceae)
Prunella (Lamiaceae)
Psidium (Myrtaceae)
Psychotria (Rubiaceae)
Pteralyxia (Apocynaceae)
Pterolepis (Melastomataceae)
Pueraria (Fabaceae)
Pycreus (Cyperaceae)
Pyracantha (Rosaceae)

Ranunculus (Ranunculaceae)
Raphanus (Brassicaceae)
Rauvolfia (Apocynaceae)
Reichardia (Asteraceae)
Remya (Asteraceae)
Reynoldsia (Araliaceae)
Rhamnus (Rhamnaceae)
Rhizophora (Rhizophoraceae)
Rhodomyrtus (Myrtaceae)
Rhus (Anacardiaceae)
Rhynchelytrum (Poaceae)
Rhynchosia (Fabaceae)
Rhynchospora (Cyperaceae)
Richardia (Rubiaceae)
Ricinus (Euphorbiaceae)
Rivina (Phytolaccaceae)
Rollandia (Campanulaceae)
Rubus (Rosaceae)
Ruellia (Acanthaceae)
Rumex (Polygonaceae)
Ruppia (Ruppiaceae)

Saccharum (Poaceae)
Sacciolepis (Poaceae)
Sagina (Caryophyllaceae)
Sagittaria (Alismataceae)
Salicornia (Chenopodiaceae)
Salsola (Chenopodiaceae)
Salvia (Lamiaceae)
Samanea (Fabaceae)

Sambucus (Caprifoliaceae)
Sanicula (Apiaceae)
Santalum (Santalaceae)
Sapindus (Sapindaceae)
Sauvagesia (Ochnaceae)
Scaevola (Goodeniaceae)
Schefflera (Araliaceae)
Schiedea (Caryophyllaceae)
Schinus (Anacardiaceae)
Schizachyrium (Poaceae)
Schizostachyum (Poaceae)
Schoenoplectus (Cyperaceae)
Scleria (Cyperaceae)
Sechium (Cucurbitaceae)
Senecio (Asteraceae)
Senna (Fabaceae)
Sesbania (Fabaceae)
Sesuvium (Aizoaceae)
Setaria (Poaceae)
Sherardia (Rubiaceae)
Sicyos (Cucurbitaceae)
Sida (Malvaceae)
Sidastrum (Malvaceae)
Sigesbeckia (Asteraceae)
Silene (Caryophyllaceae)
Sisymbrium (Brassicaceae)
Sisyrinchium (Iridaceae)
Smilax (Smilacaceae)
Solanum (Solanaceae)
Solidago (Asteraceae)
Sonchus (Asteraceae)
Sophora (Fabaceae)
Sorghum (Poaceae)
Spartium (Fabaceae)
Spathodea (Bignoniaceae)
Spathoglottis (Orchidaceae)
Spergula (Caryophyllaceae)
Spergularia (Caryophyllaceae)
Spermacoce (Rubiaceae)
Spermolepis (Apiaceae)
Spirodela (Lemnaceae)
Sporobolus (Poaceae)
Stachys (Lamiaceae)
Stachytarpheta (Verbenaceae)
Stapelia (Asclepiadaceae)
Stellaria (Caryophyllaceae)
Stenogyne (Lamiaceae)
Stenotaphrum (Poaceae)
Stictocardia (Convolvulaceae)
Stipa (Poaceae)
Streblus (Moraceae)
Strongylodon (Fabaceae)
Stylosanthes (Fabaceae)
Styphelia (Epacridaceae)
Synedrella (Asteraceae)
Syzygium (Myrtaceae)

Tacca (Taccaceae)
Tagetes (Asteraceae)
Talinum (Portulacaceae)
Taraxacum (Asteraceae)
Tecoma (Bignoniaceae)
Tephrosia (Fabaceae)
Terminalia (Combretaceae)
Tetragonia (Aizoaceae)
Tetramolopium (Asteraceae)
Tetraplasandra (Araliaceae)
Tetrazygia (Melastomataceae)
Themeda (Poaceae)
Thespesia (Malvaceae)
Thunbergia (Acanthaceae)
Tibouchina (Melastomataceae)
Tithonia (Asteraceae)
Toona (Meliaceae)
Torenia (Scrophulariaceae)
Torilis (Apiaceae)
Torulinium (Cyperaceae)
Touchardia (Urticaceae)
Tournefortia (Boraginaceae)
Tragopogon (Asteraceae)
Tragus (Poaceae)
Trema (Ulmaceae)
Trematolobelia (Campanulaceae)
Trembleya (Melastomataceae)
Trianthema (Aizoaceae)
Tribulus (Zygophyllaceae)
Tridax (Asteraceae)
Trifolium (Fabaceae)
Trimezia (Iridaceae)
Triodanis (Campanulaceae)
Trisetum (Poaceae)
Triumfetta (Tiliaceae)
Tropaeolum (Tropaeolaceae)
Turnera (Turneraceae)
Typha (Typhaceae)

Ulex (Fabaceae)
Uncinia (Cyperaceae)
Urena (Malvaceae)
Urera (Urticaceae)
Urtica (Urticaceae)
Utricularia (Lentibulariaceae)

Vaccinium (Ericaceae)
Verbascum (Scrophulariaceae)
Verbena (Verbenaceae)
Verbesina (Asteraceae)
Vernonia (Asteraceae)
Veronica (Scrophulariaceae)
Vicia (Fabaceae)
Vigna (Fabaceae)
Viola (Violaceae)
Vitex (Verbenaceae)
Vulpia (Poaceae)

Wahlenbergia (Campanulaceae)
Waltheria (Sterculiaceae)
Watsonia (Iridaceae)
Wedelia (Asteraceae)
Wikstroemia (Thymelaeaceae)
Wilkesia (Asteraceae)

Xanthium (Asteraceae)
Xylosma (Flacourtiaceae)
Xyris (Xyridaceae)

Youngia (Asteraceae)

Zantedeschia (Araceae)
Zanthoxylum (Rutaceae)
Zingiber (Zingiberaceae)
Zinnia (Asteraceae)

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Contributions to the Flora of Hawai‘i
II. Begoniaceae—Violaceae and the Monocotyledons

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ABSTRACT

This paper, alphabetically covering the dicot families Begoniaceae to Violaceae, and the monocots, is the second and final of a series providing new records of naturalized species in Hawai‘i, new combinations, and descriptions of new taxa before the publication of the *Manual of the Flowering Plants of Hawai‘i.* The following 59 new records of naturalized species are reported: *Begonia foliosa* var. *miniata, B. hirtella, B. reniformis, Myosotis discolor, Sisymbrium irio, Buddleia madagascariensis, Lonicera japonica, Atriplex eardleyae, Chenopodium album, C. hircinum, Hypericum canariense, Ipomoea ochracea, Crassula sieberiana, Elaeagnus umbellata, Chamaesyce hyssopifolia, C. maculata, Euphorbia graminea, Mallotus philippensis, Crotalaria brevidens, C. lanceolata, Glycine wightii, Lathyrus latifolius, L. tingitanus, Macroptilium atropurpureum, Prosopis juliflora, Geranium homeanum, G. molle, G. pusillum, Gonocarpus chinensis* subsp. *verrucosus, Cinnamomum burmannii, Utricularia gibba, Cuphea hyssopifolia, C. ignea, Abutilon auritum, Herissantia crispa, Malvastrum americanum, Sida urens, Sidastrum micranthum, Mollugo cerviana, Sauvagesia erecta, Polygonum convolvulus, Galium divaricatum, Mitracarpus hirtus, Spermacoce mauritiana, Buchnera pusilla, Cymbalaria muralis, Dopatrium junceum, Lindernia antipoda, Parentucellia viscosa, Solanum aviculare, S. nigrescens, S. robustum, Cyperus virens, Fimbristylis aestivalis, F. schoenoides, Rhynchospora caduca, R. globularis, Aristea gerrardii,* and *Typha latifolia.* A total of 30 new combinations were required for the new taxonomic treatments of the families Malvaceae, Myrtaceae, Rubiaceae, Thymelaeaceae, Violaceae, and Cyperaceae. They are: *Hibiscus arnottianus* subsp. *immaculatus, H. a.* subsp. *punaluuensis, H. brackenridgei* subsp. *mokuleianus, H. kokio* subsp. *saintjohnianus, H. waimeae* subsp. *hannerae, Metrosideros waialealae* var. *fauriei, Hedyotis* sect. *Gouldia, H. fosbergii, H. hillebrandii, H. terminalis, Wikstroemia oahuensis* var. *palustris, Viola chamissoniana* subsp. *robusta, V. c.* subsp. *tracheliifolia, Carex macloviana* subsp. *subfusca, C. wahuensis* subsp. *rubiginosa, Mariscus fauriei, M. hillebrandii, M. h.* subsp. *decipiens, M. hypochlorus* subsp. *brevior, M. pennatiformis, M. p.* subsp. *bryanii, M. phleoides* subsp. *hawaiiensis, M. rockii, M. sandwicensis, Gahnia*

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vitiensis subsp. *kauaiensis*, *Pycreus polystachyos* subsp. *holosericeus*, *Rhynchospora chinensis* subsp. *spiciformis*, *R. rugosa* subsp. *lavarum*, *Bolboschoenus maritimus* subsp. *paludosus*, and *Schoenoplectus lacustris* subsp. *validus*. During the preparation of the *Manual*, 1 new section, 5 new species, 1 new subspecies, and 1 new variety were discovered in the families Caryophyllaceae, Gesneriaceae, Lamiaceae, Myrsinaceae, Myrtaceae, Rubiaceae, and Cyperaceae. They are: *Silene perlmanii*, *Cyrtandra oxybapha*, *Stenogyne campanulata*, *Myrsine vaccinioides*, *Metrosideros polymorpha* var. *pumila*, *Hedyotis* sect. *Phyllozygia*, *Hedyotis tryblium*, and *Carex wahuensis* subsp. *herbstii*. Previously misidentified species in the genera *Capsella* and *Chenopodium* are discussed. An infrageneric classification of *Hedyotis* is given. Additional commentary is included for the generic distinction between *Alsinidendron* and *Schiedea*, the subdivision of *Scirpus* into *Bolboschoenus* and *Schoenoplectus*, and the subdivision of *Cyperus* into *Cyperus*, *Kyllinga*, *Mariscus*, *Pycreus*, and *Torulinium*.

INTRODUCTION

The last complete flora of Hawai'i was published 100 years ago (Hillebrand 1888). This has left the Hawaiian flora—one of the most interesting in the United States—without any modern floristic inventory of its plants. A project to produce the *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst & Sohmer, in press) was initiated in 1982 by S.H. Sohmer and funded primarily by the Irwin Charity Foundation of San Francisco and the National Science Foundation. The recently completed *Manual* brings together, with a uniform taxonomic treatment, the existing knowledge of the native and naturalized flowering plants pertinent to their identification, classification, distribution, and status. The project also has sought knowledgeable specialists to contribute treatments of specific groups to the book and has encouraged scientists to initiate more detailed research programs on Hawaiian genera. The completion of the *Manual* is a significant step towards an overall evaluation of the native and naturalized flowering plants of the Hawaiian Archipelago; however, it should be followed by more detailed studies, especially in systematics, evolution, pollination ecology, autecology, genetics, and population biology.

This is the second of two papers in the precursor series for the *Manual* (see Wagner et al. 1986). It is intended to bring out, before the publication of the *Manual*, new records of naturalized species, previously incorrectly identified naturalized species, and notes or comments on native and naturalized species. Two other papers that report newly naturalized and some adventive species were published by K. Nagata (1987, 1988) during the preparation of the *Manual*. For some genera, new combinations or new species are being published in the precursor series, since no new combinations or new species will be published in the *Manual*. Other precursor papers have been published by us and contributing specialists (Austin 1987; Davidse, in press; Fosberg 1987; Hayden 1987; Henrickson & Herbst 1988; Jones 1984; Lammers 1988; Medeiros & St. John 1988; Nagata & Gon 1987; Wagner 1988; Wagner & Herbst 1987) to make more detailed information and taxonomic innovations available before the publication of the *Manual*. In this paper certain taxonomic groups were contributed by other authors; these sources are indicated in footnotes.

Under each new record of a naturalized species reported, a single collection, usually the earliest, is cited for each island on which it occurs. References to original publications of names of naturalized species are not given, since they are available elsewhere and since the discussions here are more informal, focusing on distribution and not nomenclature. However, references to original publications and types are given for all native Hawaiian taxa. Distributions are also given for all native taxa discussed, but specimens examined are cited only for new taxa.

BEGONIACEAE

Begonia L.

A number of *Begonia* species are cultivated in Hawai'i, but only three are naturalized, none of which previously had been reported as such by St. John (1973). We thank K. Burt-Utley and L.B. Smith for verification of the determinations, and L.B. Smith for comments on these species.

Key to the Naturalized Species of *Begonia* in Hawai'i

1. Leaves numerous, closely spaced, blades in line with petioles, 1.2–5 cm long, margins crenate to serrate . . . . **B. foliosa**
1. Leaves relatively few, widely spaced, blades oblique to petioles, (2–)3–17 cm long, margins shallowly toothed or lobed 2
2(1). Stipules 0.7–1.1 cm long, conspicuously long-ciliate; leaf blades (2–)3–11 cm long, upper surface sparsely hirtellous; stamens 10–15 . . . . **B. hirtella**
2. Stipules 1.5–3 cm long, entire; leaf blades 9–17 cm long, upper surface sparsely scabrous; stamens ca. 18 . . . . **B. reniformis**

Begonia foliosa Kunth var. ***miniata*** (Planch.) L.B. Sm. & B.G. Schubert

B. fuchsioides Hook.

This species is native to Colombia and Venezuela. It has been cultivated in Hawai'i and is naturalized at least since 1917 in the Kīlauea Settlement lots, Puna District, Hawai'i, but not previously reported.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: Puna Dist, Kīlauea Volcano, 1917, *Rock 12996* (BISH).

Begonia hirtella Link

This species is native to Brazil and Peru. It is sometimes cultivated in Hawai'i, primarily as a pot plant, and has become naturalized and sometimes locally common in disturbed, wet, shaded sites, 450–940 m, at least on O'ahu, East Maui, and Hawai'i, but not previously reported.

Representative specimens examined. HAWAIIAN IS: O'AHU: Waialua Dist, Kawai Iki, 1962, *B. Bishop s.n.* (BISH); EAST MAUI: Hāna Dist, Ke'anae Arboretum [spontaneous], 1987, *Hobdy 2487* (BISH); HAWAI'I: Puna Dist, near Pāhoa, 1952, *Degener 21764* (BISH).

Begonia reniformis Dryander

This species is native from southern Mexico to Guatemala. In Hawai'i it apparently was cultivated on the McCandless Ranch, where it is now naturalized and common in pastures and disturbed areas. It was reported as adventive by Nagata (1987).

Representative specimen examined. HAWAIIAN IS: HAWAI'I: South Kona Dist, McCandless Ranch, 1976, *Herbst & Spence 5633* (BISH).

BORAGINACEAE

Myosotis L.

Myosotis discolor Pers.

This species is native to Europe and appears recently to have become sparingly naturalized in the South Hilo District, Hawai'i.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: South Hilo Dist, near Kūlani Project, 1981, *Davis et al. 468* (BISH).

BRASSICACEAE

We thank R. Rollins for annotation of the BISH material of this family from Hawai'i. Here we include one misidentified species and one previously unreported naturalized species in Hawai'i. An analysis of the naturalized *Lepidium* species in Hawai'i, including several previously unreported species, is given by Rollins (1986).

Capsella Medik.

Capsella rubella Reut.

This species, native to Eurasia, has been naturalized in Hawai'i for most of this century. It has consistently been misidentified as *C. bursa-pastoris* (L.) Medik., which differs from *C. rubella* in that its petals are about twice as long as the sepals, the sepals are usually green and often pubescent, and the siliques are straight-sided. By contrast, *C. rubella* has petals that scarcely exceed the sepals, the sepals are usually reddish at the apex and glabrous, and the siliques are slightly concave.

Representative specimens examined. HAWAIIAN IS: O'AHU: Honolulu Dist, Kaimukī, 1919, *Forbes 2531.O* (BISH); LĀNA'I: Kō'ele, 1913, *Munro 305* (BISH); MAUI: Makawao Dist, Kula, 1920, *Forbes 2177.M* (BISH); HAWAI'I: Hāmākua Dist, Ni'eni'e, Parker Ranch, 1909, *Rock 8322* (BISH).

Sisymbrium L.

Sisymbrium irio L.

This species is native to Europe, but widely naturalized. In Hawai'i it apparently is only locally naturalized in the saddle area between Mauna Kea and Mauna Loa, and has not previously been reported.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: probably Hāmākua Dist, Saddle Rd, 1963, *Kawasaki 1* (BISH).

BUDDLEJACEAE

Buddleia L.

Previously only *Buddleia asiatica* Lour. had been reported as naturalized in Hawai'i (St. John 1973). Here we report an additional naturalized species.

Buddleia madagascariensis Lam.

This species has recently become naturalized after cultivation in Hawai'i as an ornamental at least since 1931. It is easily identified by its orange corolla, pubescent ovary, and fleshy, indehiscent fruit. It presently is naturalized in the Volcano area, Hawai'i, and apparently also along the Hāna Highway, East Maui.

Representative specimens examined. HAWAIIAN IS: O'AHU: Honolulu Dist, Woodlawn (cultivated), 1931, *Neal s.n.* (BISH); EAST MAUI: Hāna Dist, 18 mi from Hāna on Hāna Highway, 1972, *Ishikawa 201* (BISH, HLA); HAWAI'I: Puna Dist, Volcano transfer dump, 1975, *Herbst & Ishikawa 5526* (BISH, HLA).

CAPRIFOLIACEAE

Lonicera L.

Lonicera japonica Thunb.

This species is often cultivated as an ornamental and unfortunately has recently become naturalized at least in Kōke'e State Park, Kaua'i, and near Volcano Village and on the slopes of Hualālai, Hawai'i. *Lonicera japonica* usually does not produce fruit in Hawai'i, but fertile strains apparently have developed recently in some populations. However, Fosberg (pers. comm.

1988) notes having observed this species fruiting in Mānoa Valley as early as the 1930s. This honeysuckle probably will become a serious pest, as it has in many other parts of the world.

Representative specimens examined. HAWAIIAN IS: KAUA'I: Waimea Dist, Kōke'e, 1987, *Plews s.n.* (BISH); O'AHU: Honolulu Dist, University of Hawaii Campus (cultivated), 1929, *Octavio s.n.* (BISH) (G. Linney [pers. comm. 1987] reports fertile plants from Mānoa Val); HAWAI'I: Ka'ū Dist, Kīlauea Military Camp, spontaneous, 1951, *Fosberg 33294* (BISH).

CARYOPHYLLACEAE

There has been confusion in the past concerning the validity of separating the genus *Alsinidendron* from *Schiedea* (Stone 1967). Hillebrand (1888, p. 36) recognized 1 species of *Alsinidendron*, *A. trinerve* H. Mann. Based on the features of the "staminodia" (referred to here as enations) and fleshiness of the calyx, he stated that "there might be good reasons for combining *S. viscosa* and *S. lychnoides* with *Alsinidendron*." Later A.A. Heller (1897) studied *S. lychnoides* and concluded that the habit and large flowers of *S. lychnoides* somewhat removed it, along with *S. viscosa*, from the remainder of *Schiedea*. In 1934 Pax and Hoffmann reduced *Alsinidendron* to a section of *Schiedea*. Later, Sherff (1944) reviewed the situation and formally transferred *S. lychnoides* and *S. viscosa* to *Alsinidendron*. He also transferred *S. verticillata* without comment. We reviewed the literature and examined available specimens for the *Manual* treatments and concurred with Hillebrand and Sherff that the two genera should be maintained. However, the floral morphology of *Schiedea verticillata* is clearly that of *Schiedea* and not *Alsinidendron*. The following key, descriptions, and discussion summarize the distinctions between the two genera.

Key to *Alsinidendron* and *Schiedea*

1. Stamens connate at base into a lobed ring, but with thin, oblong, hyaline enations alternate with stamens; sepals white or the outer pair green externally, enlarging, becoming fleshy and dark purple or membranous and not changing color in fruit; styles 4–11; flowers in axillary, compound cymes formed by the development of lateral shoots . . ***Alsinidendron***

1. Stamens distinct, those opposite the sepals with a hollow, cylindrical nectary arising at base; sepals green, sometimes purple-tinged, neither especially enlarging nor becoming fleshy and dark purple or membranous in fruit; styles usually 3, sometimes 4, or rarely 5; flowers in terminal and axillary, compound, open or congested and head-like, paniculate or corymbose cymes . . . . ***Schiedea***

Alsinidendron H. Mann

Alsinidendron H. Mann, Proc. Boston Soc. Nat. Hist. 10: 311. 1866.

Schiedea Cham. & Schlechtend. sect. *Alsinidendron* (H. Mann) Pax & K. Hoffm., Nat. Pflanzenfam. ed. 2, 16c: 326. 1934. TYPE: *Alsinidendron trinerve* H. Mann.

Schiedea Cham. & Schlechtend. sect. *Nothoschiedea* H. Mann, Proc. Boston Soc. Nat. Hist. 10: 310. 1866. TYPE: *Schiedea viscosa* H. Mann [= *Alsinidendron viscosum* (H. Mann) Sherff].

Erect shrubs or vines. Leaves opposite, conspicuously palmately 3-nerved or sometimes 5-nerved, margins entire, petiolate, stipules absent. Flowers in axillary, compound cymes formed by development of lateral shoots; sepals 4–5(6), completely white or the outer pair green externally, white within, inner ones whitish with a green midrib externally, white within, oblong, oblong-elliptic to elliptic or obovate, persistent, enlarging, becoming fleshy and dark purple or membranous and not changing color in fruit, unequal, the largest 2 subopposite and external, or when 4, decussate; petals absent; stamens 10, occasionally 8, connate at base into a lobed ring, with thin, oblong, hyaline enations alternate with the stamens arising from the outside of the staminal cup, these inconspicuous or conspicuous and 2–3-toothed; anthers reddish purple, oblong, attached above base; ovary 1-celled, placentation free-central; styles 4–11, filiform, receptive completely around upper clavate ½. Fruit a narrowly ovoid, ovoid, or subglobose capsule, enclosed by the persistent fleshy or membranous calyx, 8–12 mm long, splitting at maturity into 4–11 valves, sometimes variable in number on the same plant. Seeds numerous, black at maturity, orbicular-reniform, flattened, 1–1.5 mm long, the surface papillose, papillae especially large along margins.

Remarks. A Hawaiian endemic genus of 4 species. These can be readily divided into 2 groups, each with 2 species: (1) shrubs with sepals becoming fleshy and purple at maturity, restricted to mesic and wet forest in the Wai'anae Mountains, O'ahu; and (2) sprawling or weakly climbing subshrubs with membranous sepals that do not change color at maturity, restricted to wet forest along the western margin of the Alaka'i Swamp, Kaua'i. The Kaua'i group has previously been placed in *Schiedea* (Mann 1866, 1867; Hillebrand 1888), but their possession of connate stamens, hyaline enations, and lateral inflorescences, and absence of cylindrical nectaries show that they clearly belong in *Alsinidendron*. *Alsinidendron* differs from *Schiedea* primarily in the characters listed above, although they probably share a common ancestor, with *Alsinidendron* being the most highly derived. The nature of the oblong enations arising on the outer side of the staminal cup is presently unknown, but they probably are analogous to nectaries in *Schiedea*. It is also possible that they represent vestigial petals. Since this genus has 10 stamens it seems unlikely that the enations represent staminodes as previously suggested.

Included species are:

1. *Alsinidendron lychnoides* (Hillebr.) Sherff
2. *Alsinidendron obovatum* Sherff
3. *Alsinidendron trinerve* H. Mann
4. *Alsinidendron viscosum* (H. Mann) Sherff

Schiedea Cham. & Schlechtend.

Schiedea Cham. & Schlechtend., Linnaea 1: 46. 1826, non A. Rich. nec Bartl.

Small shrubs, subshrubs, or herbaceous or woody vines. Leaves opposite or sometimes in whorls of 3, 1-nerved or per node, palmately 3–9-nerved, margins entire, petiolate, stipules absent. Flowers perfect or unisexual (and the plants dioecious or gynodioecious), in terminal and axillary, compound, open or congested and head-like, paniculate or corymbose cymes; sepals (4)5(6), green, sometimes purple-tinged, imbricate, persistent; petals absent; nectaries 5, arising at base of and between stamens and sepals, the nectary sheath cylindrical, hollow, thin and translucent, apex entire or bifid, base an enlarged, usually yellowish, horseshoe-shaped, nectar-producing gland; stamens usually 10, rarely fewer, distinct, in 2 series, 5 alternate with the sepals, inserted between the nectaries, the other 5 opposite the sepals, inserted in center of nectary, staminodes often present in pistillate flowers, these often smaller than the stamens, with empty anther sacs; anthers yellow, oblong, attached above base; ovary 1-celled, placentation free-central; styles usually 3, sometimes 4, rarely 5, filiform, receptive completely around upper clavate ½. Fruit an ovoid capsule, enclosed by or exserted from the persistent dried calyx, dehiscing at maturity by as many valves as styles. Seeds relatively few to numerous, usually black or dark reddish brown, sometimes grayish black or brown, orbicular-reniform, reniform, or rarely orbicular, usually laterally compressed, 0.6–1 mm long, the surface rugose, papillose, or sometimes nearly smooth.

Remarks. An endemic genus of 22 species. *Schiedea* and the related genus *Alsinidendron* are presumably derived from a single *Arenaria*-like ancestor. *Schiedea verticillata*, *S. kaalae*, and *S. globosa* are quite distinct in the genus. *Schiedea verticillata* is the most distinctive with its large, densely glandular pubescent flowers and fleshy, usually whorled leaves with 7–12 nerves. Nearly as distinctive are *S. kaalae*, with its large, open inflorescences, large, thick, chartaceous, 1-nerved leaves, and greatly reduced stems, and the coastal *S. globosa*, with its fleshy leaves and stems and congested, head-like inflorescences. The remaining species fall into 2 distinct groups: (1) plants with flowers distant, in open, paniculate cymes (*S. amplexicaulis*, *S. diffusa*, *S. helleri*, *S. implexa*, *S. lydgatei*, *S. membranacea*, *S. nuttallii*, *S. pubescens*, and *S. stellarioides*); and (2) plants with flowers in contracted and often congested, paniculate cymes (*S. adamantis*, *S. apokremnos*, *S. haleakalensis*, *S. hookeri*, *S. kealiae*, *S. ligustrina*, *S. mannii*, *S. menziesii*, *S. salicaria*, and *S. spergulina*). Smaller groups of closely related species can be discerned within each of these larger, rather polymorphic groups.

Included species are:

1. *Schiedea adamantis* St. John
2. *Schiedea amplexicaulis* H. Mann
3. *Schiedea apokremnos* St. John
4. *Schiedea diffusa* A. Gray
5. *Schiedea globosa* H. Mann
6. *Schiedea haleakalensis* Degener & Sherff
7. *Schiedea helleri* Sherff
8. *Schiedea hookeri* A. Gray
9. *Schiedea implexa* (Hillebr.) Sherff
10. *Schiedea kaalae* Wawra
11. *Schiedea kealiae* Caum & Hosaka
12. *Schiedea ligustrina* Cham. & Schlechtend.
13. *Schiedea lydgatei* Hillebr.
14. *Schiedea mannii* St. John
15. *Schiedea membranacea* St. John
16. *Schiedea menziesii* Hook.
17. *Schiedea nuttallii* Hook.
18. *Schiedea pubescens* Hillebr.
    var. *pubescens*
    var. *purpurascens* Sherff
19. *Schiedea salicaria* Hillebr.
20. *Schiedea spergulina* A. Gray
    var. *leiopoda* Sherff
    var. *spergulina*
21. *Schiedea stellarioides* H. Mann
22. *Schiedea verticillata* F. Brown

Silene L.

Silene perlmanii W.L. Wagner, Herbst & Sohmer, **sp. nov.** TYPE: HAWAIIAN IS: O'AHU: 'Ewa Dist, Wai'anae Mts, below ridge crest trail between Palikea and Pōhākea Pass, 790 m, 5.III.1987, *S. Perlman & J. Obata 5401* (BISH-509428!, holotype).

Planta suffruticosa est, foliis anguste ellipticis glabris excepta pagina superficia ad basim strigillosa marginibus in parte 5–6 mm longa ciliatis, cymis dense breve hirtellis, pedicellis 7–10 mm longis, calycibus 22–30 mm longis, petalis albis laminis 8–10 mm longis ungue 11–12.5 mm longo, carpophoro ca. 13 mm longo.

Subshrubs, usually many-branched from base, often forming clumps; stems erect to ascending, 3–5 dm long, glabrous. Leaves narrowly elliptic, 50–105 mm long, 7–16 mm wide, glabrous except upper surface strigillose toward base, margins ciliate in the lower 5–6 mm and sometimes also toward apex, sometimes somewhat undulate, apex acute, gradually tapering to base. Flowers few in terminal, corymbose cymes, densely short-hirtellous throughout, pedicels 7–10 mm long; calyx tubular, 5-lobed, 22–30 mm long, 10-nerved, sometimes with conspicuous lateral nerves from the sinus nerves in upper ⅓, densely short-hirtellous, the lobes 3–6 mm long, margins scarious and weakly purple-tinged, also sparsely ciliate; petals white, blades obovate, 8–10 mm long, deeply notched, the appendage ca. 2.5–3 mm long, deeply 2-cleft, each tooth obliquely bifid, the claw 11–12.5 mm long, sparsely ciliate; stamens exserted beyond calyx; styles 3–4; carpophore ca. 13 mm long. Capsules oblong-obovoid, 3–4-celled in the lower ⅔, 9–10 mm long (immature). Seeds unknown.

Distribution. Extremely rare, known from a single population of perhaps 20 individuals on a cliff face in a diverse mesic forest, 790 m, between Palikea and Pōhākea Pass, southern Wai'anae Mountains, O'ahu.

Remarks. *Silene perlmanii* appears to be most closely related to *S. alexandri* Hillebr., an extremely rare plant from Moloka'i, and differs primarily in the densely short-hirtellous calyx and pedicels, the latter being 7–10 mm long. *Silene alexandri* has a glabrous calyx and pedicels, the latter being 10–19 mm long. Both these species are related to a single colonizing ancestor and appear to share it with the other white-flowered species, *S. lanceolata* A. Gray (formerly known from Kaua'i, Lāna'i, and Hawai'i, and presently rare on Moloka'i), *S. cryptopetala* Hillebr. (probably extinct, known only from the type from East Maui), and *S. degeneri* Sherff (probably extinct, known only from the type and one other collection from East Maui).

CHENOPODIACEAE

Here we report a naturalized species of *Atriplex*, two of *Chenopodium*, and a long-standing confusion in Hawai'i between *C. album* and *C. murale*. We thank P. Brennan, H. Wilson, and P. Wilson for determinations, literature, and comments on *Chenopodium* in Hawai'i.

Atriplex L.

Atriplex eardleyae Aellen

This annual species is a native of Australia. It was found in 1984 to be naturalized at Pu'uhonua O Hōnaunau National Historical Park, Hawai'i.

Atriplex eardleyae is easily distinguished from the other three species of *Atriplex* naturalized in Hawai'i by its fan-shaped fruiting bracts. The other species are *A. lentiformis* (Torr.) S. Wats., *A. semibaccata* R. Br., and *A. suberecta* Verd. The latter species was previously confused with *A. muelleri* Benth., and in Hawai'i often mistaken for *A. semibaccata*. It is readily distinguished by its ascending stems and fruit bracts 2–3.5 mm long, which become hardened and yellow at maturity. By contrast, *A. semibaccata* has prostrate stems and fleshy red or red-tinged fruiting bracts 4–6 mm long.

Specimen examined. HAWAIIAN IS: HAWAI'I: South Kona Dist, Pu'uhonua O Hōnaunau National Historical Park, 1984, *Higashino et al. 10266* (BISH).

Chenopodium L.

Chenopodium album L.

This species is a cosmopolitan weed, but only recently has become naturalized in Hawai'i. It is currently known only from the Kula area, East Maui. Many Hawaiian specimens of *Chenopodium murale* L.—which differs from *C. album* by a more keeled calyx that does not enclose the fruit, and acutely keeled seeds—have been misidentified by Hawaiian botanists as *C. album*.

Representative specimen examined. HAWAIIAN IS: MAUI: Makawao Dist, Kula area, 1986, *Hobdy 2573* (BISH).

Chenopodium hircinum Schrad.

This previously unreported species is native to South America. In Hawai'i it is known from only two naturalized collections. This species is most readily distinguished from other species in Hawai'i by its alveolate seeds. Both specimens listed below were identified by H. Wilson, the latter only tentatively.

Specimens examined. HAWAIIAN IS: MAUI: district unknown, Haleakalā Crater, 2,500 m, 1909, *Faurie 1059* (BISH); HAWAI'I: South Kohala Dist, Parker Ranch, west of Ke'āmuku Camp, 915 m, 1982, *Wagner et al. 4734* (BISH).

CLUSIACEAE

Hypericum L.

Hypericum canariense L.

This species is native to the Canary Islands and Madeira and is now widely cultivated as an ornamental. In Hawai'i it is cultivated and recently has become sparingly naturalized in disturbed areas at 970–1,100 m, Kula, East Maui.

Representative specimen examined. HAWAIIAN IS: MAUI: Makawao Dist, Kula, 1985, *Hobdy 2394* (BISH).

CONVOLVULACEAE

Ipomoea L.

Ipomoea ochracea (Lindl.) G. Don

Although this species has been a naturalized component of the Hawaiian flora since at least 1919, it has not previously been reported in the literature. Earlier collections either were unidentified or confused with *I. obscura* (L.) Ker-Gawler. Native to Africa, in Hawai'i it is naturalized in disturbed mesic sites, 15–600 m, on Kaua'i, O'ahu, Maui, and Hawai'i.

Representative specimens examined. HAWAIIAN IS: KAUA'I: Kawaihau Dist, Wailua Homesteads, 1986, *Flynn 1511* (BISH); O'AHU: Honolulu Dist, Kamehameha School Grounds, 1919, *Forbes 2532.O* (BISH); MAUI: Makawao Dist, Hāmākua Poko, 1985, *Hobdy 2319* (BISH); HAWAI'I: South Kona Dist, Ho'okena, 1976, *Herbst & Spence 5631* (BISH).

CRASSULACEAE

Crassula L.

Crassula sieberiana (Schult.) Druce

This inconspicuous, fleshy, annual herb has minute flowers, stamens as many as the distinct petals, opposite leaves, and 3–5 ovaries. It is native to Australia, Tasmania, and New Zealand. It recently was discovered to be naturalized in subalpine vegetation at ca. 1,585 m in the Pōhakuloa Training Area, Hawai'i.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: Hāmākua Dist, Pōhakuloa Training Area, 1978, *Warshauer & McEldowney 1882* (BISH).

ELAEAGNACEAE

Elaeagnus L.

Elaeagnus umbellata Thunb.

This species, which is native to Asia, is cultivated as an ornamental in Hawai'i. It is now sparingly naturalized at Volcano Village and Kīlauea, Hawai'i Volcanoes National Park, Hawai'i. It was first collected at an old dwelling site at Hawai'i Volcanoes National Park Headquarters in 1963, at which time it was not spreading. By 1984 it had become sparingly naturalized from plants cultivated in Volcano Village along the roadside of Haunani Rd. (*Stemmermann 6872*, BISH).

Representative specimen examined. HAWAIIAN IS: HAWAI'I: Ka'ū Dist, Hawai'i Volcanoes National Park Headquarters, 1963, *Fosberg 44457* (BISH).

EUPHORBIACEAE

We thank M. Huft for identification of Hawaiian Euphorbiaceae.

Chamaesyce S.F. Gray

Chamaesyce hyssopifolia (L.) Small

This species is an annual herb not previously reported for Hawai'i. It is native from the southern United States to Argentina and the West Indies. The species superficially resembles *C. hypericifolia* (L.) Millsp., which has been naturalized in Hawai'i for at least 75 years, differing in its leafy cymes and larger capsules (1.5–2 mm long vs. 1–1.5 mm long in *C. hypericifolia*). In Hawai'i it is naturalized in low elevation, dry, disturbed sites on Kaua'i, O'ahu, Maui, and Hawai'i.

Representative specimens examined. HAWAIIAN IS: KAUA'I: Koloa Dist, grounds of Pacific Tropical Botanical Garden, 1983, *Wagner et al. 5140* (BISH); O'AHU: Honolulu Dist, lower campus, University of Hawaii at Manoa, 1975, *Nagata 1262* (BISH); MAUI: Makawao Dist, Kahului airport toward Kanahā Beach Park, 1988, *Wagner et al. 5786* (BISH); HAWAI'I: Ka'ū Dist, roadside near Punalu'u, 1959, *Stone 3014* (BISH).

Chamaesyce maculata (L.) Small

This prostrate or decumbent annual herb is native to the eastern United States. It has long been naturalized in the western United States and Europe, and is now naturalized in Hawai'i on Kure and Midway atolls. As only military aircraft are allowed to land on these islands, the aircraft or, more likely, the personnel or supplies brought from the mainland United States undoubtedly were the dispersal agents.

Representative specimens examined. HAWAIIAN IS: KURE ATOLL: Green Island, around LORAN buildings, 1979, *Herbst et al. 6286* (BISH); MIDWAY ATOLL: Sand Island, 1980, *Herbst & Takeuchi 6392* (BISH).

Euphorbia L.

Euphorbia graminea Jacq.

This species is native from northern Mexico to Colombia and Venezuela. In Hawai'i it apparently is recently naturalized and is currently known only from the raised coralline plain near sea level, Barbers Point, O'ahu.

Representative specimen examined. HAWAIIAN IS: O'AHU: 'Ewa Dist, 'Ewa Plains (Barber's Point), 1978, *Char et al. 78.094* (BISH).

Mallotus Lour.

Mallotus philippensis (Lam.) Müll. Arg.

This tree, which is native to southeast Asia, is now naturalized and fairly common in the Lualualei Naval Ammunition Depot, Wai'anae, O'ahu. It is easily recognized when in fruit by the conspicuous carmine red powdery covering of the capsules.

Representative specimen examined. HAWAIIAN IS: O'AHU: Wai'anae Dist, Lualualei Naval Magazine, 1984, *Funk 240* (BISH).

FABACEAE

Crotalaria L.

We thank D. Windler and S.G. Skinner for identifications of *Crotalaria* specimens from Hawai'i.

Crotalaria brevidens Benth.

This species is native to Africa. It is distinguished from other *Crotalaria* species in Hawai'i by its short calyx teeth (1.3–2 mm long). In Hawai'i, it was recently found naturalized along roadsides, at least at Ulumalu and in Makawao Forest Reserve, at 250–670 m, Maui.

Representative specimen examined. HAWAIIAN IS: MAUI: Makawao Dist, Makawao Forest Reserve access road in Haleakalā Homesteads, 1984, *Hobdy 2012* (BISH).

Crotalaria lanceolata E. Mey.

Native to Africa, in Hawai'i this species is recently naturalized at least on the Kona Coast and Kapoho, Puna District, Hawai'i. This species and *Crotalaria brevidens* can be easily distinguished from the other species in Hawai'i by their calyx lobes, which are much shorter than the tubes, and from *C. brevidens* by flowers 7–8.5 mm long and keel petals with a short beak. *Crotalaria brevidens* has flowers 11–18.5 mm long with a prolonged beak on the keel petals.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: Puna Dist, Kea'au transfer dump, 1975, *Herbst & Ishikawa 5548* (BISH).

Glycine Willd.

Glycine wightii (Wight & Arnott) Verdc.

Native to Central and South America and the West Indies, and now widely naturalized, in Hawai'i this species is cultivated as a fodder plant and at least since 1975 has become naturalized in pastures, along roadsides, and in other low elevation, disturbed areas at least on O'ahu, Maui, Kaho'olawe, and Hawai'i.

Alternatively, this species has been placed in the genus *Neonotonia* Lackey as *N. wightii* (Wight & Arnott) Lackey (Lackey 1977). *Neonotonia* is distinguished from *Glycine* by its pseudoracemose inflorescences and calyx with the upper 2 lobes completely connate.

Representative specimens examined. HAWAIIAN IS: O'AHU: Waialua Dist, Wai'anae Mts, Keālia Trail above Dillingham Airfield, 1984, *Wagner et al. 5322* (BISH); MAUI: Makawao Dist, along the road to 'Ulupalakua, Palauea, 1979, *Hobdy s.n.* (BISH); KAHO'OLAWE: southwest of Luamakika, 1980, *Clarke et al. ESP215* (BISH); HAWAI'I: Ka'ū Dist, along the highway south of Pāhala, 1975, *Herbst & Ishikawa 5515* (BISH).

Lathyrus L.

Lathyrus latifolius L.

Native to Europe, where it is widely cultivated and naturalized, in Hawai'i this species is cultivated and now naturalized at least at 1,130 m, Olinda area, East Maui, but not previously reported.

Specimen examined. HAWAIIAN IS: MAUI: Makawao Dist, Olinda, in pasture by roadside, 1985, *Hobdy 2412* (BISH).

Lathyrus tingitanus L.

Native to Spain, Portugal, Sardinia, and the Azores, sometimes cultivated, in Hawai'i this species is apparently cultivated as a forage plant and recently sparingly naturalized along roadsides and in pastures, 915–1,220 m, Olinda, Maui.

Specimen examined. HAWAIIAN IS: MAUI: Makawao Dist, Olinda, a roadside weed, 1985, *Hobdy 2409* (BISH).

Macroptilium (Benth.) Urb.

Macroptilium atropurpureum (DC) Urb.

Native to the Neotropics, now widely cultivated and naturalized throughout the tropics and subtropics, in Hawai'i this species is naturalized along roadsides and in other disturbed areas on O'ahu, Maui, and Hawai'i, but not previously reported.

Representative specimens examined. HAWAIIAN IS: O'AHU: Ko'olau Poko Dist, Waimānalo Agr. Exp. Sta., 30–40 m, 1975, *Herbst & Shearard 5348* (BISH); MAUI: Wailuku Dist, a disturbed area near Paukūkalo Hawaiian Home settlement, 1982, *Hobdy 1674* (BISH); HAWAI'I: Ka'ū Dist, Nīnole Bay, along dirt roadside, 1986, *Stemmermann & Warshauer 7064* (BISH).

Prosopis L.

Prosopis juliflora (Sw.) DC

Native to the Neotropics, introduced and naturalized in many tropical countries, in Hawai'i this species is naturalized on O'ahu at Sand Island and vicinity.

Representative specimen examined. HAWAIIAN IS: O'AHU: Honolulu Dist, mitigation islands, Ke'ehi Lagoon, 1978, *Herbst & Walker 6048* (BISH).

Remarks. *Prosopis pallida* (Humb. & Bonpl. ex Willd.) Kunth also grows in the same area and appears to hybridize with *P. juliflora* (e.g., *Herbst & Walker 6049*, BISH).

Prosopis pallida differs from *P. juliflora* in being spineless or having slender spines 0.3–1(–1.7) cm long and leaves with (1–)3–4 pairs of pinnae, each with 6–15 pairs of leaflets, while *P. juliflora* has stout spines 1–3(–5) cm long and leaves with 1–2(–4) pairs of pinnae with (6–)12–25(–29) pairs of leaflets on each.

Prosopis pallida in Hawai'i was originally identified by Hillebrand (1888) as "*Prosopis juliflora* DC or *P. dulcis* Kunth." Heller (1897) pointed out that *P. dulcis* had torulose pods and could not possibly be the species growing in Hawai'i; he also believed the local tree to be distinct from the *P. juliflora* he knew from the southwestern part of the United States. However, the name *juliflora* has persisted in the local botanical literature until recent times. In a 1966 publication, Fosberg identified the common Hawaiian plant as *P. pallida*, and most local botanical literature has used that name since. In 1978 the true *P. juliflora* was found growing naturalized on Sand Island and six of the other small islets in Ke'ehi Lagoon during a botanical survey of the area. A tree believed to be a hybrid between the two species was discovered by D. Herbst and J. Porter (*Herbst & Porter 1960*, BISH) on another of the Ke'ehi Lagoon islets in 1971.

GERANIACEAE

Geranium L.

In addition to the six endemic woody species of *Geranium* sect. *Neurophyllodes* A. Gray, there are five herbaceous naturalized *Geranium* species in Hawai'i. Fosberg (1937a) indicated that two introduced species of *Geranium* occurred in Hawai'i. One of them, *G. dissectum* L., was at that time known from a single collection (*Forbes 218.M*, BISH) collected on Maui in 1910. This species is now known to occur on Kaua'i, Maui, and Hawai'i. Fosberg identified the remainder of the Hawaiian specimens of naturalized *Geranium* as *G. carolinianum* L. var. *australe* (Benth.) Fosb. According to Carolin (1964), this name actually represents *G. solanderi* Carolin, which is not naturalized in Hawai'i. The Hawaiian collections studied by Fosberg actually represent three different species: *G. homeanum*, *G. pusillum*, and *G. retrorsum*. Carolin (1964) mentioned that the last species was naturalized in Hawai'i and in fact was the first recorded from the islands before 1871 (*Hillebrand s.n.*, BISH). It is not especially common, but has been collected on Lāna'i, Maui, and Hawai'i. One additional species, *G. molle*, was recorded in 1938 after Fosberg's paper. The naturalized *Geranium* species are distinguished by the following key. Notes on the newly recorded species follow the key. We thank R.O. Gardner for determinations on these plants and R. Carolin for comments on our key and notes.

Key to the Naturalized Species of *Geranium* in Hawai'i

1. Sepals awnless, at most bluntly mucronate; seeds smooth 2
1. Sepals prominently awned, the awn 0.4–1.5 mm long; seeds reticulate 3
2(1). Carpel bodies glabrous, conspicuously transversely wrinkled; stylar column with a narrower apical portion 1–2 mm long .... ***G. molle***
2. Carpel bodies finely and densely puberulent, smooth; stylar column without a narrower apical portion .... ***G. pusillum***
3(1). Annual herbs; hairs of pedicels spreading, usually glandular .... ***G. dissectum***
3. Perennial herbs; hairs of pedicels retrorsely appressed, never glandular 4
4(3). Sepals with 3 prominent veins, hairs usually confined to veins and toward base; seeds reddish brown; central lobe of leaves nearly as wide as long; root cylindrical, branched .... ***G. homeanum***
4. Sepals with 3 inconspicuous veins, hairs more evenly distributed, but somewhat denser along veins; seeds dark brown to nearly black; central lobe of leaves usually longer than wide; root enlarged, fleshy, unbranched .... ***G. retrorsum***

Geranium homeanum Turcz.

Native to Australia and New Zealand, this species is now naturalized in other areas, including Hawai'i, where it occurs in disturbed areas, primarily pastures, 1,130–2,150 m, on Kaua'i, Maui, and Hawai'i. It is the most common of the naturalized species.

Representative specimens examined. HAWAIIAN IS: KAUA'I: Waimea Dist, Halemanu Val, Kōke'e, 1984, *Flynn 861* (BISH); MAUI: Makawao Dist, 'Ulupalakua Ranch south of Pu'u'io, 1986, *Wagner et al. 5665* (BISH); HAWAI'I: Ka'ū Dist, near Kīlauea, 1926, *Degener 30233* (BISH).

Geranium molle L.

This species, native to Europe and North Africa, is now widely naturalized. In Hawai'i it is known from a single collection at 1,525 m on Hawai'i Island, and perhaps no longer persists.

Specimen examined. HAWAIIAN IS: HAWAI'I: Hāmākua Dist, upper Pā'auhau, 1938, *Hosaka 2203* (BISH).

Geranium pusillum N. L. Burm.

This species is native to temperate Eurasia. In Hawai'i it is known from a single collection made at 2,000 m on Hawai'i Island, and probably no longer persists.

Specimen examined. HAWAIIAN IS: HAWAI'I: district unknown, Mauna Kea, 1909, *Faurie 856* (BISH).

GESNERIACEAE

Cyrtandra J.R. Forster & G. Forster

A distinctive new species of *Cyrtandra* sect. *Crotonocalyces* Hillebr. was recently discovered by R. Hobdy on West Maui. This brings the total number of species in this section to 13. In addition to the new species, the only other species in sect. *Crotonocalyces* to occur on Maui are *C. platyphylla* A. Gray and *C. munroi* C. Forbes.

Cyrtandra oxybapha W.L. Wagner & Herbst, **sp. nov.** TYPE: HAWAIIAN IS: MAUI: Wailuku Dist, West Maui, forests of Hana'ula, upper Pōhākea Gulch, 1,130 m, 23.V.1986, *R. Hobdy 2107* (BISH-459848!, holotype).

Calycibus ca. actinomorphicis late campanulatis 20–21 mm longis ca. ½ partitis ambitu dense villosis, tubo corollae subcylindrico 19–20 mm longo et 10–11 mm diametro, ovario glabro.

Shrubs 2–3 m tall; stems many-branched. Leaves opposite, borne on upper 3–4 nodes, those of a pair unequal, slightly asymmetrical, chartaceous, suborbicular to very broadly elliptic, ca. 12–18 cm long, ca. 8–9 cm wide, upper surface moderately hirtellous, lower surface densely velvety villous, margins coarsely and irregularly serrate-dentate, apex acuminate, base truncate to broadly cuneate, petioles ca. 4–6.5 cm long, densely brown villous. Flowers 1–2 in cymes arising in the leaf axils, densely villous throughout, peduncles stout, ca. 20–25 mm long, pedicels stout, ca. 18–25 mm long, elongating to ca. 32–35 mm long in fruit, bracts foliaceous, very broadly elliptic, 17–19 mm long; calyx nearly actinomorphic, apparently pale green, chartaceous, broadly campanulate, ca. 20–21 mm long, cleft ca. ½ its length, the lobes broadly elliptic, erect at anthesis, spreading at nearly right angles to fruit, both surfaces densely villous, apex acute; corolla white(?), tube subcylindrical, flaring slightly below mouth, 19–20 mm long, ca. 10–11 mm in diameter medially, moderately villous, upper lobes rhombic-orbicular, ca. 5 mm long, ca. 8 mm wide, lower lobes rhombic-orbicular, ca. 6.5–7.5 mm long, ca. 9–10 mm wide; ovary glabrous; style ca. 2 mm long, glabrous. Berries white, ovoid, ca. 1.8 cm long, surrounded by the persistent, spreading calyx.

Distribution. This species is very rare and is known from only one site in the wet forest of the type locality.

Specimen examined. HAWAIIAN IS: MAUI: Wailuku Dist, West Maui, Hana'ula, gulch below reservoir, 1,220 m, 1988, *Wagner et al. 5862* (BISH).

Remarks. *Cyrtandra oxybapha* is related to *C. platyphylla* and probably represents a specialized derivative of it. It is distinguished by its campanulate calyx, fewer-flowered cymes, and corolla tubes greater in diameter. The specific epithet is from the Greek for saucer, in reference to the configuration of its calyx.

HALORAGACEAE

We thank A.E. Orchard for determination of the following record.

Gonocarpus Thunb.

Gonocarpus chinensis (Lour.) Orch. subsp. ***verrucosus*** (Maiden & E. Betcke) Orch.

This taxon is native to the coastal regions of New South Wales and Queensland, Australia. In Hawai'i it is sparingly naturalized in Hawai'i Volcanoes National Park, but was previously reported by Orchard (1975) as *Gonocarpus chinensis* subsp. *chinensis*.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: Puna Dist, Volcano area near the 27-mile marker from Hilo, 1966, *Degener & Degener 30591* (BISH).

LAMIACEAE

Stenogyne Benth.[4]

Stenogyne campanulata Weller & Sakai, **sp. nov.** TYPE: HAWAIIAN IS: KAUA'I: Hanalei Dist, from a cliff above Kalalau Val, ca. 1,130 m, 16.VIII.1986, *S.L. Montgomery s.n.* (BISH-504033!, holotype).

Calycibus latiore campanulatis 13–14 mm longis dense pubercentibus dentibus superis et inferis aequaliter connatis, tubo corollae albo recto 12–13 mm longo, labiis purpureis extra dense tomentosis.

Apparently vines; stems 4-angled, densely tomentose. Leaves membranous, broadly ovate, 5–6.3 cm long, 2.6–3.6 cm wide, both surfaces densely tomentose, margins serrate, apex acute,

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[4] Contributed by Stephen G. Weller and Ann Sakai, Department of Ecology and Evolutionary Biology, University of California, Irvine, CA 92717, USA.

base cordate, petioles 14–17 mm long, densely pubescent. Flowers ca. 6 per verticillaster, raised on peduncles ca. 2 mm long, pedicels ca. 4 mm long, densely pubescent; calyx radially symmetrical, very broadly campanulate, 13–14 mm long, densely pubescent, the teeth obtuse, 2–3 mm long, 5–6 mm wide at base; corolla tube white, lips purple, densely tomentose externally, scattered glandular pubescent within, tube straight, 12–13 mm long, upper lip 3.5–5 mm long, lower lip ca. 3 mm long. Nutlets unknown.

Distribution. Rare and known only from the type locality.

Remarks. This is a distinctive species characterized by the large, broadly campanulate calyces that nearly enclose the relatively small corollas.

LAURACEAE

Cinnamomum Schaeff.

Cinnamomum burmannii (Nees) Blume

Native to Indonesia, in Hawai'i this species is cultivated on O'ahu, where it has recently become naturalized at least in Mānoa Valley and on Pauoa Flats. Although it has been cultivated in Hawai'i during most of this century, the first naturalized collection was made in 1975.

Representative specimen examined. HAWAIIAN IS: O'AHU: Honolulu Dist, H.L. Lyon Arboretum, 1975, *Baker 99* (BISH).

LENTIBULARIACEAE

Utricularia L.

Utricularia gibba L.

This species is a pantropical aquatic or subaquatic herb now naturalized in Europe, New Zealand, and Hawai'i. In Hawai'i it is presumably sparingly naturalized and is known from a single collection made in 1982 in a wet forest along the Stainback Highway, Hawai'i. This is the first report of the family in Hawai'i. We thank P. Taylor for the determination of our specimen.

Specimen examined. HAWAIIAN IS: HAWAI'I: South Hilo Dist, in a stagnant pond at 960 m in the 'ōhi'a rain forest along the Stainback Highway, 1982, *Stemmermann et al. 6815* (BISH).

LOGANIACEAE

Labordia Gaud.

The low-growing *Labordia* shrub, known only from cloud-swept summits of the Ko'olau Mountains and described as *L. hedyosmifolia* var. *hosakana* by Sherff in 1938, is the only member of the *L. hedyosmifolia* complex occurring on O'ahu. Further, it is the only member currently recognized that is treated at the varietal level. The other members of the complex are: *Labordia hedyosmifolia* Baill. (Moloka'i, Lāna'i, Maui, and Hawai'i); *L. pumila* (Hillebr.) Skottsb. (Kaua'i); and *L. venosa* Sherff (East Maui). Because the Ko'olau populations are equally distinctive, if not more so than the other members of the complex, in their low-growth habit, rugose leaves, and bracts 8–13 mm long, they merit recognition at the same taxonomic level. Thus the following new combination is necessary.

Labordia hosakana (Sherff) W.L. Wagner, Herbst & Sohmer, **comb. et stat. nov.** *Labordia hedyosmifolia* Baill. var. *hosakana* Sherff, Amer. J. Bot. 25: 584. 1938. TYPE: HAWAIIAN IS: O'AHU: 'Ewa Dist, Waipi'o, Kīpapa Gulch, south ridge, denuded ridge, 750 m, 4.VII.1932, *E.Y. Hosaka 679* (BISH-510928!, holotype).

Distribution. Occurring on cloudswept summits in wet forest, 790–860 m, Ko'olau Mountains from Kīpapa to Wa'ahila, O'ahu.

LYTHRACEAE

Cuphea P. Br.

Cuphea hyssopifolia Kunth

This subshrub, which is native from Mexico to Guatemala and Honduras, is commonly grown as an ornamental. It has been cultivated in Hawai'i at least since 1909 and now is naturalized, usually in open, disturbed sites and streambeds, on Hawai'i, although not previously reported. The name was incorrectly applied by Hillebrand (1888) to the common, naturalized *C. carthagenensis* (Jacq.) Macbr.

Representative specimens examined. HAWAIIAN IS: O'AHU: Honolulu Dist, University of Hawaii at Manoa (cultivated), 1985, *Lau 1157* (BISH); HAWAI'I: Puna Dist, in an intermittent streambed near Mountain View, 1976, *Herbst 5818* (BISH).

Cuphea ignea A. DC

This species is native to Mexico but is now widely cultivated. In Hawai'i it was introduced before 1871 for its flowers, which are used for *lei*, and has become sparingly naturalized in Honokāne Nui Valley and Honoka'a, Hawai'i, although not previously reported.

Representative specimens examined. HAWAIIAN IS: O'AHU: Honolulu Dist, Kamilo Nui Val (cultivated), 1986, *Lau 1849* (BISH); HAWAI'I: North Kohala Dist, Honokāne Nui Val, 1952, *Degener & Greenwell 21914* (BISH).

MALVACEAE[5]

Abutilon Mill.

Abutilon auritum (Wall. ex Link) Sweet

Native to New Guinea, Indonesia, the Philippines, New Caledonia, and Queensland, Australia, this *Abutilon* has been collected once in Hawai'i, in 1910, although not previously reported. It is not known if it has persisted.

Representative specimen examined. HAWAIIAN IS: MAUI: Hāna Dist, Kahikinui, 1910, *Rock s.n.* (BISH).

Herissantia Medik.

Herissantia crispa (L.) Briz.

This species is native to and widespread in the New World tropics. It is now naturalized, primarily at low elevations, in nearly all tropical parts of the world. In Hawai'i, a small population was recently discovered on an arid ridge in West Maui.

Representative specimen examined. HAWAIIAN IS: MAUI: Lahaina Dist, on an arid ridge west of Olowalu Val, 1986, *Herbst et al. 8715* (BISH).

Hibiscus L.

Hibiscus arnottianus A. Gray, U.S. Expl. Exped., Phan. 176. 1854. TYPE: SANDWICH [HAWAIIAN] IS: on the Ka'ala Mts behind Honolulu, O'ahu, *U.S. Expl. Exped. s.n.* (US, lectotype; lectotype designated by H. St. John in Rhodora 87: 568. 1985.).

The native, white-flowered populations of *Hibiscus* are here treated as two modally distinct species: *H. arnottianus* and *H. waimeae*. Collectively, they comprise a complex of morphological forms in which character intergradation is extensive, although differences between individual populations or plants may be pronounced. Three subspecies of *H. arnottianus* are recognized, based largely on modal differences between populations.

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[5] Contributed by David M. Bates, L.H. Bailey Hortorium, Cornell University, Ithaca, NY 14873, USA.

Hibiscus arnottianus A. Gray subsp. ***arnottianus***

Hibiscus arnottianus A. Gray f. *parviflorus* Skottsb., Acta Horti Gothob. 15: 396. 1944. TYPE: HAWAIIAN IS: O'AHU: Wai'anae Mts, 1 mi S of Kolekole Pass, 1938, *O. Selling 3364* (BISH-57481!, syntype).
Hibiscus waimeae A. Heller var. *hookeri* Hochr., Annuaire Conserv. Jard. Bot. Genève 4: 132. 1900. TYPE: HAWAIIAN IS: O'AHU: Mts behind Honolulu, 1864–65, *H. Mann & W.T. Brigham 530* (BISH-57492!, isotype).

Subspecies ***arnottianus*** has young stems, leaves, pedicels, and calyces glabrate, leaves 4–10 cm long, involucral bracts reflexed, 5–8(–10) mm long, calyx 1.5–2.8 cm long, and petals (5–)6–8(–10) cm long from the point of insertion.

Distribution. Occurring throughout the Wai'anae Mountains and the eastern end of the Ko'olau Mountains from Wahiawā to Niu Valley, 120–790 m, O'ahu.

Hibiscus arnottianus A. Gray subsp. ***immaculatus*** (M. Roe) D. Bates, **comb. et stat. nov.** *Hibiscus immaculatus* M. Roe, Pacific Sci. 15: 22. 1961. TYPE: HAWAIIAN IS: MOLOKA'I: Wailau Val, pali of Oloku'i above Waiehu, 1912, *C.N. Forbes 551.Mo* (BISH-511115!, holotype).

Subspecies ***immaculatus*** differs from subsp. *arnottianus* in usually having deeply crenate leaves, caudate calyx teeth, a white staminal column, and capsules enclosed by the calyx.

Distribution. A rare plant recorded only from Wailau, Waihānau, and Pāpalaua valleys, Moloka'i.

Hibiscus arnottianus A. Gray subsp. ***punaluuensis*** (Skottsb.) D. Bates, **comb. et stat. nov.** *Hibiscus arnottianus* A. Gray var. *punaluuensis* Skottsb., Acta Horti Gothob. 15: 396. 1944. *Hibiscus punaluuensis* (Skottsb.) Degener & I. Degener, Fl. Hawaiiensis, fam. 221. *Hibiscus punaluuensis*. Publ. priv., 2 pp. 1957. TYPE: HAWAIIAN IS: O'AHU: Ko'olau Loa Dist, Ko'olau Mts, Punalu'u, 1938, *O. Selling 3638* (BISH-57473!, S, syntypes).

Subspecies ***punaluuensis*** is a robust variant with young stems, leaves, pedicels, and calyces moderately coarsely pubescent, leaves 10–20(–30) cm long, involucral bracts apparently appressed to the calyx, 10–25 mm long, calyx 2–3.4 cm long, and the petals (7–)8–11(–13) cm long from their point of insertion.

Distribution. Occurring in the Ko'olau Mountains from Kaipapa'u to Waiāhole valleys, 200–700 m, O'ahu.

Hibiscus brackenridgei A. Gray, U.S. Expl. Exped., Phan. 175. 1854. TYPE: SANDWICH [HAWAIIAN] IS: on a mountain in the W division of Maui, *U.S. Expl. Exped. s.n.* (US, holotype).

Hibiscus brackenridgei is closely related to the widespread *H. divaricatus* Jacq. and may not be specifically distinct from it. It varies morphologically from island to island, but the population series seem to fall into two principal morphological types.

Hibiscus brackenridgei A. Gray subsp. ***brackenridgei***

Hibiscus brackenridgei A. Gray var. *molokaiana* Rock in Caum, Occas. Pap. Bernice P. Bishop Mus. 9(5): 4. 1930. TYPE: HAWAIIAN IS: MOLOKA'I: W end, 1920, *J.F. Rock s.n.* (BISH-512430!, holotype; BISH! 5 sheets, isotypes).

Subspecies ***brackenridgei*** is an erect to sprawling shrub or small tree with calyx 1.5–2.5 cm long, involucral bracts from ½ as long to equally long as the calyx, and petals 3.5–5(–6) cm long.

Distribution. Occurring in dry forest and shrubland from near sea level to 370 m, on Moloka'i, Lāna'i, Maui, and Hawai'i.

Hibiscus brackenridgei A. Gray subsp. ***mokuleianus*** (M. Roe) D. Bates, **comb. et stat. nov.** *Hibiscus brackenridgei* A. Gray var. *mokuleiana* M. Roe, Pacific Sci. 15: 12. 1961. TYPE: HAWAIIAN IS: O'AHU: Waialua Dist, Mokulē'ia, second gulch E of Pu'ukaupakuhale, NE slope of Mount Ka'ala, 1957, *M. Roe 210* (BISH-511162!, holotype; BISH, isotype).

Subspecies ***mokuleianus*** is a tree with calyx 2.5–4 cm long, involucral bracts 18–25 mm long, and petals 6–8 cm long.

Distribution. Occurring in a habitat similar to subsp. *brackenridgei* in the Wai'anae Mountains between Kawaihāpai and Pu'upane, 120–240 m, O'ahu, and reportedly from Līhu'e and Olokele Canyon, Kaua'i.

Hibiscus kokio Hillebr., Fl. Hawaiian Isl. 48. 1888. *Hibiscus arnottianus* A. Gray var. *kokio* (Hillebr.) Hochr., Annuaire Conserv. Jard. Bot. Genève 4: 133. 1900. TYPE: HAWAIIAN IS: MOLOKA'I: Hālawa Val, 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed; lectotype designated by O. Degener and I. Degener in Phytologia 35: 465. 1977; BISH, isolectotype, not located).

Hibiscus kokio is variable in vegetative and floral characters throughout its range. Variations are largely recurrent among the populations of each island except in the coastal valleys of northwestern Kaua'i; these populations are here recognized as a subspecies. The two subspecies of *H. kokio* are:

Hibiscus kokio Hillebr. subsp. ***kokio***

Hibiscus kahilii C. Forbes, Occas. Pap. Bernice P. Bishop Mus. 5(1): 4. 1912. TYPE: HAWAIIAN IS: KAUA'I: Kōloa Dist, on the slopes of Kāhili above Wahiawa Bog, 1909, *C.N. Forbes 259.K* (BISH-511116!, holotype; BISH 2 sheets, isotypes).

Hibiscus kokio Hillebr. var. *pekeloi* Degener & I. Degener, Phytologia 35: 465. 1977. TYPE: HAWAIIAN IS: MOLOKA'I: rainy, shrubby, coastal ledges, Wailau Val, 1928, *O. Degener 18222* (NY, holotype; BISH-57574!, isotype).

Hibiscus kokio Hillebr. var. *pukoonis* Caum, Occas. Pap. Bernice P. Bishop Mus. 9(5): 7. 1930. TYPE: HAWAIIAN IS: MOLOKA'I: bottom of Pūko'o Val, just inside the native forest (neither flower nor fruit), 1921, *E.L. Caum 155* (not located). There are two sheets in BISH labeled *Caum 155* in pencil, which were collected in 1930. They are from plants cultivated in Caum's garden from cuttings from *Caum 155.*

Hibiscus oahuensis Degener & I. Degener, Phytologia 35: 468. 1977. TYPE: HAWAIIAN IS: O'AHU: Waialua Dist, Kawai Iki Ditch Trail, Kawailoa, Ko'olau Range, 1956, *M. Roe 204* (presumably NY, holotype).

Hibiscus ula Degener & I. Degener, Phytologia 35: 467. 1977. TYPE: HAWAIIAN IS: MAUI: Wailuku Dist, on a narrow ridge about an hour's walk from the 'Īao Valley State Park, West Maui, date unknown, *R. Sylva s.n. (O. Degener & I. Degener number 34145)* (NY, holotype; AC, B, CU, E, G, K, L, LE, MO, W, isotypes).

Subspecies ***kokio*** is characterized by stellate pubescence on the calyx and a red corolla.

Distribution. This subspecies occurs in dry to wet forests, 70–800 m, on Kaua'i, O'ahu, Moloka'i, Maui, and probably Hawai'i.

Hibiscus kokio Hillebr. subsp. ***saintjohnianus*** (M. Roe) D. Bates, **comb. et stat. nov.** *Hibiscus saintjohnianus* M. Roe, Pacific Sci. 15: 18. 1961. TYPE: HAWAIIAN IS: KAUA'I: Hanalei Dist, headland W of Hanakāpī'ai, Nāpali Coast, on sharply precipitous slopes, 1956, *H. St. John 25989* (BISH-511392! and BISH-511132!, holotype, mounted on 2 sheets).

Hibiscus roetae St. John, Pacific Sci. 26: 286. 1972. TYPE: HAWAIIAN IS: KAUA'I: Waimea Dist, bottom of short Nu'alolo Trail, 1969, *R. Hobdy 158* (BISH-511131!, holotype).

Subspecies ***saintjohnianus*** is characterized by glandular pubescence on the calyx and flower color ranging from yellow to red orange.

Distribution. This subspecies occurs in dry to mesic forests, 150–890(–1,100) m, in northwestern Kaua'i.

Hibiscus waimeae A. Heller, Minnesota Bot. Stud. 1: 851. 1897. *Hibiscus waimeae* A. Heller var. *helleri* Hochr., Annuaire Conserv. Jard. Bot. Genève 4: 132. 1900, nom. illeg. TYPE: HAWAIIAN IS: KAUA'I: Waimea, 1,000 m, 2–9.IX.1895, *A.A. Heller 2785* (MINN, holotype; BISH, isotype).

Hibiscus waimeae can be divided into two subspecies based upon leaf and flower size:

Hibiscus waimeae A. Heller subsp. ***hannerae*** (Degener & I. Degener) D. Bates, **comb. et stat. nov.** *Hibiscus waimeae* A. Heller var. *hannerae* Degener & I. Degener, Fl. Hawaiiensis, fam. 221. *Hibiscus waimeae*. Publ. priv., 2 pp. 1962. TYPE: HAWAIIAN IS: KAUA'I: Hanalei Dist, Kalihi Wai, 1913, *J. Lydgate s.n.* (BISH-511394!, holotype).

Subspecies ***hannerae*** has flowers with the calyx 2–2.5 cm long, petals 4–6 cm long, and combined staminal and petal tube length ca. 1.5 cm.

Distribution. The range of this subspecies includes Hanakāpī'ai, Limahuli, and Kalihi Wai valleys on northwestern Kaua'i; it is apparently rare.

Hibiscus waimeae A. Heller subsp. ***waimeae***

Subspecies ***waimeae*** has smaller leaves but larger flowers than subsp. *hannerae*, with the calyx 3–4.5 cm long, petals 6–13 cm long, and the combined staminal and petal tube length ca. 3–6 cm.

Distribution. Occurring in diverse mesic forests, 250–1,200 m, from upper Waimea Canyon to the valleys of the western and northern coasts of Kaua'i.

Malvastrum A. Gray

Malvastrum americanum (L.) Torr.

This species is a pantropical weed occurring from near sea level to above 2,000 m; in Hawai'i it is apparently recently naturalized in the boulder-strewn grass and shrubland, ca. 5 m, at Kaloko (Queen's Beach), where it is locally common. It differs from the common, long-established *M. coromandelianum* (L.) Garcke in its dense, terminal spikes, stellate hairs with usually 6–12 arms, and more or less unarmed mericarps. *Malvastrum coromandelianum* has solitary or few axillary flowers, 4-armed stellate hairs, and mericarps armed with a ventro-apical awn.

Representative specimen examined. HAWAIIAN IS: O'AHU: Honolulu Dist, Kaloko, 1985, *Nagata 3245* (BH, HLA).

Sida L.

Sida urens L.

Native from Mexico to the Caribbean, South America, and Africa, in Hawai'i this species apparently is recently naturalized and known from a single collection on Hawai'i Island.

Specimen examined. HAWAIIAN IS: HAWAI'I: North Kona Dist, North Kona, 1980, *Nagata & Park 2114* (BISH, HLA).

Sidastrum E.G. Baker

Sidastrum micranthum (St. Hil.) Fryx.

This species is widespread throughout its native range of South America, the Caribbean, and Central America. In Hawai'i it is naturalized in the pastures of Makaleha Valley, O'ahu, and Ka'awaloa, Hawai'i. It has been observed on Hawai'i Island since about 1900, but the first specimen was not collected until 1948. It has not been previously reported.

Representative specimens examined. HAWAIIAN IS: O'AHU: Waialua Dist, Makaleha pastureland, common weed along road to Mount Ka'ala, 1986, *Takeuchi & Ziegler 2978* (BISH); HAWAI'I: South Kona Dist, Ka'awaloa, 1948, *Greenwell & Greenwell 19369* (BISH).

MOLLUGINACEAE

Mollugo L.

Mollugo cerviana (L.) Ser.

A weed of warm temperate and tropical regions, which may be native to the Old World. In Hawai'i, it has been found only on Hawai'i Island, where it apparently is recently naturalized in dry sites at low elevation. This is the first report of the family in Hawai'i.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: South Kohala Dist, along Ka'ahumanu Highway E of Waikoloa junction, 1975, *Herbst & Ishikawa 5386* (BISH).

MYRSINACEAE

Myrsine L.

A distinctive new species of *Myrsine* from West Maui came to our attention as we prepared the treatment of this genus for the *Manual*. The single early collection of this species had been determined as *Myrsine rockii* (Degener & Hosaka) Hosaka [= *M. punctata* (H. Lév.) Wilbur], from Kaua'i, which differs from the new species, *M. vaccinioides*, in that the leaves lack conspicuous secretory lines, the flowers are 2–6 per fascicle, and drupes ca. 7–8 mm in diameter.

Myrsine vaccinioides is probably most closely related to the widespread wet forest species *M. sandwicensis* A. DC, and differs primarily in its prominent secretory lines on the lower surface of the leaves, serrulate leaf margin, and fewer flowers per fascicle.

Myrsine vaccinioides W.L. Wagner, Herbst & Sohmer, **sp. nov.** TYPE: HAWAIIAN IS: MAUI: Pu'ukukui Trail, in open bogs around Violet Lake, 1,500 m, 11.XII.1980, *R. Hobdy 958* (BISH-447238!, holotype).

Foliis anguste obovatis varie oblongo-obovatis 1–2 cm longis 0.6–1 cm latis infra plerumque cum lineis secretoriis longis elevatis conspicuis plerumque rubrubri-purpureis marginibus serrulatis et in parte ⅓–¼ supra revolutis, drupis 8–9.5 mm diametro.

Small branched shrubs 0.3–1 m tall; branches brown to reddish brown, glabrous. Leaves coriaceous, narrowly obovate to oblong-obovate, 1–2 cm long, 0.6–1 cm wide, midrib prominent, lower surface usually with conspicuous long, raised, usually reddish purple secretory lines, glabrous, both surfaces black punctate, margins entire, becoming serrulate in upper ⅓–¼, revolute, apex rounded, base cuneate, petioles 1–2 mm long. Flowers apparently perfect, 1–2 in bracteolate fascicles among or just below the leaves, pedicels 2.5–6 mm long, glabrous; calyx lobes 1–1.3 mm long, margins sparsely ciliate; petals linear-oblanceolate, ca. 3.5 mm long, the inner surface with conspicuously raised, reddish secretory lines, margins ciliate; anthers ca. 1.5–1.6 mm long, apex nearly glabrous; ovary glabrous; stigma capitate-angled. Drupes purplish black, subglobose, 8–9.5 mm in diameter.

Distribution. Restricted but not uncommon in shrubby bogs, 1,520–1,525 m, near Violet Lake, Pu'ukukui, W Maui.

Specimens examined. HAWAIIAN IS: MAUI: W Maui, Pu'ukukui, open bog, 1,500 m, *Wilbur & Webster 901* (BISH); *Hobdy 2128* (BISH).

This distinctive species is unique in having raised reddish purple secretory lines on the lower leaf surface.

MYRTACEAE[6]

Metrosideros Banks ex Gaertn.

Metrosideros polymorpha Gaud. var. ***dieteri*** J. Wyndham Dawson & Stemmermann, **var. nov.** TYPE: HAWAIIAN IS: KAUA'I: Hanalei Dist, Kalalau Lookout, Kōke'e National Park, 4.VI.1983, *Dawson s.n.* (BISH, holotype).

Arbores parvae sunt, cortie asperi, gemmis 2–3 cm longis et 2 cm latis, foliis glabris 4–6 cm longis et 3–4 cm latis obovatis cum nervis jugatis compluribus elevatis ex basi radiatis apice late rotundatis basi cuneata varie rotundata marginibus non revolutis, floribus rubris, staminibus 20–25 mm longis, fructibus 6.5–7 mm latis 5.5–6 mm altis, capsulis paulum exsertis.

Small trees to 7 m tall, bark fissured, flaky; branchlets obscurely 4-angled, vegetative buds unusually large, obovoid, 2–3 cm long, 2 cm wide, scales red, broadly ovate to almost orbicular, sometimes emarginate, fimbriate, 1.5–2.5 cm long, 1–1.5 cm wide. Leaves broadly obovate to oblong, 4–6 cm long, 3–4 cm wide, glabrous, apex broadly rounded, base cuneate to rounded, lowermost 2–3 pairs of secondary veins raised and prominent, radiating from the base of the lamina, petiole 6–10 mm long, 2–3 mm wide. Flowers red; inflorescences of 3–4 pairs of cymules with a dense, woolly, white to pale gray pubescence on all external parts, peduncles 5–18 mm long, 2–3 mm wide, pedicels 2–3 mm long, 2 mm wide, bracts ovate to almost orbicular, 6–10 mm long, 4–6 mm wide; hypanthium 6–7 mm high, 7–8 mm wide; sepals triangular, acute, 3.5–4 mm high, 2.5–3 mm wide; petals ± orbicular, 3.5–5 mm long, 3–4.5 mm wide; stamens 20–25 mm long; style 25–30 mm long. Fruiting hypanthium pubescent, 5.5–6 mm long, 6.5–7 mm wide, capsules only slightly exserted.

Distribution. Occasional on slopes, 800–1,200 m, at Kōke'e State Park to the Alaka'i Swamp and near Wahiawa Bog, Kaua'i.

The broadly obovate leaves with raised basal secondary veins and large vegetative buds and flowers make this a handsome as well as distinctive variety.

Metrosideros polymorpha Gaud. var. ***pumila*** (A. Heller) J. Wyndham Dawson & Stemmermann, **comb. et stat. nov.** *Nania pumila* A. Heller, Minnesota Bot. Stud. 1: 864. 1897. TYPE: HAWAIIAN IS: KAUA'I: in the bog at the head of the Wahiawa Riv, 914 m, 1896, *A.A. Heller 2738* (MINN, holotype; fragment of this collection BISH!, but it is not known from which duplicate Rock took it, perhaps the B sheet).

This variety, known as *lehua maka noe*, *lehua ne'ene'e*, or *lehua nene'e*, comprises shrubs growing in bogs, prostrate and rooting or with few to numerous ascending branches up to 1 m long, bark separating in thin flakes, leaves glabrous on lower surface with a woolly or appressed tomentum, broadly ovate to orbicular, apex rounded to obtuse, base obtuse to cordate, and margins slightly revolute.

Distribution. Variety *pumila* grows in the bogs of Kaua'i, Moloka'i, and Maui.

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[6] Contributed by John W. Dawson, Botany Department, Victoria University of Wellington, Private Bag, Wellington, New Zealand, and Lani Stemmermann, P.O. Box 308, Volcano, Hawai'i 96785, USA.

Metrosideros waialealae (Rock) Rock var. ***fauriei*** (H. Lév) J. Wyndham Dawson & Stemmermann, **comb. nov.** *Nania* × *fauriei* H. Lév., Repert Spec. Nov. Regni Veg. 10:150. 1911. *Metrosideros collina* (J.R. Forster & G. Forster) A. Gray subsp. *polymorpha* (Gaud.) Rock var. *fauriei* (H. Lév.) Rock, Hawaii, Board Agric. Forest. Bot. Bull. 4: 67. 1917. TYPE: HAWAIIAN IS: MOLOKA'I: Kamalō, 1910, *U. Faurie s.n.* (P, holotype; BM, isotype).

This variety is distinguished from var. *waialealae* by its usually longer and more slender petioles 1–1.5(–2) mm wide and narrower bracts ca. 3 mm long and 1 mm wide. By contrast, var. *waialealae* has petioles 2–3 mm wide and bracts ca. 4 mm long and 3 mm wide; it occurs on Kaua'i. Variety *fauriei* occurs on ridges at higher elevations on Moloka'i and Lāna'i.

OCHNACEAE

Sauvagesia L.

Sauvagesia erecta L.

This small herb may possibly be native to Africa, but it is now naturalized throughout the tropics. In Hawai'i, it apparently has only recently become naturalized and presently is found in pastures and along roadsides, 425 m, near Keōpuka Loa, Moloka'i.

Representative specimen examined. HAWAIIAN IS: MOLOKA'I: Keōpuka Loa, Kalepa Rd, a weed along the rough dirt pasture road, 1985, *Hobdy 2424* (BISH).

POLYGONACEAE

Polygonum L.

Polygonum convolvulus L.

Native to Europe and western Asia, this plant is now widely naturalized throughout tropical and temperate regions of the Northern Hemisphere. In Hawai'i it is known from a single previously unreported collection made in a horse pasture, Haleakalā National Park. We are not certain of the present status of this species.

Specimen examined. HAWAIIAN IS: MAUI: Makawao Dist, Haleakalā National Park, on barren, disturbed ground in a horse pasture, 2,070 m, 1981, *Nagata s.n.* (BISH).

RUBIACEAE

Galium L.

Galium divaricatum Pourr. ex Lam.

This species, which is native to southern Europe, apparently is recently naturalized at least in the Waihou Springs area of East Maui.

Specimen examined. HAWAIIAN IS: MAUI: Makawao Dist, Waihou Spring, growing on a damp cliff face, 970 m, 1981, *Hobdy 1087* (BISH).

Hedyotis L.

Hedyotis is a heterogeneous genus of more than 250 species, primarily of tropical and subtropical regions of the world, but best developed in the Old World. Generic delimitation is problematic on a worldwide basis, and several segregate genera are sometimes recognized. The Pacific taxa can be subdivided into several subgenera and sections. The treatment followed by us for the Hawaiian species is adapted from Fosberg (1943), except for the addition of sect. *Phyllozygia*, which is described here, and the reduction of the genus *Gouldia* to a section within *Hedyotis*. The Hawaiian species appear to be the result of 1 or perhaps 2 independent introductions.

The reduction of *Gouldia* is made because of the common ancestry with *Hedyotis* sect. *Gouldiopsis*, which was discussed by Fosberg (1943), and because these species differ from *Hedyotis* only in having indehiscent capsules, a fleshy hypanthium, and a trend toward a more arborescent habit. All of these features, except arborescence, were already known to occur in *Hedyotis*.

Furthermore, the most important consideration in the classification proposed here is its overall consistency. Previous classifications (Fosberg 1937b, 1943) have recognized the readily distinguishable group of *Gouldia* species at the generic level, while the equally distinguishable groups of *Hedyotis* species have been treated at infrageneric ranks. Our principal argument with this is that all of these groups of related species are readily distinguishable even at a distance in the field and should be recognized at a similar taxonomic level. It is not consistent to treat one of them at a higher level. This is especially inconsistent when the group segregated, in this case *Gouldia*, is clearly related to one of the taxa within the other heterogeneous group (*Hedyotis*). The classification proposed here is confirmed as more appropriate cladistically in that if *Gouldia* is recognized at the generic level while at the same time retaining related taxa at infrageneric ranking in *Hedyotis*, then the thus constituted genus *Hedyotis* is a paraphyletic group.

The question of the appropriate hierarchical level for the taxa treated here at infrageneric rank remains open and must be addressed by more detailed study of *Hedyotis sensu lato* and related taxa on a worldwide basis. With current information, an equally acceptable treatment of the taxa in Hawai'i would be to divide them among at least four genera. We find this idea less desirable because it would require more extensive nomenclatural innovation without a firm basis on detailed analysis. We have selected the less disruptive , but consistent, classification by reducing *Gouldia* to sectional status adjacent to its sister group in *Hedyotis* and by describing the new species as a related section of *Hedyotis*.

The key to the sections and subgenera presented below indicates the diagnostic features differentiating them. Following the synoptical key is a summary of the 4 fleshy-fruited species here added to *Hedyotis*.

Synoptical Key to the Subgenera and Sections of *Hedyotis* in Hawai'i

1. Slender annual or perennial herbs; peduncles filiform; corolla thin, broadly tubular; capsules thinly cartilaginous; naturalized species [subg. *Oldenlandia* (L.) Fosb.]
    H. callitrichoides (Griseb.) W. Lewis   *H. corymbosa* (L.) Lam.

1. Erect to scandent subshrubs, shrubs, or lianas, sometimes trees or succulent perennial herbs; pedicels not filiform; corolla fleshy or (in *H. acuminata*) not or only slightly fleshy, salverform to salverform-funnelform or urceolate; capsules sclerified or surrounded by fleshy hypanthium; native species 2

2(1). Peduncles adnate to stem at base or nearly throughout its length; flowers 1(–7), in axillary inflorescences; capsules woody [subg. *Kadua* (Cham. & Schlechtend.) Fosb.]
    H. acuminata (Cham. & Schlechtend.) Steud.   *H. fluviatilis* (C. Forbes) Fosb.

2. Peduncles distinct; flowers often more than 5, in terminal or terminal and axillary inflorescences; capsules dry or fleshy (subg. *Polynesiotis* Fosb.) 3

3(2). Fruit a drupaceous indehiscent capsule, surrounded by fleshy hypanthium, dark blue to purplish black 4

3. Fruit a dry or thinly fleshy capsule, dehiscent at least at apex, partially surrounded by very thinly fleshy or dry hypanthium, greenish brown to purple 5

4(3). Leaves with spreading, strongly to moderately arcuate lateral veins; stipules adnate to petioles only at base; flowers in terminal inflorescences or, if lateral, on short branches terminated by an inflorescence; corolla basically fusiform in bud, the limb gradually expanded, weakly quadrangular, the lobes linear to oblong, each with a terminal fleshy appendage—sect. *Gouldia* (A. Gray) W.L. Wagner & Herbst

H. fosbergii
H. hillebrandii
H. terminalis

4. Leaves with strongly ascending, weakly arcuate lateral veins; stipules completely adnate to petioles; flowers in axillary congested thyrses; corolla limb abruptly expanded from tube in bud, strongly quadrangular, the lobes broadly ovate, with a minute terminal appendage—sect. *Phyllozygia* W.L. Wagner & Herbst

H. tryblium

5(3). Corolla lobes conspicuously inflexed in bud, apex of bud depressed 6

5. Corolla lobes not conspicuously inflexed in bud, apex of bud not depressed 7

6(5). Calyx lobes usually foliaceous, conspicuous in fruit; corolla limb not quadrangular in bud; upper part of plant and inflorescence sometimes strongly glaucous; capsules nearly as wide or wider than long—sect. *Wiegmannia* (Meyen) Fosb.

H. cookiana (Cham. & Schlechtend.) Steud.
H. degeneri Fosb.
H. elatior (H. Mann) Fosb.
H. foliosa (Hillebr.) Fosb.
H. littoralis (Hillebr.) Fosb.
H. mannii Fosb.
H. parvula (A. Gray) Fosb.
H. st.-johnii Stone & Lane
H. schlechtendahliana Steud.

6. Calyx lobes small, deltate, not enlarging in fruit; corolla limb quadrangular in bud; upper part of plant and inflorescence not noticeably glaucous; capsules longer than wide—sect. *Protokadua* Fosb.

H. coriacea Sm.

7(5). Corolla limb not strongly quadrangular in bud; capsules much longer than wide—sect. *Bikkiocarpa* Fosb.

H. formosa (Hillebr.) Fosb.

7. Corolla limb strongly quadrangular in bud; capsules wider than long—sect. *Gouldiopsis* Fosb.

H. centranthoides (Hook. & Arnott) Steud.
H. foggiana Fosb.
H. knudsenii (Hillebr.) Fosb.

Sect. ***Gouldia*** (A. Gray) W.L. Wagner & Herbst, **comb. et stat. nov.** *Gouldia* A. Gray, Proc. Amer. Acad. Arts 4: 310. 1860. TYPE: *Gouldia sandwicensis* A. Gray, nom. illeg. [= *Hedyotis terminalis* (Hook. & Arnott) W.L. Wagner & Herbst]

Sect. *Gouldia* is endemic to the Hawaiian Islands and consists of 3 species:

Hedyotis fosbergii W.L. Wagner & Herbst, **nom. nov.** *Gouldia st.-johnii* Fosb., Bernice P. Bishop Mus. Bull. 147: 62. 1937, non *Hedyotis st. johnii* B. Stone & Lane (1958). TYPE: HAWAIIAN IS: O'AHU: 'Ewa Dist, Ko'olau Mts, Waipi'o, ridge S of Kīpapa Gulch, rain forest, 750 m, 18.IX.1932, *F.R. Fosberg 8691* (BISH-510593!, holotype).

Distribution. Occurring on windswept ridges and upper slopes in wet forest, 610–900 m, Ko'olau Mountains from Castle Trail to Pālolo, O'ahu, and 795–1,000 m, Lāna'ihale, Lāna'i.

Remarks. This species differs from *Hedyotis terminalis* primarily in its more compact habit and concave leaves with strongly impressed veins. These habit and leaf features are paralleled in species of several genera, such as *Labordia*, *Metrosideros*, and *Psychotria*, that also occur in cloudswept areas; they may represent ecotypes. In spite of its somewhat anomalous distribution on O'ahu and Lāna'i, *Hedyotis fosbergii* is maintained because it is unique in having spreading calyx lobes in addition to the features already mentioned. Plants from Lāna'i differ from O'ahu populations in having leaves usually broadest above the middle, moderately impressed veins, and inflorescences that are more open and usually more than 2 cm long, while those from O'ahu have leaves broadest at or below the middle, strongly impressed veins, and congested inflorescences usually less than 2 cm long. Apparent intergradations between *Hedyotis fosbergii* and *H. terminalis* were reported by Fosberg (1937b). These specimens are rather intermediate and may represent hybrids or more likely elements along an ecological continuum from exposed windy sites to more protected, wet forest habitats.

Hedyotis hillebrandii (Fosb.) W.L. Wagner & Herbst, **comb. nov.** *Gouldia hillebrandii* Fosb., Bernice P. Bishop Mus. Bull. 147: 59. 1937. TYPE: HAWAIIAN IS: MAUI: Makawao Dist, Haleakalā, Ha'ikū Uka Trail, 950 m, 18.VIII.1933, *F.R. Fosberg 9874* (BISH-510590!, holotype).

Gouldia axillaris Wawra, Flora 57: 297. 1874, non *Hedyotis axillaris* Thwaites (1859). TYPE: HAWAIIAN IS: MAUI: "Mailukuthal" [according to Fosberg (1937b, p. 77) probably Wailuku Val], *H. Wawra 1849* (W).

Distribution. Occurring in mesic to wet forest, 400–1,830 m, on Moloka'i, Maui, and Hawai'i.

Remarks. Fosberg (1937b) treated plants with terminal and axillary inflorescences as hybrids between *Hedyotis hillebrandii* and *H. terminalis* (as *Gouldia*). It is more likely, however, that these plants, which occur widely on Hawai'i and Maui, merely represent the expression of terminal and axillary inflorescences, a feature not at all uncommon in Rubiaceae and many other flowering plants. In other features these plants are not atypical. In fact, *H. hillebrandii* is so closely related to *H. terminalis* that detailed population studies using chemical, morphological, and possibly cytological markers should be made to determine whether the hybridization hypothesis is valid.

Hedyotis terminalis (Hook. & Arnott) W.L. Wagner & Herbst, **comb. nov.** *Petesia? terminalis* Hook. & Arnott, Bot. Beechey Voy. 85. 1832. TYPE: HAWAIIAN IS: O'AHU: Ko'olau Range, 1826–27, *G.T. Lay & A. Collie s.n.* (K, holotype, BISH photo). *Gouldia terminalis* (Hook. & Arnott) Hillebr., Fl. Hawaiian Isl. 169. 1888.

Kadua? affinis DC, Prodr. 4: 431. 1830. TYPE: HAWAIIAN IS: O'AHU: Without further locality, 1816–17, *L.C.A. von Chamisso s.n.* (G-DC, holotype). *Gouldia affinis* (DC) Wilbur, Pacific Sci. 17: 423. 1963, non *Hedyotis affinis* Roem. & Schult. (1818) nec Wight & Arnott (1834).

Distribution. Occurring in mesic to wet forest, sometimes bogs or mesic shrubland, 260–2,040 m, on all of the main islands except Ni'ihau and Kaho'olawe.

Remarks. *Hedyotis terminalis* is probably the most polymorphic species among Hawaiian flowering plants. The variations involve virtually every part of the plant. Fosberg (1937b) described many new varieties and forms (in *Gouldia*), recognizing a total of 85 infraspecific taxa. While many of the variants within *H. terminalis* are distinctive and probably merit formal recognition, sorting out these entities within this polymorphic complex is beyond the scope of this treatment. Fosberg also recognized, without additional detailed study, intermediates between a great number of his described entities, suggesting that rampant hybridization was the cause of the extensive, nearly continuous intergradation between the taxa. A considerable number of his entities appear to represent artificial partitionings of a rather continuous variation pattern, particularly those based on leaf size and shape, pubescence, and size of inflorescence. The process of formally describing each end point in the overall variation pattern forces the recognition of the connecting phenotypes as hybrids.

The biological basis of variation in *Hedyotis terminalis* would be intriguing to study. The study of population variation and sympatric occurrences of different morphological entities should be emphasized. Morphological studies should be correlated with cytological and perhaps chemical data as well as detailed study of the breeding system. Such a study appears to be the only reasonable way to achieve an improved taxonomy of this complex. For this reason, *H. terminalis* is treated here without further subdivision.

Skottsberg (1953) reports an apparent aneuploid series of high chromosome numbers, predominantly from Maui collections of this complex. These reports may be unreliable—especially since many of the reports for other groups in Skottsberg's paper have proved to be incorrect, possibly as a result of difficulties with cytoplasmic staining due to secondary compounds present in many Rubiaceae. It is possible, however, that *Hedyotis* sect. *Gouldia* is an aneuploid complex; therefore, Skottsberg's reports should be confirmed and greatly elaborated. Cytological variation such as this could help to explain the tremendous variation in *Hedyotis terminalis*. Skottsberg (1944) also suggested that *Hedyotis* sect. *Gouldia* species are apomictic, based on his observation of a great number of stigmas in fully mature expanded flowers that never had pollen on them and yet produced fruit with numerous ripe seeds. He also commented on Wawra's observation (1874) that short-styled flowers, which Skottsberg regarded as staminate, also produced fruit. This observation would help to explain the sympatric occurrence of different forms of *H. terminalis*, but should be verified by a detailed examination of each step in the fertilization process.

In summary, due to the lack of biological information on this complex and the as-yet-unconfirmed possibility of chromosomal variation and apomixis, we are treating *Hedyotis terminalis* in the broad sense without further subdividing it at this time.

Sect. ***Phyllozygia*** W.L. Wagner & Herbst, **sect. nov.** TYPE: *Hedyotis tryblium* Herbst & W.L. Wagner.

Frutices scandenti sunt, nervis lateralibus valde adscendentibus illis minoribus obscuris, stipulis membranaceis omnino cum petiolis connatis cupulatis 25–40 mm altis, fructibus drupaceis.

The distinctive specialized monotypic sect. *Phyllozygia* forms a connecting phylogenetic link between the species of *Hedyotis* sect. *Gouldiopsis* and *Hedyotis* sect. *Gouldia*. The distinctive venation pattern, corolla morphology in bud, breeding system, and adnate stipules are shared with *Hedyotis* sect. *Gouldiopsis*, whereas the fleshy hypanthium is shared with sect. *Gouldia*. The section is additionally characterized by its unique habit of long, arcuate, sparingly branched stems that sometimes root along their length.

Hedyotis tryblium Herbst & W.L. Wagner, **sp. nov.** TYPE: HAWAIIAN IS: KAUA'I: Mt Kāhili, 860 m, 18.X.1972, *D.R. Herbst 2834* (BISH-500000!, holotype; isotypes to be distributed).

Frutices scandenti sunt, foliis supra viridibus infra pallide viridibus et cum areis purpureis vel badio-purpureis nervis lateralibus valde adscendentibus illis minoribus obscuris, petiolis supra sulcatis, stipulis membranaceis omnino cum petiolis connatis cupulatis 25–40 mm altis, floribus in thyrsis axillaribus densis, limbo corollae in gemma subito expanso valde quadrangulari lobis cum appendice terminali minuto, fructibus drupaceis.

Glabrous, scandent shrubs; stems sometimes rooting where in contact with ground, up to 5 m long, few-branched, arcuate. Leaves green on upper surface, lower surface pale green and irregularly marked with purple or brownish purple areas, coriaceous, oblong-elliptic to elliptic or narrowly elliptic, slightly asymmetrical, 13–22 cm long, 3–7.5 cm wide, lateral veins strongly ascending, only slightly arcuate, higher order venation obscure, evident veins few, glabrous, apex long-acuminate or sometimes attenuate, base cuneate or sometimes attenuate, petioles 1.8–5.5 cm long, upper surface ragged, appearing grooved as a result of the stipular scars, stipules membranous, completely adnate to petioles to form a cup 25–40 mm high that collects water and debris, quickly becoming ripped along petiole margins as stem and leaves elongate, caducous by second or third node, apex abruptly acuminate, prolonged into a thinly fleshy mucro 7–9 mm long. Flowers heterostylous, apparently perfect or functionally pistillate, in dense, axillary thyrses, peduncles 1–12 mm long, pedicels 1–2 mm long, bracts connate, ovate, 6–10 mm long; hypanthium turbinate, 1.5–2 mm long; calyx lobes ovate, 2–3 mm long, margins fimbriolate; corolla yellowish green, the tube tinged reddish purple, fleshy, funnelform, slightly dimorphic, those of short-styled flowers bulging at the throat due to underlying anthers, those of long-styled flowers scarcely bulging, the tube 6.5–9 mm long, the limb abruptly expanded from tube in bud, strongly quadrangular, the lobes broadly ovate, 2.5–3 mm long, apex with a minute appendage; anthers fertile in short-styled flowers, sterile in long-styled flowers; style glabrous, 2-lobed, the lobes firmly appressed together in short-styled flowers, exserted and spreading in long-styled flowers. Fruit drupaceous, subglobose, 4–5 mm in diameter when dry, indehiscent. Seeds dark brown, irregularly shaped, minutely papillose.

Distribution. Rare on steep slopes of the windward (eastern) and less commonly leeward side of Mount Kāhili, in Wahiawa drainage, and 1 population just below upper rim of Kalalau Valley, Kaua'i.

Specimens examined. HAWAIIAN IS: KAUA'I: Hanalei Dist, Kōke'e State Park, along Hwy 550 near mile marker 18.3 in Kalalau Val, ca. 10 m below road, *Flynn 1234* (BISH, PTBG), *Wagner et al. 5700* (BISH); Waimea Dist, Mt Kāhili, 860 m, *Herbst 2483* (BISH), *Wagner et al. 5387* (BISH); Wahiawa drainage, *Perlman 491* (BISH), *Wagner et al. 6014* (BISH).

Remarks. The description of the breeding system of *Hedyotis tryblium* is based on examination of 2 collections and a field observation. The type (*Herbst 2834*) has long-styled flowers represented by small anthers that contain abortive pollen (stainability 0%). The population represented by *Flynn 1234* and *Wagner et al. 5700* has short-styled flowers with plump anthers and fertile pollen (stainability 80%) that is shed before corollas open, much of it falling on the short style, as well as some long-styled flowers. The latter observation was confirmed in a field study of this population by Wagner and Flynn. *Flynn 1234* has one apparently mature fruit; however, it is not known from which type of flower it developed.

Mitracarpus Zucc.

Mitracarpus hirtus (L.) DC

This species is native to the Neotropics. In Hawai'i it was recently discovered naturalized in disturbed mesic sites near Hilo.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: South Hilo Dist, Kaūmana Substation, 320 m, 1982, *Wagner & Stemmermann 4631* (BISH).

Spermacoce L.

Spermacoce mauritiana Gideon

This species, native to Africa and Malesia, is now widely naturalized in the Pacific Basin and Central and South America. Fosberg (pers. comm. 1988), however, indicates that the native range is Africa and the Neotropics. In Hawai'i it is naturalized in relatively dry areas on Hawai'i Island, although previously unreported.

Spermacoce mauritiana differs from the common *S. assurgens* Ruiz & Pav. [*Borreria laevis* sensu auct., non (Lam.) Griseb.] in its shorter hypanthium (ca. 0.5 mm long) and corolla (0.6–0.7 mm long), and its compressed, oblong fruit. *Spermacoce assurgens* has a hypanthium 2–2.5 mm long, corolla 2.4–2.6 mm long, and fruit ellipsoid or obovoid-fusiform.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: Puna Dist, Kea'au, weed of a macadamia orchard, 1973, *Oaka s.n.* (BISH).

SCROPHULARIACEAE

Buchnera L.

Buchnera pusilla Kunth

This species, which is native from Mexico to South America, appears recently to have become naturalized in Puna, Hawai'i.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: Puna Dist, Halekamahina, on a grassy roadside S of Lava Tree State Park at 180 m elevation, 1987, *Imada & Takeuchi 1001* (BISH).

Cymbalaria J. Hill

Cymbalaria muralis Gaertn.

This species is native from the southern Alps to Italy. In Hawai'i, it was first collected in 1986 and presently is known from a single gulch on Maui. Apparently it is very recently naturalized.

Specimen examined. HAWAIIAN IS: MAUI: Makawao Dist, Olinda, in gulch E of Pi'iholo Rd, 790–950 m, 1986, *Hobdy 2549* (BISH).

Dopatrium F. Ham. ex Benth.

Dopatrium junceum (Roxb.) F. Ham. ex Benth.

Native to Asia and Australia, in Hawai'i this species is naturalized near sea level in and around the taro paddies of Hanalei and Hanapēpē valleys, Kaua'i, although not previously reported.

Specimen examined. HAWAIIAN IS: KAUA'I: Hanalei Dist, U.S. Fish and Wildlife Reservation, Hanalei Val, in and around taro patches, 1977, *Herbst 5950* (BISH).

Lindernia All.

Lindernia antipoda (L.) Alston

This species is native from India to Asia and Malesia. In Hawai'i, it was recently found naturalized in Waipi'o Valley, Hawai'i.

Specimen examined. HAWAIIAN IS: HAWAI'I: Hāmākua Dist, in a muddy ditch on the floor of Waipi'o Val, 1987, *Stemmermann & Luce 7172* (BISH).

Parentucellia Viv.

Parentucellia viscosa (L.) Caruel

Native to the Mediterranean area, in Hawai'i this species appears recently to have become sparingly naturalized in the pastures of Kahuku and Kūka'iau ranches on Hawai'i Island.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: Ka'ū Dist, Kahuku Ranch, in pastures along the road to the Nēnē Cabin, ca. 1,520 m, 1971, *St. John 26828* (BISH).

SOLANACEAE

We thank David E. Symon for the identification or verification of the three species of *Solanum* treated below.

Solanum L.

Solanum aviculare G. Forster

Although unreported in the local literature, this species was first collected on Lāna'i in 1955, where it is naturalized. It is native to New Guinea, eastern Australia, and New Zealand, and is occasionally cultivated as an ornamental or novelty elsewhere; it has become naturalized in a number of localities, such as on the mainland United States and in New Caledonia. More recently, it has been cultivated as a source of solasodine, from which cortico-steroid drugs are manufactured.

Representative specimen examined. HAWAIIAN IS: LĀNA'I: Kalulu, at the edge of the forest at the junction of Kaiholena and the main ridge, 1955, *Sakimura s.n.* (BISH).

Solanum nigrescens Mart. & Galeotti

This plant is native to North, Central, and South America, where it is a widespread and extremely variable species. In Hawai'i it is known only from the saddle between Mauna Loa and Mauna Kea, Hawai'i Island, where it was first collected in 1982. The determination of this species is tentative, as sure identification is difficult. It can be distinguished from *S. americanum* Mill., with which it is often confused, by its drab rather than glossy berries, forked and shortly racemose rather than subumbelliform inflorescences, and greater amount of pubescence. The only known collection of *S. nigrescens* was that made in 1982 (*Symon s.n.*, AD); we have not seen the specimen.

Solanum robustum Wendl.

This South American native is widely grown in botanical gardens, and occasionally as an ornamental for its attractive foliage and winged petioles and stems. In Hawai'i, it is found naturalized only in the guava-infested cattle pastures of Kailua Gulch, Maui, but has not previously been reported.

Representative specimen examined. HAWAIIAN IS: MAUI: Makawao Dist, Kailua Gulch, 230 m elevation, growing under guava trees in a heavily grazed pasture, 1977, *Hobdy 288* (BISH).

THYMELAEACEAE

Wikstroemia Endl.[7]

Wikstroemia oahuensis (A. Gray) Rock, Indig. trees Haw. Isl. 316. 1913. *Wikstroemia foetida* (L. fil.) A. Gray var.? *oahuensis* A. Gray, J. Bot. 3: 303. 1865. TYPE: HAWAIIAN IS: O'AHU: 1851–55, *J. Rémy 223* (GH!, lectotype, designated by Heller, Minnesota Bot. Stud. 1: 860. 1897; NY, P, isolectotype).

Wikstroemia oahuensis is a polymorphic species. The morphological extremes look quite different, and several have been recognized as distinct species. However, as they are interconnected by a series of intermediate forms, it is impossible to keep any of them as segregate species or even as infraspecific taxa, except for the Kaua'i population. That population is here recognized at the varietal level. *Wikstroemia oahuensis* can be divided into two varieties:

Wikstroemia oahuensis (A. Gray) Rock var. ***oahuensis***

Variety ***oahuensis*** is a low shrub or a slender or robust tree up to 4 m tall.

Distribution. This variety is found at higher elevations on Kaua'i, O'ahu, Moloka'i, Lāna'i, and Maui.

Wikstroemia oahuensis (A. Gray) Rock var. ***palustris*** (Hochr.) Peterson, **comb. et stat. nov.** *Wikstroemia palustris* Hochr., Candollea 2: 442. 1925. TYPE: HAWAIIAN IS: KAUA'I: Waimea Dist, clairière toubière de Lihuemakanoi, au-dessus de Weimea, non loin du cottage Gay, alt. 400 m, 1905, *B.P.G. Hochreutiner 3582* (G, holotype; Z, isotype).

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[7] Contributed by Bo Peterson, Botanical Museum, University of Göteborg, S–413 19 Göteborg, Sweden.

Wikstroemia palustris Hochr. var. *palustris* f. *hirtella* Skottsb., Acta Regiae Soc. Litt. Gothob., Bot. 1: 85. 1972. TYPE: HAWAIIAN IS: KAUA'I: Waimea Dist, Alaka'i Bog near Kilohana, alt. 1,220 m, 1938, *L.M. Cranwell et al. 2876a* (GB!, holotype; BISH!, S!, isotypes).

Wikstroemia palustris Hochr. var. *major* Skottsb. f. *oblonga* Skottsb., Acta Regiae Soc. Litt. Gothob., Bot. 1: 91. 1972. TYPE: HAWAIIAN IS: KAUA'I: Waimea Dist, W rim of Kalalau Val, in open woods, 1960, *O. Degener et al. 27131* (S!, holotype; BISH!, S!, isotypes).

Variety ***palustris*** is a densely foliaceous shrub or dwarf tree up to 1 m tall; the common bog form.

Distribution. This variety is restricted to Kaua'i.

VIOLACEAE

Viola L.

Viola chamissoniana Ging., Linnaea 1: 408. 1826. TYPE: HAWAIIAN IS: O'AHU: 1817, *L.C.A. von Chamisso s.n.* (LE, holotype, photo BISH!; B, K, isotypes).

The segregation of populations into *V. chamissoniana*, *V. tracheliifolia*, and *V. robusta*, here treated as one species, appears to have been based on minor morphological and ecological trends rather than discontinuities between population series. Careful comparison is needed of populations on each island along the ecological gradient from mesic to wet habitats. Three modally distinct subspecies are here recognized.

Viola chamissoniana Ging. subsp. ***chamissoniana***

Viola helioscopia Hillebr., Fl. Hawaiian Isl. 17. 1888. TYPE: HAWAIIAN IS: O'AHU: Wai'anae Dist, Mākaha, on dry open ridges, 1851–71, *W. Hillebrand (& J. Lydgate?) s.n.* (B, holotype, presumably destroyed, fragment BISH!; K, isotype).

Subspecies ***chamissoniana*** is a small, branched plant with leaves ca. 2–4 cm long, with a rounded to broadly rounded-cuneate base, and with petioles usually less than 1 cm long. It has 1–2 flowers per peduncle.

Distribution. This rare plant grows on dry cliff sites in the Wai'anae Mountains, O'ahu.

Viola chamissoniana Ging. subsp. ***robusta*** (Hillebr.) W.L. Wagner, Herbst & Sohmer, **comb. et stat. nov.** *Viola robusta* Hillebr., Fl. Hawaiian Isl. 16. 1888. TYPE: HAWAIIAN IS: MOLOKA'I: Kala'e, Kamalō, in boggy clearings on heights, 760 m, 1851–71, *W. Hillebrand s.n.* (B, holotype, presumably destroyed, photo BISH!; K, isotype).

Subspecies ***robusta*** has few lateral branches and has leaves 6–12 cm long with a truncate to broadly cuneate base, and with petioles 2–5 cm long. It usually has more than 1 flower per peduncle.

Distribution. This subspecies grows in wet forests on Moloka'i.

Viola chamissoniana Ging. subsp. ***tracheliifolia*** (Ging.) W.L. Wagner, Herbst & Sohmer, **comb. et stat. nov.** *Viola tracheliifolia* Ging., Linnaea 1: 409. 1826. *Viola chamissoniana* Ging. var. *tracheliifolia* (Ging.) Wawra, Flora 56: 174. 1873. TYPE: HAWAIIAN IS: O'AHU: 1817, *L.C.A. von Chamisso s.n.* (LE, holotype, photo BISH!).

Viola chamissoniana Ging. var. *olokelensis* Skottsb., Acta Horti Gothob. 2: 250. 1926. *Viola tracheliifolia* Ging. var. *olokelensis* (Skottsb.) Skottsb., Acta Horti Gothob. 13: 496. 1940. TYPE: HAWAIIAN IS: KAUA'I: Waimea Dist, Olokele Canyon, on steep rock wall among shrubs, 1922, *C. Skottsberg 1047* (GB, holotype; BISH!, S, isotypes).

Viola robusta Hillebr. var. *mauiensis* Rock, Coll. Hawaii Publ. Bull. 1: 6. 1911. TYPE: HAWAIIAN IS:

MAUI: Makawao Dist, Haleakalā, gulches above Makawao, 1,065 m, 1910, *J.F. Rock 8563* (BISH-522374!, lectotype, designated by Skottsberg, Acta Horti Gothob. 13: 493. 1940).

Viola tracheliifolia Ging. var. *populifolia* Skottsb., Acta Horti Gothob. 13: 494. 1940. TYPE: HAWAIIAN IS: O'AHU: Ko'olau Mts, date unknown, *C. Skottsberg 87* (GB, holotype).

Viola tracheliifolia Ging. var. *tomentosa* W. Becker, Beih. Bot. Centralbl. 34: 216. 1916. *Viola tracheliifolia* Ging. f. *tomentosa* (W. Becker) Skottsb., Acta Horti Gothob. 13: 490. 1940. TYPE: HAWAIIAN IS: KAUA'I: 1853–71, *V. Knudsen s.n.* (B, holotype, presumably destroyed).

Subspecies ***tracheliifolia*** is usually somewhat branched with short lateral branches, leaves 5–29 cm long with a truncate to cordate base, and with petioles 1.5–8 cm long. It has 1 or rarely 2 flowers per peduncle.

Distribution. This subspecies is found in mesic forests on Kaua'i, O'ahu, Moloka'i, and Maui.

CYPERACEAE[8]

Carex L.

Eight species of *Carex* are native to Hawai'i; 4 of them (*C. alligata* Boott, *C. kauaiensis* R. Krauss, *C. montis-eeka* Hillebr., and *C. wahuensis* C.A. Mey.) are endemic, and the other 4 (*C. echinata* J.A. Murray [including *C. hawaiiensis* St. John and *C. svenonis* Skottsb.], *C. macloviana* Dum. d'Urv., *C. meyenii* Nees, and *C. thunbergii* Steud. [including *C. nealae* R. Krauss]) also occur outside Hawai'i. Nomenclatural changes and one new taxon are given below.

The occurrence of each of these species in Hawai'i is the result of an independent colonization event, except that *C. alligata* and *C. kauaiensis* share a single colonizing ancestor.

Carex macloviana Dum. d'Urv. subsp. ***subfusca*** (W. Boott) T. Koyama, **comb. et stat. nov.** *Carex subfusca* W. Boott in S. Wats., Bot. Calif. 2: 234. 1880. *Carex macloviana* Dum. d'Urv. var. *subfusca* (W. Boott) Kükenth., Pflanzenr. IV. 20 (Heft 38): 197. 1909. TYPE: U.S.A.: CALIFORNIA: Lake Tahoe, Bear Camp, *Kellogg s.n.* (GH, holotype).

Carex wahuensis C.A. Mey., Zap. Imp. Akad. Nauk Fiz.-Mat. Otd. 1: 218, *pl. 10.* 1831. TYPE: Habitat in montibus insulae Wahu [O'ahu], 1816–17, *L.C.A. van Chamisso s.n.* (LE, holotype).

Carex wahuensis is subdivided into 3 subspecies. These basically correspond to the 3 varieties recognized by Krauss (1950). The most distinctive is subsp. *herbstii*, which is characterized by leaves 1.5–2 mm wide, spikes 0.8–1.5 cm long and up to 5 mm wide, perigynium 1–1.5 mm wide, teeth of the beak 0.5 mm long, and achenes without a constriction on the angles. The other 2 subspecies are similar to one another in having leaves over 3 mm wide, spikes 5–10 cm long, and achenes conspicuously constricted at the angles. The unique features of subsp. *rubiginosa* are its broadly obovoid reddish brown to dark red perigynia with teeth 0.2–0.9 mm long. By contrast, the unique features of subsp. *wahuensis* are its ellipsoid to obovoid green to yellow or yellowish brown perigynia, with teeth 1–3 mm long.

Carex wahuensis C.A. Mey. subsp. ***herbstii*** T. Koyama, **subsp. nov.** TYPE: HAWAIIAN IS: O'AHU: Honolulu Dist, N side of Moanalua Val, 365 m, 11.I.1970, *D. Herbst & L.E. Bishop 1495* (BISH−76091!, holotype).

Differt a subsp. *wahuensis* omnibus partibus multo minoribus, utriculis ovoideis tantum 3.5 mm longis et 1.5 mm latis, spicis 8–15 mm longis, 5 mm latis, achaenio ad angulos non constricto.

This new subspecies is distinct from the other 2 subspecies of *C. wahuensis*, subsp. *wahuensis*

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[8] Contributed by Tetsuo Koyama, The New York Botanical Garden, Bronx, NY 10458, USA.

and subsp. *rubiginosa*, in its much smaller habit with slender culms up to 10 cm tall, narrow leaves 6–9 cm long, 1.5–2 mm wide, unisexual spikes with the terminal spike linear and staminate, and the 2 lateral ones broader, 8–15 mm long, 5 mm wide and pistillate, ellipsoid perigynium 3.5 mm long, 1–1.5 mm wide with a 1.5 mm long beak, achenes trigonous, obovoid, 2–2.2 mm long, 1.2 mm wide, not constricted on the angles, and pistillate glumes ovate, the body 2.5 mm long and the awn 1.2 mm long.

Distribution. Known only from the type.

Carex wahuensis C.A. Mey. subsp. ***rubiginosa*** (R. Krauss) T. Koyama, **comb. et stat. nov.** *Carex wahuensis* C.A. Mey. var. *rubiginosa* R. Krauss, Pacific Sci. 4: 257. 1950. TYPE: HAWAIIAN IS: HAWAI‘I: Ka‘ū Dist, Kīlauea Iki, 1,200 m, 21.XII.1931, *H. St. John, R.S. Bean & E.Y. Hosaka 11228* (BISH-501912!, holotype).

Distribution. Occurring primarily in subalpine shrubland and dry forest or shrubland, 510–2,500 m, on Maui and Hawai‘i; also a few specimens from scattered mesic sites, ca. 240–600 m, on Kaua‘i, O‘ahu, and Lāna‘i.

Remarks. The few collections referred to subsp. *rubiginosa* from Kaua‘i, O‘ahu, and Lāna‘i are atypical in occurring in more mesic sites and having smaller, pale reddish brown or brown perigynia, and thus are somewhat intermediate between subsp. *rubiginosa* and subsp. *wahuensis*. The teeth of the perigynia of these specimens, however, fit the normal range of subsp. *rubiginosa*.

Carex wahuensis C.A. Mey. subsp. ***wahuensis.***

Carex wahuensis C.A. Mey. var. *meyeri* Franch. & Sav., Enum. pl. Jap. 563. 1879.

Carex nupitalis Boott, Illustrations of the Genus *Carex* 4: 175, *pl. 591.* 1867. TYPE: SANDWICH [HAWAIIAN] IS: O‘AHU: *T. Nuttall* (K, syntype); ‘Voyage de Remy’, *J. Rémy 142* (P, GH, syntypes).

Distribution. Occurring primarily in mesic forest, sometimes dry forest and mesic shrubland or mesic coastal forest, (10–)450–1,000 m, on all of the main islands except Ni‘ihau and Kaho‘olawe.

Subdivision of *Cyperus*

Cyperus L., when treated in the broad sense, is a genus of about 650 species readily recognized by its distichous arrangement of spikelet scales, and spikelets with perfect, usually numerous flowers lacking bristles. Tucker (1987) follows this broad circumscription, as do many other recent workers. When delimited in this fashion, a number of subgenera are recognized. Here a more homogeneous and narrow generic concept is employed, with the elevation of these subgenera to generic status. They are delimited mostly by features of the spikelet. Using this approach, the Hawaiian species fall into 5 genera: *Cyperus*, *Kyllinga* Rottb., *Mariscus* Vahl, *Pycreus* P. Beauv., and *Torulinium* Desv. The following key distinguishes them. A synopsis of the Hawaiian species is given after the key.

Key to *Cyperus* and Segregate Genera

1.	Rachilla not articulate, persistent on the axis of spikes	2
1.	Rachilla articulate, deciduous	3
2(1).	Achenes trigonous or rarely flattened, with 1 side facing the rachilla	***Cyperus***
2.	Achenes laterally flattened with 1 angle facing the rachilla	***Pycreus***
3(1).	Rachilla articulate at base and between flowers, breaking into segments, with winged marginal extensions that become corky and clasp the achene	***Torulinium***
3.	Rachilla articulate only at base, not breaking into segments, without winged marginal extensions	4

4(3). Stigmas 2; achenes lenticular . . . . ***Kyllinga***
4. Stigmas 3; achenes trigonous . . . . ***Mariscus***

Cyperus L.

Cyperus alternifolius L. subsp. ***flabelliformis*** (Rottb.) Kükenth.

Distribution. Native to tropical Africa, Madagascar, Mauritius, and the Mascarene Islands, often cultivated as an ornamental in greenhouses; in Hawai‘i cultivated and naturalized in marshy areas and along streams, 0–460 m, at least on Midway Atoll, Kaua‘i, O‘ahu, and Maui.

Cyperus compressus L.

Distribution. Pantropical; in Hawai‘i naturalized in disturbed, moist sites and coastal areas, 0–300 m, on Hawai‘i Island.

Cyperus difformis L.

Distribution. Native to warm temperate and tropical regions worldwide in wet places, presumably originally distributed only in the Old World; in Hawai‘i naturalized in wet sites, beach parks, urban sites, cultivated fields, and along roadsides, 0–50 m, on Kaua‘i and O‘ahu.

Cyperus esculentus L.

Distribution. Native to southern Europe, Mediterranean region, South Africa, North America, and the Andean region of South America; in Hawai‘i known from a single collection from Onomea, Hawai‘i, made in 1956 (*Collector unknown s.n.*, BISH), and perhaps no longer persisting.

Cyperus gracilis R. Br.

Distribution. Native to Australia and New Caledonia in wet, partially shaded areas; in Hawai‘i cultivated as a ground cover in shaded sites and sparingly naturalized, 0–170 m, at least on Kaua‘i, O‘ahu, and Maui.

Cyperus halpan L.

Distribution. Native to subtropical and tropical regions worldwide, common in wet places; in Hawai‘i naturalized in wet, disturbed sites, especially in bogs, wet forest, and open, muddy areas, 3–1,700 m, on Kaua‘i, Maui, and Hawai‘i.

Remarks. The epithet of this species has long been spelled “haspan”; however, Linnaeus misread the vernacular name “halpan” as “haspan.” According to ICBN Art. 73.1, this orthographic error is to be corrected.

Cyperus laevigatus L.

Distribution. Widespread in warm temperate and subtropical regions; in Hawai‘i indigenous, occurring on mud flats, sandy coastal sites, and on edges of and in fresh, brackish, and saltwater ponds, 0–10 m, on Laysan, Ni‘ihau, O‘ahu, Moloka‘i, Maui, and Hawai‘i.

Cyperus papyrus L.

Distribution. Native to eastern tropical Africa and Madagascar, now widely cultivated elsewhere as an ornamental in water gardens and greenhouses; in Hawai‘i cultivated in water gardens and sparingly naturalized at least by offshoots, at least on Kaua‘i.

Cyperus pilosus Vahl

Distribution. Native to India, southern China, Malesia, and western Japan in wet places, often by rivers and in rice fields; in Hawai'i perhaps introduced in connection with rice cultivation, but known only from a single collection from Līhu'e, Kaua'i, made in 1916 (*Forbes 481.K*, BISH).

Cyperus rotundus L.

Distribution. A cosmopolitan weed; in Hawai'i naturalized and common in disturbed areas, 0–800 m, on Kure and Midway atolls, Ni'ihau, Kaua'i, O'ahu, Lāna'i, Maui, and Hawai'i.

Cyperus trachysanthos Hook. & Arnott

Distribution. An endemic species occurring in wet sites such as margins of ponds and wet slopes, 3–160 m, on Ni'ihau, Kaua'i, O'ahu, Moloka'i, and Lāna'i. Few collections have been made in recent years.

Cyperus trinervis R. Br.

Distribution. Native to Australia; in Hawai'i known only from 3 collections from disturbed sites in wet forest, Hawai'i Volcanoes National Park, ca. 915 m, Hawai'i Island.

Cyperus virens Michx.

This species has not been previously reported from Hawai'i.

Distribution. Native from southeastern United States through tropical America southward to northern Argentina; in Hawai'i apparently recently naturalized in disturbed, wet sites, 600–1,000 m, in Waiākea and Hilo forest reserves, Hawai'i Island; not previously reported in the literature.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: Puna Dist, Ōla'a, growing in a marshy area along a cane road 2.6 mi from Mountain View, 1976, *Herbst 5815* (BISH).

Kyllinga Rottb.

Kyllinga brevifolia Rottb.

Distribution. Pantropical; in Hawai'i naturalized in disturbed areas such as gardens and lawns, roadsides, pastures, and along trails in mesic to wet forest, 20–1,220 m, on all of the main islands except Ni'ihau and Kaho'olawe.

Kyllinga nemoralis (J.R. Forster & G. Forster) Dandy ex Hutchinson & Dalziel

Distribution. Pantropical; in Hawai'i naturalized primarily in gardens and lawns, from sea level up to at least 200 m, on Kaua'i, O'ahu, Maui, and Hawai'i, but probably also on other of the main islands.

Mariscus Vahl

Mariscus congestus (Vahl) C.B. Clarke

Distribution. Native to Australia and South Africa, and now naturalized in southern Europe and Japan; in Hawai'i 2 collections from 'Ewa plain, O'ahu, were made in 1916 (*Forbes 2327.O*, *2345.O*, BISH). It is not known to have persisted.

Mariscus cyperinus (Retz.) Vahl

Distribution. A common weed of the Paleotropics, Australia, and many Pacific islands; in Hawai'i indigenous, occurring in open, grassy sites on Kaua'i, O'ahu, and Moloka'i.

Mariscus fauriei (Kükenth.) T. Koyama, **comb. nov.** *Cyperus fauriei* Kükenth., Repert. Spec. Nov. Regni Veg. 16: 431. 1920. TYPE: HAWAIIAN IS: MOLOKA'I: Kamalō, VI.1910, *U. Faurie 1276* (B, holotype; BISH 2 sheets!, isotypes).

Distribution. Apparently rare endemic occurring in dry and perhaps mesic and subalpine forest, 300–1,830 m, on Moloka'i, Lāna'i, and Hawai'i.

Mariscus hillebrandii (Boeck.) T. Koyama, **comb. nov.** *Cyperus hillebrandii* Boeck., Flora 63: 436. 1880. TYPE: HAWAIIAN IS: MAUI: S slopes of Haleakalā, 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, holotype; MEL, isotype, photo BISH!).

Two subspecies of this endemic species are recognized: (1) subsp. ***decipiens*** with leaves (3–)7–12 mm wide, as long as or longer than the culm, inflorescences relatively lax, with rays 5–18 cm long, spikelets oblong-lanceoloid, 5.5–6 mm long, and glumes pale green, but usually tinged pale reddish brown, 3–3.5 mm long; and (2) subsp. ***hillebrandii*** with leaves 3–8 mm wide, as long as or longer than the culm, inflorescences congested, with rays 1–4 cm long, spikelets ellipsoid to oblong-ellipsoid, 3–5.5 mm long, and glumes reddish brown to brown, 2.5–2.8 mm long.

Mariscus hillebrandii (Boeck.) T. Koyama subsp. ***decipiens*** (Hillebr.) T. Koyama, **comb. et stat. nov.** *Cyperus decipiens* Hillebr., Fl. Hawaiian Isl. 467. 1888. *Cyperus hillebrandii* Boeck. var. *decipiens* (Hillebr.) Kükenth., Pflanzenr. IV. 20(Heft 101, 4): 484. 1936. TYPE: HAWAIIAN IS: MAUI or MOLOKA'I: without further locality, 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, holotype).

Distribution. Occurring on ridges, gulches, and along streams, dry forest to mesic forest, 360–1,070 m, Kaua'i, Wai'anae Mountains, O'ahu, Lāna'i, and West Maui.

Mariscus hillebrandii (Boeck.) T. Koyama subsp. ***hillebrandii***

Cyperus mauiensis Hillebr., Fl. Hawaiian Isl. 469. 1888. *Cyperus hillebrandii* Boeck. var. *mauiensis* (Hillebr.) Kükenth., Pflanzenr. IV. 20(Heft 101, 4): 484. 1936. TYPE: HAWAIIAN IS: MAUI: 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, holotype).

Cyperus hillebrandii Boeck. var. *helleri* Kükenth., Pflanzenr. IV. 20(Heft 101, 4): 484. 1936. TYPE: HAWAIIAN IS: O'AHU: Nu'uanu Pali, 425 m, 1896, *A.A. Heller 2363* (B, presumably destroyed, holotype; GH, MO, NY, isotypes).

Distribution. Occurring on dry ridges, *'a'ā* lava, dry forest, subalpine forest, and sometimes mesic forest, (60–)250–1,980 m, O'ahu, Lāna'i, East Maui, and Hawai'i.

Mariscus hypochlorus (Hillebr.) C.B. Clarke

Two subspecies of this endemic species are recognized: (1) subsp. ***brevior*** with lax habit, leaves 3–7 mm wide, spikelets 6–7 mm long, usually 3–5-flowered, and glumes 3.5–4.5 mm long; and (2) subsp. ***hypochlorus*** with leaves 8–15 mm wide, spikelets 10–16 mm long, 6–8-flowered, and glumes 4.5–5.5 mm long.

Mariscus hypochlorus (Hillebr.) C.B. Clarke subsp. ***brevior*** (Kükenth.) T. Koyama, **comb. et stat. nov.** *Cyperus hypochlorus* Hillebr. var. *brevior* Kükenth., Pflanzenr. IV. 20(Heft 101, 3): 409. 1936. TYPE: HAWAIIAN IS: O'AHU: 'Ewa Dist, Wai'anae Mts, Pālehua, 25.VIII.1922, *C. Skottsberg 300* (B, presumably destroyed, holotype; BISH!, isotype).

Distribution. Occurring in mesic forest, 350–760 m, Kaua'i, O'ahu, Moloka'i, and Maui.

Mariscus hypochlorus (Hillebr.) C.B. Clarke subsp. ***hypochlorus***

Cyperus hypochlorus Hillebr. var. *densespicatus* Skottsb., Acta Horti Gothob. 15: 303. 1944. TYPE: HAWAIIAN IS: KAUA'I: Waimea Dist, Wai'alae Val near Ranger Station, 28.VIII.1938, *L.M. Cranwell, O. Selling & C. Skottsberg 2530* (S, syntype).

Distribution. Occurring in open sites in wet forest, especially waterways, occasionally mesic forest, 850–1,280 m, Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i.

Mariscus javanicus (Houtt.) Merr. & Metcalfe

Distribution. Native to tropical Africa and Asia; in Hawai'i indigenous and common in marshes and taro paddies, along streams and ditches, in coastal pastures, and on rocky coastal sites and cliffs, 0–180 m, on Midway Atoll and documented from all of the main islands except Kaho'olawe.

Mariscus kunthianus Gaud.

Distribution. A rare endemic species of wet forest on West Maui.

Mariscus meyenianus (Kunth) Nees

Distribution. Native to the Neotropics from the West Indies, Brazil and adjacent Uruguay, Paraguay, and northern Argentina; in Hawai'i naturalized in wet, disturbed sites in mesic to wet forest, especially along trails, 30–1,050 m, on Kaua'i; a single collection from Mākua Valley, O'ahu, also appears to represent this species.

Mariscus pennatiformis (Kükenth.) T. Koyama, **comb. nov.** *Cyperus pennatiformis* Kükenth. in Christoph. & Caum, Bernice P. Bishop Mus. Bull. 81: 23. 1931. TYPE: HAWAIIAN IS: MAUI: Hāna, IX.1909, *U. Faurie 1262* (presumably B, holotype; BISH!, isotype).

This endemic species is subdivided into 2 subspecies: (1) subsp. ***bryanii*** with spikelets 8–12 mm long, 3–4 mm wide, loosely 8–12-flowered, glumes grayish brown, slightly spreading, narrowly oblong, 4–5.5 mm long, 1.5–2.2 mm wide, and achenes ellipsoid, ca. 1 mm long; and (2) subsp. ***pennatiformis*** with spikelets 10–14(–20) mm long, 1.7–3.5 mm wide, densely 15–24 flowered, glumes yellowish brown, oblong-ovate, closely imbricate, 4–5 mm long, 2–2.5 mm wide, and achenes oblong, ca. 2 mm long.

Mariscus pennatiformis (Kükenth.) T. Koyama subsp. ***bryanii*** (Kükenth.) T. Koyama, **comb. et stat. nov.** *Cyperus pennatiformis* Kükenth. var. *bryanii* Kükenth. in Christoph. & Caum, Bernice P. Bishop Mus. Bull. 81: 23. 1931. TYPE: HAWAIIAN IS: LAYSAN: V.1911, *W.A. Bryan 8732* (not located, syntype); May 1911, *W.A. Bryan 8733* (BISH-502528!, syntype); 1896, *H.H. Schauinsland* (BISH!, syntype); 1902, *Snyder s.n.* (US, syntype).

Distribution. Growing between clumps of *Eragrostis variabilis*, sand dunes, northeastern Laysan; in 1980, only 12 individuals were observed by Herbst.

Mariscus pennatiformis (Kükenth.) T. Koyama subsp. ***pennatiformis***

Distribution. Rare in low-elevation grasslands, open sites such as ridges, and mesic forest, 0–1,200 m, Kaua'i, O'ahu, Maui, and Hawai'i.

Mariscus phleoides Nees ex Kunth

Two subspecies of this endemic species are recognized: (1) subsp. ***hawaiiensis*** with culms up to 90 cm tall, much longer than the leaves, inflorescences with rays up to 6 cm long and often further branched, and glumes, bracteoles, and prophylls smooth on keel and nerves; and (2) subsp. ***phleoides*** with culms 10–50 cm tall, much shorter than the leaves, inflorescences with rays 0.3–3 cm long, only rarely further branched, and glumes, bracteoles, and prophylls spinulose-scabrous on the keel and nerves.

Mariscus phleoides Nees ex Kunth subsp. ***hawaiiensis*** (H. Mann) T. Koyama, **comb. et stat. nov.** *Cyperus hawaiiensis* H. Mann, Proc. Amer. Acad. Arts 7: 208. 1868. *Cyperus phleoides* (Nees ex Kunth) Hillebr. var. *hawaiiensis* (H. Mann) Kükenth. in Hochr., Candollea 6: 424. 1936. TYPE: HAWAIIAN IS: KAUA'I: Waimea, 610–915 m, 1864–65, *H. Mann & W.T. Brigham 246* (CU, holotype).

Distribution. Occurring on bog margins and open sites or cliffs in mesic forest, (230–)490–1,100 m, on all of the main islands except Kaho'olawe and Hawai'i.

Mariscus phleoides Nees ex Kunth subsp. ***phleoides***

Distribution. Occurring in coastal sites in grasslands, on cliffs, and among rocks on beaches, Kaua'i, Moloka'i, Lāna'i, Maui, and Hawai'i.

Mariscus rockii (Kükenth.) T. Koyama, **comb. nov.** *Cyperus rockii* Kükenth., Repert Spec. Nov. Regni Veg. 16: 431. 1920. TYPE: HAWAIIAN IS: KAUA'I: Waimea Dist, swampy forest near Wai'alae Stream, 1,220 m, X.1911, *J. F. Rock 9019* (B, presumably destroyed, holotype; BISH! 3 sheets, isotypes).

Distribution. A possibly extinct endemic species known only from 4 collections from the type locality, Wai'alae Valley, ca. 1,200 m, Kaua'i.

Mariscus sandwicensis (Kükenth.) T. Koyama, **comb. nov.** *Cyperus sandwicensis* Kükenth., Repert. Spec. Nov. Regni Veg. 16: 430. 1920. TYPE: HAWAIIAN IS: MOLOKA'I: on high palis, 610 m, 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, syntype); MOLOKA'I: Makanalua, 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, syntype); O'AHU: 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, syntype); MAUI [actually KAUA'I]: summit bog, Mt Wai'ale'ale, 1,585 m, *J. F. Rock 8892* (B, presumably destroyed, BISH-117115 [not located], syntypes).

Cyperus sandwicensis Kükenth. var. *pseudo-prescottianus* Kükenth., Pflanzenr. IV. 20(Heft 101, 3): 406. 1936. TYPE: HAWAIIAN IS: O'AHU: 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, syntype); MOLOKA'I: Kala'e, pali of Makanalua, 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, syntype).

Distribution. An endemic species occurring in open wet forest on cliffs, steep slopes, and valley floors, (90–)370–1,160 m, Kaua'i, O'ahu, Moloka'i, and Maui.

Pycreus P. Beauv.

Pycreus polystachyos (Rottb.) P. Beauv.

Pycreus polystachyos is a polymorphic species, primarily with regard to the size of spikelets, the color of the glumes, and the relative contraction of the inflorescences. Two subspecies are indigenous to Hawai'i: (1) subsp. ***holosericeus*** with leaves often longer than the culm, inflorescences usually open, forming a simple or partially compound corymb, with 2–7 slender rays 2–6 cm long, spikelets pale or yellowish brown, 8–26-flowered, 5–12 mm long, 1–1.2 mm wide, and glumes yellowish brown; and (2) subsp. ***polystachyos*** with inflorescences ± contracted, forming a head-like cluster or with 2–5 short rays up to 5 cm long, spikelets pale to dark reddish brown, 10–40-flowered, 10–25 mm long, 1.5–2 mm wide, and glumes reddish brown.

A form with extremely short culms 2–5 cm long and simple, head-like inflorescences is sometimes separated as var. *miser.* This form appears to represent an ecotype (e.g., *Hobdy 1365,* BISH).

Subspecies *holosericeus* is usually rather easily recognizable by the characters cited above. However, plants with intermediate features are known in Hawai'i (e.g., *Rock 8738, Hitchcock 12891, Munro 149,* and *Forbes s.n.* in 1912, all BISH). These intermediate forms are usually sterile with abortive achenes, suggesting that subsp. *holosericeus* may best be treated as a species with its overall distinctness partially obscured by hybridization between it and *Pycreus polystachyos* subsp. *polystachyos.*

Pycreus polystachyos (Rottb.) P. Beauv. subsp. ***holosericeus*** (Link) T. Koyama, **comb. et stat. nov.** *Cyperus holosericeus* Link, Hort. Berol. 1: 317. 1827.

Cyperus polystachyos Rottb. var. *pallidus* Hillebr., Fl. Hawaiian Isl. 463. 1888. TYPE: HAWAIIAN IS: EAST MAUI: 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, syntype); HAWAI'I: 1851–71, *W. Hillebrand s.n.* (B, presumably destroyed, syntype).

Cyperus polystachyos Rottb. var. *pallidus* Hillebr. f. *pernanus* Kükenth., Pflanzenr. IV.20(Heft 101, 3): 371. 1936. TYPE: HAWAIIAN IS: Lehua, 18.IV.1931, *E.L. Caum 17* (B, presumably destroyed, holotype; BISH! 2 sheets, isotypes).

Cyperus polystachyos Rottb. var. *miser* Kükenth., Pflanzenr. IV.20(Heft 101, 3): 370. 1936. TYPE: HAWAIIAN IS: HAWAI'I: Kīlauea, IV.1911, *W.M. Giffard s.n.* (*J.F. Rock's no. 8738, 8739*) (B, presumably destroyed, syntype; BISH! 2 sheets, syntypes); AUSTRALIA: NEW SOUTH WALES: Port Jackson Dist, *Boorman s.n.* (B, presumably destroyed, syntype); Botany Bay, *Boorman s.n.* (B, presumably destroyed, syntype).

Distribution. Native to tropical and subtropical regions worldwide; in Hawai'i occurring on open or grassy, often disturbed areas, from mesic coastal sites to mesic and wet forest, 0–1,420 m, on all of the main islands except Kaua'i and Kaho'olawe.

Pycreus polystachyos (Rottb.) P. Beauv. subsp. ***polystachyos***

Distribution. Native to tropical and subtropical regions worldwide; in Hawai'i occurring on open or grassy, often disturbed areas, from mesic coastal sites to mesic and wet forest, 0–1,420 m, on Midway Atoll, Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i.

Pycreus sanguinolentus (Vahl) Nees

This species has not been previously reported for Hawai'i.

Distribution. Native to Southern Canada, United States, and Mexico; in Hawai'i naturalized in marshy sites, 910–920 m, Hawai'i Island.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: South Kona Dist, *mauka* of Captain Cook, 1949, *Degener 20251* (BISH).

Torulinium Desv.

Torulinium odoratum (L.) S. Hooper subsp. ***auriculatum*** (Nees & Meyen ex Kunth) T. Koyama, **comb. et stat. nov.** *Cyperus auriculatus* Nees & Meyen in Nees, Linnaea 9: 285. 1834; ex Kunth, Enum. Pl. 2: 83. 1837. *Cyperus ferax* Rich var. *auriculatus* (Nees & Meyen ex Kunth) Kükenth. TYPE: Needs to be lectotypified.

Distribution. Subspecies *auriculatum* is endemic to the Hawaiian Islands, apparently rare in low-elevation wet sites such as margins of ponds and vernal pools, taro paddies, and along streams, on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i.

Remarks. The Hawaiian populations are characterized by larger glumes 3–3.5 mm long, in contrast to glumes 2–2.5(–3) mm long in subsp. *odoratum.*

Fimbristylis Vahl

There are 5 species of *Fimbristylis* in Hawai'i, including 1 endemic species (*F. hawaiiensis* Hillebr.), 2 indigenous species [*F. cymosa* R. Br. and *F. dichotoma* (L.) Vahl], and the 2 previously unrecorded naturalized species treated here.

Fimbristylis aestivalis (Retz.) Vahl

Native from Japan and China south to India, Malesia, and Australia; in Hawai'i apparently only sparingly naturalized and known from 2 collections from ca. 3 m in taro paddies, Hanalei Valley, and 1 collection from a pond in Lāwa'i Valley, Kaua'i.

Representative specimen examined. HAWAIIAN IS: KAUA'I: Hanalei Dist, Hanalei Val, common along the edges of taro paddies, 1977, *Herbst 5953* (BISH).

Fimbristylis schoenoides (Retz.) Vahl

Native to India, southern China, Malesia, and Australia; in Hawai'i known only from a few collections from wet ground near an abandoned runway at Hilo Airport, Hawai'i Island.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: South Hilo Dist, Hilo Airport, growing in wet areas along an abandoned runway, 1984, *Stemmermann 6884* (BISH).

Gahnia J.R. Forster & G. Forster

The endemic taxon previously treated as *Gahnia kauaiensis* Benl is very closely related to *G. vitiensis* Rendle. They differ in only a few relatively minor features. Therefore, it seems reasonable to treat the Hawaiian and Fijian populations as subspecies of a single species.

Gahnia vitiensis Rendle, J. Linn. Soc. Bot. 39: 179. 1909. TYPE: FIJI IS: VITI LEVU: Vicinity of Nandarivatu, Mba Province, X.1907, *Gibbs 613* (BM).

Distribution. Indigenous to Viti Levu, Vanua Levu, and Taveuni in Fiji, and Kaua'i and Hawai'i in Hawai'i.

The following key summarizes the essential differences.

Key to Subspecies of *Gahnia vitiensis*

1. Leaves 10–15 mm wide; spikelets obovoid, 3–3.5 mm long; achenes (1.8–)2–2.6 mm long . . . . subsp. ***kauaiensis***
1. Leaves 7–10 mm wide; spikelets oblanceoloid, 2–3 mm long; achenes 1.7–2 mm long . . . . subsp. ***vitiensis***

Gahnia vitiensis Rendle subsp. ***kauaiensis*** (Benl) T. Koyama, **comb. et stat. nov.** *Gahnia kauaiensis* Benl, Bot. Arch. 40: 190. 1940. *Gahnia javanica* Moritzi var. *ellipsoidea* Kükenth., Repert. Spec. Nov. Regni Veg. 16: 433. 1920. TYPE: HAWAIIAN IS: KAUA'I: Kauluweli Swamp, X.1911, *J. F. Rock 9020* (BISH–502529!, lectotype, selected by Benl [1940]).

Distribution. Subspecies *kauaiensis* occurs in open sites in wet forest and margins of bogs, vicinity of Alaka'i Swamp to Mount Wai'ale'ale, 610–1,590 m, Kaua'i.

Rhynchospora Vahl

There are 5 species of *Rhynchospora* in Hawai'i, including 3 indigenous species (*R. sclerioides* Hook. & Arnott and 2 taxa for which new classifications are here proposed), and 2 newly recorded naturalized species, both of which are native to North America.

Rhynchospora caduca Elliott

This species is native to the southern United States. It was first collected on Hawai'i in 1972. It now is naturalized in wet, disturbed areas, sometimes locally common, 320–1,400 m, on Maui and Hawai'i.

Representative specimens examined. HAWAIIAN IS: MAUI: Hāna Dist, Waimoku Falls, 1982, *Hobdy 1392* (BISH); HAWAI'I: South Hilo Dist, Kaūmana, 1972, *Shinbara H110* (BISH).

Rhynchospora chinensis Nees & Meyen subsp. ***spiciformis*** (Hillebr.) T. Koyama, **comb. et stat. nov.** *Rhynchospora spicaeformis* Hillebr., Fl. Hawaiian Isl. 477. 1888. TYPE: HAWAIIAN IS: MAUI: in the swamp on the summit of Mt Eeka ['Eke], before 1871, *W. Hillebrand s.n.* (B, presumably destroyed, holotype).

Distribution. Indigenous to China, Japan, India, Malesia, and Hawai'i; in Hawai'i occurring in open, wet sites in pastures, wet forest, and bogs, (150–)550–1,750 m, on Kaua'i, Moloka'i, Maui, and Hawai'i.

Rhynchospora globularis (Chapm.) Small

This species is native to the coastal plains of the United States from Delaware south to Florida and west to Texas. In Hawai'i it is apparently recently naturalized and local in disturbed sites along the Saddle Road, 400–1,500 m, Hawai'i Island.

Representative specimen examined. HAWAIIAN IS: HAWAI'I: S Hilo Dist, 4.7 mi E along Saddle Rd from jct. with road to Pi'ihonua in Kaūmana, 1982, *Wagner & Warshauer 4656* (BISH).

Rhynchospora rugosa (Vahl) Gale subsp. ***lavarum*** (Gaud.) T. Koyama, **comb. et stat. nov.** *Rhynchospora lavarum* Gaud., Voy, Uranie, part 10: 415. 1829. TYPE: HAWAIIAN IS: "Insulis Sandwicensibus (alt. 400–500 hexap."), 1819, *C. Gaudichaud-Beaupré s.n.* (P, holotype).

Distribution. Native to the Neotropics and Hawai'i; in Hawai'i occurring in wet forest and bogs, occasionally in mesic forest, 280–1,620 m, on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i.

Subdivision of *Scirpus*

The genus *Scirpus* L. *sensu lato* is heterogeneous when compared to other genera in the Cyperaceae (Kern 1974). It traditionally comprises all of the species of the subfam. Cyperoideae except for a number of homogeneous groups relegated to separate genera. To make the classification of this assemblage more consistent within the family, the groups of species usually treated as sections should be elevated to generic status. These segregate genera are still often treated as sections within a more broadly delimited genus *Scirpus* (see Tucker 1987). The Hawaiian species have been traditionally treated as members of *Scirpus* (e.g. Koyama and Stone 1960); they are here relegated to 2 segregate genera, *Bolboschoenus* Palla and *Schoenoplectus* (Rchb.) Palla. These genera can be distinguished by the following key. A synopsis of the Hawaiian species is given after the key.

Key to *Bolboschoenus* and *Schoenoplectus*

1. Culms nodose, leafy; inflorescences subtended by 2 to few leaf-like bracts . . . . ***Bolboschoenus***
1. Culms not nodose above base, naked with all leaves reduced to bladeless sheaths grouped at base of culms; inflorescences pseudolateral to the lowest erect, culm-like bract . . . . ***Schoenoplectus***

Bolboschoenus Palla

In Hawai'i there is one indigenous species of *Bolboschoenus.*

Bolboschoenus maritimus (L.) Palla subsp. ***paludosus*** (A. Nels.) T. Koyama, **comb. et stat. nov.** *Scirpus paludosus* A. Nels., Bull. Torrey Bot. Club 26: 5. 1899. TYPE: U.S.A.: WYOMING: Granger, 30.VII.1897, *A. Nelson 3874* (RM).

Distribution. Widely distributed in saline or fresh water, on mudflats and in marshes at low elevations in temperate and tropical areas nearly worldwide; in Hawai'i primarily in coastal sites, 0–6 m, on Ni'ihau, Kaua'i, O'ahu, Moloka'i, and Maui.

Schoenoplectus (Rchb.) Palla

In Hawai'i there are 3 species of *Schoenoplectus.*

Schoenoplectus californicus (C.A. Mey.) Palla

Distribution. Native to coastal areas of southern United States (south of South Carolina and California) south to Argentina and Chile in salt or freshwater marshes at low elevations; in Hawai'i naturalized or possibly indigenous, 0–1,220 m, on all of the main islands except Kaho'olawe.

Schoenoplectus juncoides (Roxb.) Palla

Distribution. Occurring in wet sites, often in rice fields, from Japan south to Malesia and India, disjunct in Hawai'i and Fiji; in Hawai'i indigenous, occurring in and around bogs, pond margins, and in wet forest, (5–)180–1,370 m, on Kaua'i, and recently collected once in the Kohala Mountains, Hawai'i (*Stemmermann 6694*, BISH).

Schoenoplectus lacustris (L.) Palla subsp. ***validus*** (Vahl) T. Koyama **comb. et stat. nov.** *Scirpus validus* Vahl, Enum. Pl. 2: 268. 1805. TYPE: "in Caribaeis."

Distribution. Widely distributed in the New World and Pacific Basin; in Hawai'i indigenous, occurring in freshwater or brackish marshes, 0–1,220 m, on Ni'ihau, Kaua'i, O'ahu, Moloka'i, and Hawai'i.

IRIDACEAE

Aristea Aiton

Aristea gerrardii Weim.

Native to coastal Natal, South Africa; in Hawai'i naturalized plants documented only from Volcano, ca. 1,130 m, Hawai'i.

Specimen examined. HAWAIIAN IS: HAWAI'I: Puna Dist, Volcano, near Wright Road, recently naturalized on sunny, hard, packed lava under rock, 1975, *Degener & Degener 33566* (BISH).

TYPHACEAE

Typha L.

Typha latifolia L.

This species is native to Eurasia, northern Africa, and North America. In Hawai'i it is sparingly naturalized in low-elevation, marshy sites at least along the Wailua River, Kaua'i, and in the Salt Lake and Pearl Harbor areas, O'ahu, and perhaps also on Hawai'i. It can be distinguished from *T. domingensis* Pers., the other naturalized species of the genus in Hawai'i, by its pistillate flowers without scales, staminate flowers with simple hairs instead of scales, and by contiguous (occasionally separated by an interval up to 2.5 cm long) staminate and pistillate spikes. The staminate and pistillate spikes of *T. domingensis* are separated by a gap of (0.5–)2–6 cm.

Representative specimens examined. HAWAIIAN IS: KAUA'I: Līhu'e Dist, in marshy places along Wailua River, 1988, *Wagner et al. 6000* (BISH); O'AHU: Honolulu Dist, in standing fresh water, Honolulu International Country Club, Salt Lake, 1979, *Liu s.n.* (BISH).

ACKNOWLEDGMENTS

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Samoana Medana, New Species (Gastropoda, Pulmonata: Partulidae)

Yoshio Kondo[1] and John B. Burch[2]

ABSTRACT

A new small (12.0 × 8.0 mm), dextral species of *Samoana* from the Marquesas Islands is described and named *Samoana medana* in honor of the discoverer of the Islands, Alvaro de Medaña. The species is found on 3 islands, Hivaoa, Tahuata, and Fatuhiva, and is added to the 6 species of *Samoana* already known from the Marquesas. The new species is characterized by its tiny size, which makes it the smallest known Partulidae; its fragile, thin, dark brown shell; and its rotundate shape.

INTRODUCTION

The land snail family Partulidae is represented in the Marquesas Islands by the single genus *Samoana* Pilsbry & Cooke, 1934, of which 6 species previously have been recognized. Listed chronologically by their dates of 1st description, these 6 species are *S. inflata* (Reeve, 1842) (found on Tahuata and Hivaoa), *S. ganymedes* (Pfeiffer, 1846) (Hivaoa), *S. decussatula* (Pfeiffer, 1849) (Nukuhiva, Hivaoa, Tahuata), *S. strigata* (Pease, 1868) (Nukuhiva, Uahuka, Fatuhiva), *S. bellula* (Hartman, 1885) (Uapou) and *S. magdalinae* (Hartman, 1885) (Fatuhiva). A 7th species, found on Hivaoa, Tahuata, and Fatuhiva, is now recognized for the Marquesas Islands. Its description follows.

SYSTEMATICS

Samoana medana, new species Figs. 1, 3–7

Description of holotype. *Shell* of holotype (Fig. 1) dextral, very small for the family, rimate-perforate, conic, thin, fragile, translucent, dull, and uniformly dark brown in color. Surface of shell sculptured with fine spiral striae that on crossing delicate growth striae form wavy lines, resulting in a decussate pattern. There are 4½ whorls, of which the 1st 2½ are embryonic; the 1st embryonic whorl is also decussate, with spiral and transverse striae. Whorls of spire slightly convex; sutures only slightly impressed; last whorl is rotund, capacious. Shell aperture is large and ovate. Peristome white, out-curving, thin, its inner side forming a slight ledge, its outer curvature forming a broad flange. Columella simple, forming a narrow triangularly curved flap near the rimation.

Animal. The mantle is maculate, the opaque white maculae occurring on a clear, transparent background.

Genitalia (Fig. 3). Ovotestis (hermaphrodite gland, not shown) is located ½ whorl from tip of visceral mass. Ovotestis is very small, four-lobate, with a few tiny follicles. Albumen gland large; prostate gland is large and overlies pre-uterine oviduct. Uterus is inflated with a single

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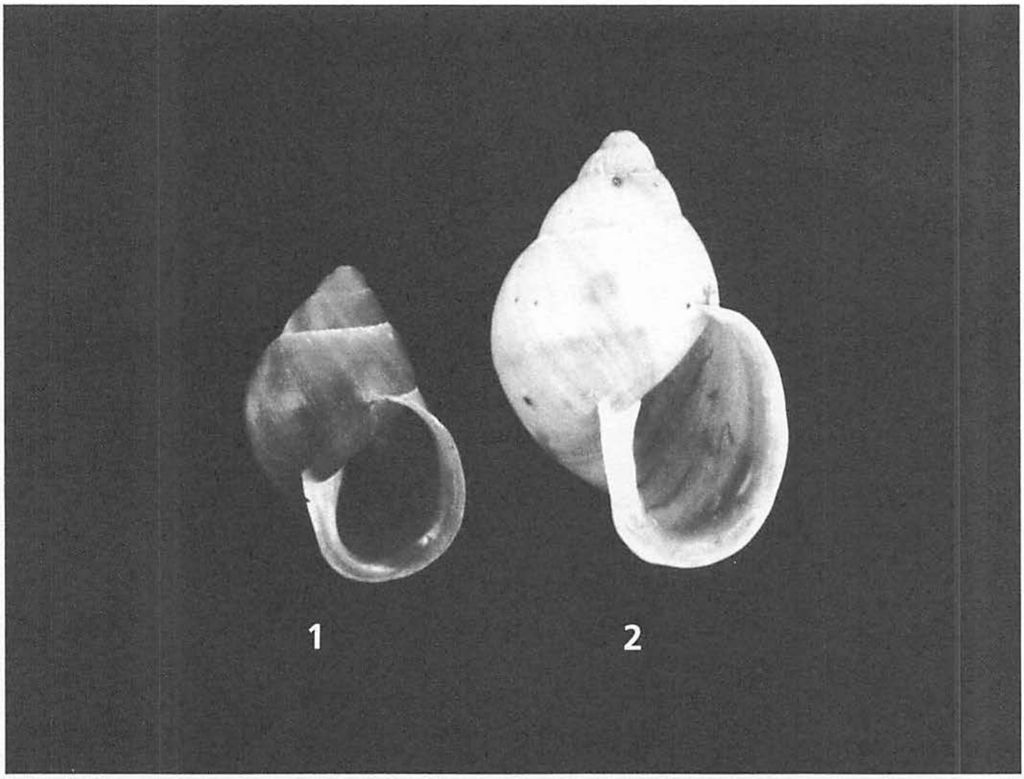


Figs. 1–2. **1,** *Samoana medana,* n. sp., holotype. **2,** *Samoana decussatula* (Pfeiffer), Tahauku Valley, Hivaoa, Bishop Museum coll. no. 1969-47.2.

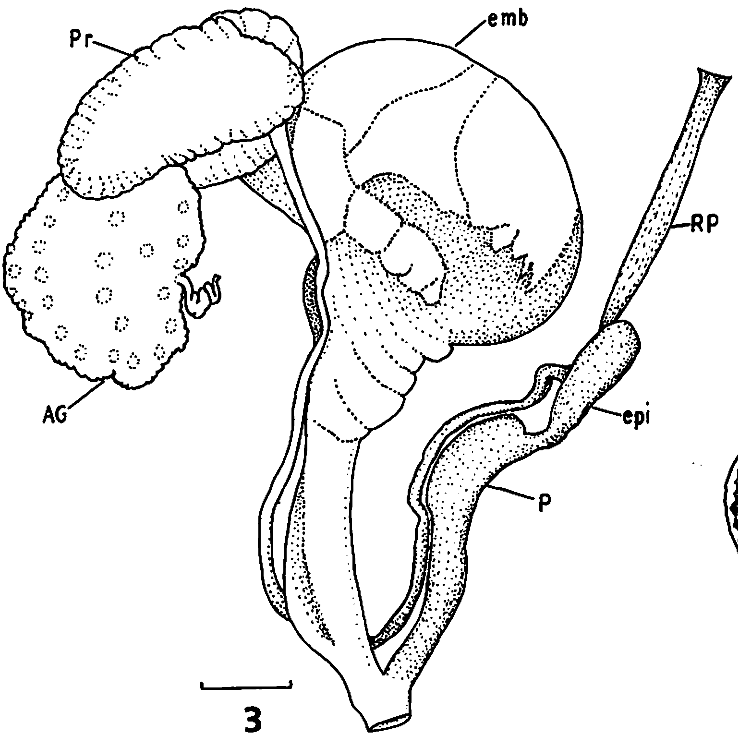
emerging embryo, its fragmenting eggshell dissolving. Spermatheca long, terminating at upper oviduct. Vagina is short. Phallus is large and long, ¾ length of oviduct. A deep pinch divides epiphallus from subphallus. Vas deferens is subterminal. Penial or phallic retractor muscle large and long; vestigial retractor (not shown in Fig. 3) conspicuously silky. It terminates at head of subphallus. Interior of phallus is shown in Fig. 4. Epiphallus ornamented with 5 or 6 vertical zigzag ridges; 1 ridge strong, others smaller, some appearing only as isolated tubercles. Subphallus has single broad, vertical, fleshy pilaster; right wing swollen and conspicuous, left wing flat.

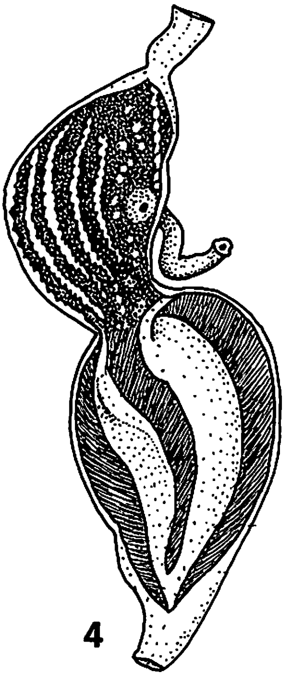
Type data. Holotype: cat. no. 11879 ex 94655; shell size, 12 × 8 mm. Paratypes: cat. nos. 94655–94658, 11 adults. Collected by E. P. Mumford, 2.VI.1929.

Type locality. MARQUESAS IS: Hivaoa I: Vaiepoepo, on shrubs, 710–732 m (2,330–2,400 ft). Other localities on Hivaoa: Kapaafaa, Tepuna, Teipunui, Maunaofefe, Temetiu, Kaava, and Ootua, 610–1,158 m (2,000–3,800 ft), on *Freycinatia, Metrosideros, Weimannia,* and other native plants, collected by the Bishop Museum's Pacific Entomological Survey (PES). *Samoana medana* has been found also on Tahuata (4 populations) and Fatuhiva (8 populations).

Remarks. The Bishop Museum has 301 adult *Samoana medana,* as follows: Hivaoa, 153 specimens (145 collected by PES in 1929, 8 by Kondo in 1969); Tahuata, 63 specimens collected by PES; Fatuhiva, 85 specimens (12 by PES, 73 by Kondo).

Samoana medana is named for Alvaro de Medaña, who discovered the Marquesas Islands in





Figs. 3–4. Genitalia of *Samoana medana* from Vaiepoepo, Hivaoa, Bishop Museum cat. no. 94655. **3**, External aspect of the entire genitalia, except for the ovotestis, which is not attached. AG = albumen gland; emb = embryo; epi = epiphallus; P = phallus; Pr = prostate gland; RP = retractor muscle of phallus. Scale line = 1 mm. **4**, Internal anatomy of the subphallus and epiphallus.

1595.[3] This name was suggested to Dr. Charles Montague Cooke, Jr., by Henry A. Pilsbry, who had inspected specimens and agreed with Cooke that this was a distinct, undescribed species.

COMPARISONS OF POPULATIONS OF *SAMOANA MEDANA*

Shells

Comparisons of the shells of the various populations were made by randomly selecting 6 specimens from each colony, counting their whorls, and measuring the shells' lengths and

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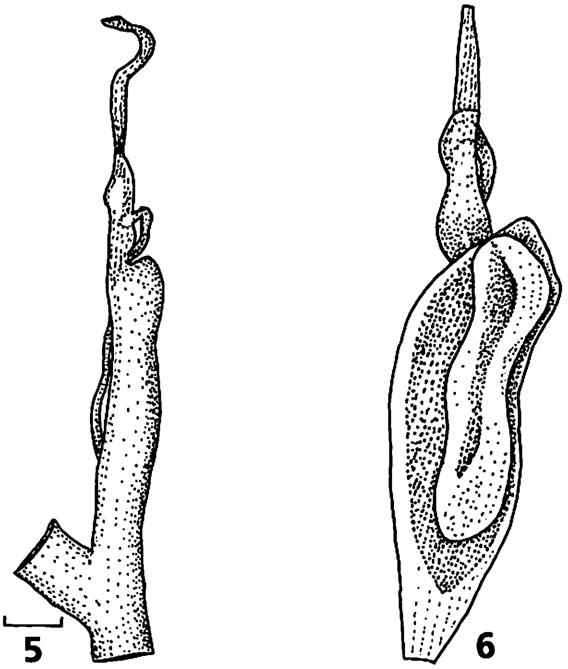
[3] Medaña named the islands Las Islas de Marquesas de Mendoza in honor of the Viceroy of Peru. Medaña gave the following names to his discoveries: Magdalena (Fatuhiva), Santa Christina (Tahuata), Dominica (Hivaoa), and San Pedro (Motane) (Buck 1953).



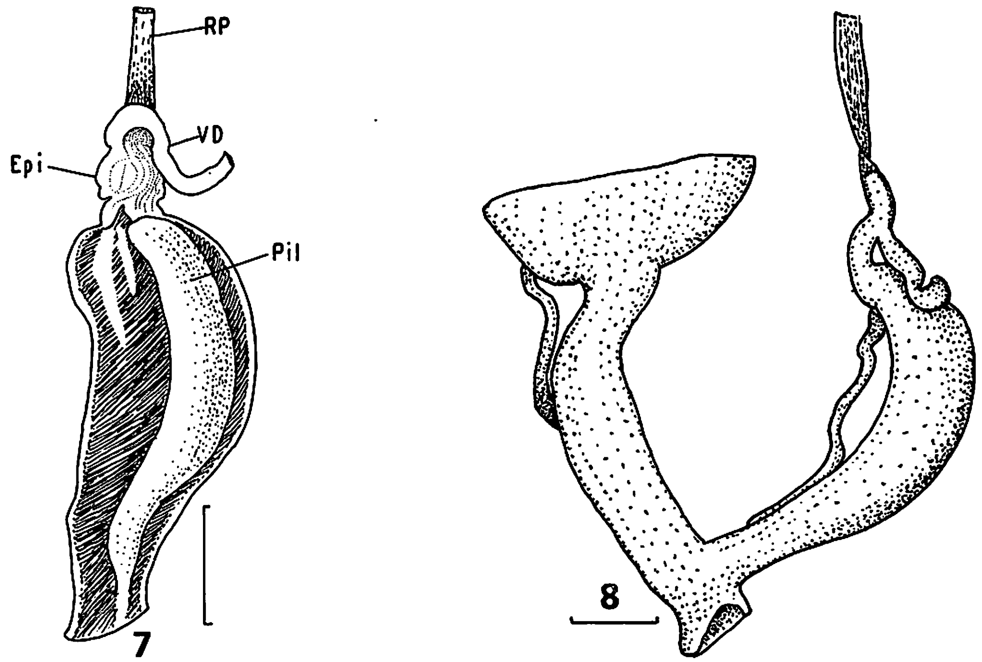
Figs. 5–6. Phallus of *Samoana medana* from Vaitupaahei, Tahuata, Bishop Museum cat. no. 99823. **5**, External view. **6**, Internal aspect of subphallus. Scale line = 1 mm.

widths. For example, for the Vaiepoepo population, from which the Bishop Museum has 17 specimens, measurements for the 6 selected specimens are as follows:

Whorls	*Dimensions (mm)*
4⅓	11 × 8
4½	12 × 8
4½	12 × 8
4½	12 × 8 (median)
4½	12 × 8 (holotype)
4⅓	12 × 8

Here, the median specimen had 4½ whorls and measured 12 × 8 mm. Measurements of the median specimens selected the same way from the other 7 Hivaoan populations are as follows:

Location	*Whorls*	*Dimensions (mm)*
Kapaafaa	4½	11 × 8
Tepuna	4½	13 × 9
Teipunui	4½	13 × 9
Maunaofefe	4½	13 × 8
Temetiu	4½	13 × 8
Kaava	4½	13 × 8
Ootua	4½	13 × 9



Figs. 7–8. **7,** Internal aspect of the subphallus of *Samoana medana* from Mt Upe, Fatuhiva, Bishop Museum coll. no. 1969-4. Epi = epiphallus; Pil = pilaster; RP = retractor of phallus; VD = vas deferens. **8,** Lower genitalia of *Samoana decussatula* from Tahauku Valley, Hivaoa, Bishop Museum coll. no. 1969-4. Scale line = 1 mm.

A summary of median shell measurements of *Samoana medana* for the 3 islands (Hivaoa, 8 populations; Tahuata, 4; Fatuhiva, 8) is as follows:

Location	*Range (mm)*	*Median (mm)*
Hivaoa	11 × 8–14 × 10	13 × 8
Tahuata	10 × 7–15 × 10	12 × 7
Fatuhiva	12 × 8–14 × 10	13 × 9

The average shell measurement from these median figures is 12.6 × 8 mm.

Phallic Anatomies

As a supplement to the description of the genitalia of *Samoana medana*, the following comparisons of the phalluses of specimens from the 3 islands are given.

In specimens from Hivaoa (Figs. 3, 4), a vertical slit the length of the phallus (Fig. 4) reveals the internal characteristics of the subphallus and epiphallus. In the subphallus, a vertical double-winged, fleshy, white pilaster is attached solidly to the penial sheath. The right wing of the pilaster is larger and is incurved to form a shallow median concavity. The left wing is thinner, its edge forming a thin flap. In the epiphallus, small vertical ridges attach to the epiphallic sheath. These subphallic and epiphallic structures are considered to be stimulator-papillae.

In specimens from Tahuata (the island closest to Hivaoa), the phallus (Figs. 5, 6) is similar to that found in Hivaoan specimens, but the epiphallus is shorter and smaller and the pilaster of the subphallus is not as elaborate. In specimens from Fatuhiva (an island more distant from Hivaoa), the epiphallus (Fig. 7) is very short, and the right wing of the subphallic pilaster is well developed, but the left wing is smaller, indicating that some degeneration may be taking place. The phalluses (not shown) of the 2 specimens from Hivaoa dissected (Ootua, Bishop Museum coll. no. 1969-41) were like those observed in the Vaiepoepo specimens.

It is concluded that the differences in the phalluses among the populations of the 3 islands are too slight to warrant insular subspecific designations.

Comparisons with Other Marquesan *Samoana* Species

The simplest way to describe *Samoana medana* is as a minature *S. decussatula* (Pfeiffer) (Fig. 2), the species from which it could have evolved. The 1930 collections of Guilliaume Le Bronnec for PES from Tahuata were arranged according to size by Dr. Cooke to illustrate this concept:

S. medana, small to very small, 10 × 7 to 12 × 7 mm, 609–823 m (2,000–2,700 ft).

S. medana, medium to large, 12 × 8 to 15 × 10 mm, 313–732 m (1,028–2,400 ft).

S. decussatula, very large, 15 × 9 to 18 × 12 mm, 313–533 m (1,028–1,750 ft).

There appears to be a slight gradation in size in conjunction with altitude. The melding point in size (perhaps of no significance) appears to be 15 × 9 mm.

The number of whorls and shell dimensions of the Marquesan species of *Samoana* are given here to illustrate the differences in these conchological characters between *S. medana* and the other 6 species. (The average dimensions of the Marquesan species are from 2–3 samples of each species given in Pilsbry [1909, 169–75].)

Species	*Whorls*	*Average dimensions (mm)*
S. inflata	5½	22.0 × 16.8
S. ganymedes	5½	21.6 × 11.6
S. strigata	4¾	19.7 × 11.8
S. bellula	4½	14.9 × 9.7
S. decussatula	4¼	15.5 × 9.6
S. magdalinae	4½	14.0 × 10.3
S. medana	4¼	12.6 × 8.0

It should be noted that *S. medana* is the smallest known Partulidae.

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New Species of *Copidognathus* (Acari: Halacaridae) from Hawaiian Islands

Ilse Bartsch[1]

ABSTRACT

Five species of *Copidognathus* are described. The species were collected on beaches of the islands Hawai'i and Kaua'i (Hawaiian Archipelago). *C. ventriscutatus* n. sp. is an arenicolous form, while the others (*C. hawaiiensis* n. sp., *C. dentipes* n. sp., *C. unispinosus* n. sp., and *C. areolatus* n. sp.) are thought to inhabit crevicular habitats such as rhizoids, algae, and coarse sediment.

INTRODUCTION

Copidognathus is the largest genus of the superfamily Halacaroidea; with 240 described species *Copidognathus* comprises almost ¼ of all halacarid species known. Up to present time a single species of *Copidognathus* was known from Hawaiian waters, that is *C. matthewsi* Newell, a species living among the gills of the decapod crustacean *Parribacus antarcticus* (Lund) (Newell 1956). Five species, collected from intertidal sediment and from algae washed up on shore, are described in this paper.

MATERIAL AND METHODS

The halacarid mites were collected by Dr. H. Kunz and his wife during a research stay on the Hawaiian Archipelago in autumn 1979. The halacarids had been fixed and stored in formalin; they were cleared in lactic acid and mounted in glycerin jelly.

All holotypes are deposited in the Bernice P. Bishop Museum, Honolulu, Hawai'i (BPBM).

The following abbreviations are used in the descriptions: AD, anterodorsal plate; AE, anterior epimeral plate; ds, dorsal setae; ds-1, 1st pair of dorsal setae; GA, genitoanal plate; GO, genital opening; OC, ocular plate(s); P, palp; P-1, 1st palpal segment; pas, parambulacral setae; PD, perigenital setae; sgs, subgenital setae. Leg segments: I-1, trochanter of leg I; II-2, basifemur of leg II; III-3, telofemur of leg III; IV-4, genu of leg IV; I-5, tibia of leg I; I-6, tarsus of leg I.

SYSTEMATICS

Copidognathus dentipes Bartsch, **new species** Fig. 1A–I, 2A–D

♀. Idiosoma length 303 µm. Dorsal plates separated by coarsely striated integument. Plates with cuticular panels and narrow raised areolae with rosette pores (Fig. 1C). Rosette pores with fine canaliculi surrounding a small alveolus that opens with an ostium to the surface. AD with small frontal projection and with rosette pores on 3 raised areolae (1 small ovate anterior and 2 crescent posterior). OC with 2 corneae; 6–8 and 1–3 rosette pores medial and lateral to corneae respectively. PD long, ovate, truncate posteriorly; with 2 medial costae, 1–2 pores wide, and 2 lateral costae, 0–1 pores wide. Gland pores small. First pair of gland pores on lateral margin of AD at level of insertion of leg I, 2nd pair of pores on OC lateral to corneae; pore canaliculus

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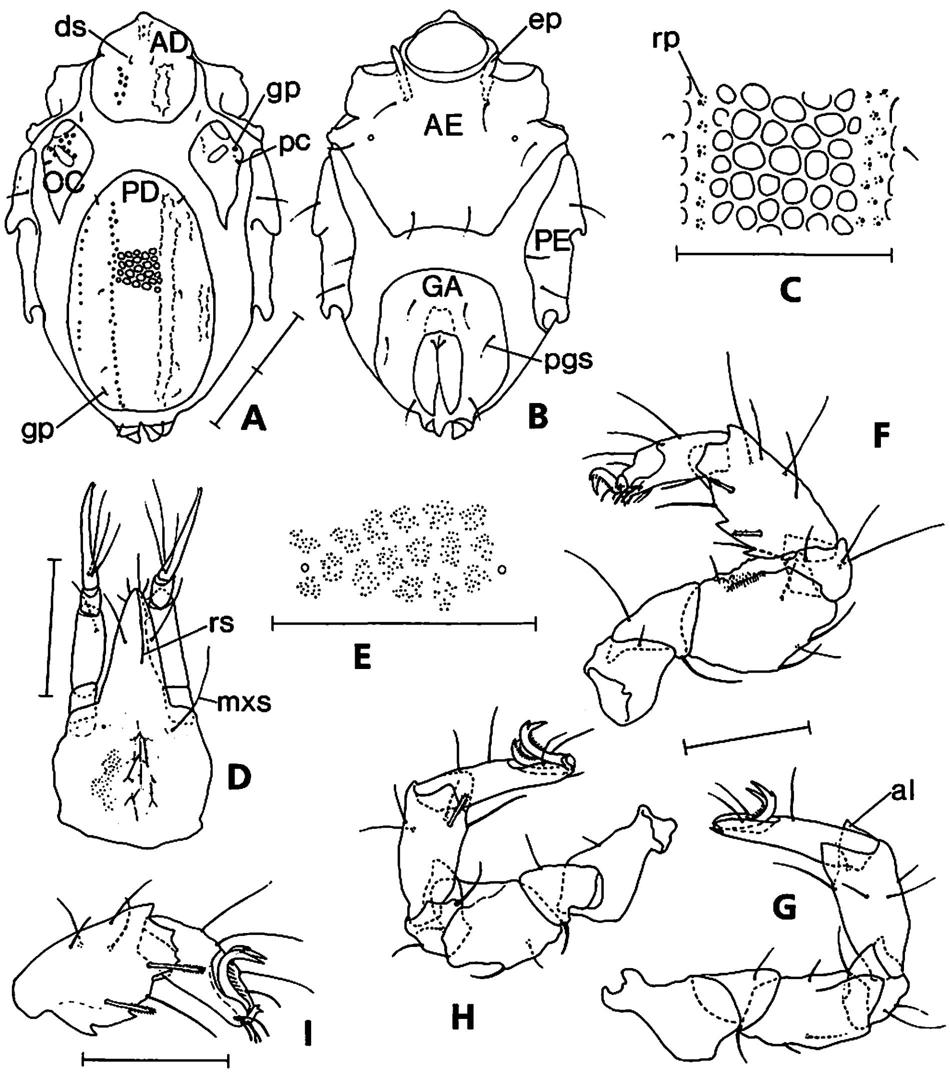

Fig. 1. *Copidognathus dentipes* Bartsch, n. sp., ♀: **A,** idiosoma, dorsal view; **B,** idiosoma, ventral view; **C,** portion of PD at level of setae ds-4; **D,** gnathosoma, ventral view; **E,** portion of AE at level of posterior setae; **F,** leg I, medial view; **G,** leg IV, medial view; **H,** leg III, medial view; **I,** tibia and tarsus II, medial view. (Abbreviations: AD, anterodorsal plate; AE, anterior epimeral plate; al, articular lamella; ds, dorsal setae; ep, epimeral process; GA, genitoanal plate; gp, gland pore; mxs, maxillary setae; OC, ocular plate; pc, pore canaliculus; PD, posterodorsal plate; PE, posterior epimeral plate; pgs, perigenital setae; rp, rosette pore; rs, rostral sulcus.) Scale divisions represent 50 μm.

present just posterior to gland pore (Fig. 1A). A slightly raised gland pore present at end of PD. All dorsal setae minute; ds-1 inserted on AD, anterior to crescent costae; ds-2 within striated integument; ds-3 to ds-5 on PD, lateral to medial costae.

Ventral plates all separated by wide areas of striated integument. Ventral plates pierced by fine

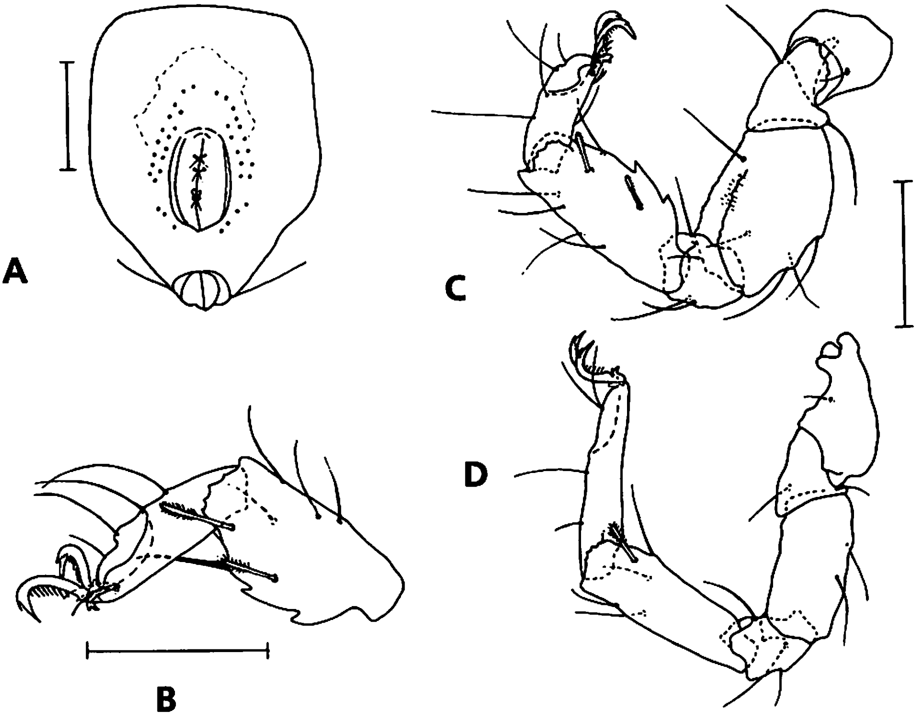

Fig. 2. *Copidognathus dentipes* Bartsch, n. sp., ♂: **A,** genitoanal plate; **B,** tibia and tarsus II, medial view; **C,** leg I, medial view; **D,** leg III, medial view. Scale divisions represent 50 µm.

pores arranged within panels (Fig. 1E). Claparède organ opens with an often H-like slit at the plate surface. Epimeral process I very long. Epimera I wide, with marginal lamella partly concealing base of trochanter II. Ventral setae long, inserted as illustrated (Fig. 1B). Distance from anterior margin of GA to that of GO less than length of GO. Ovipositor surpassing GO, not reaching to anterior pair of pgs.

Gnathosoma slender. Gnathosoma base ventrally pierced by fine pores, dorsally paneled. Tectum truncate. Rostrum almost as long as gnathosoma base, rostrum extending to end of P-3. First pair of maxillary setae inserted on gnathosoma base, 2nd pair on rostrum (Fig. 1D). Rostral sulcus extending beyond 2nd pair of maxillary setae. Palp chaetotaxy as characteristic for *Copidognathus*: P-2 with 1 dorsal seta, P-4 with 3 long basal and 1 minute distal setae.

Legs shorter than idiosoma. Telofemora and tibiae paneled. Telofemora short. Telofemora I and II ventrally porose. I-3 and II-3 with narrow ventrolateral and ventromedial lamellae, III-3 and IV-3 with large distilateral and smaller distimedial lamellae. Genua and tibiae also with distal lamellae, often the lateral lamella larger than the medial. Tibiae I and II with 2 strong cuticular ventral spinelets, and with 2 bipectinate ventromedial and 1 smooth ventral bristle. Tibia III with 1 bipectinate ventromedial and 1 smooth ventral bristle; tibia IV with both bristles smooth. Number and insertion of setae shown in Figs. 1f-h. Lateral membranes of claw fossa on all tarsi huge, medial membranes on tarsus I and II smaller, on tarsus III and IV almost as large as lateral membrane. Tarsi I and II each with 3 dorsal setae, 1 inserted on lateral membrane of claw fossa anterior to the seta-like solenidion. Tarsus III with 4 dorsal setae, tarsus IV with 3 setae.

Claws on leg I shorter than claws on the following legs; claws on leg I with strong accessory process and small teeth from claw comb. Claw comb on the following legs with strong teeth.

♂. Idiosoma length 297–300 μm. In dorsal aspect similar to female, but areolae with rosette pores slightly larger; medial costae 2-3 pores wide, lateral costae longer than in female, 1-2 pores wide. GO surrounded by 37 pgs, arranged in a rather dense corona around the GO (Fig. 2A). Four pairs of sgs, with the 2 anterior and the posterior pair seta-like, the 3rd spur-like. Distance from GO to anterior pgs ½ length of GO. Distal lamellae on telofemora, genua, and tibiae smaller than those in ♀ (Figs. 2B–D).

Type data. Holotype ♀ (BPBM 14321), KAUA'I: Wainiha Bay, 0 m, coarse sand and red algae washed up on beach, 30.X.1979. 1 ♂, O'AHU: Pupukea Beach, 0 m, low energy beach with coarse sand and clay, 0–10 cm sediment depth, 26.X.1979. 1 ♂, O'AHU: Waimea Bay, 0 m, exposed beach, from 10 cm sediment depth, 26.XI.1979. Holotype in BPBM, other specimens in author's collection.

Remarks. Characteristics are: AD with crescent areolae; PD with 4 narrow costae; ventral plates porose; tibia I and II each with ventral cuticular spinelets; I-3 and II-3 with porose areolae. ♂ differs from ♀ in having smaller distal lamella on telofemora, genua, and tibiae. *Copidognathus dentipes* is closely related to *C. punctatissimus* (Gimbel 1919) and *C. dentatus* Viets (1940), known from the western and eastern Atlantic Ocean respectively (Gimbel 1919; Viets 1940; Green & MacQuitty 1987). *C. dentipes* is separated from the others by the smaller idiosoma length, larger lamellae on legs, and wider corona of pgs in ♂. The 3 species form a natural group.

Copidognathus hawaiiensis Bartsch, **new species** Figs. 3A–J

♀. Idiosoma length 298 μm. Similar to male except for the genital region. Length of GA 60 μm. Three pairs of pgs present. Ovipositor small, hardly surpassing GO (Fig. 3F). Subgenital setae minute.

♂. Idiosoma length 300-317 μm. Dorsal plates with ample and prominent porose areolae; plates paneled outside these areolae (Figs. 3A,C). AD with anterior projection; posterior margin truncately rounded. OC long, squarish anteriorly, tail-like posteriorly; with 1 garland-shaped porose areola. Anterior cornea prominent, posterior cornea indistinct. PD large, with 4 longitudinal porose costae, all contiguous anteriorly. First pair of gland pores opening on small projections at lateral margin of AD, at level of insertion of leg I; 2nd pair on lateral margin of OC; 3rd and 4th pairs at posterior end of PD, with 3rd pore within marginal porose costae and 4th pore within medial costae (Fig. 3A). Dorsal setae minute; 1st pair of setae on AD medial to paired porose areolae; ds-2 on medial margin of OC; ds-3 on anterior margin of PD; ds-4 and ds-5 within paneled areas of PD.

Integument of ventral plates pierced by fine pores arranged within panels (Fig. 3D); pores on epimera I to IV slightly deeper than on ventral portion of AE and PE. Pore of Claparède organ circular. AE with 3 pairs of setae. PE with 1 dorsal and 3 ventral setae. GA with 28 pgs arranged loosely around GO (Fig. 3B). Distance from anterior pgs to GO more than latter's length. Subgenital setae minute; 2 proximal pairs seta-like, 3rd pair spur-like, 4th pair seta-like.

Gnathosoma short with globular gnathosoma base and short, cone-like rostrum. Gnathosoma base ventrally porose, dorsally paneled, tectum truncate (Fig. 3G). Palpi short. First pair of maxillary setae inserted close to base of rostrum, 2nd pair in distal ⅓ of rostrum. Rostral sulcus extending posteriad for more than ½ rostrum's length.

Legs: Leg I stronger than posterior legs. Integument of all telofemora finely paneled. Telofemur I with prominent cuticular spines, usually 2 long ventrolateral, 1 small obtuse distilateral, and 1 pointed distimedial cuticular spine. Genu I and tibia I with pointed articular lamellae (Fig. 3J), both laterally and medially. Ventral spine on tibia I slender, smooth, with a cuticular, spinelike projection on its lateral flank (Fig. 3H). Tibia I with 2 ventral bristles, the basal one blunt, slightly pectinate, the distal one slender; both bristles with minute, pointed

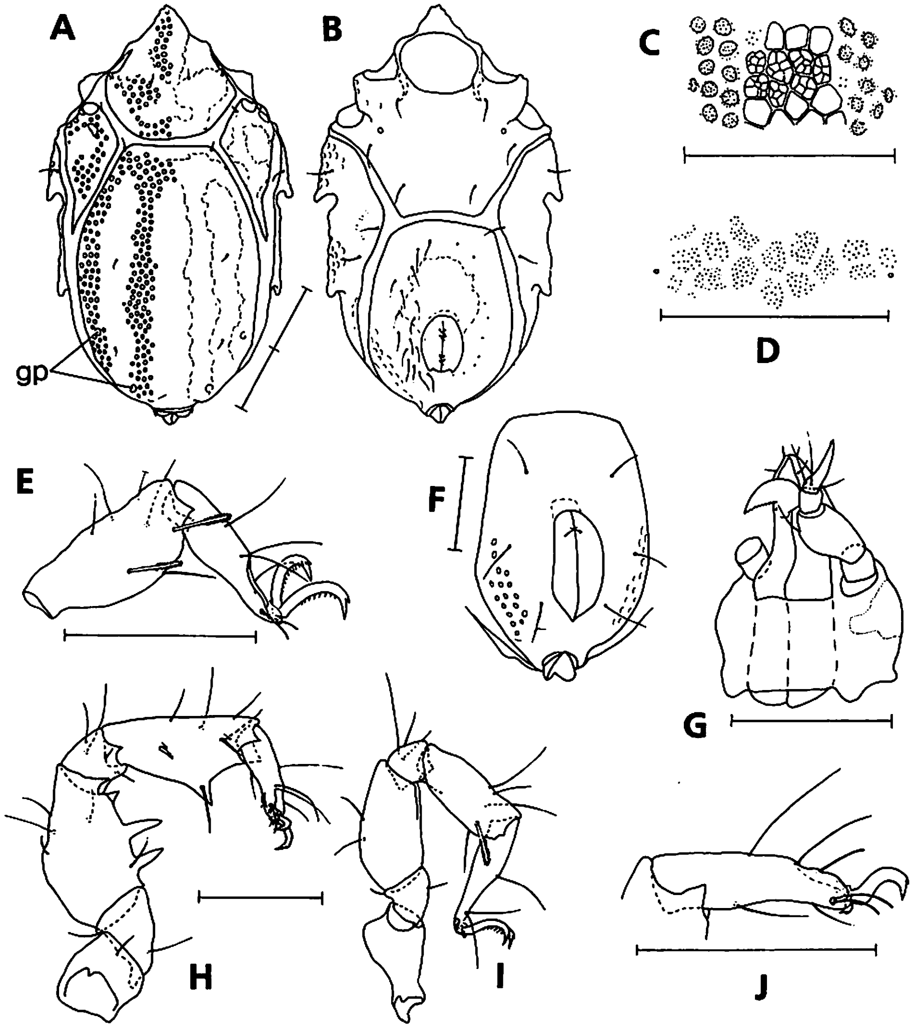

Fig. 3. *Copidognathus hawaiiensis* Bartsch, n. sp.: **A,** idiosoma, dorsal view, ♂; **B,** idiosoma, ventral view, ♂; **C,** portion of median PD anterior to setae ds-4, ♂; **D,** portion of AE at level of posterior setae, ♂; **E,** tibia and tarsus II, medial view, ♂; **F,** genitoanal plate, ♀; **G,** gnathosoma, dorsal view, ♂ (stippled areas include porose areola); **H,** leg I, medial view, ♀; **I,** leg IV, medial view, ♀; **J,** tarsus I, lateral view, ♀ (medial setae omitted). (Abbreviation: gp, gland pore.) Scale divisions represent 50 μm.

cuticular projections at their base. Tibiae II to IV with pointed articular lamellae both laterally and medially. Tibia II with 2 ventromedial, bipectinate bristles and 1 slender ventral bristle (Fig. 3E), tibiae III and IV each with 1 bipectinate ventromedial and 1 smooth ventral bristle. Genu IV with 4 setae (Fig. 3I). Lateral membrane of claw fossa on tarsus I large, medial membrane small. Posterior legs with both lateral and medial membranes of claw fossa inconspicuous. Tarsi I and II each with 3 dorsal setae, all inserted outside region of claw fossa. Tarsi III and IV each with 3 dorsal setae, the 2 distal ones inserted close to end of tarsus, within area of claw fossa. Tarsus I with 1 seta-like solenidion and 1 canalicular famulus, tarsus II with 1 long, seta-like solenidion, dorsolateral in position.

Claws on tarsus I slightly smaller than those on following legs, with an accessory process but no claw comb. Claws on tarsi II to IV with claw comb with few strong teeth. Median claw minute.

Type data. Holotype ♂ (BPBM 14322), KAUA'I: Anini Beach, 1 m, sheltered beach area, 1.XI.1979. Allotype ♀ (BPBM 14322a), same data as holotype. Paratype ♂, same data as holotype. 1 ♀, KAUA'I: Anini Community Beach, coarse sand, 3.XI.1979. Holotype ♂ and allotype ♀ in BPBM, paratypes in author's collection.

Remarks. Characteristics of *C. hawaiiensis* are: telofemur I with large ventrolateral spine-like projections; porose areolae on dorsal plates wide; ventral bristle on tibia I with cuticular projection at its base.

C. hawaiiensis is similar to *C. ornatus* Bartsch, a species found in the Mozambique Channel (Bartsch, 1981). *C. hawaiiensis* is separated from the latter by the above-mentioned characters. Another closely related species has been found in intertidal and subtidal sediments along Philippine shores (unpublished data).

A protonymph (*Copidognathus* sp. A) described in Bartsch (1979) is supposed to be conspecific with *C. hawaiiensis.*

Copidognathus unispinosus Bartsch, **new species** Figs. 4A–G

♂. Idiosoma length 263 μm. Dorsal plates with distinct areolae with rosette pores; outside these areolae, integument finely paneled. AD with a frontal spine and 2 small lateral projections (Fig. 4B). OC wide, with 1 large distinct cornea anteriorly, and 1 indistinct ovate cornea posterior to 1st. Two areolae with rosette pores on either side of corneae. PD wide, with 4 narrow longitudinal costae, 1–2 pores wide. Gland pores large. First pair of gland pores on AD, anterolateral to paired porose areolae; 2nd pair on OC, with a delicate wall arising above the plate (Fig. 4D); 3rd and 4th pairs of gland pores in posterior PD, both open within porose costae, with delicate ostia raised above surrounding integument. Dorsal setae minute. First pair of setae on AD anterior to paired porose areolae; ds-2 at anterior margin of OC; ds-3 to ds-5 on PD, ds-4 at level of insertion of leg IV, ds-5 slightly posterior to ds-4 but anterior to gland pores.

Integument of ventral plates with wide areolae with almost evenly scattered pores and with rosette pores on narrow areolae marginally and ventrally on PE, and garland-like on both sides of GO (Fig. 4C). Ventral setae on AE and PE long and slender. Thirty-three pgs, arranged loosely around GO; anterior pgs almost halfway between anterior margin of GO and that of GA.

Gnathosoma short, with porose areolae on both sides of the pharyngeal area (Fig. 4A). Tectum truncate. First pair of maxillary setae inserted close to base of rostrum, 2nd pair at beginning of distal ⅓ of rostrum.

Legs: Leg I larger than following legs. Telofemur I with a huge spine-like ventrolateral lamella (Fig. 4G). Genu I with 1 blunt ventromedial spine, 1 strong ventral bristle, 1 slender and 1 stout dorsal setae. Tibia I with 1 long slender ventral spine, 1 short blunt ventromedial spine, and 1 ventromedial bristle. Telofemora II to IV without ventral lamellae. Genua II, III, and IV with 4, 3, and 4 setae respectively, none spiniform. Tibia II with 1 smooth ventral and 2 bipectinate ventromedial bristles (Fig. 4F), tibia III with 1 slender ventral and 1 blunt bipectinate ventromedial bristle, tibia IV with both bristles (ventromedial and ventrolateral) seta-like (Fig. 4E). Tarsus I with large lateral membrane of claw fossa. Medial membrane and membranes on posterior legs narrow. Tarsi I and II each with 3 dorsal setae, inserted outside area of claw

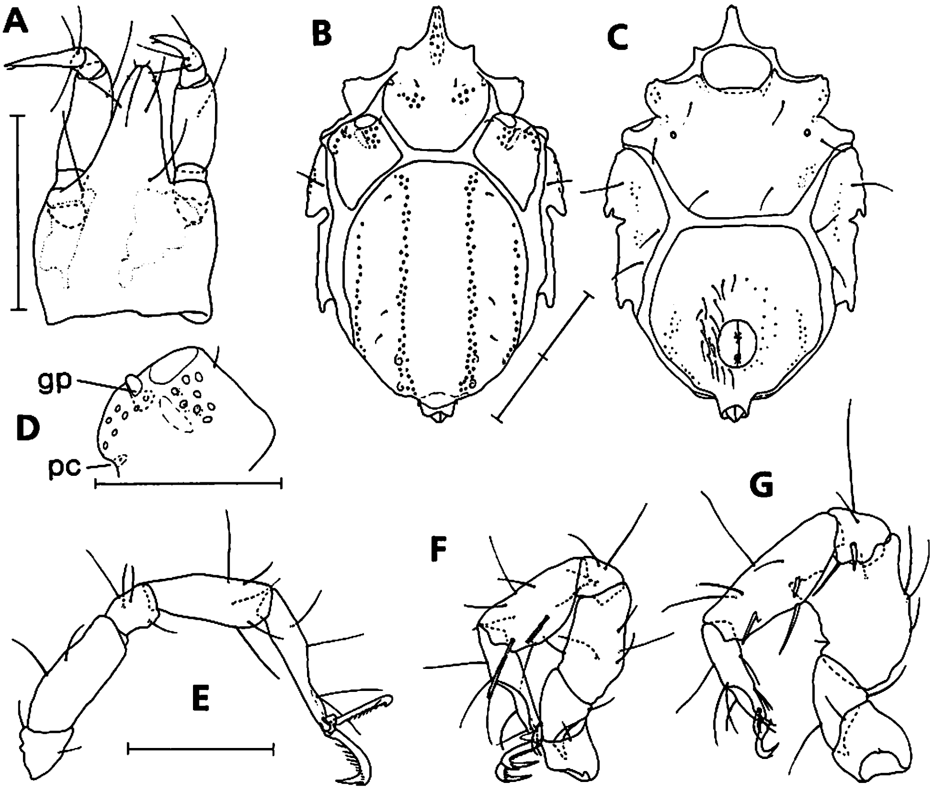

Fig. 4. *Copidognathus unispinosus* Bartsch, n. sp., ♂: **A,** gnathosoma, ventral view (stippled areas include porose areolae); **B,** idiosoma, dorsal view; **C,** idiosoma, ventral view; **D,** anterior ocular plate; **E,** leg IV, medial view; **F,** leg II, medial view; **G,** leg I, medial view. (Abbreviations: gp, gland pore; pc, pore canaliculus.) Scale divisions represent 50 μm.

fossa, and 1 solenidion dorsolateral in position. Tarsi III and IV each with 4 dorsal setae, the paired distal ones arising within area of claw fossa.

Claws on tarsus I smaller than those on posterior legs, claws I with an accessory tooth but no distinct claw comb. Claws on posterior legs with long claw comb with strong teeth.

♀. Not seen.

Type data. Holotype ♂ (BPBM 14323), KAUA'I: Wainiha Bay, on red algae washed ashore, 30.X.1979.

Remarks. Characteristic is the combination of: AD with frontal spine; narrow areolae with rosette pores on AD, PD, PE, and GA; PD with 4 longitudinal costae; gland pores on PD arising close together, both posterior to ds-5; telofemur I with huge spine-like ventrolateral lamella; genu I with 1 blunt ventromedial spine.

C. unispinosus belongs to the *bairdi* group (see Bartsch 1984). Most of the known species within the *bairdi* group have telofemora with no or only slender ventral lamella, though small projections are present in *C. gibberipes* Viets (1936), *C. grandiculus* Bartsch (1977), and *C. spinula* (Trouessart 1899). Unique in *C. uniscutatus* is the huge spine-like lamella on telofemur I.

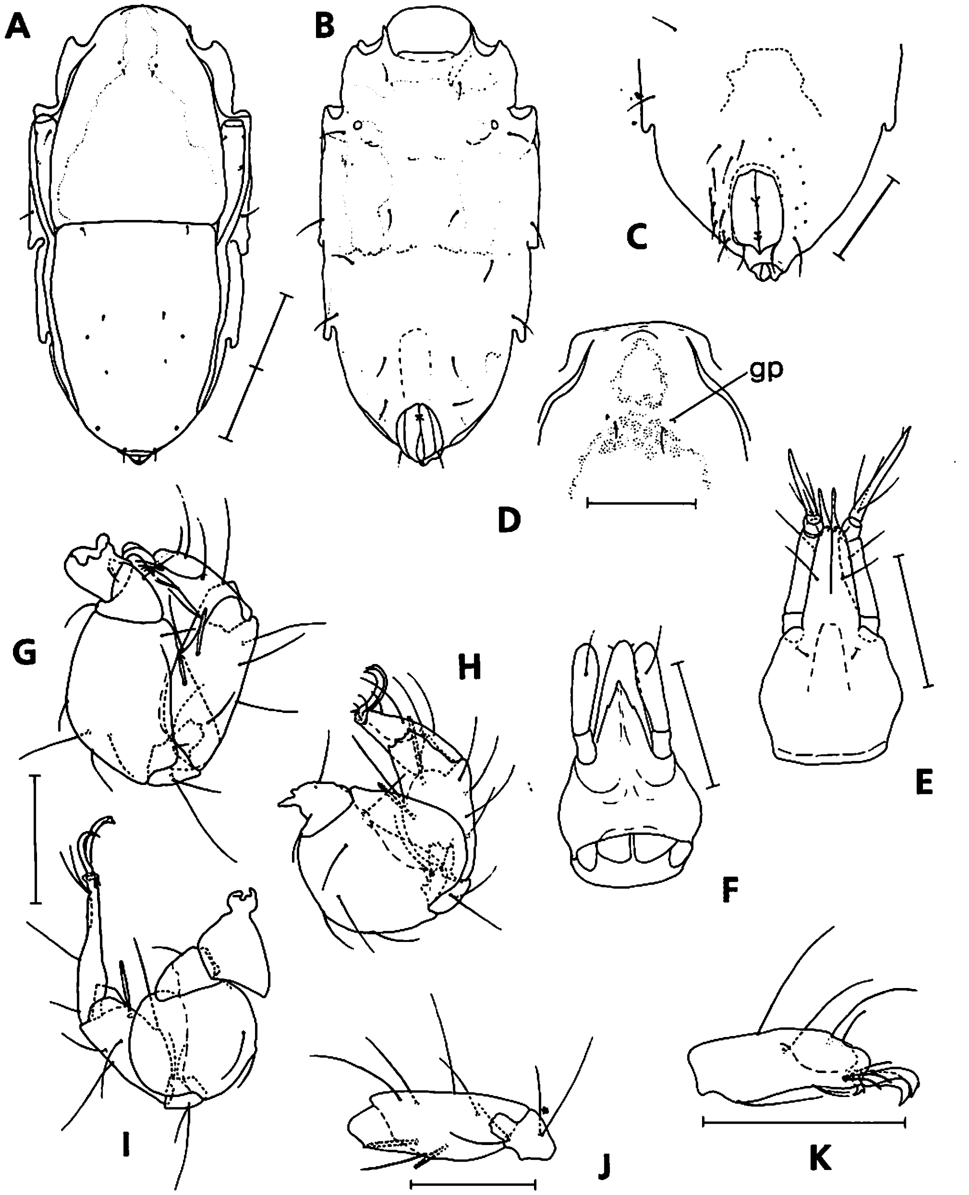

Fig. 5. *Copidognathus ventriscutatus* Bartsch, n. sp.: **A,** idiosoma, dorsal view, ♀; **B,** idiosoma, ventral view, ♀; **C,** posterior idiosoma, ventral view, ♂; **D,,** anterior anterodorsal plate, ♀; **E,** gnathosoma, ventral view, ♀; **F,** gnathosoma, dorsal view, ♂; **G,** leg I, medial view, ♀; **H,** leg II, medial view, ♀; **I,** leg IV, lateral view, ♀; **J,** tibia I, lateral view, ♀; **K,** tarsus I, lateral view, ♀. (Abbreviation: gp, gland pore.) Scale divisions represent 50 μm.

Copidognathus ventriscutatus Bartsch, new species Figs. 5A–K

♀. Idiosoma length 282–292 µm. Surface of dorsal plates rather smooth, though pierced by fine, evenly scattered pores; pores on AD slightly deeper than on PD, but lacking on anterolateral margin of AD and on a small transverse bar (Figs. 5A, D). OC slender, with some scattered pores within oblong area in middle of plate and 1 distinct cornea at anterior margin. Posterior end of OC narrow, hidden beneath PD.

Gland pores small. First pair of gland pores standing close together on AD, at level of transverse cuticular bar; 2nd gland pore and pore canaliculus on lateral margin of OC; 3rd pair of gland pores on PD at level of leg III, and 4th pair at posterior margin of PD.

Ventral plates all fused to a ventral shield. Integument pierced by uniformly scattered pores; these slightly deeper within a central area of AE and on marginal areas of AE, PE, and GA (Fig. 5B). Epimeral process I long and pointed. Pore for Claparède organ distinct. GO placed near end of idiosoma; thus, genital sclerites partly concealing anal cusps. Ovipositor projecting beyond GO for slightly more than length of GO and surpassing anterior pair of 3 pairs of pgs.

Gnathosoma slender. Gnathosoma base finely punctate ventrally and marginally. Rostrum slightly shorter than gnathosoma base. Tectum spine-like (Fig. 5F). Rostrum projecting beyond P-2 (Fig. 5E).

Legs: All telofemora with huge ventral lamellae and all tibiae with large distal lamellae (Figs. 5G–I). Trochantera III and IV dorsally cuspidate, basifemora III and IV with ventral lamellae. Tarsi I and II each with huge lateral membrane of claw fossa; membranes on tarsi III and IV narrow. Tarsus I with 3 dorsal and 3 ventral setae, and with 1 solenidion and 1 utricular famulus on lateral membrane of claw fossa (Fig. 5K).

Claws on tarsi III and IV slender, longer than those on tarsi I and II. Median claw on all tarsi small, bidentate.

♂. Idiosoma length 282–301 µm. In dorsal aspect similar to female. Ventral plates fused. GO surrounded by 11 pairs of pgs. Spermapositor large (Fig. 5C).

Type data. Holotype ♀ (BPBM 14324), HAWAI'I, Anaeho'omalu Bay, 0 m, medium coarse sand, 14.XI.1979. 3 ♀, 2 ♂ paratypes, same data as holotype. Holotype and 1 paratype in BPBM, rest in author's collection.

Remarks. *Copidognathus ventriscutatus* belongs to the *gibbus* group (see Newell 1984: key group 4000; Bartsch 1985). It is easily distinguished from the other species in this group by the fused ventral plates AE, PE, and GA.

Copidognathus areolatus Bartsch, new species Figs. 6A–H

♂. Idiosoma length 233 µm. Dorsal plates AD, OC, and PD contiguous. AD with a raised crest that forms a frontal spine and diverges posteriad and with a small internal transverse bar at level of ds-1 (Fig. 6H). Raised crest beset with ostia (from reduced rosette pores). PD with 2 slightly raised costae with large ostia surrounded by minute canaliculi. Costae in anterior PD 2 pores wide, in middle and posterior PD 1 pore wide (Fig. 6A). Integument finely reticulate medial to costae, coarsely paneled lateral to costae. Gland pores inconspicuous. First pair of gland pores on AD; 2nd gland pore and 1 minute pore canaliculus at lateral margin of OC. Dorsal setae slender, with ds-1 inserted on AD at level of transverse internal bar; ds-2 on small protruding anterior edges of OC; ds-3, ds-4, and ds-5 on PD, ds-3 close to anterior margin, ds-4 and ds-5 within costae, anterior and posterior to insertion of leg IV respectively.

Ventral plates ventrally punctate, marginally with rosette pores with wide ostia and numerous fine canaliculi. AE and GA fused laterally (Fig. 6B). Pore for Claparède organ narrow due to 2 projecting cuticular teeth. Distance from anterior GA to plate of GO slightly more than 2x the latter's length. Spermapositor large. Ventral setae long and slender, inserted as shown in

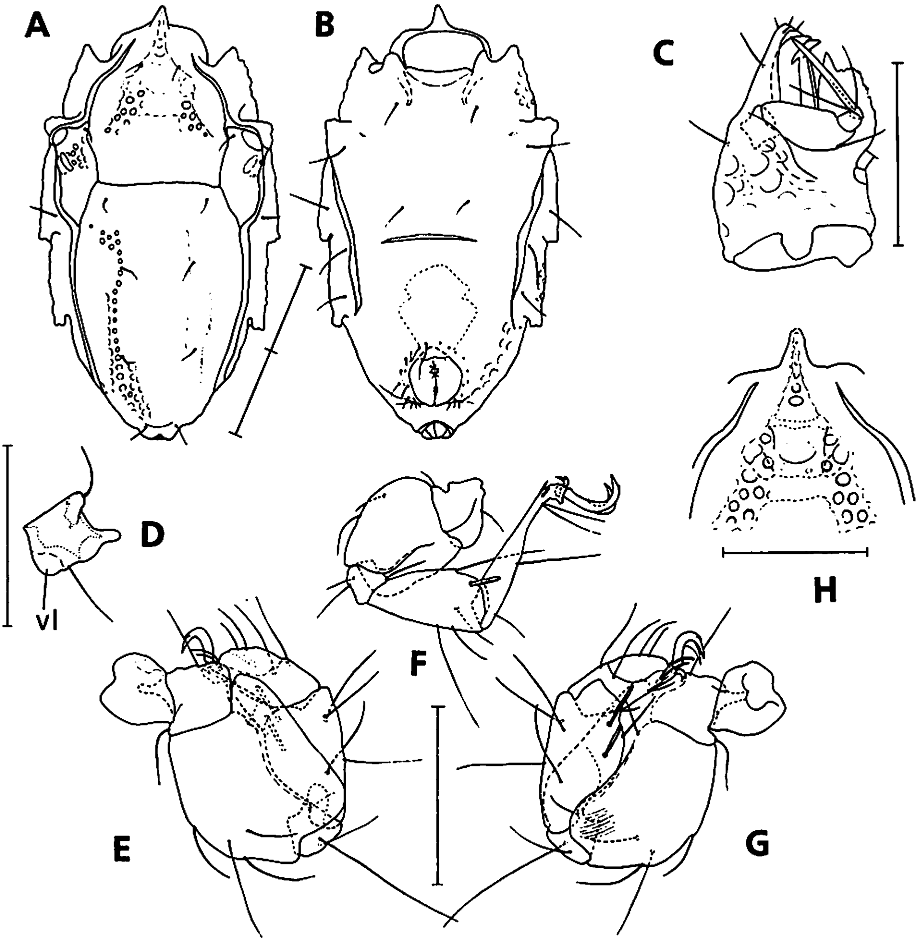

Fig. 6. *Copidognathus areolatus* Bartsch, n. sp., ♂: **A,** idiosoma, dorsal view; **B,** idiosoma, ventral view; **C,** gnathosoma, lateral view; **D,** basifemur I, lateral view; **E,** leg I, lateral view; **F,** leg IV, medial view; **G,** leg I, medial view; **H,** anterior anterodorsal plate. (Abbreviation: vl, ventral lamella.) Scale divisions represent 50 μm.

Fig. 6B. GO surrounded by 22 pgs. Genital sclerites with 4 pairs of sgs, the 2 anterior and the posterior most seta-like, the 3rd pair spur-like.

Gnathosoma with a wide base, integument ornamented with wide pores (ostia) and numerous fine canaliculi. Tectum with a huge crest (Figs. 6C). First pair of maxillary setae inserted on base of gnathosoma, 2nd pair on rostrum.

Legs with large lamellae (Figs. 6E–G). I-2, III-2, and IV- 2 each with ventral lamella (Fig. 6D); lamella on II-2 smaller. All telofemora with huge ventrolateral but narrow ventromedial lamellae. Medial lamellae on I-3 and II-3 each with areolae with longitudinal striae (Fig. 6G); medial lamellae delicately reticulate. Genua I and II with elongate distilateral lamellae but without medial lamellae, genua III and IV without lamellae. Tibiae I and II each distally with large articular lamellae, tibiae III and IV with lamellae smaller, rectangular. Trochantera III and

IV cuspidate. Lateral membranes of claw fossa large on tarsi I and II; medial membranes on tarsi I and II and both membranes on tarsi III and IV inconspicuous. Tarsus I with 3 ventral and 3 dorsal setae; tarsus II with 3 dorsal setae; both tarsi with 1 of 3 dorsal setae inserted on lateral membrane of claw fossa, just anterior to seta-like solenidion. Tarsi III and IV with 4 dorsal setae. III-5 and IV-5 each with 1 slender smooth bristle ventrally and 2 obtuse bipectinate bristles ventromedially.

Claws long and slender; all with accessory process. Claw comb on posterior legs with fine teeth. Median claw bidentate.

♀. Not seen.

Type data. Holotype ♂ (BPBM 14325), KAUA'I: Wainiha Bay, intertidal, from red algae washed up on beach, 30.X.1979.

Remarks. *C. areolatus* belongs to the *gibbus* group. Within this group, *C. areolatus* is distinguished by the combination of: AD with raised A-like costae, protruding anteriorly; PD with 2 costae with rosette pores, 2–3 pores wide anteriorly and 1 pore wide halfway and posteriorly; median PD reticulate; AE and GA partly fused in males; base of trochantera I and II flanked by protruding medial and lateral epimeral processes; tectum with a huge crest; basifemora with ventral lamellae; articular lamellae on tibiae III and IV small, rectangular; claw comb with delicate teeth.

Copidognathus areolatus is similar to *C. incarinatus* Newell, a species found in South Chile, on mussels and algae (Newell 1984). *C. areolatus* differs from the latter by the narrower costae on PD, and by insertion of ds-4 and ds-5 (anterior and posterior to insertion of leg IV in *C. areolatus*; posterior to leg IV in *C. incarinatus*).

ECOLOGY

The material on hand is a very small collection of marine mites. According to the collecting data and the habitus of the mites, *C. ventriscutatus* is thought to be arenicolous in habit, while the other species (*C. hawaiiensis*, *C. dentipes*, *C. unispinosus*, and *C. areolatus*) certainly will be found in crevicular habitats such as rhizoids, algae, and coarse sediments.

ACKNOWLEDGMENTS

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Corrections for Two Ambush Bugs Described from Pakistan (Hemiptera: Phymatidae)

Nicholas A. Kormilev[1]

ABSTRACT

The species recently described as *Macrocephalus pakistanensis* Abbasi and Yousuf (1973) is described and correctly identified as the previously undescribed female of *Agreuocoris nasalis* Maa and Lin (1959). *Amblythyreus murreeana* Yousuf and Ahmad (1976) is transferred to the subfamily Carcinocorinae, and placed as *Chelocoris murreeana* (Yousuf and Ahmad), **new combination**.

INTRODUCTION

Recently I received copies of two papers previously unknown to me, one by Abbasi and Yousuf (1973) and one by Yousuf and Ahmad (1976). Each contained the description of 1 new species of *Phymatidae*, but because of the obvious lack of appropriate previous literature both were improperly treated.

In the Abbasi and Yousuf paper (1973: 216) the new species was *pakistanensis* designated as *Macrocephalus pakistanensis*. *Macrocephalus* Swederus (1787: 183) is properly known only from the Western Hemisphere. The holotype was deposited in the Pakistan Forest Institute, Peshawar. It proved to be the previously undescribed female of *Agreuocoris nasalis* Maa and Lin (1959: 318) and must be placed as a junior synonymy thereof. A short description of this female is given below.

SUBFAMILY MACROCEPHALINAE

Genus ***Agreuocoris*** Handlirsch (1897)

Agreuocoris nasalis Maa and Lin

1959, *Agreuocoris nasalis* Maa and Lin, Pac. Ins. I: 318

1973, *Macrocephalus pakistanensis* Abbasi and Yousuf, Pakistan J. For. 23: 216. **New synonymy.**

Specimen examined. PAKISTAN, 1 ♀, 5.IX.1972, swat on *R. Hastatus* (Shabbar Ali). Deposited at the Entomological Museum, Pakistan Forest Institute, Peshawar, Pakistan. Type of *Macrocephalus pakistanensis* Abbasi and Yousuf, 1973.

♀. Similar to male but larger and of different color. *Ratios*: head 45: 29; preocular borders of head shorter than postocular 15: 22; antennae 18(6): 10(5): 8(3.5): – (segment IV missing); labium 27: 20: 10; pronotum 82: 115, maximal width across posterolateral angles; scutellum 138: 63; abdomen 157: 165; fore femora 65: 27. Lateral borders of fore lobe of pronotum densely granulate; lateral angles acute, directed upwards; posterolateral angles rectangular with rounded tips; hind angles rounded; hind border angularly produced backward. Scutellum constricted at fore ⅓, then enlarged again. Abdomen cordate, rounded at III–IV, then straight; posterolateral

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angles of connexiva II–IV protruding, V–VII not protruding; hind border of VIII rounded. Scutellum a little shorter than abdomen. Corium leaving a portion of dorsum visible. *Color*: head, antennae, fore lobe of pronotum, scutellum with exception of irregular whitish spot on hind ¼ and corium are brown; posterolateral border of corium pale yellow; abdomen yellow brown on upper side, venter reddish brown, paler medially; pleurae and legs orange yellow.

Measurements. Total length 11.80 mm; width of pronotum 4.60 mm; width of abdomen 6.60 mm.

The paper by Yousuf and Ahmad (1976: 167) described the new species *Amblythyreus murreeana* from a single female and reported the holotype was deposited in the Natural History Museum, Department of Zoology, University of Karachi, Pakistan. Unfortunately, my requests to borrow it have been unanswered and I must place the species as best I can by means of the original description and its four accompanying drawings, the latter not always agreeing with the written text. Drawing No. 2 of the foreleg clearly shows the "cancer-type" that is diagnostic of the subfamily *Carcinocorinae* and not found in subfamily *Macrocephalinae*, to which the genus *Amblythyreus* Westwood (1841: 28) belongs. The dorsal habitus shown in drawing No. 1 depicts a member of the genus *Chelocoris* Bianchi (1899: 233), related to *Chelocoris truncatus* Kormilev (1962: 360), also described from Punjab. At this time it is not possible for me to decide if this specimen is only related to *C. truncatus* or is identical with it, so I must consider it a good species in the following combination:

SUBFAMILY CARCINOCORINAE

Genus ***Chelocoris*** Bianchi (1899)

Chelocoris murreeana (Yousuf and Ahmad), **new combination**

1976, *Amblythyreus murreeana* Yousuf and Ahmad, Pakistan J. Sci. Ind. Res., 19: 167

Holotype ♀, PAKISTAN: PUNJAB: Murree Hills (Sandian village), 15.V.1971, on *Rumex hastatus* (Azhar A. Khan).

ACKNOWLEDGMENTS

I thank Dr. R.C. Froeschner for kindly bringing to my attention the two papers discussed herein and Mr. Muhammad Ismail Chaudhry for lending the type of *Macrocephalus pakistanensis*.

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Aglycyderidae of the Society Islands[1] (Coleoptera: Curculionoidea)

Elwood C. Zimmerman[2] and Gérard H. Perrault[3]

ABSTRACT

Four species of *Proterhinus* are recorded from the Society Islands for the first time. Three of these, *P. brevicornis* (from Tahiti and Tahaa), *P. fimbriatus* (from Tahiti, Moorea, and also from Rurutu in the Austral Islands), and *P. gourvesi* (from Tahiti), are new to science. The fourth species, *samoae*, is widely distributed in Polynesia on *Cocos nucifera* and is now reported from Huahini, Raiatea, and Maupiti.

RÉSUMÉ

Quatre espèces de *Proterhinus* sont rapportées pour la première fois des îles de la Société. Trois de celles-ci, *brevicornis* (de Tahiti et Tahaa), *fimbriatus* (de Tahiti, Moorea, et aussi de Rurutu dans les îles Australes), et *gourvesi* (de Tahiti), sont nouvelles pour la science. La quatrième espèce, *samoae*, largement distribuée en Polynésie sur *Cocos nucifera*, est à présent citée de Huahine, Raiatea, et Maupiti.

INTRODUCTION

No species of the primitive curculionoid family Aglycyderidae (= Proterhinidae) has been described heretofore from the Society Islands, but Zimmerman (1935, 1948) noted that he had discovered undescribed species in the islands in 1934. We now record 4 species, 3 of them new, from the Society Islands.

The Aglycyderidae were first made known by Westwood when he exhibited specimens from the Canary Islands (off the west coast of North Africa) at the December 1863 meeting of the Entomological Society of London. Westwood (1864) described these as *Aglycyderes setifer.* Since then, species of Aglycyderidae have been described from the New Caledonia area, New Zealand, Samoa, the Phoenix Islands, the Marquesas, and the Hawaiian Islands, and E.C.Z. has under study new species from other mid-Pacific islands. When R.C.L. Perkins (1907) described *Proterhinus samoae*, the first *Proterhinus* to be found outside Hawai'i, he wrote: "I anticipate that when the islands of the Southern Pacific are thoroughly investigated by skilled collectors of Micro-coleoptera that other forms of Proterhinidae will be discovered, and possibly some that will more nearly connect these with *Aglycyderes.*" Perkins's prophecy has been proven correct.

The greatest contemporary development of the Aglycyderidae is in Hawai'i, where *Proterhinus* Sharp, 1878, long ago found a safe haven and where more than 200 species now exist. In

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Hawai'i, aglycyderids are among the most common, abundant, and widely distributed of the endemic Coleoptera. Elsewhere only a few uncommon or rare species represent the remnants of a mostly extinct group of Coleoptera that is, among living groups of curculionoids, most closely allied to the Belidae (now found in South America, New Zealand, Australia, and New Guinea) and Oxycorynidae (now living in South America, South Africa, and Indomalaya). Aglycyderidae was probably extensively developed in the Cretaceous. The reason it is now restricted to islands and has disappeared from continents is shrouded in mystery. It is especially inexplicable why none has been found in Australia, where Belidae reaches its greatest development, because Aglycyderidae is present in the nearby ancient islands of New Caledonia and New Zealand. Jean Menier (1974) described a new species of *Aglycyderes* from southern Morocco. This is the first record of a member of the family from a continent, and if the record represents a truly distinct species and not just an established colony of the variable Canary Island species, the continental African discovery is of particular interest.

In 1934, as a member of the Mangarevan Expedition to southeastern Polynesia, E.C.Z. searched especially for *Proterhinus* in the Society Islands. He was able to find only 3 specimens, each representing a different species. In 1961, the late J.L. Gressitt of Bishop Museum collected 5 examples of a new species on Mount Aorai, the 2nd highest mountain on Tahiti. Collections made in 1973, 1974, and 1975 by G.H.P. and M.J. Gourvès and in 1985 by G.H.P. produced multiple specimens of 2 species from Tahiti, of which one was the species found by Gressitt, and single examples of 2 other species, 1 from Tahiti and 1 from Huahine. Gustav Paulay collected 1 specimen each of 2 of these on Mount Marau in 1977 and 1984. A single specimen of 1 of them was also found on Mount Aorai by B.H. Gagné in 1972. Although E.C.Z. had carefully searched for *Proterhinus* in September 1934 on the same plant species at the same localities on Mount Aorai where Gressitt, G.H.P., and Gourvès later found *Proterhinus*, he failed to find any specimens. Moreover, E.C.Z. found only 1 example of *Proterhinus* on Moorea, 1 on Raiatea, and 1 on Tahaa. In view of the methods used by E.C.Z. to collect specimens, and the fact that he has collected large numbers of the genus, especially in Hawai'i, we have concluded that there are few species of *Proterhinus* in the Society Islands and that they are evidently mostly rare. The reason for the abundance of *Proterhinus* in Hawai'i and its rarity elsewhere remains an enigma.

The following Aglycyderidae are now known from the Society Islands:

Proterhinus brevicornis, n. sp.: Tahiti, Tahaa.
Proterhinus fimbriatus, n. sp.: Tahiti, Moorea (and Rurutu, Austral Islands).
Proterhinus gourvesi, n. sp.: Tahiti.
Proterhinus samoae Perkins: Huahine, Raiatea, and Maupiti (introduced from western Polynesia).

The holotypes of the new species here described are deposited in Bishop Museum in Honolulu, which houses the world's largest collection of Polynesian insects. Paratypes, where available, are deposited in the Museum National d'Histoire Naturelle in Paris and in the British Museum (Natural History) in London.

Specimens of the 3 new species collected on Tahiti were mostly taken by beating low vegetation, shrubs, and trees, including *Cyathea* and other ferns, *Metrosideros*, and *Weinmannia*, growing on or near the windblown crests of high ridges above 1,000 m.

Key to the *Proterhinus* of the Society Islands

1. Strongly depressed, explanate species with anterolateral corners of prothorax acute and conspicuously projecting cephalad; lateral margins of pronotum and elytra armed with a continuous row of very conspicuous, long, sharply pointed setae, forming a fringe (Figs. 33–38, 56) . . . . ***fimbriatus*, n. sp.**
   Facies not as above 2

2(1). First antennal segment appearing mostly nude, with only a few fine, subapical setae, segments 3–8 each with only 1 whorl of fine setae; antennae not capable of extending caudad of base of pronotum (Figs. 29–32, 51–52, 57) . . . . **brevicornis, n. sp.**

First antennal segment densely clothed dorsad with coarse setae and setulae that partly or mostly conceal the derm, segments 3–8 with more than 1 whorl of fine setae; antennae capable of extending over base of elytra 3

3(2). Longitudinal dorsal contour of elytra (viewed from side) continuously convex from base to apex; antennal segments 10 and 11 more or less similar in shape to segment 9 . . . (flightless species found on native vegetation in the high mountains of Tahiti) (Figs. 39–42, 50, 54) . . . . **gourvesi, n. sp.**

Elytra almost flat longitudinally from base to top of caudal declivity; antennal segments 10 and 11 broader than 9 . . . (fully winged species found normally on *Cocos nucifera* in the lowlands) (Figs. 43–48, 53, 55) . . . . ***samoae*** Perkins

Proterhinus brevicornis Zimmerman & Perrault, **new species** Figs. 29–32 (♂, ♀), 51–52 (antennae), 57 (metapleural area)

♂ (holotype). Facies as in Fig. 29; subcylindrical in form. *Derm* mostly rufous to piceous; vestiture mostly yellowish or golden with some rather poorly defined condensations of golden squamules on elytra. *Head and rostrum* as in Fig. 30; widest at a point about length of an eye in front of eyes, at this point as wide as distance across eyes; width subequal to total length of head and rostrum, width divided into greatest width of pronotum = 1.35; surface entirely densely punctate, punctures much larger and coarser on head; microsculpture coarse and conspicuous on entire surface, with a large, broad, shallow concavity on each side of medial line (latter narrowly cariniform on holotype but probably variable); with coarse, decurved squamules, scattered erect setae, and more conspicuous, longer, erect, sharply pointed, marginal and submarginal setae. *Antennae* as in Figs. 29, 52, not capable of reaching caudad of base of prothorax; segment 1 (total length measured from beneath head) as long as segment 2 + about ½ of 3, only slightly wider than 2; 2 as long as 3 + about ½ of 4; 3 as long as 4 + about ½ of 5; 6, 7, and 8 each successively slightly shorter; 8 about ¾ as wide as long and about ½ as long as 3; clava appearing to be formed of segments 10 and 11, which are about 2x as wide as 9; total length of segments 9–11 subequal to combined length of segments 4–8 inclusive; segments 1 and 2 with only a few erect hairlike setae and no squamules; segments 3–8 each with only 1 whorl of long, fine setae. *Prothorax* shaped as in Fig. 29; widest at about middle and there a little wider than length, somewhat longer than head + rostrum and a little less than ½ as long as elytra; anterior corners angular and slightly produced behind extreme apex; pronotum densely and coarsely punctate and coarsely reticulate, with a row of conspicuous, short, erect setae around margins and a few mostly shorter, scattered erect setae in addition to the decurved squamules. *Scutellum* nude. *Elytra* as in Fig. 29; surface lacking elevations or depressions; humeri rounded, not produced; microsculpture noticeably less coarse than on pronotum; punctures large and dense; decumbent squamules rather sparsely distributed but with some irregular patches of condensed squamules; with 4 longitudinal rows of long, erect, sharp, spikelike setae (some of the rows may be incomplete) in addition to a row of similar setae that extends along lateral margin from above ventrite 3 to around apex. *Legs* with erect, mostly sharply pointed setae on femora and tibiae comparatively short (mostly not more than about ⅓ as long as long erect elytral setae and conspicuously different in appearance from latter); 3 pairs of femora rather similar in shape; tarsi with segment 3 (excluding claws) extending beyond apex of 2 as far as length of 2, lobes asymmetrical. *Ventral surface* mostly with microsculpture moderately coarse; prosternum, metasternum, and ventrite 1 densely, coarsely punctate; ventrites 2–5 successively less obviously punctate; mesosternum coarsely punctured only along caudal margin; setae moderate, fine, sharply pointed, slanting erect; distances separating pro-, meso-, and metacoxae subequal; medial length of metasternum distinctly longer than distance between mesocoxae and as long as or a little longer than ventrites 2+3; ventrite 1 with medial length as long as ventrites 2–3 + ½ of 4; ventrite 2 a little longer than 3; 3 and 4 subequal in length; 5 distinctly longer than 1.

♀. Head, rostrum, and facies as in Figs. 31–32; width across eyes conspicuously greater than greatest width in front of eyes, lateral contours of head and rostrum narrowed from eyes to mandibles; dorsal separation of head and rostrum ill defined but, assuming base of rostrum to be at bases of sulci, length (excluding mandibles) and basal width subequal and distance from front of an eye to apex of epistoma as great as interocular distance + an eye; with 6 well-defined dorsal sulci that bear erect, sharp setae.

Total length 3.25–3.40 mm; width 1.0–1.2 mm.

Distribution. Society Islands: Tahiti and Tahaa.

Type specimens. SOCIETY IS. TAHITI: holotype ♂, [Mt] Pito Iti, crest of mt, 900–1,000 m [not labeled with date of capture, 1973 or 1974] (Gourvès) (BPBM 13785); allotype ♀, Mt Marau, 1,300 m, 29.VIII.1984, on fern (Paulay) (BPBM). TAHAA: paratype ♀ (teneral specimen), Mt Purauti, E ridge, ca. 420 m, 11.X.1934, beaten from *Devalia solida* (Zimmerman).

Remarks. The short antennae whose first segment bears only a few fine setae will alone serve easily to distinguish this species from the other species of *Proterhinus* known from the Society Islands.

Proterhinus fimbriatus Zimmerman & Perrault, **new species** Figs. 1–6 (♂ genitalia), 17–19 (♀ genitalia), 33–38 (♂, ♀), 49 (antenna), 56 (metapleural area)

♂. Facies as in Fig. 33; a strongly depressed species; usually with a mealy incrustation. *Derm* mostly reddish brown to piceous; vestiture mostly appearing dirty white to pale yellowish and arranged on dorsum as on Fig. 33, but variable. *Head and rostrum* combined (there appears to be no rostrum when viewed from above) as in Figs. 33, 35, and in Fig. 36 of ventral surface; widest at point about equal to length of an eye in front of eyes and there conspicuously wider than width across eyes, about ¼ wider than total length of combined head and rostrum, only slightly narrower than extreme width of prothorax (width divided into extreme width of pronotum = 1.11 on holotype ♂); surface coarsely and closely punctate basad, with coarse reticulate microsculpture distad to epistoma and with a large, shallow, conspicuous depression on each side of medial line in front of middle; cephalic margins with erect, thick, mostly lanceolate setae. *Antennae* as in Fig. 49; capable of reaching nearly to middle of elytra; extreme length of segment 1 (measured from beneath head) somewhat longer than 2+3, almost 2x as thick as 2, with numerous fine, hairlike setae and some coarse prostrate squamules; segment 2 about as long as 3 + ½ of 4; segments 3–8 each successively slightly shorter, all claviform and longer than broad, each with more than 1 whorl of very fine, erect setae; 8 about ½ as long as 2; 9–11 forming a weak clava whose total length is a little longer than funicular segments 5–8. *Prothorax* shaped as in Fig. 33; medial length subequal to that of combined head and rostrum or about ½ medial length of elytra; anterior corners acute, very conspicuously protruded cephalad; lateral margins with a fringe of long, lanceolate, very conspicuous, sharply pointed setae that arise from tuberculiform bases; surface coarsely, closely punctate, mostly shiny (when clean), with fine microsculpture and with very shallow, irregular, variable depressions. *Scutellum* nude. *Elytra* shaped as in Fig. 33; puncturation dense, coarse, confused; lateral margins fringed with very long, conspicuous, lanceolate setae continuous with lateral fringes of prothorax; humeri rounded, not produced; disc of each elytron with an oblique row of long and short, erect, lanceolate setae extending from near suture at top of caudal declivity toward humerus and borne from an irregular, variable carina that terminates at a large, broad, shallow, variable depression at about basal ⅓, usually a less-developed dorsal depression just behind middle, these depressions with derm often darker and with sparser vestiture, vestiture usually condensed and more conspicuous behind and in front of posterior depressions; another variable row of erect setae similar to those described above on either side of suture; base with a broad, low elevation on either side of scutellum; derm shiny (when clean), with fine microsculpture and dense, coarse punctures. *Legs* with numerous, long, erect, lanceolate setae; 3 pairs of femora similar in shape; tarsi with segment 3 (excluding claws) extending beyond apex of 2 about length of 2, which is asymmetrical. *Ventral surface* with short, sharp setae; abdomen and metasternum dulled by coarse, reticulate microsculpture but prosternum moderately shiny with microsculpture much less developed; puncturation of sternum and ventrite 1 mostly comparatively shallow, punctures of ventrites 2–5 indefinite or absent; mesosternum conspicuously punctate only near caudal margin; metasternum with medial length ⅔ as great as distance between mesocoxae and subequal to medial length of ventrite 2; ventrite 1 as long as 2 + 3 + about ⅓ of 4; 3 shorter than 2; 4 shorter than 3; 5 about as long as 1.

♀. Head and rostrum very different from those of ♂, facies as in Figs. 34, 37, 38; width across eyes slightly greater than greatest width of head in front of eyes; rostrum (excluding mandibles) about as long as broad, about as long as head from caudal margin of eyes to base of rostrum, longitudinally multistriate, with numerous, very fine, erect setae.

Total length 3.0–4.0 mm; width 1.0–1.4 mm.

Distribution. Society Islands: Tahiti and Moorea. Austral Islands: Rurutu.

Type specimens. SOCIETY IS. TAHITI: holotype ♂ (BPBM 13786), 3 ♂, 1 ♀, paratypes, Mt Aorai, 1,350 m, 14.IV.1973 (Perrault); allotype ♀, 1 ♀ paratype, Mt Aorai, 12.IV.1974 (Gourvès). Other/additional paratypes. TAHITI: 1 ♂, 2 ♀, Mt Aorai, crest of mt, 1,350 m, 9.IX.1973 (Perrault); Mt Aorai, 1 ♀, 12.IV.1974 (Gourvès); 1 ♀, [Mt] Pito Iti, 1,000 m, 12.IV.1970 (Gourvès); 1 ♀, Mt Marau, 1,300–1,450 m, 15.VII.1973 (Perrault); 1 ♂, 1 ♀, Mt Marau, crest of mt, 1,400 m, 1.VI.1974 (Perrault); 1 ♀, Mt Marau, 1,450 m, 12.II.1974 (Perrault); 1 ♂, 1 ♀, Mt Pito Iti trail, 1,000 m, 30.IV.1977 (Gourvès); 2 ♂, 2 ♀, Mt Marau, summit of mt, 1,400 m, 20.IX.1977 (Gourvès); 1 ♀, Mt Marau, 1,400 m, 18–21.VIII.1977, found under bark (W.C. Gagné); 2 ♂, Mt Marau, 21.X.1985 (Perrault); 1 ♀, [Mt] Pito Iti trail, 1,000 m, 18.XI.1985 (Perrault); 2 ♂, Mt Atara, 1,100 m, 30.XI.1985 (Perrault). MOOREA: 1 ♀, Mt Teaharea, N ridge, about 600 m, 25.IX.1934, beaten from an unidentified shrub (Zimmerman). AUSTRAL IS. RURUTU: 1 ♀, Mt Manureva, SW slope, 300 m, 25.VII.1934, beaten from *Dryopteris* fern (Zimmerman); 2 ♀, same locality, about 335 m, 29.VII.1934, beaten from *Metrosideros* (Zimmerman).

Remarks. This is one of the most distinctive of the described species of *Proterhinus*. The only known close ally is an undescribed species from Rapa (Zimmerman, unpubl.). The depressed form and the conspicuous lateral fringes of large setae render the species easily recognized. The large bladderlike appendage arising from the ductus seminalis of the female genital system is particularly noteworthy.

The fact that this species occurs on Rurutu in the Austral Islands and also on Tahiti and Moorea in the Society Islands is unusual and unexpected.

Proterhinus gourvesi Zimmerman & Perrault, **new species** Figs. 7–10 (♂ genitalia), 20–22 (♀ genitalia), 39–42 (♂, ♀), 50 (antenna), 54 (metapleural area)

♂. Facies as in Fig. 39; subcylindrical in form. *Derm* reddish brown to piceous, variable; vestiture mostly white or dirty white but with some yellowish-tinged squamules and some of shorter erect setae on elytra darker; on unabraded specimens a conspicuous patch of condensed squamules at about middle of each side of pronotal disc, and similar prominent patches arranged on elytra as follows: a basal humeral patch, a basal patch on each side of scutellum, a patch behind these at about basal ⅓ of elytral length, obliquely posterolaterad of latter patch a similar patch just behind middle on each elytron, and other variable condensations of squamules. *Head and rostrum* as in Fig. 40, widest at point about length of an eye in front of eyes and there slightly wider than width across eyes, subequal to length of combined head and rostrum, width divided into extreme width of pronotum = 1.25 on holotype; surface coarsely, closely punctate and coarsely reticulate; with a large, broad concavity on either side of medial line in front of a line drawn between points of greatest cephalic width; with coarse, decurved squamules and some erect, coarse setae and with narrower, sharply pointed setae around rostral apex. *Antennae* as in Fig. 50, capable of extending caudad to about apex of ventrite 1; segment 1 (total length measured from beneath head) slightly shorter than 2+3, about ¼ wider than 2; 2 about ⅔ as long as 3; 3 slightly longer than 5; 5–8 each successively slightly shorter, 8 a little longer than 2; dorsal side of segment 1 with numerous, thick, blunt-tipped setae rather similar to those on adjacent part of head, all other segments with numerous long, fine, hairlike setae; segments 9–11 forming a poorly defined clava whose total length equals combined lengths of segments 6–8. *Prothorax* shaped as in Fig. 39; length subequal to width, about ¼ longer than head plus rostrum and about 4⁄7 length of elytra; anterior corners not projecting; pronotum densely, coarsely punctate, microsculpture inconspicuous; erect setae very short on disc but with a row of well-developed, blunt-tipped, erect setae around margins similar to larger erect setae on elytra. *Scutellum* nude. *Elytra* as in Fig. 39, without any conspicuous elevations or depressions; humeri not produced, subrectangular with only corners rounded; less coarsely sculptured than pronotum; microsculpture inconspicuous; in addition to prostrate squamules, numerous erect, stout setae that are shortest on disc and longest laterad and caudad. *Metepisternum* with cephalic end enlarged, convex, somewhat protuberant, conspicuously indenting subhumeral elytral margin (Fig. 54; compare *samoae, fimbriatus,* and *brevicornis,* Figs. 55–57). *Legs* with numerous erect setae (in addition to background squamules) that resemble longer erect setae on elytra and pronotum; 3 pairs of femora of rather similar shape; tarsi with segment 3 (excluding claws) extending beyond apex of 2 for a distance less than length of 2, lobes of segment 2 symmetrical. *Ventral surface* with microsculpture mostly inconspicuous and derm mostly shiny, except laterad and caudad on abdomen; all setae small, fine, mostly inconspicuous; pro- and metasternum not coarsely punctured, punctures only moderately large, some separated by their diameters; disc of mesosternum with numerous punctures, punctures less coarse and dense than caudad; most punctures of ventrite 1 small and not closer together than their diameters on disc; metasternum with medial length as long as distance between mesocoxae and as long or somewhat longer than ventrite 2 + ½ of 3; ventrite 1 with medial length greater than 2+3+4; 2 about as long as 3 + ½ of 4; 3 and 4 subequal; 2 and 5 subequal.

♀. Head, rostrum, and facies as in Figs. 41–42; width across eyes slightly but distinctly greater than greatest width of head in front of eyes; rostrum (excluding mandibles) a little broader than long and about as long as head from base of rostrum to caudal margin of an eye, longitudinally multistriate, strial punctures bearing long, erect, hairlike setae.

Total length 3.2–4.2 mm; width 0.9–1.4 mm.

Distribution. Society Islands: Tahiti.

Type specimens. SOCIETY IS. TAHITI: Holotype ♂ (BPBM 13787, allotype ♀ (BPBM), 1 ♂, 3 ♀, paratypes, [Mt] Pito Iti trail, 1,000 m, 12.IV.1974 (Gourvès). Additional paratypes. TAHITI: 1 ♂, 3 ♀, Mt Aorai, 1,450 m, 14.V.1974 (Perrault); 1 ♂, [Mt] Pito Iti trail, 1,000 m, 26.VII.1974 (Perrault); 1 ♂, 1 ♀, [Mt] Pito Iti trail, 26.VII.1974 (Perrault); 2 ♂, 11 ♀, Mt Aorai, 1,350 m, 14.IV.1973 (Gourvès); 1 ♂, Mt Aorai, crest of mt, 1,350 m, IX.1973 (Perrault); 1 ♂, 1 ♀, Mt Aorai trail, 1,400 m, IX.1976 (Gourvès); 1 ♀, Mt Aorai, N side, 1,400 m, 10.IX.1977 (B.H. Gagné); 1 ♂, Mt Marau, 1,300–1,400 m, from *Metrosideros* (Paulay); 5 ♂, 3 ♀, Mt Marau, 1,400 m, 13.XI.1985 (Perrault); 1 ♂, Mt Aorai, NW ridge, 1,400–1,450 m, 9.VII.1961, on *Metrosideros collina* (Gressitt); 2 ♀, Mt Aorai, 1,400 m, 11–12.VII.1961, on *Weinmannia parviflora,* "No. 3746" (Gressitt).

Remarks. The subtubular shape in combination with the long antennae that reach far caudad of the base of the elytra make easy the recognition of this species in the Society Islands' fauna.

We take pleasure in dedicating this species to Mr. J. Gourvès in recognition of the outstanding work he has done in collecting the coleopterous fauna of Tahiti and in recognition of the numerous excursions to the interior of Tahiti he made in the company of his friend Gérard Perrault.

Proterhinus samoae Perkins Figs. 11–16 (♂ genitalia), 23–28 (♀ genitalia), 43–48 (♂, ♀), 53 (antenna), 55 (metapleural area)

Proterhinus samoae Perkins, 1907, Proc. Hawaii. Entomol. Soc. 1: 87; 1928, Insects of Samoa 4(2): 173.

Distribution. Although this species is widely distributed in Polynesia, Melanesia, and Micronesia, its distribution has not been recorded in literature.

Specimens examined. SOCIETY IS. HUAHINE: 1 specimen, small islet in front of Parea, sea level, IV.1974 (Gourvès), first record for the island of Huahine. MAUPITI: 1 specimen, small islet, XII.1977 (Gourvès), first record for the island. RAIATEA: Tetaro Islet, 1 specimen, about 1 m above sea, 4.X.1934, beneath a limb of *Hibiscus tiliaceus* (not a true host) on ground (Zimmerman), first record from Raiatea and earliest record for the Society Islands.

Remarks. The cephalic ends of the metepisterna (Fig. 55) are enlarged and protrude distinctly into the lateral margins of the elytra (compare *P. gourvesi*). This is the only known species of *Proterhinus* whose hind wings are developed for flight, and this fact is here reported for the first time.

The larvae of this species live in various dead parts of *Cocos nucifera*, particularly in the dead fronds. The species appears to be a comparatively recent immigrant to the Society Islands, and it has no doubt been introduced by commerce from islands to the west. It often infests the stem ends of *C. nucifera* fruits, and it is thus easily transported. It was described by Perkins from a male bred in Honolulu from the fruit-stem of a coconut imported from Samoa for planting in Hawai'i.

ACKNOWLEDGMENTS

The assistance of Elizabeth Lockie and Kathy Pickerd in preparing the scanning electron photomicrographs is gratefully acknowledged. G.A. Samuelson supplied specimens for study from the collections of Bishop Museum.

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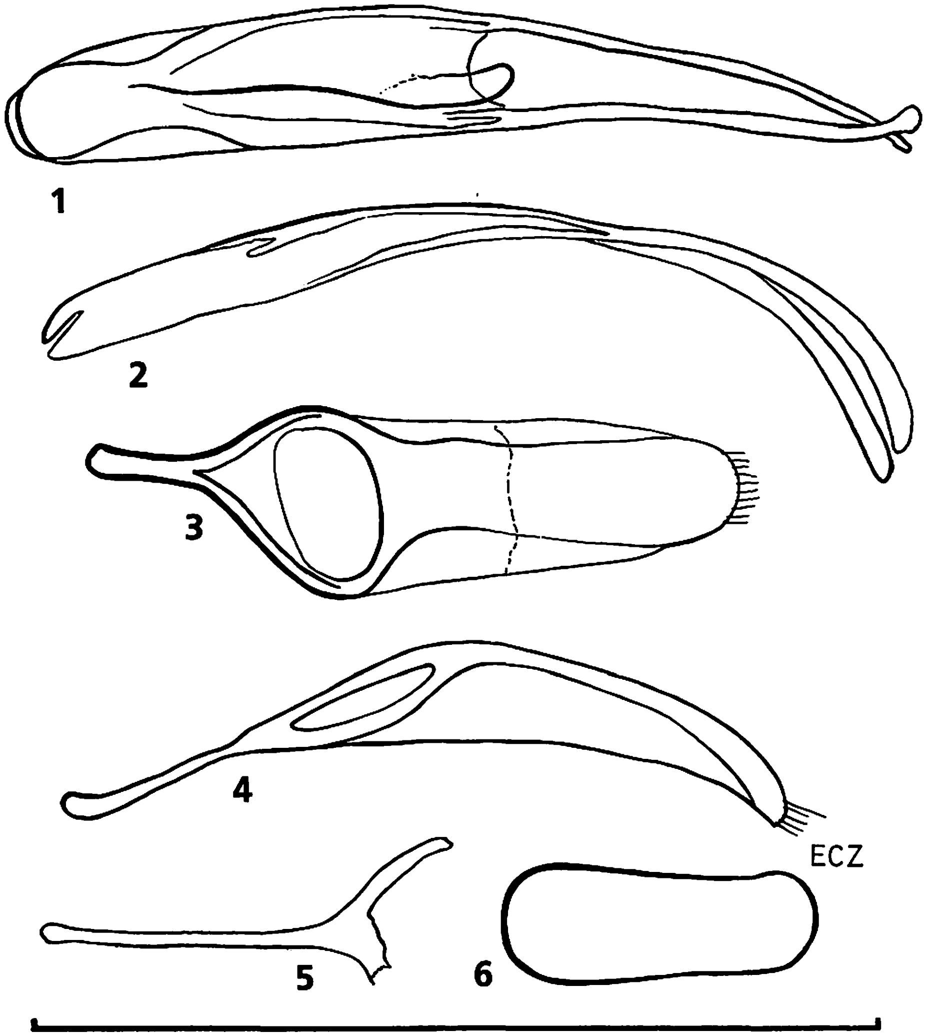
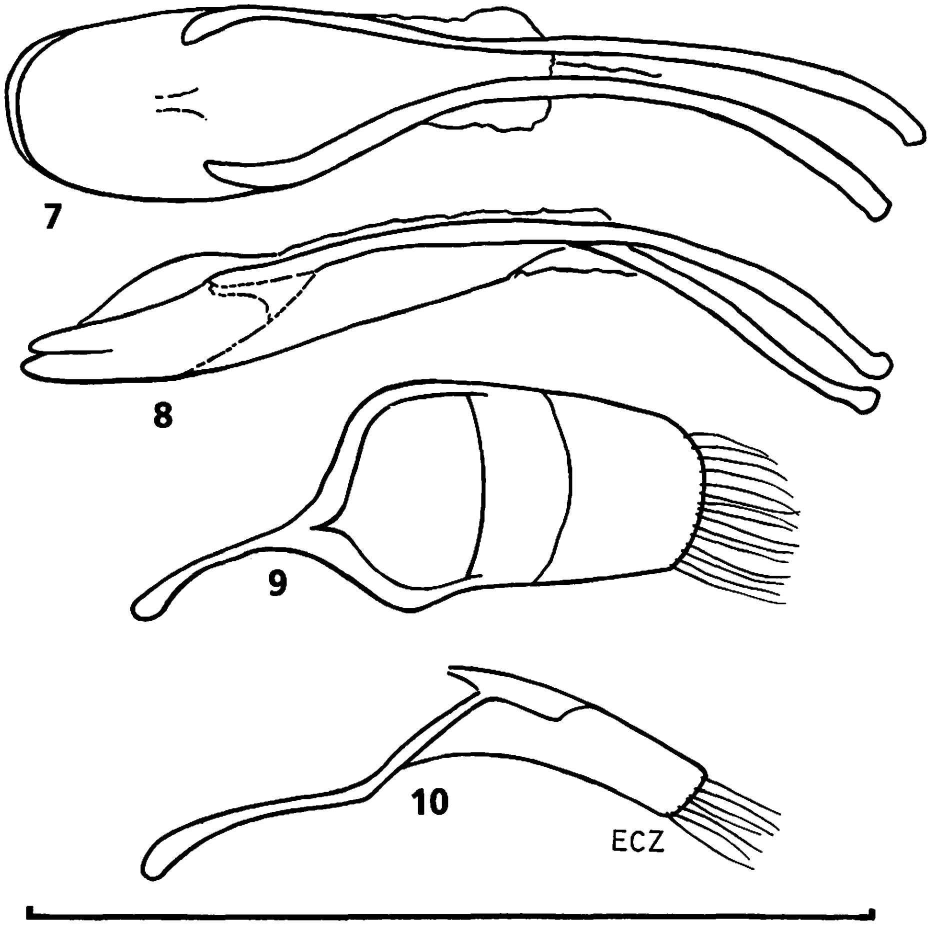
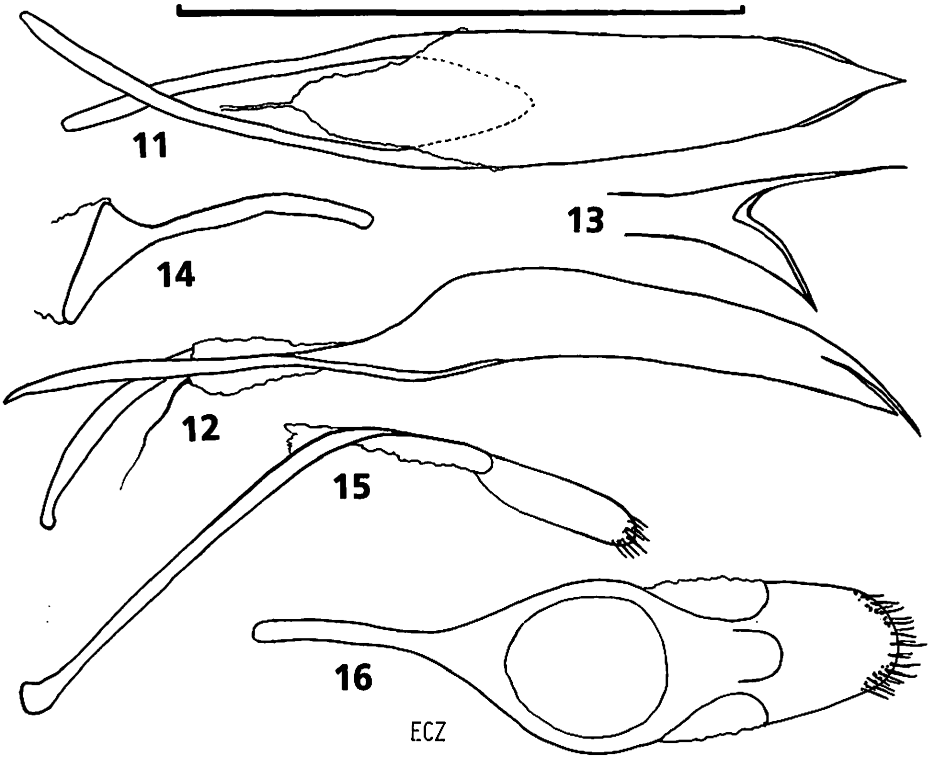


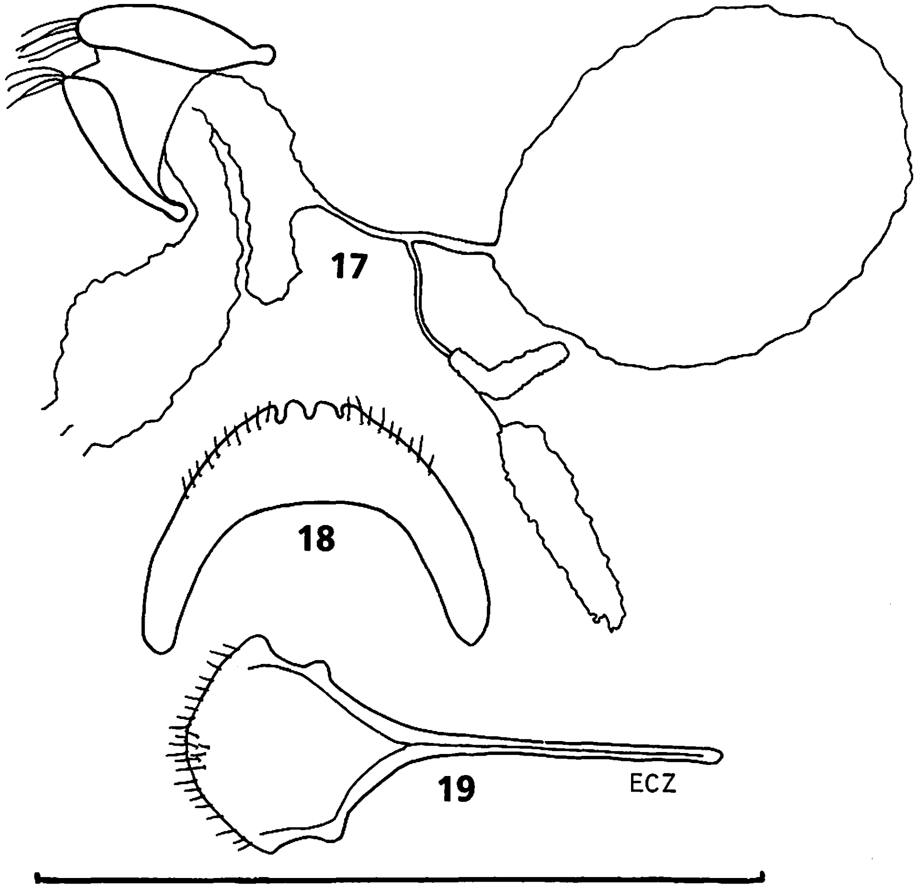
Figs. 1–6. ♂ genitalia of *Proterhinus fimbriatus*: **1–2,** dorsal and lateral views of aedeagus; **3–4,** dorsal and lateral views of tegmen (optically distorted); **5,** sternite 9; **6,** sclerotized loop of rectum. Scale line = 1.0 mm.



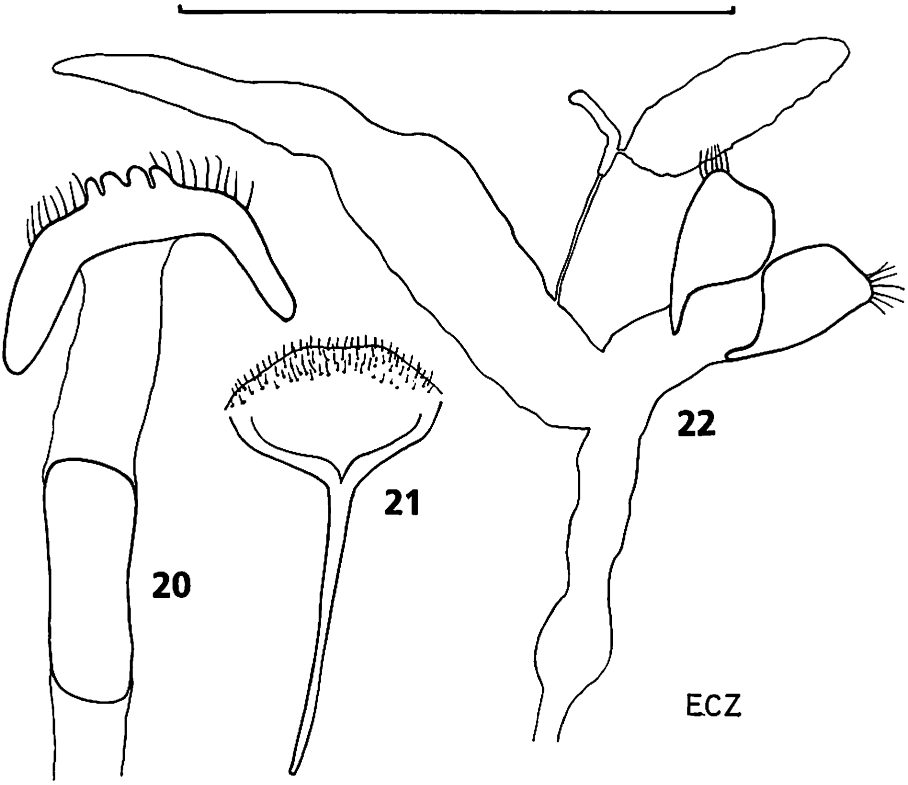
Figs. 7–10. ♂ genitalia of *Proterhinus gourvesi*: **7–8**, dorsal and lateral views of aedeagus; **9–10**, dorsal and lateral views of tegmen (optically distorted). Scale line = 1 mm.



Figs. 11–16. ♂ genitalia of *Proterhinus samoae*: **11–12,** dorsal and lateral views of aedeagus (with ostium closed); **13,** apex of aedeagus with ostium open; **14,** sternite 9; **15–16,** lateral and dorsal views of tegmen (optically distorted). Scale line = 1.0 mm.



Figs. 17–19. ♀ abdominal details of *Proterhinus fimbriatus*: **17,** genital tract; **18,** tergite 8; **19,** sternite 8. Note the unusual, balloonlike process of the ductus seminalis, and compare Figs. 22 and 23. Scale line = 1.0 mm.



Figs. 20–22. ♀ abdominal details of *Proterhinus gourvesi*: **20,** tergite 8 with part of rectum and sclerotized loop; **21,** sternite 8; **22,** genital tract. Scale line = 0.5 mm.

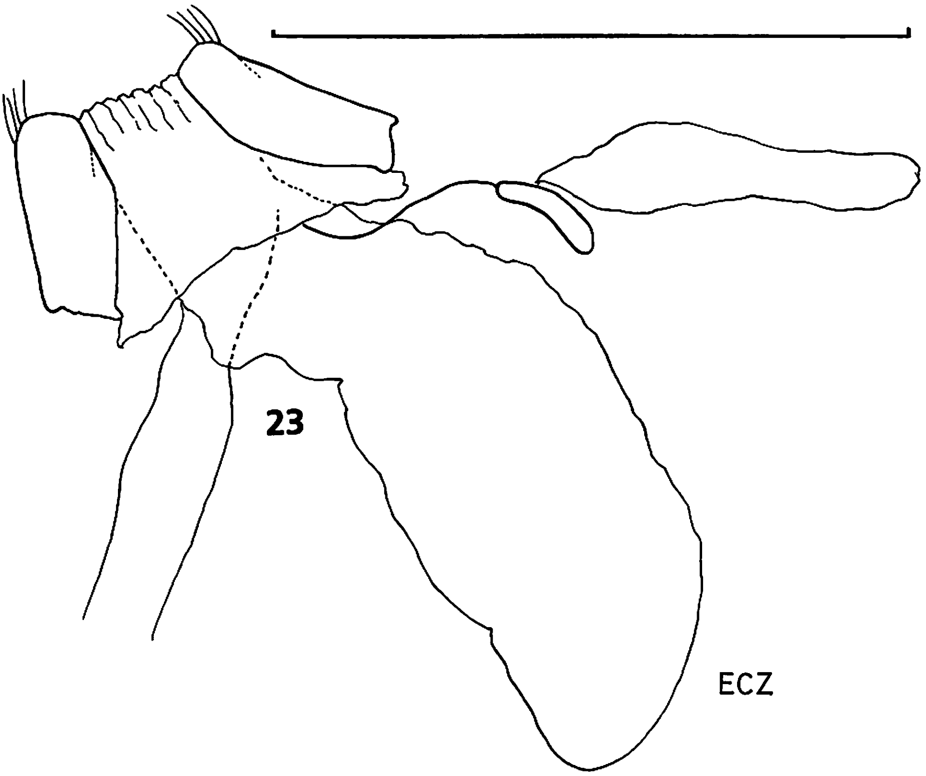
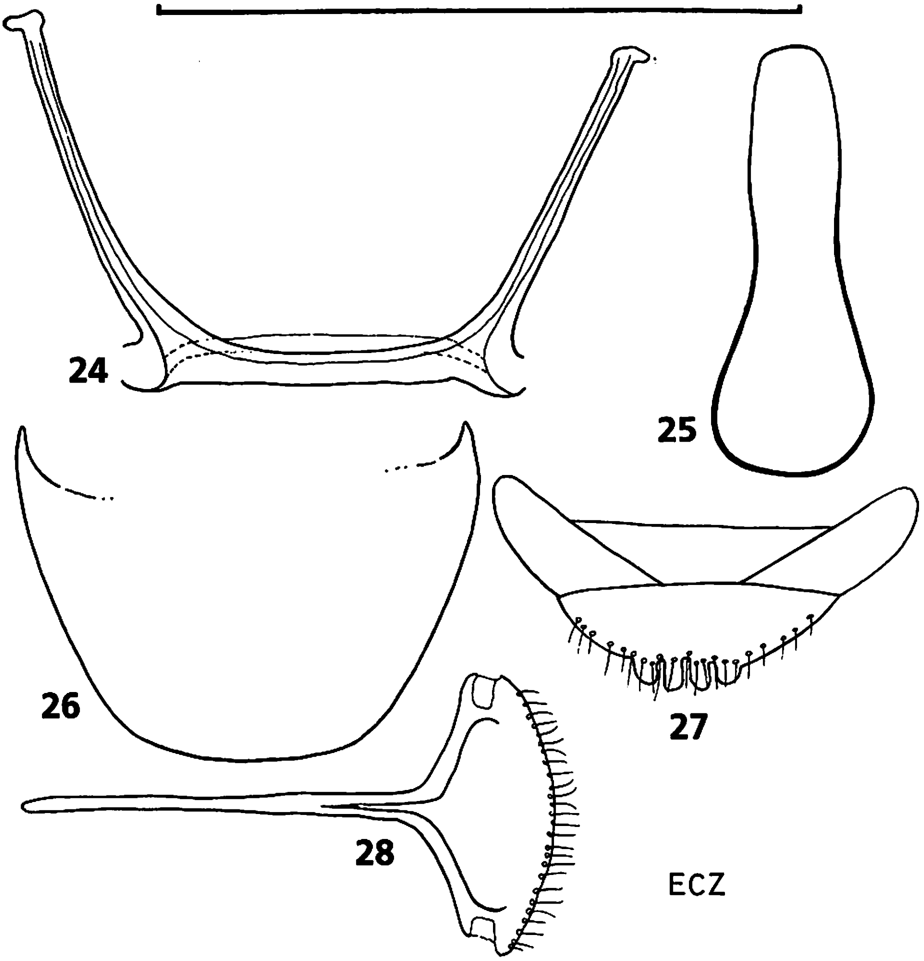
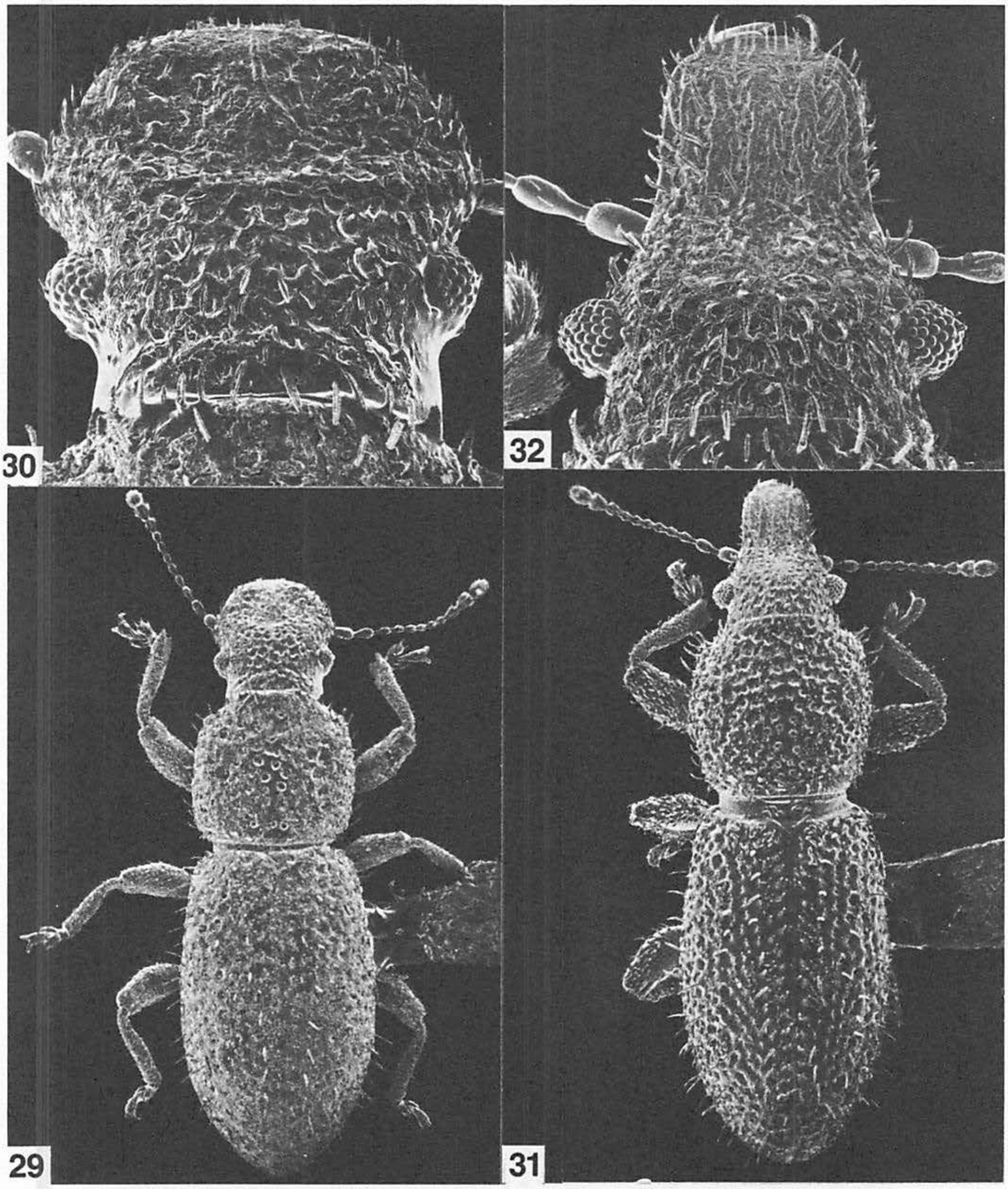


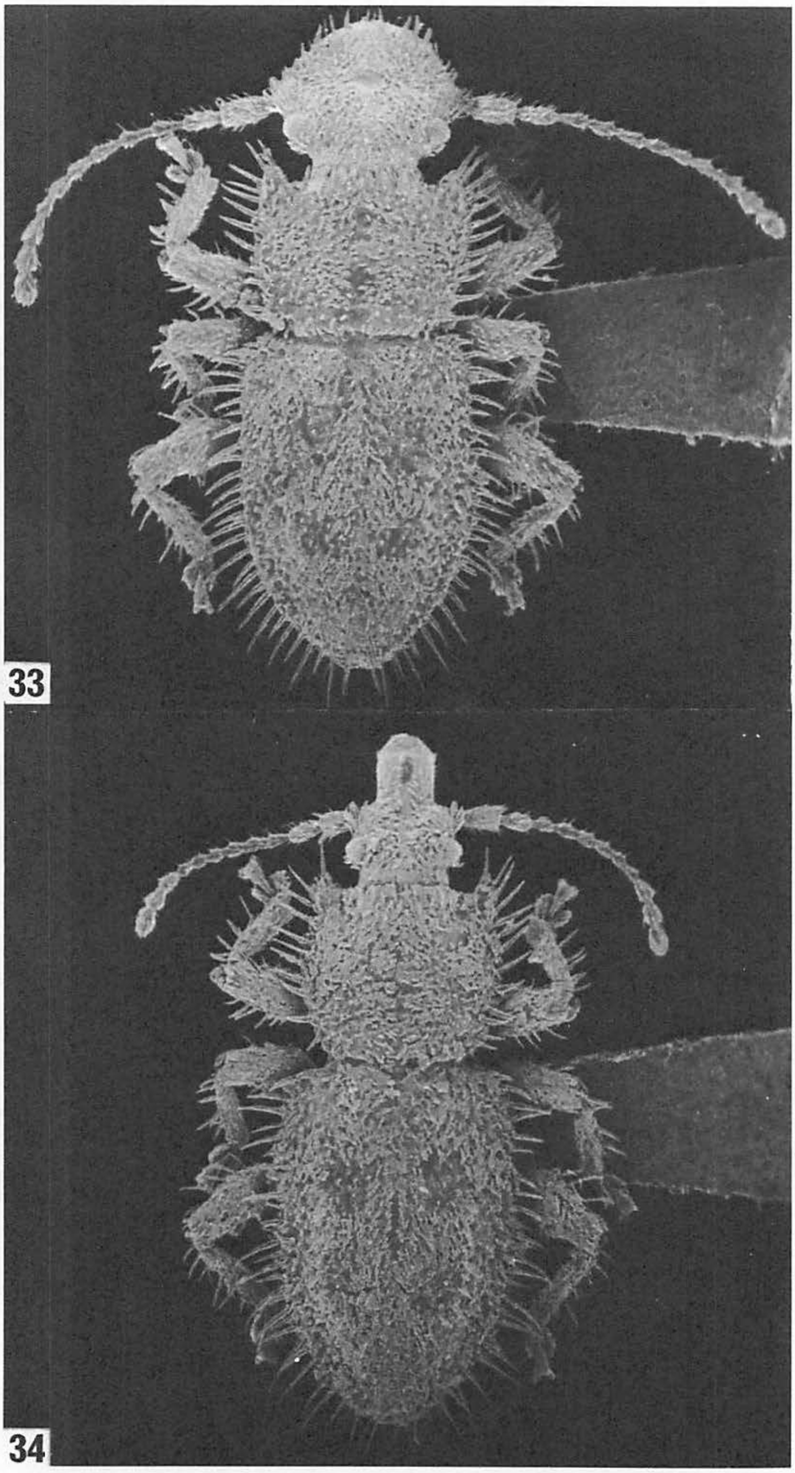
Fig. 23. ♀ genital tract of *Proterhinus samoae*. Scale line = 0.5 mm.



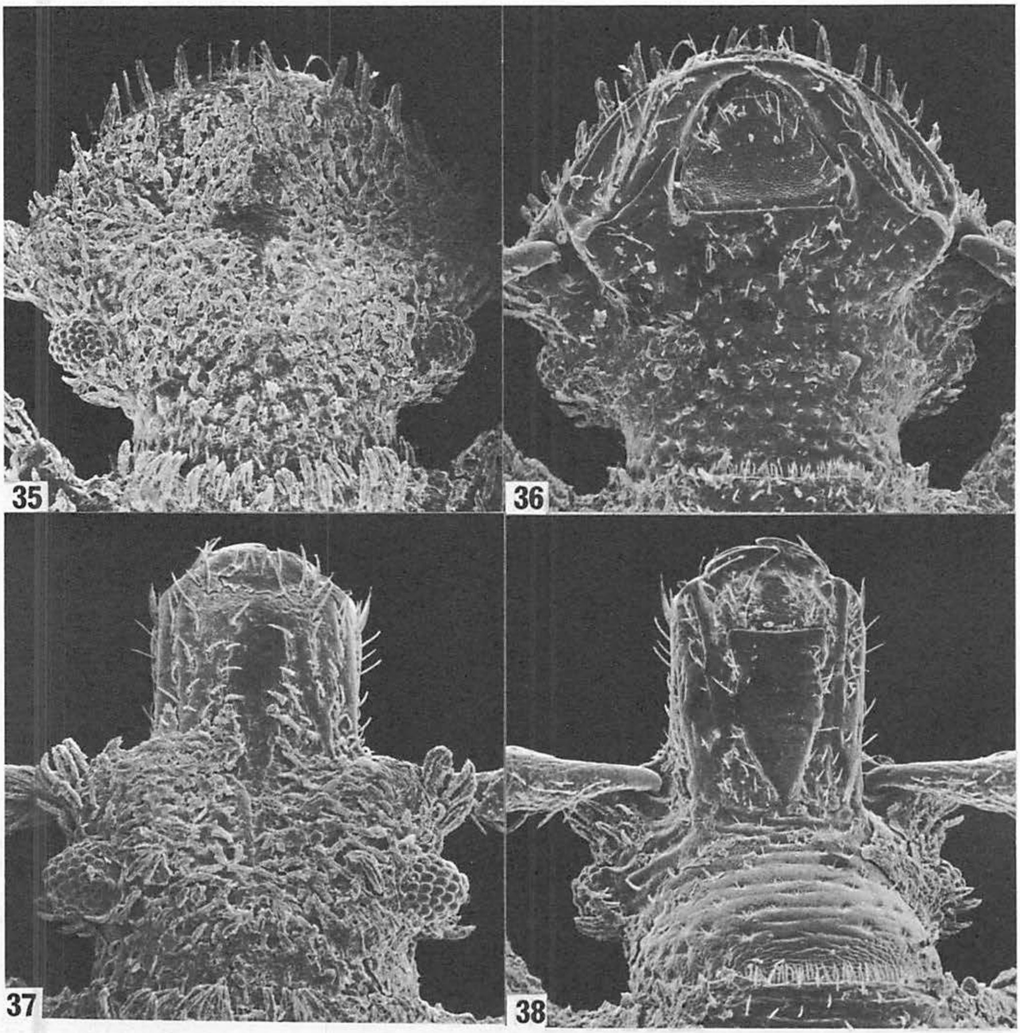
Figs. 24–28. Features of ♀ *Proterhinus samoae*: **24,** metendosternite (no posterior marginal tendons observed); **25,** sclerotized loop of rectum; **26,** tergite 7 (pygidium); **27,** tergite 8; **28,** sternite 8. Scale line = 0.5 mm.



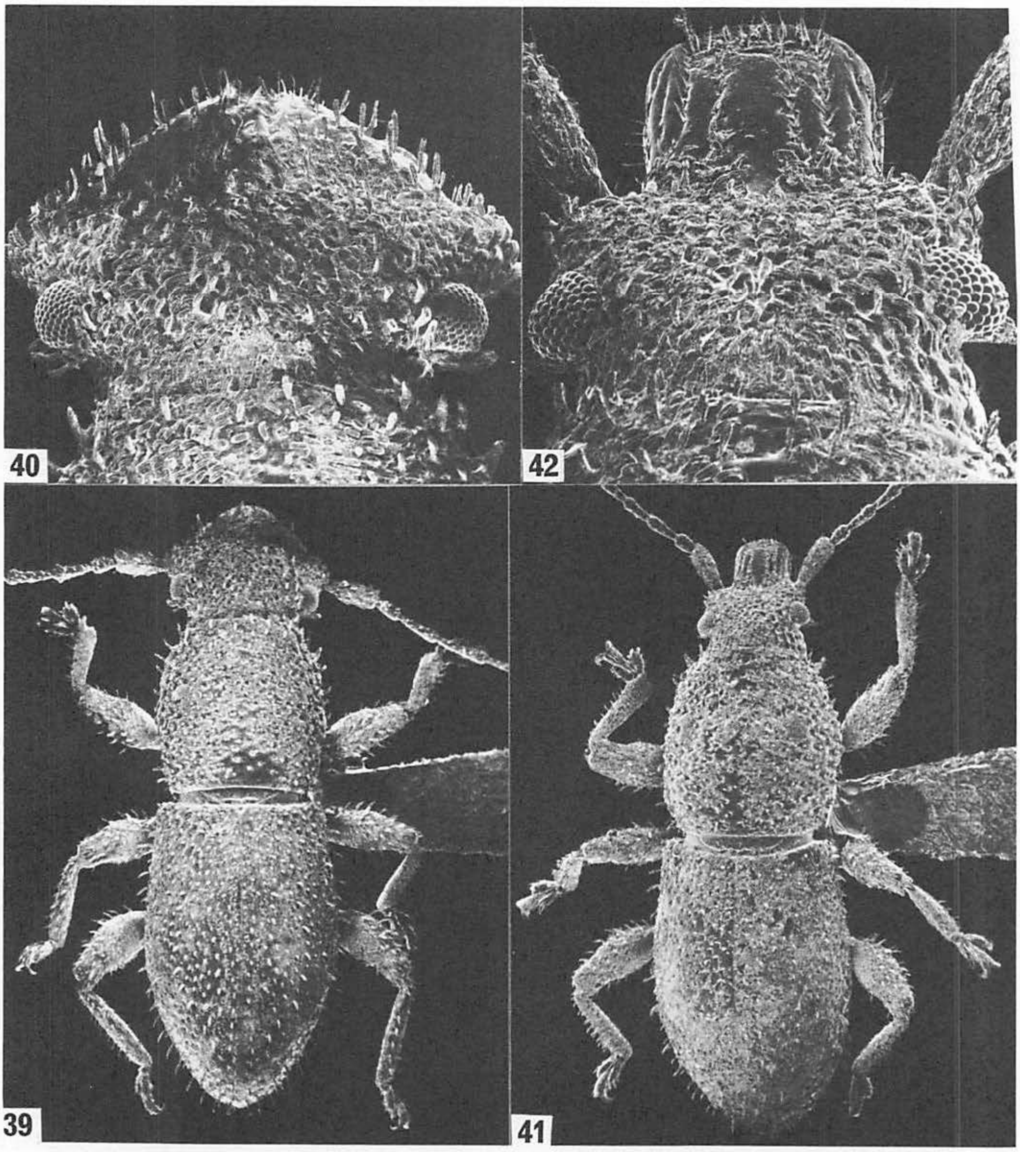
Figs. 29–32. *Proterhinus brevicornis*: **29,** holotype ♂ (total length 3.5 mm); **30,** head of same specimen enlarged (optically somewhat foreshortened); **31,** paratype ♀ (total length 3.3 mm); **32,** head of same specimen enlarged.



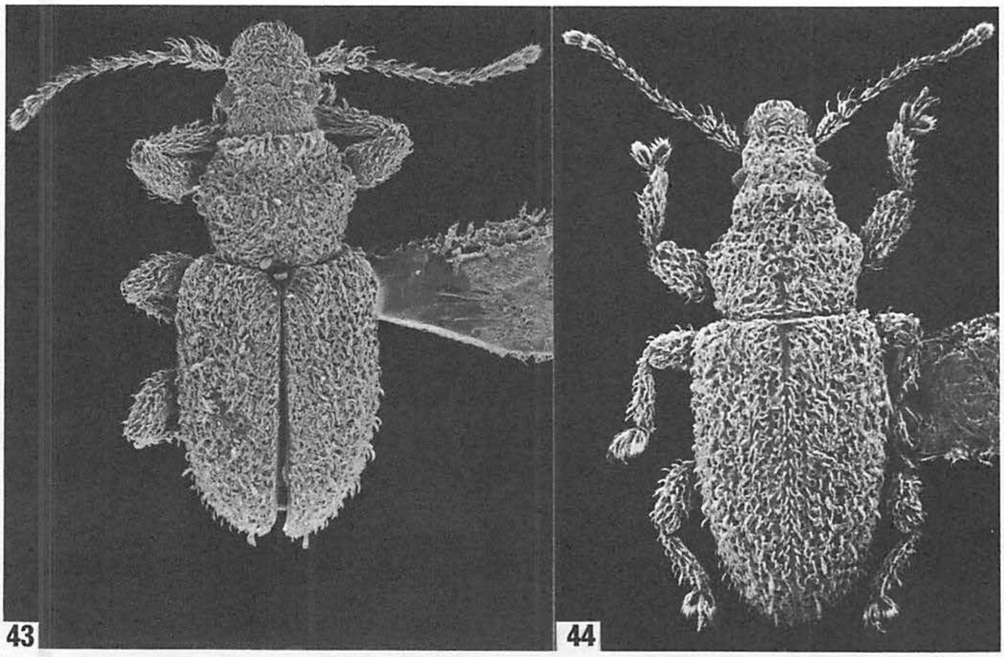
Figs. 33–34. Paratypes of *Proterhinus fimbriatus* from Mt Marau, Tahiti: **33,** ♂ (total length 3.7 mm); **34,** ♀ (total length 3.9 mm).



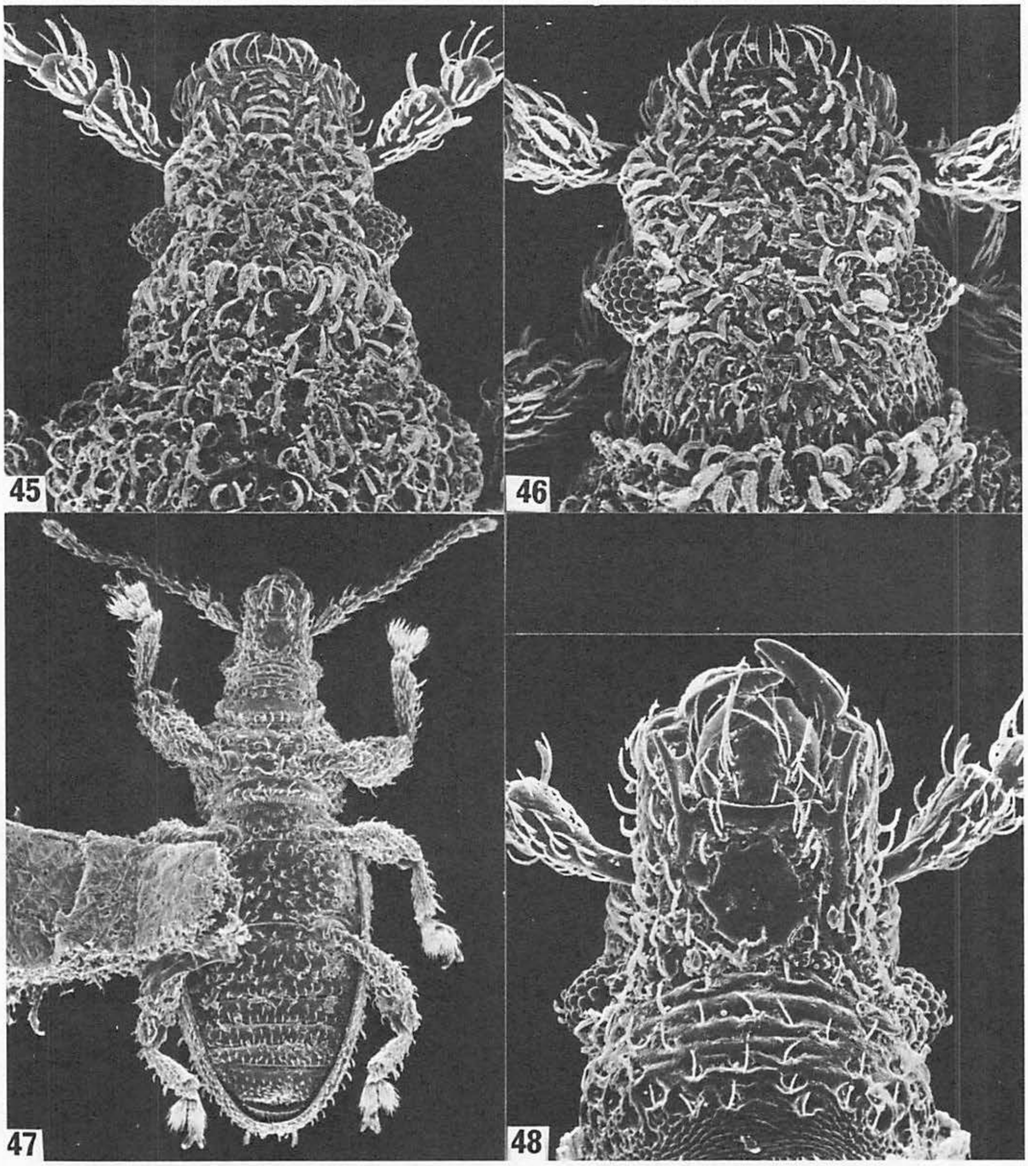
Figs. 35–38. Details of heads of *Proterhinus fimbriatus* specimens illustrated in Figs. 33 and 34: **35–36,** dorsal and ventral views of ♂ (note the conspicuous adelognathus nature of the mouth, a feature not mentioned in literature); **37–38,** dorsal and ventral views of ♀ (note the absence of posterior gular sutures and the conspicuous pregula).



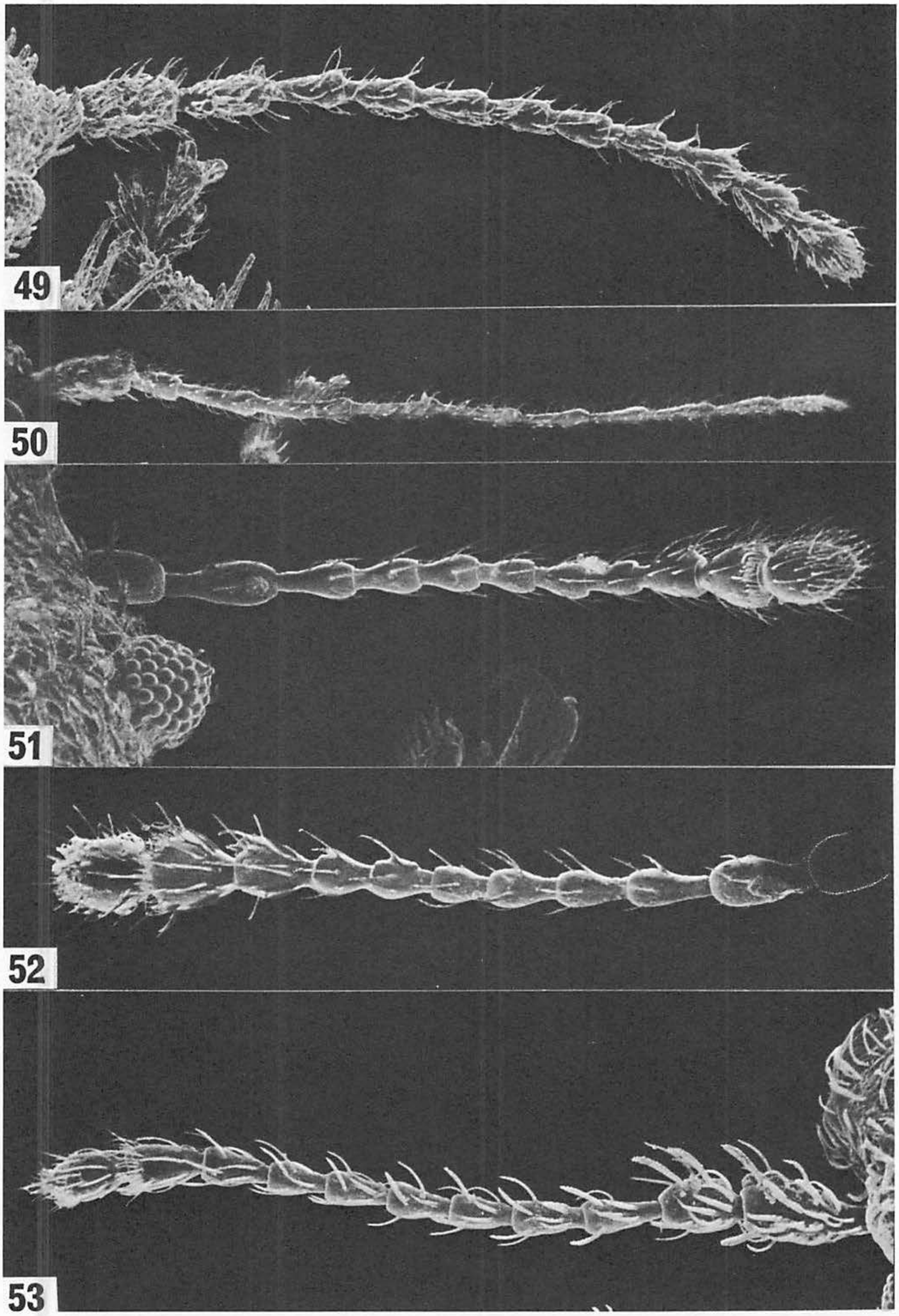
Figs. 39–42. *Proterhinus gourvesi* paratypes from Mt Pito Iti, Tahiti: **39,** ♂ (total length 4.3 mm); **40,** head of same specimen enlarged; **41,** ♀ (total length 3.6 mm); **42,** head of same specimen enlarged.



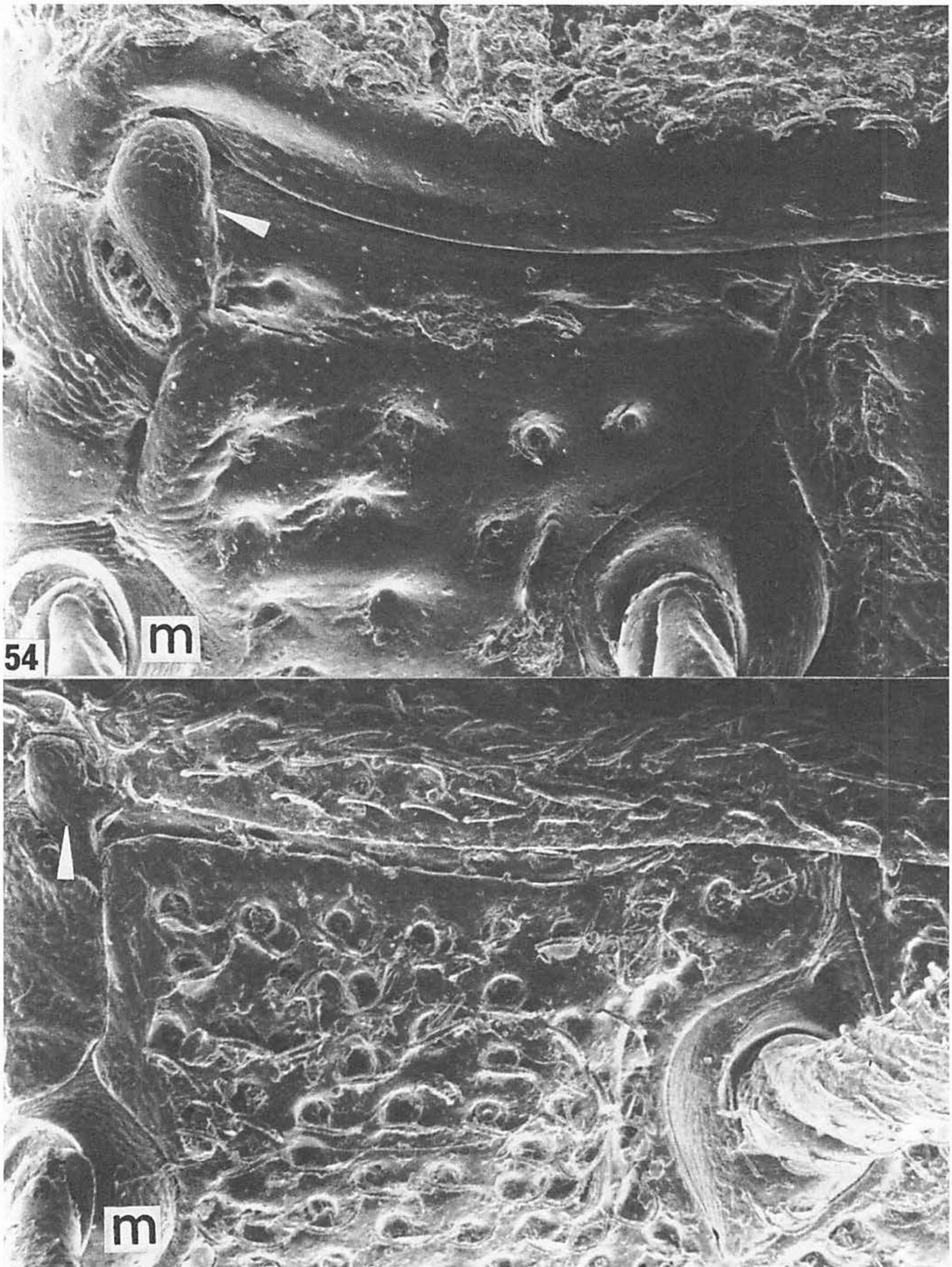
Figs. 43–44. *Proterhinus samoae* specimens from Vanua Mblavu, Fiji: **43,** ♂; **44,** ♀ (total lengths 2.1 mm) (photographs not equally enlarged).



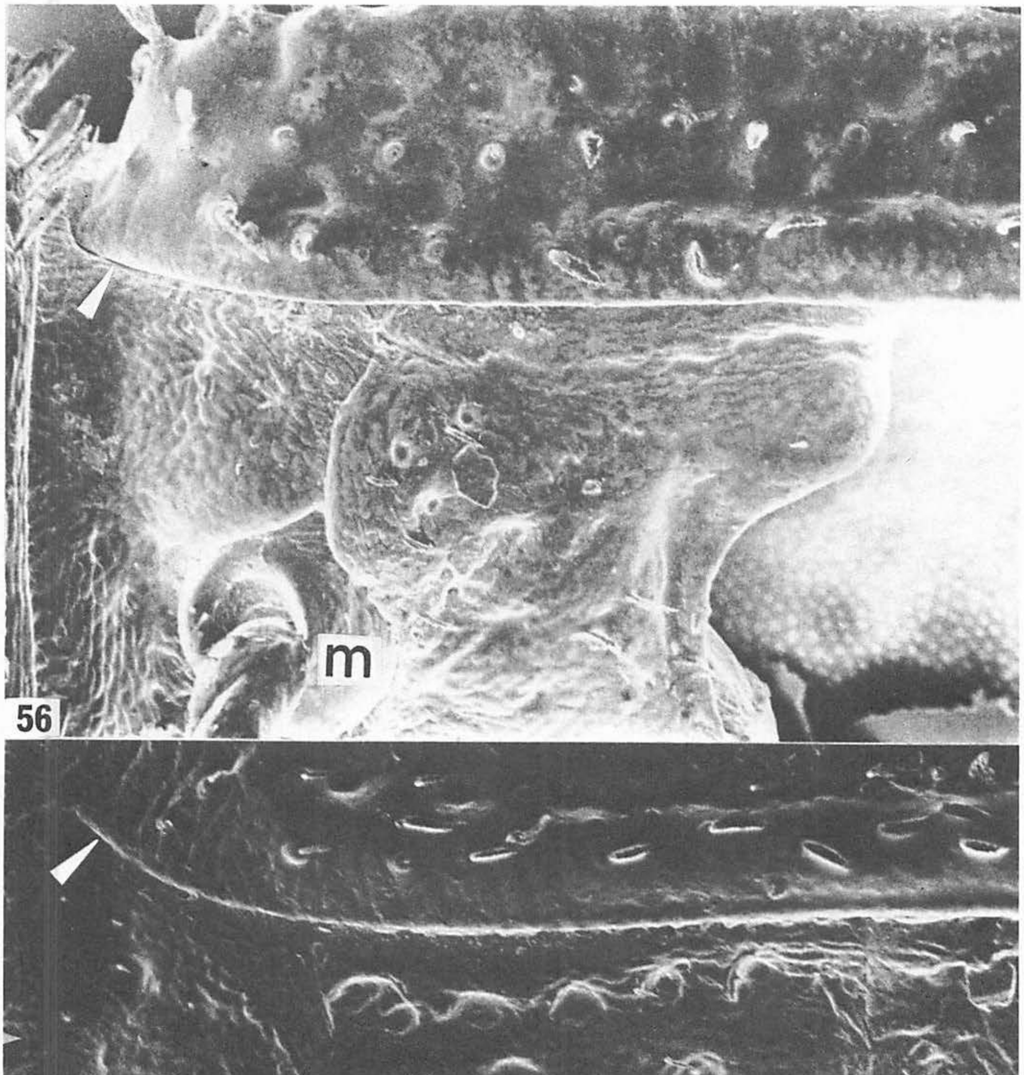
Figs. 45–48. Details of *Proterhinus samoae* specimens illustrated in Figs. 43 and 44: **45,** head and part of prothorax of ♀; **46,** same view of ♂; **47,** underside of ♀; **48,** enlargement of underside of head of ♀.



Figs. 49–53. Antennae of *Proterhinus* species. **49,** *Proterhinus fimbriatus*. **50,** *Proterhinus gourvesi* (edge view; note the short segment 2). **51–52,** *Proterhinus brevicornis*: **51,** ♀; **52,** ♂. **53,** *Proterhinus samoae*.



Figs. 54–55. Left metapleural areas showing the protuberant cephalic ends (arrows) of the metepisterna that protrude into the lateral elytral margins (m = mesocoxa): **54,** *Proterhinus gourvesi* paratype from Mt Aorai, Tahiti; **55,** *Proterhinus samoae* specimen from Raiatea.



Figs. 56–57. Left metapleural areas showing continuous lateral margins of elytra (arrows) and reduced metepisterna (m = mesocoxa): **56,** *Proterhinus fimbriatus* paratype from Mt Aorai, Tahiti; **57,** *Proterhinus brevicornis* paratype from Tahaa.

Taxonomic Studies in New Guinea and Solomons Nymphalidae (Lepidoptera: Rhopalocera), and Discovery of Abdominal Scent Organs in the Females of Various Nymphalinae Genera

Michael Parsons[1]

ABSTRACT

The New Guinean mainland montane genus *Pieridopsis* is synonymized with *Erycinidia* (Satyrinae). A new genus, *Algiachroa* (Nymphalinae), is erected for the endemic Solomon Islands species, previously known as *Cupha woodfordi*, and its relationships within the subfamily Nymphalinae are discussed. A key to *Algiachroa* and related genera is provided. The New Guinean mainland taxa *felderi* and *mimicus*, previously placed in *Cirrochroa*, are combined under *Algia*. The *A. woodfordi* female (like those of several other related genera) was found to bear paired club-like organs laterally below the tip of the abdomen. These are considered to be androconial in function and to be analogous to those of Neotropical *Heliconius* (Nymphalinae). Each organ of the pair in *A. woodfordi* is given here the name *clavatium* (plural: *clavatia*). Their discovery in *Algiachroa*, and in certain other related nymphaline genera, may provide a particularly useful character for defining the tribal relationships of these nymphalids as discussed.

INTRODUCTION

The following account is part of an ongoing taxonomic study in preparation for the forthcoming monograph entitled *Butterflies of Papua New Guinea* (Parsons, in prep.). Papers in this series include Parsons (1984a,b; 1986a,b; 1989). General information on the taxonomy of New Guinea butterflies will be found in the introductions to these papers.

A complete revisionary classification of the family, and especially the subfamily Nymphalinae, is still wanting. Ehrlich (1958) stated that Nymphalinae was in more need of thorough generic work than any other subfamily of the Nymphalidae. This view was endorsed by Scott (1985) who suggested that the structure of the larvae and pupae would provide useful characters for analysis. Ackery & Vane-Wright (1984) maintained that the higher classification of the family is, at present, in a "totally unsatisfactory state." This view was upheld by De Vries et al. (1985) who used mainly larval characters in a cladistic study of one particular group of nymphalids. The cladograms obtained by studying also several outgroups were surprisingly different from those suggested by existing systematic hypotheses. According to R. Vane-Wright (pers. comm. 1986), the study was the first of a series of intermittent papers that should greatly rectify the present state of confusion regarding nymphalid classification.

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As with the Lycaenidae, the task of systematically arranging the numerous and often very different-looking nymphalid species demands careful study and access to much material. De Vries et al. (1985) suggested that early stages would be particularly important in future systematic studies of the Nymphalidae, and this suggestion is endorsed here. Many nymphalid systematists have been greatly biased by the large number of specialized adult characters exhibited by the family and so have divided it unnecessarily or irregularly. De Vries et al. (1985) have shown that Nymphalinae (*sensu* Ehrlich), like Satyrinae, is probably polyphyletic. It remains to be seen, therefore, what "final" arrangement a refining of nymphaline classification will produce.

Erycinidia Rothschild & Jordan

Erycinidia Rothschild & Jordan, 1905 Novit. Zool. 12: 457. Type species fixed by authors: Erycinidia gracilis Rothschild & Jordan, 1905, Novit. Zool. 12: 457.

Pieridopsis Rothschild & Jordan, 1905, Novit. Zool. 12: 457. Type species fixed by authors: *Pieridopsis virgo* Rothschild & Jordan, 1905, Novit. Zool. 12: 457 **New synonomy.**

Erycinidia Rothschild & Jordan and *Pieridopsis* Rothschild & Jordan: Miller 1968, Mem. Amer. Ent. Soc. No. 24: 80.

The taxon represented by the nominal species *Pieridopsis virgo* Rothschild & Jordan is here treated subjectively as being congeneric with that represented by *Erycinidia gracilis* Rothschild & Jordan, 1905. *E. gracilis* is the type species of *Erycinidia* Rothschild & Jordan, 1905, of which therefore *Pieridopsis* is a junior subjective synonym.

Thus, the genus Erycinidia now contains the following taxa previously placed in *Pieridopsis*: *virgo* (Rothschild & Jordan, 1905) **n. comb.**, and *ducis* (Jordan, 1930) **n. comb.** It also comprises: *gracilis* Rothschild & Jordan, 1905; *tenera* Jordan, 1930; *hemileuca* Jordan, 1930.

Remarks. Miller (1968) revised the satyrine nymphalids (according them family rank) and accepted *Pieridopsis* and *Erycinidia* as distinct. However, the genus *Pieridopsis* is treated here as a synonym of *Erycinidia* because the characters by which it supposedly differs from *Erycinidia* are now known to be inconsistent, and the 2 taxa share important morphological features (see below). At the time of their descriptions by Rothschild & Jordan (1905), only 1 species from each genus was available. This overemphasized their supposed differences. *Erycinidia* has page position priority over *Pieridopsis*. Jordan (1924: 286) was the first to point out the possibility of the synonymy of the 2 taxa when he noted that "the discovery of *E. maudei* renders it probable that the slight difference between the two genera will be entirely wiped out by further new forms." However, he made no attempt to synonymize the 2 taxa when he later described 2 further species under each genus (Jordan 1930). A. Sibatani (pers. comm. 1986) had independently reached the same conclusion as the present author regarding the synonymy of *Erycinidia* and *Pieridopsis*.

The original statement by Rothschild & Jordan (1905) that *Pieridopsis* is "allied to *Erycinidia*, but easily distinguished by the short discoidal cell of the hindwing" is incorrect. Jordan (1924) defined the character in another way: "cell of [*Pieridopsis*] hindwing only as long as R_3 [M_3], i.e. somewhat shorter than in *Erycinidia*." This is the only character by which the 2 taxa are supposedly separable. However, a detailed study using accurate measurements of the hindwing venation of all taxa has shown that the character is incorrectly stated. In fact, the concave to convex profile of the hindwing termen, which is anyway somewhat individually variable, has a direct bearing on the length of vein M_3, and this, therefore, varies between all species (Figs. 1–4). It is notable that the venation, coloration, and male genitalia of *Erycinidia maudei* and "*Pieridopsis*" *ducis* are very similar. Holloway (1974: 93) pointed out: "In *Dodonidia* [from New Zealand], *Erycinidia* and *Pieridopsis* the ductus bursae [of the female genitalia] has its exterior opening in a sclerotised plate; these three genera are also characterised by a developed juxta in the male and similarity of wing shape and banded markings."

Algiachroa Parsons, **new genus** Figs. 8–10, 14–16

Type species. *Cupha woodfordi* Godman & Salvin, 1888: 97.

Diagnosis. A monotypic genus of the Nymphalidae, endemic to the Solomons (including Bougainville, North Solomons Province, which is politically part of PNG, but faunistically part of the Solomons). Average forewing length/wingspan: ♂ 37/64, ♀ 39/68. Closely allied to *Cirrochroa* Doubleday, 1847, and *Algia* Herrich-Schäffer, 1864, with the following combination of characters:

Description. Antenna slightly under ½ length of forewing costa, club narrow and tapering, barely broader than shaft. Eye smooth. Labial palpus (Fig. 9) erect, terminal segment short and pointed. Legs typically nymphalid, male forelegs slightly more modified than in female. Forewing costa convex, inner margin slightly concave, termen convex and weakly scalloped; hindwing tornus slightly pronounced, inner margin very slightly concave between anal veins, termen evenly scalloped; wing cilia short. Venation (Fig. 8); forewing cell approximately ⅓ length of costa, apex rather narrowly rounded at origins of veins R_2, R_3, and M_1, which are closely and approximately parallel, origins of Sc and M_2 more widely separate, but approximately equidistant from either side of cell apex, R_5 arises from middle of R_3, R_4 from subbasal region of R_5, lower discocellular long (⅔ width of distal end of cell), concave above cubitus, and very narrow. Coloration of male dorsally predominantly dark brown, a broad oblique white band covering central ¼ of forewing, from tornus to mid-costa, subtornally enclosing a large dark brown spot, hindwing with a complete postmedian row of large black spots, broadly ringed with orange, a scalloped pale mauve subterminal line and a more diffuse pale brown terminal line; ventrally similar to dorsally, but ground color much paler, especially pale gray-brown from median to basal regions of wings. Slightly dimorphic with some males lacking a strong mauve sheen. Female similar to this male form but lacking sex-brands.

Male genitalia and androconia (Fig. 10). Uncus simple, beak-like, lacks gnathos, apex slightly hooked, basally waisted in dorsal profile; valvae simple, distally ovate, proximally truncate, ventrally extended into a short, blunt process, inner lamina with a short, proximally hooked, sclerotized ridge; juxta simple, V-shaped; aedeagus simple, short, distally flared, with a short coecum, aperture bearing short, distally directed external cornuti. Forewing dorsally with an elongate ovate orange-brown sex-brand subbasally on vein M_2, and a similar brand slightly more proximally positioned on M_1 (Fig. 8).

Female genitalia and androconia (Figs. 14–16). Genital aperture wide; antevaginal region of ostium bursae weakly sclerotized with an irregular median sinus and a pair of weakly sclerotized lateral stays; ductus bursae short, broad, narrowing slightly before opening into a short elongate-ovate corpus without signa; papillae anales normal, hirsute; clavatium (see below), apically scaled with fairly loose androconial scales, these spatulate, elongate-subtriangular, crenulate, and with a deeply serrate distal margin (Fig. 16).

Remarks. Godman & Salvin (1888) first described *woodfordi* under the genus *Messaras* Doubleday, 1848, which according to Hemming (1967) is a synonym of *Cupha* Billberg, 1820, as Doubleday designated the same type species, *erymanthis* (Drury, 1773), for *Messaras*. Godman & Salvin (and subsequent authors) failed to note that the *woodfordi* male bears a pair of small, elongate, forewing upperside sex-brands at the bases of veins M_2 and M_1, otherwise they might have realized that the true affinities of the taxon lie closer to *Cirrochroa* and *Algia* than to *Cupha*. They merely stated that "though evidently a member of this genus [*Messaras*], the colouration of the wings renders it at once easy of recognition." Ribbe (1898) did point out that *woodfordi* does not fly in open forest glades as *Cupha* species do but instead in the shade, and that it is a notably slow flier. In a study of *Cupha* Fruhstorfer (1899) merely mentioned that *woodfordi*, treated at the end of his checklist, is the largest and most handsome species of the genus. Van Eecke (1915) maintained that the 10 species of *Cupha* listed in Seitz all belong to *C. lampetia* (Linnaeus, 1764) as their male genitalia vary only slightly and inconsistently. However, he failed to include *woodfordi* in his studies.

The taxon *woodfordi* warrants a new genus because it clearly does not belong in any of its most closely related genera. It differs in several respects: size, being larger than *Algia* and *Cupha*, and of a size similar to smaller species of Oriental *Cirrochroa*; wing shape (compare figures 5–8), the forewings being especially broad and apically rounded, and never as falcate as is usual in *Cirrochroa*; its broad pure white forewing band, not present in any members of *Cirrochroa*, *Algia*, or *Cupha*; the configuration of its forewing cell venation (compare figures 5–8); the configuration of its male sex-brands (compare figures 5, 7, and 8), brands being absent in *Cupha* (figure 6); the morphology of its male genitalia (compare figures 10–13), which are most similar to those of *Cirrochroa*, but differ mainly in the lack of the prominent harpe present on the inner lamina of the *Cirrochroa* valva; and the morphology of its female genitalia and clavatia (compare figures 14–20), notably the corpus bursae being longer and more ovate than in *Algia*, and lacking the double-chamber of the proportionately larger *Cirrochroa* corpus bursae. Other differences include the *Algiachroa* female foreleg tarsus, which is slightly more inflated ventrally ("clubbed") at its apex than in *Cirrochroa* and more so than in *Algia* or *Cupha* (in which it is somewhat tapered). Otherwise the legs of the sexes of all these genera are similar. They all bear smooth eyes. In *Algiachroa*, *Algia*, and *Cirrochroa*, all male androconia hardly differ from normal scales except in color and their usually more deeply serrate distal margins.

Most of the above-mentioned facies place *woodfordi* in a well-defined group of genera that includes *Algiachroa*, *Algia*, and *Cirrochroa*. It is considered here that the following are apomorphic (i.e., derived or specialized) characters in *Algiachroa* at the level of its generic group: well-rounded forewing cell apex; male dimorphism; broad white forewing upperside band; presence in male of only forewing upperside sex-brands, and absence of hindwing brands; elongate-ovate, non-double-chambered female corpus bursae; and weakly sclerotized ostium bursae antevaginal region with irregular median sinus and a pair of weakly sclerotized lateral stays.

The following adult facies in *Cupha* show that the genus belongs in a separate, well-defined group of 3 genera that also includes *Phalanta* Horsfield, 1829, and *Vagrans* Hemming, 1934: the extremely narrow and elongate female corpus bursae, being as long as the abdomen in *Vagrans* (Figs. 23 and 24); the tubular, not distally flared, male aedeagus that bears 2 groups of densely packed cornuti in the vesica; the whip-like, irregularly dentate dorsal appendage to valva (Fig. 13), which Roepke (1938) figured for *Vagrans*, and which he termed a "flagellum"; the simple, rather spatulate female androconial organs (Figs. 23 and 24: see below); the origin of vein R_2 from vein R_5 (as opposed to directly from the cell in nearly all other Nymphalid genera); the connection of discocellular M_2–M_3 with the cubitus at, or slightly distally to, base of vein CuA_1; and the lack of male sex-brands. Like *Algiachroa*, *Vagrans* is monobasic.

The following key is provided to assist in the identification of the above-mentioned genera. Members of *Vindula* Hemming, 1934, and some of *Cethosia* Fabricius, 1807 (both Indo-Australian genera), are superficially similar to many Oriental *Cirrochroa* (in general wing shape and mainly orange coloration), so they are included. However, the resemblance is likely the result of mimicry of *Vindula* and *Cethosia* by *Cirrochroa*. This is because all *Vindula* and *Cethosia* are *Passiflora*-feeders as larvae, and this genus of plants, as far as is known, confers toxicity (or at least a distastefulness to predators) on its Neotropical heliconiine herbivores (Brower et al. 1963), whereas *Cirrochroa*, *Cupha*, *Vagrans*, and *Phalanta* utilize predominantly flacourtiaceous foodplants not known to contain noxious secondary plant compounds. Apart from the different foodplant relations of *Vindula* and *Cethosia*, their adult characters and the morphology of their early stages show that they belong in a group distinct from the *Cirrochroa* and *Cupha* groups.

Key to Genera of *Cirrochroa* and *Cupha* Groups and Similar Genera

1. Termens of both wings, especially HW, prominently dentate, accentuated on underside by a single, distinct, zigzagged, white or cream submarginal line . . . . . ***Cethosia*** (10 species)
Wing termens smoothly and shallowly dentate, or almost rounded, not marked as above 2
2(1). HW with short triangular tail at vein M_3 3
HW without short triangular tail at vein M_3 4
3(2). HW with a distinct pair of white-pupiled postmedian eye-spots (sometimes with additional vestigial satellite eye-spots) . . . . . ***Vindula*** (4 species)
HW with a postmedian row of small black spots . . . . . ***Vagrans*** (1 species)
4(2). FW discocellular M_2–M_3 connects with cubitus at, or slightly distally to, base of vein CuA_1 (Fig. 6) 5
FW discocellular M_2–M_3 connects with cubitus between bases of veins CuA_1 and CuA_2 (Figs. 5, 7, and 8) 7
5(4). FW cell apex acutely pointed (Figs. 5 and 7) 6
FW cell apex well-rounded (Fig. 8) . . . . . ***Algiachroa*, n. gen.** (1 species)
6(5). HW upperside with discrete 1–4 mm wide cream or yellow submedian band . ***Algia*** (3 species)
HW upperside not marked as above . . . . . ***Cirrochroa*** (16 species)
7(4). FW termen straight or concave, wing apex acute . . . . . ***Phalanta*** (4 species)
FW termen notably convex, wing apex broad and/or well-rounded (Fig. 6) . . . . . ***Cupha*** (9 species)

Genus ***Algia*** Herrich-Schäffer

Algia Herrich-Schäffer, 1864, Correspbl. zool. min. ver Regensberg 18: 125 repaged offprint as Prodromus 1. 1: 27. Type species by subsequent designation by Hemming (1964, Annot. Lepid. [4]: 124): *Cirrochroa satyrina* C. & R. Felder, [1867] Reise Fregatte "Novara," Lep.-Rhop. (3): 389.

Paduca Moore, 1886, J. Linn. Soc. Lond., Zool. 21: 34. Type species by original designation: *Atella fasciata* C. & R. Felder, 1860, Wein. ent. Monats. 4: 236.

Ducapa Moore, 1900, Lep. Ind. 4 (47): 209. Type species through Section (i) (replacement names) of Article 67: *Atella fasciata* C. & R. Felder, 1860, Wein. ent. Monats. 4: 236.

D' Abrera (1971, 1978) treated the New Guinea species, *felderi* Kirsch, 1877, in the genus in which it was first described, *Cirrochroa*, but later (D' Abrera 1985) employed the generic name *Paduca* for its Oriental Region relatives. However, Corbet & Pendlebury (1978) pointed out—undoubtedly with reference to *felderi* and also based on Moore (1900), who placed the species under *Ducapa*—that *Paduca* (i.e., *Algia*) has a single representative in New Guinea. They noted that the genus is structurally close to *Cirrochroa*, but that *Algia* adults are smaller in size and differ also in appearance and habits (*A. fasciata* being "feeble in flight and frequents shaded forest paths on the plains"). They pointed out that, in the *Algia* male, forewing veins M_2 and M_1, and hindwing veins M_1 and Rs, are comparatively broadly margined with buff-brown specialized scales. As in the similar scales of *Cirrochroa*, these are apparently androconial in function.

Hemming (1964, 1967) showed that *Paduca* and *Ducapa* are synonyms of *Algia*. However, Cowan (1968) stated that it was wrong to treat *Paduca* as not in current use because it ranked as a perfect example of a *nomen oblitum* when, according to him, a century after its introduction, Hemming (1964) improperly reviewed the genus. Cowan stated that this act contravened Article 23b of the Code in that Hemming did not refer it to the Commission to be placed on the appropriate Official Index of Rejected Names. He maintained that the continued use of *Paduca*, and the rejection of *Algia*, would best serve stability and universality, and proposed to submit this to the Commission. However, Cowan (1970), without giving reasons, stated that his proposed 1968 23b application had not been carried out. He believed that *Algia* and *Paduca* both remained valid, their synonymy being purely subjective, and maintained that the respective type species, *satyrina* and *fasciata*, are "remarkably different in appearance and there is even some structural difference between them." However, as shown by the present study, this is incorrect, and Hemming (1964) was correct in his original synonymy.

As the taxon *felderi* has all the features characteristic of the genus *Algia* (Figs. 7, 12, 17, and 18) it is now formally placed in that genus. Therefore, besides the type species *satyrina* and the species *fasciata*, *Algia* contains the following nominal PNG taxa, previously placed in *Cirrochroa*:

felderi (Kirsch, 1877), **n. comb.**
mimicus (Rothschild, 1904), **n. syn.**

The taxon *Messaras mimicus* Rothschild, 1904, is synonymized here with *felderi*. Study of various series of topotypical specimens of the 2 taxa (including Kirsch's original figures of *felderi* from Nappan, southwest coast of the Geelvink Bay, Irian Jaya, and the *mimicus* holotype from the Upper Aroa River, Central Province, Papua New Guinea housed in the British Museum of Natural History [London]) has shown that there are no differences by which *mimicus* can be distinguished. Rothschild (1904) was apparently unaware of Kirsch's (1877) publication of *felderi* and erroneously described *mimicus* as a new species from only a single male.

Nymphalinae Female Scent Organs

A survey of the female genital structure of all related Indo-Australian genera was carried out when it was found that the *Algiachroa woodfordi* female bore a pair of club-like organs (Figs. 14–16), almost certainly androconial in function, and apparently analogous to those present in Neotropical Region *Heliconius* (Fig. 25) of the subfamily Nymphalinae. Similar organs were then found to be present in *Algia* and *Cirrochroa* (Figs. 17–20). Even more specialized organs were observed in *Terinos* Boisduval, 1836, and the African genus *Lachnoptera* Doubleday, 1848 (Figs. 21 and 22)—these 2 genera being studied because they were mentioned by various authors to be related to *Phalanta*, *Algia*, and/or *Cirrochroa*. Simple organs were located in *Phalanta*, *Cupha*, and *Vagrans* (Figs. 23 and 24), with a reduction in their structure across the genera in this order, those of *Vagrans* (not illustrated) apparently being vestigial, merely raised irregular humps in the positions where the organs should be. The genera *Cethosia* and *Vindula*, unexpectedly, were found to lack androconial clubs (as they have been assumed to be Old World representatives of the tribe Heliconiini, e.g., by Clark [1927], Eliot in Corbet & Pendlebury [1978], and Brown [1981]).

Algiachroa, *Algia*, and *Cirrochroa* club-like female abdominal androconial organs are most similar in structure to the apparently homologous organs of *Heliconius*. In *Phalanta*, *Cupha*, and *Vagrans* the lateral organs are simple and spatulate, being almost absent in the latter 2 genera, and with minute androconia visible along the dorsal margin of the organ only in *Phalanta*. In *Terinos* and *Lachnoptera* the organs are more impressive club-like structures, those of *Terinos* being very strongly sclerotized, long, inwardly curved and prominently knobbed. In *Lachnoptera* the organ is strongly sclerotized with a broad spatulate apex bearing a deep median sinus. Its spatulate androconia are obviously designed, like those of *Heliconius*, to interact with a dorsal gland. However, the *Lachnoptera* dorsal gland, positioned on the smooth membrane between the 8th and 9th tergites, is interesting because it bears a covering of setose androconia, whereas that of *Heliconius*, despite deep reticulate convolutions, is naked.

The *Clavatium*

There has not yet been a formal scientific naming of any Nymphalinae female organs in the literature (see below), and a concise and descriptive term is wanting to replace word pairs or phrases used in describing the organs noted above. Therefore, the name *clavatium*, derived from the Latin *clava*, meaning club (plural: *clavatia*), is given here to the organs of *Algiachroa woodfordi*

(Figs. 14–16). These are a pair of simple, posteriorally directed, club-like processes, laterally, 1 each side of the abdomen, each of which arises near the distal margin of the 8th sternite and bears an array of spatulate androconial scales, the distal margins of which are deeply serrate. The clavatia are recessed in lateral "pockets" formed by the overlap of the 8th tergite. Their apices are drawn out and exposed as the abdomen tip is curved downwards.

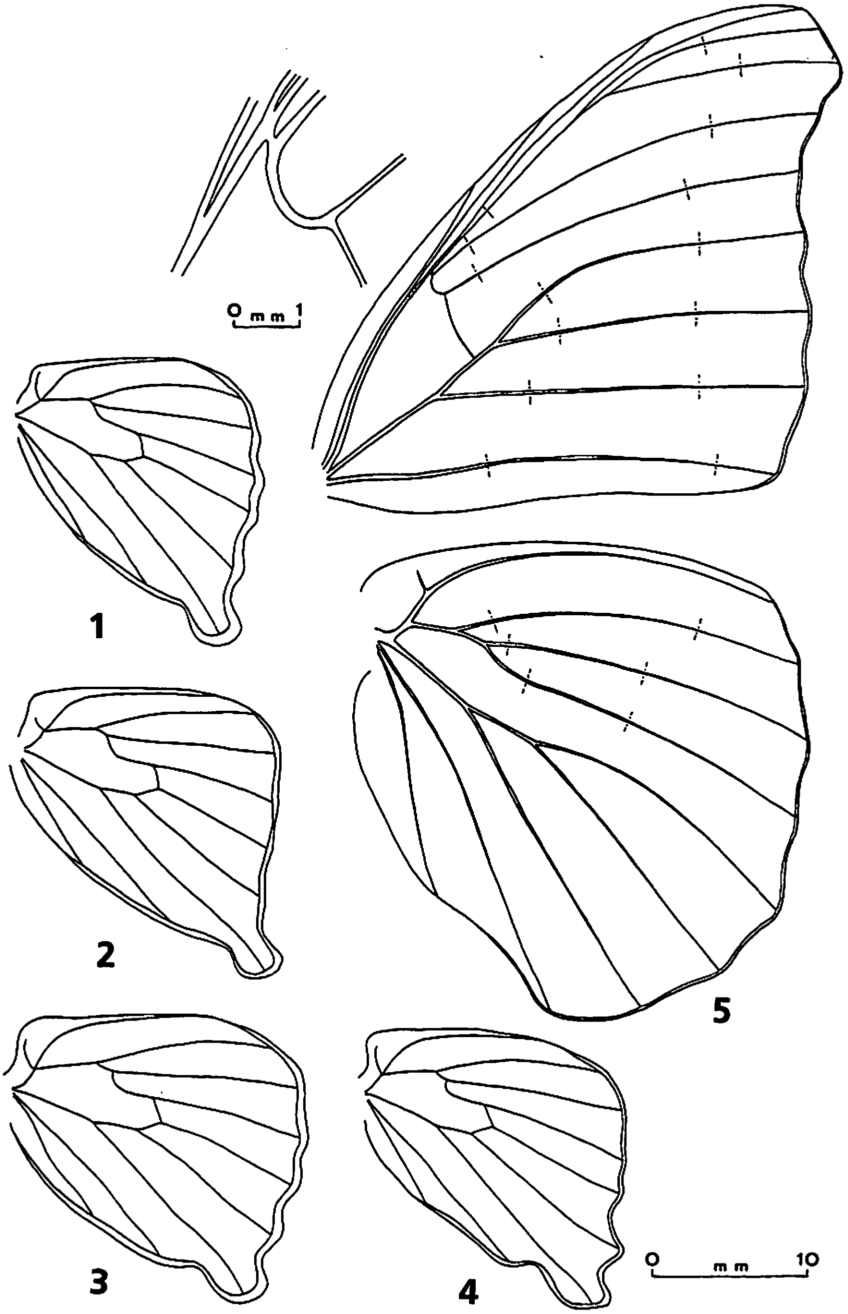
This new term also applies to the similar structures present in females of the closely related genera *Cirrochroa* and *Algia*, all 3 genera composing the *Cirrochroa* group discussed above. The name *clavatium* is presently restricted to this group, because of uncertainty as to the homologies of the various female androconial organs reported in Nymphalinae. However, it is expected that the similar structures present in Neotropical heliconiines and the above-mentioned Indo-Australian genera will, with detailed morphological and histological study of freshly caught specimens, prove to be homologous with clavatia. In this case the term will become available for use in broader discussion of female androconial organs in these nymphaline groups (and possibly still others).

DISCUSSION

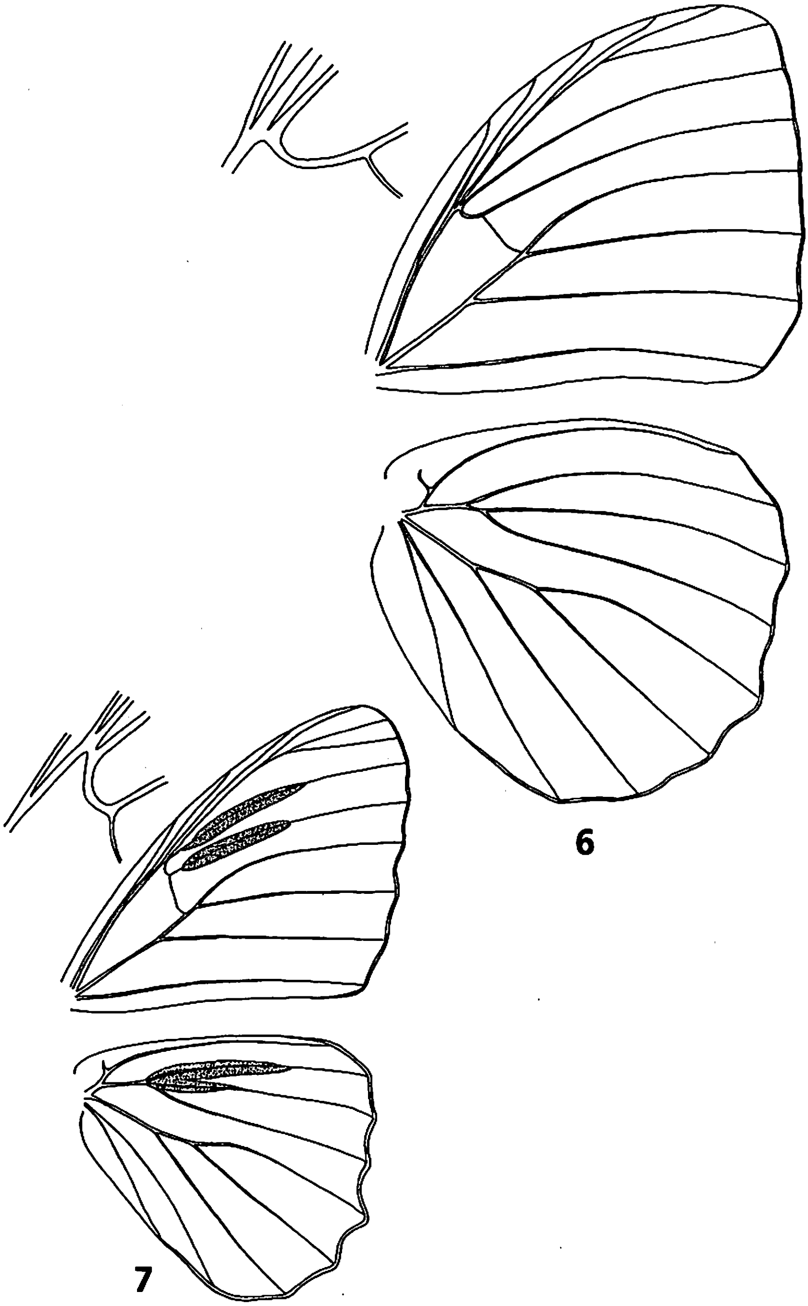
Müller (1878) was apparently the first author to observe, fully describe, and illustrate the lateral, club-like heliconiine female androconial organs, which he termed "stink-clubs," and which he noted were associated with a bright yellow dorsal gland. He pointed out that the latter has a dorsal median furrow and is quickly exposed if a female *Heliconius* is captured. He found that the presence of the stink-clubs indicated the close relationships between heliconiine genera, and that they also exhibited clear morphological differences between species. Müller stated that he had not located stink-clubs in any other Lepidoptera he had studied. Müller (1877) had previously recorded that the odor produced from the female gland is rather nauseating and is exactly similar to a smell originating from yellowish glands in valvae of the males. The latter glands are invariably exposed by opening the valvae when males are captured. In his detailed study of the stink-clubs Müller noted, by cutting off their apices, that these knobbed, androconia-bearing portions are responsible for dispersing the strong smell. Eltringham (1925) also studied heliconiine stink-clubs in detail, including their histology, on the basis of field observations and fresh specimens provided by Dr. Withycombe from Trinidad. He concurred with Withycombe's conclusions that the organs and glands were of "repugnatorial" function, producing an odor like the phenylcarbylamine-like smell of the male valval glands.

Emsley (1963) pointed out (with figures) that female Neotropical Heliconiini possess a pair of "ventro-lateral processes developed from the posterior margin of the eighth segment which project dorsally." He stated that, as the abdomen tip is bent downwards, the heads of these clubs are withdrawn from the dorsal glands. The latter comprise a medianly divided structure developed from the dorsal membrane separating segments 8 and 9. They form a pair of highly infolded cuticular pouches whose lining is presumably secretory, and which are capable of eversion (inflation) by hydraulic pressure: if the abdomen is lightly squeezed, instead of being hidden "internal" pouches, the dorsal glands become exposed from beneath the 8th tergite and form 2 visible yellow dome-like structures (personal observation of live North American Gulf Fritillary, *Agraulis vanillae* [Linnaeus, 1758]). Emsley also noted that, during copulation, the lateral clubs fit into grooves on the inner lamina of the male valvae. Emsley (1963, 1965) found that there is specific variation in the *Heliconius* female "abdominal processes" and their androconia, and the sculpturing of the surface of the dorsal glands. In the latter work he maintained of the clubs that these "captitate processes" are one of a key group of features by which Heliconiinae could be defined.

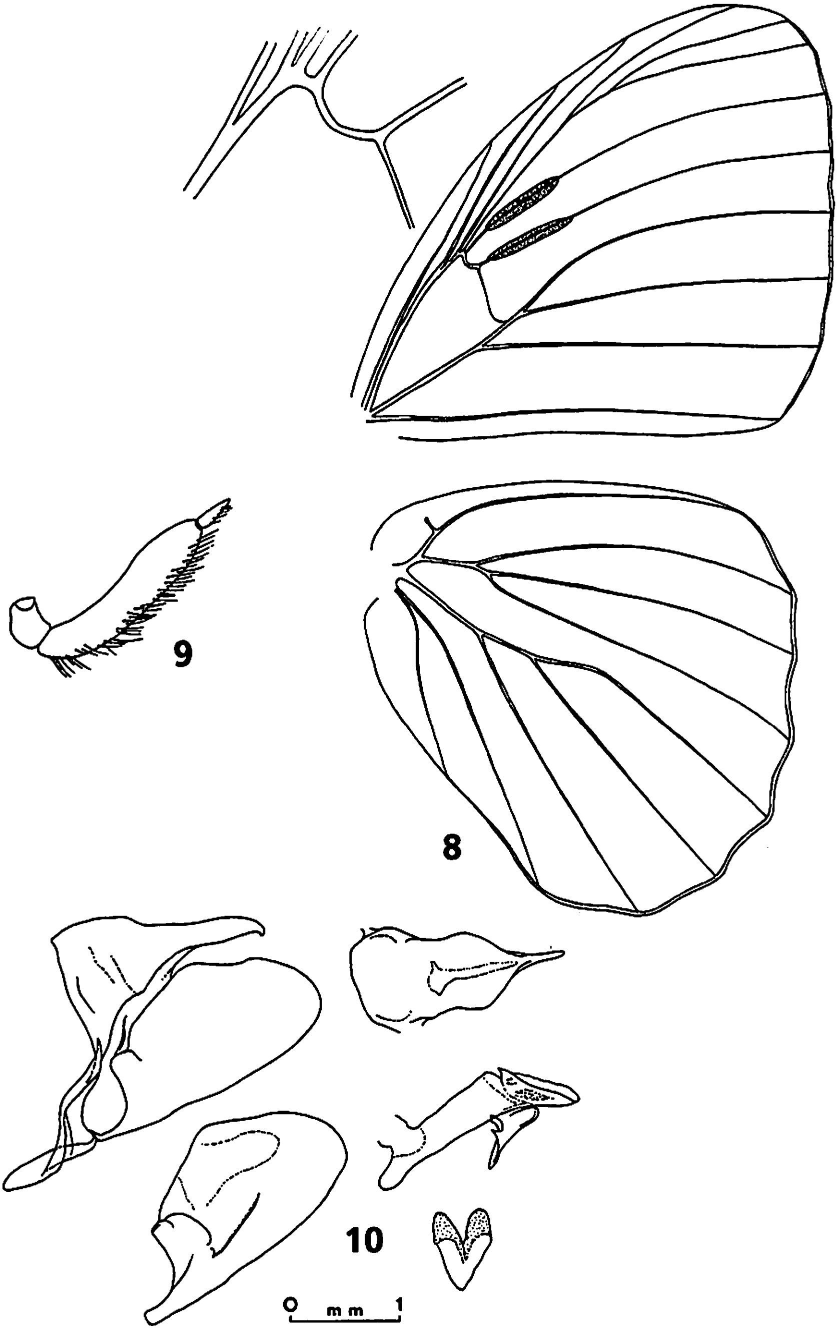
Gilbert (1976) found that the stink-clubs function to transfer a chemical from the male valval glands to the female dorsal glands. The resulting "antiaphrodisiac" pheromone (absent in virgin females) then serves to repel males after females have mated and, therefore, helps to enforce



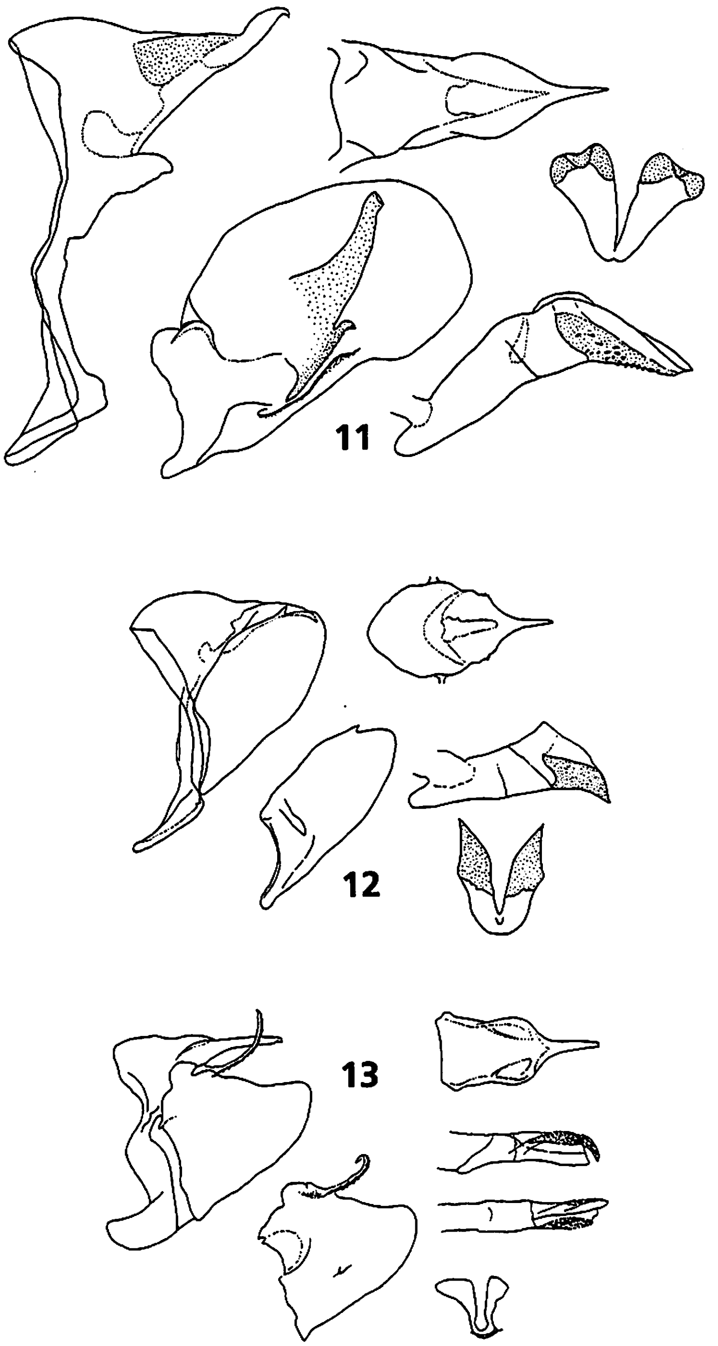
Figs. 1–5. Wing venation: **1,** *Erycinidia hemileuca* hindwing; **2,** *Erycinidia maudei* hindwing; **3,** *Erycinidia virgo* hindwing; **4,** *Erycinidia ducis* hindwing; **5,** *Cirrochroa aoris* (Bhutan) (sex-brands between hatches) with forewing cell apex detail.



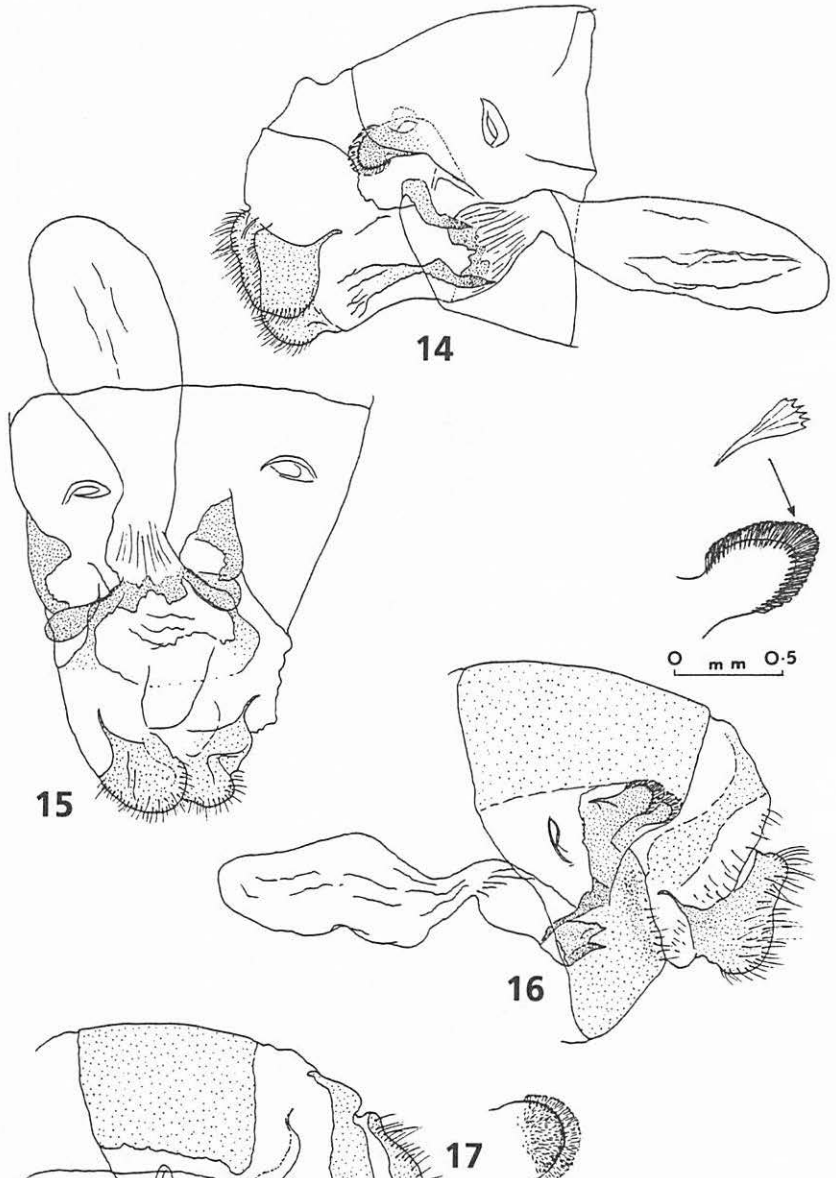
Figs. 6–7. Wing venation: **6,** *Cupha prosope* (Papua New Guinea) with forewing cell apex detail; **7,** *Algia fasciata* (Thailand) with sex-brands and forewing cell apex detail.



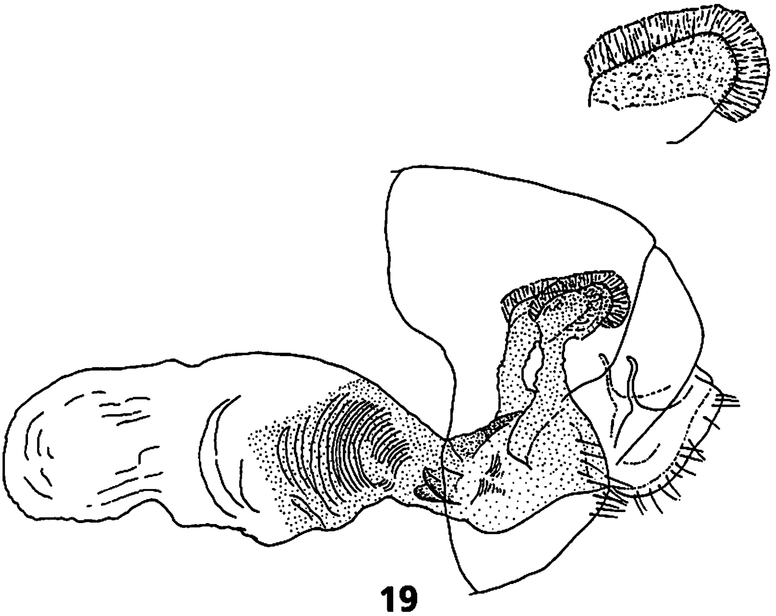
Figs. 8–10. *Algiachroa woodfordi*: **8,** wing venation, sex-brands and forewing cell apex detail; **9,** labial palpus (to same scale as forewing cell apex detail in Fig. 5); **10,** male genitalia.



Figs. 11–13. Male genitalia: **11,** *Cirrochroa regina* (Papua New Guinea); **12,** *Algia felderi* (Papua New Guinea); **13,** *Cupha melichrysos* (New Ireland).



Figs. 14–18. Female genitalia and details of clavatia: **14,** *Algiachroa woodfordi* lateral aspect (from righthand side); **15,** *A. woodfordi* same specimen ventral aspect; **16,** *A. woodfordi* another specimen lateral aspect (from lefthand side) with detail of one androconial scale; **17,** *Algia felderi*; **18,** *Algia fasciata* (clavatium only).



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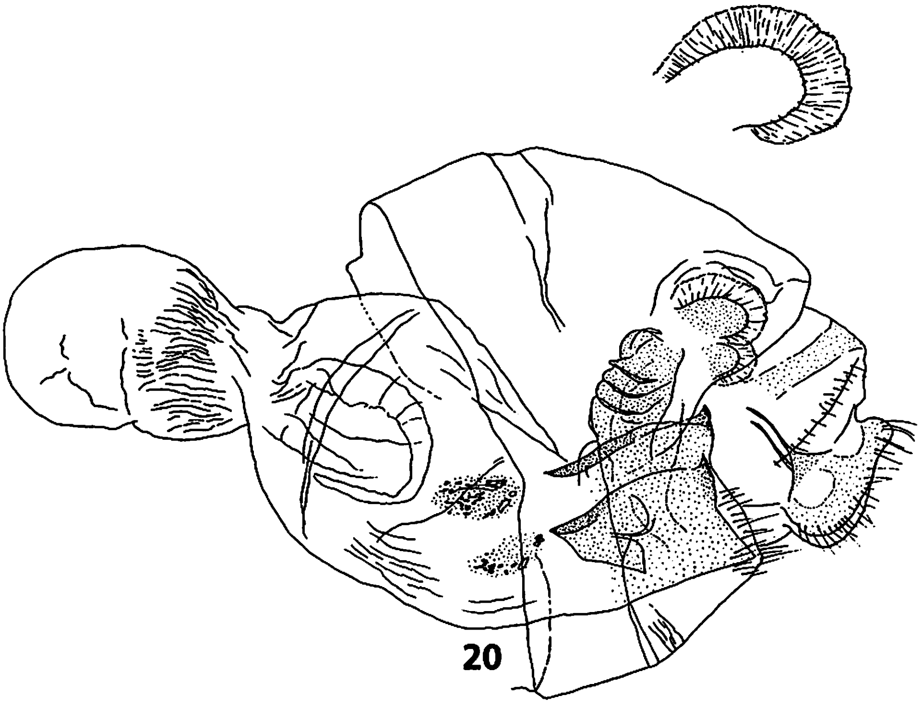

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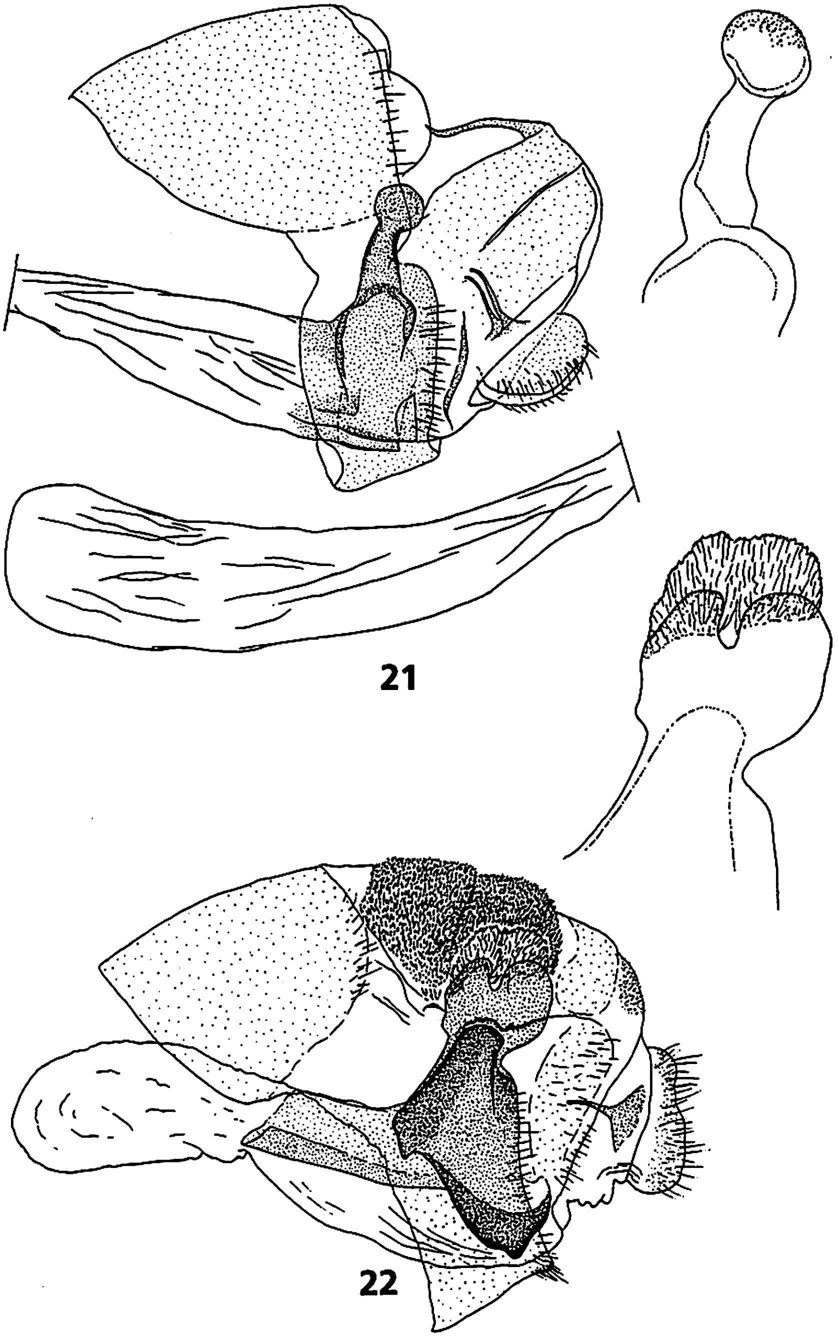
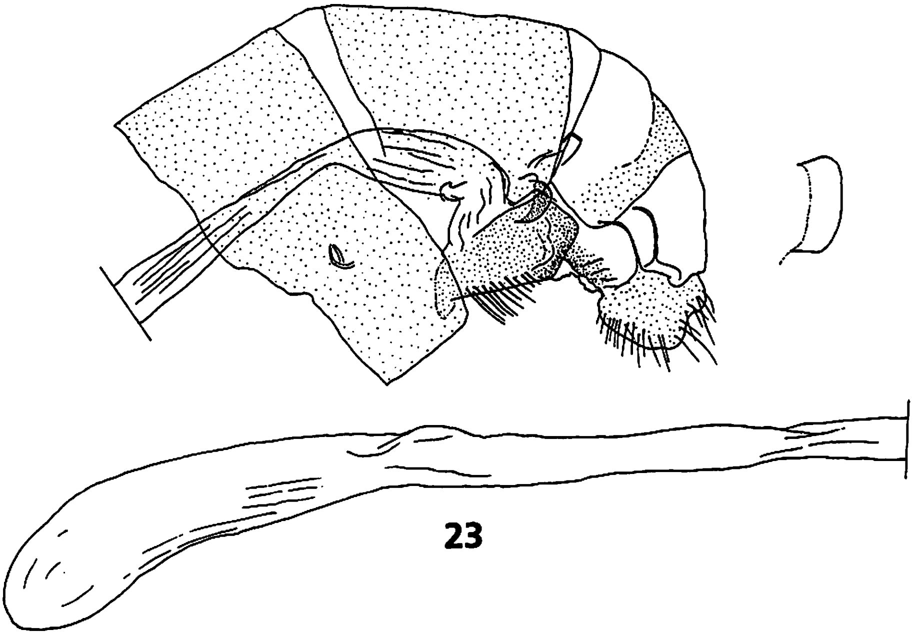
Figs. 19–20. Female genitalia and details of androconial organs: **19,** *Cirrochroa aoris*; **20,** *Cirrochroa regina*.



Figs. 21–22. Female genitalia and details of androconial organs: **21,** *Terinos alurgis* (Papua New Guinea); **22,** *Lachnoptera iole* (Uganda).



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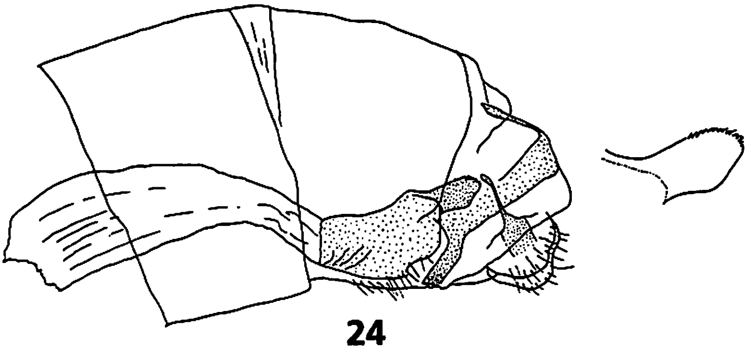

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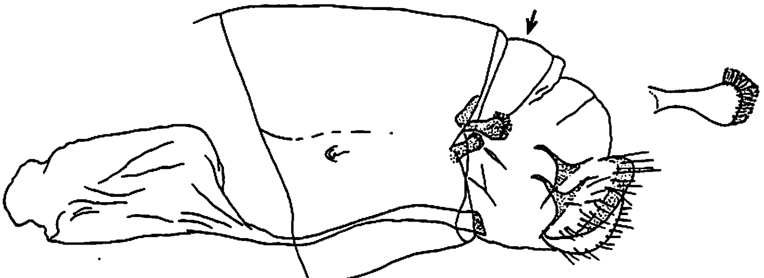

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Figs. 23–25. Female genitalia and details of androconial organs: **23,** *Cupha melichrysos*; **24,** *Phalanta alcippe* (Papua New Guinea) (corpus bursae incomplete, but otherwise as long as in *C. melichrysos* above); **25,** *Heliconius charitonius* (Jamaica), arrow indicates position of dorsal gland.

monogamy among females. It is still not clear, however, whether the antiaphrodisiac is wholly produced by the male, with some transferred to the female via the stink-clubs for storage in the sponge-like dorsal gland and subsequent use, or whether it is a similar but chemically different compound produced continuously by the female dorsal glands after mating, once an activating (or "trigger") chemical has been received from the male via the stink-clubs. Possibly it is the latter, as Gilbert found that males can tolerate the presence of each other, but that they will disperse in seconds if groups resting on female pupae are presented with the abdomen of a mated female of their species. He noted that the postmating female odor is strong and is said to resemble phenylcarbylamine, or witch hazel. Scott (1973) stated that the female's mate-repelling odor is developed about 1 hour after mating.

In a review of the literature on chemical interactions between butterflies Boppré (1984) reported that Urbahn (1913) and Götz (1951) had both described 2 small glandular sacs present in the female of the European Silver-washed Fritillary, *Argynnis paphia* (Linnaeus, 1758). These are situated in a similar position to the above-mentioned heliconiine dorsal glands, but there are no associated androconial clubs present (personal observation of dissected material). Boppré reported that Treusch (1967) observed that the glands were visibly exposed to an approaching male by bending the abdomen, the tip of which was always kept directed towards the male. Therefore, in this case, the glands are assumed to be a signal of the female's receptivity before copulation (i.e., a converse effect to that reported for the dorsal glands of *Heliconius*). Urbahn also located dorsal glands in members of several other argynnine genera.

Scott (1986) stated that females of the argynnine genus *Speyeria* Scudder, 1872, and of the genus *Nymphalis* Kluk, 1802 (Nymphalini), also have similar dorsal glands. C. Häuser (pers. comm. 1988) pointed out that von Siebold (1838) had termed female abdominal glands "glandulae odoriferae," and that Petersen (1900) and and Weidner (1935) located dorsal abdominal glands in 5 European species of *Vanessa* Fabricius, 1807. C. Häuser (in prep.) discovered that dissected fresh females of the European argynnine nymphalid genera *Melitaea* Fabricius, 1807, and *Euphydryas* Scudder, 1872, and some European satyrine nymphalid genera, such as *Erebia* Dalman, 1816, also bear dorsal glands. Newly discovered paired sub-anal papillary glands in Acraeinae by Pierre (1986) are apparently not homologous with Nymphalinae glands under consideration here. However, they may be similar in function and were stated by Pierre to provide important morphological characters. In a review of mating in butterflies Scott (1973) pointed out that *Gonepteryx rhamni* (Linnaeus, 1758) (Pieridae) females produce repellent pheromones from abdominal glands that are extruded during rejection posture, but not during successful courtship.

It is likely that the female nymphaline clavatium will present an important morphological character for use in nymphalid classification and systematics. The clavatium, and other associated structures, such as the dorsal gland, should be employed in the character sets of future cladistic studies of the Nymphalidae.

The apparent relationship between the New World Neotropical Heliconiini and Old World Indo-Australian *Cethosia* has been suggested in the literature for a long time (e.g., Clark 1927). Shirōzu & Saigusa (1973) regarded the Argynninae as a subfamily that includes not only many Holarctic genera but also several Oriental and Afrotropical genera, such as *Phalanta* and *Cirrochroa*. Scott (1985) found that he could draw no conclusions as to the tribal evolution within the Nymphalinae, except for the close relationship between the Heliconiini and the Argynnini. He noted that groups such as the Biblidini, Eurytelini, Limenitidini, Marpesiini, etc., may not even be valid phenetically. Scott also commented that, on the basis of various characters (humeral vein, larval head horns, and passifloraceous [or other] foodplants), *Vindula*, *Cethosia*, *Terinos*, and other Oriental "Argynnini" should probably be combined into 1 tribe: Heliconiini (by priority). This is because, on a worldwide basis, the 2 tribes cannot be sustained because of the inconsistency of these features. Scott added that it remains to be seen whether this combination is a monophyletic group or not. Eliot (in Corbet & Pendlebury 1978) regarded the genus *Cethosia* as being the sole representative of the "Cethosiini (Heliconiinae)" in the Oriental Region. He also included various genera (*Cupha*, *Phalanta*, *Vagrans*, *Vindula*, *Cirrochroa*, *Algia*, *Terinos*, and *Argyreus*) in the subfamily Argynninae. Ackery (1984) employed only the subfamily Heliconiinae in his classification of the Nymphalidae. He pointed out that Brown (1981) had suggested that Old World passifloraceous-feeding *Cethosia* and *Vindula* should be more correctly placed in the Heliconiinae, and that the heliconiines will probably prove to represent a highly specialized subgroup of the Argynnini. However, Ackery (1988) used, as subfamilies, both Heliconiinae and Argynninae, noting that records for passifloraceous foodplants are common to both groups.

Within the Nymphalidae clavatia, or similar organs, are apparently absent in the following: Danainae (from figures and text in Ackery & Vane-Wright [1984]); Acraeinae (from figures and text in van Son [1963], and Pierre [1986]); genera of the Nymphalini, such as *Vanessa* (from figures and text in Field [1971]); *Doleschallia*, and Australian Region Satyrinae, such as *Platypthima* Rothschild & Jordan, 1905, and *Altiapa* Parsons, 1986 (all the latter from personal observation of dissected material; see also Parsons [1986b]). Probably all other Australian Region Satyrinae also lack such organs (from figures and text in Holloway [1974]). From these observations—together with the apparent synapomorphy with the androconial organs in *Heliconius*, and at least the above-mentioned Indo-Australian genera that possess them—it appears that the organ is a good indicator of a natural grouping within the Nymphalidae. It is unlikely that such a specialized organ, of sexual function, has evolved independently in Old and New World nymphalids, especially as only certain genera of the Nymphalidae (of all the butterflies) possess them. Nevertheless, the reduction and loss of these organs (if once present in an ancestor common to all of the modern-day androconial organ-bearing genera) is possible, as illustrated by their apparent reduction across the *Cupha* group genera (*Phalanta*, *Cupha*, and *Vagrans*), and their absence in supposedly heliconiine genera such as *Cethosia* and *Vindula*. However, whether or not the androconial organ-bearing genera should all be treated as belonging to the tribe Heliconiini is still open to question. Nevertheless, the present findings also suggest that genera such as *Algiachroa*, *Algia*, *Cirrochroa*, *Terinos*, and *Lachnoptera* might now be regarded as true heliconiines; also that other characters must be sought to resolve the tribal relationships of *Cethosia* and *Vindula*.

Regarding the problem of the tribal relationships of *Cethosia* and *Vindula*, it is unfortunate that the dorsal glands often present in androconial organ-bearing nymphalid females are not easily observable in vial (glycerol) or slide genitalic preparations. For example, their presence or absence in females of nearly all of the above-mentioned genera could not be easily confirmed from the vial preparations of abdomens used in this study (although the well-defined, androconia-bearing dorsal glands are obvious in *Lachnoptera*, Fig. 22). It is probably best, therefore, if their presence or absence is confirmed by squeezing the abdomens of live females, as dorsal glands, if present, will provide a further useful character for defining nymphalid relationships, even though they are apparently present in Nymphalinae (Nymphalini, Heliconini, Argynnini), Satyrinae, and the unrelated family Pieridae.

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A New *Delias* Subspecies, a New *Sabera*, and a New *Parantica* from Papua New Guinea (Lepidoptera: Pieridae, Hesperiidae, Nymphalidae)

Michael Parsons[1]

ABSTRACT

Three new butterfly taxa are described from Papua New Guinea: *Delias messalina vigasa* from New Britain, *Sabera iloda* from the mainland, and *Parantica fuscela* from New Britain.

INTRODUCTION

The following new taxa will be included in the forthcoming monograph entitled *Butterflies of Papua New Guinea* (Parsons, in prep.). Papers in this series include Parsons (1984a,b; 1986a,b; 1989). General information on the taxonomy of Papua New Guinea (PNG) butterflies can be found in the introductions to these papers.

PIERIDAE (PIERINAE)

Delias messalina vigasa Parsons, **new subspecies** Figs. 6–9

Description. Holotype ♂. Antennae broken (see ♀); head and frons with long silvery-gray hair scales; palpi yellow, apical segment black, a ventral fringe of black hair scales; thorax with long silvery-white hair scales dorsally, ventrally mainly dark brown, laterally with yellow hair scales; abdomen creamy-white; legs dark brown finely longitudinally striped with white. Forewing length (FWL)/wingspan (WS) 29.5/50.75 mm; costa and termen convex; dorsally dark brown, a silvery-white patch within area bounded by base to subterminal line of inner margin, and curving upwards back in an arc through lower half of cell; ventrally inner margin from base to subterminal line broadly pure white, suffusing to yellow diagonally to cell apex; costa and remainder of wing dark brown except for 3 large yellow subapical spots divided by dark brown veins. Hindwing costa and termen convex; dorsally, including costa, silvery-white with a dark brown termen 6.0 mm broad, narrowing greatly along inner margin; ventrally dark brown with a large pure white dorso-median cell patch, spreading outside cell between veins Rs and M_1, and very slightly so on other side of M_1; a series of 4 red postmedian spots between veins $Sc + R_1$ and M_3, a yellow patch at costa base, and 3 diffuse white subterminal spots between veins Rs and M_1, decreasing in size towards tornus. Cilia of both wings short and dark brown.

Paratype ♀. Antennal length 15.0 mm, shaft and club dark brown, ventrally suffused with pure white, decreasing towards shaft base. FWL/WS 26.0/46.0 mm. Similar to male, but for the following characters: abdomen dorsally pale yellow, suffusing to creamy-white ventrally; pale areas of wings dorsally much more reduced, producing a corresponding increase in dark brown areas, silvery-white region also more diffuse and with a large creamy-white hindwing

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patch in same position as pure white cell patch ventrally; forewing ventrally with a band-like row of 5 (not 3) yellow subapical spots; red and white hindwing ventral markings bolder, broader, forming bands, and extending farther tornally, white cell patch larger.

Type data. Holotype ♂, PAPUA NEW GUINEA: NEW BRITAIN: Upper Warrongoi Riv, 1,000 m, 4. XII.1962, J. Sedlacek (genitalia vial no. BBMH MJP 038); paratype ♀, PAPUA NEW GUINEA: NEW BRITAIN: Upper Warrongoi Riv, 1,300 m, 5. XII.1966, J. Sedlacek (genitalia vial no. BBMH MJP 039); in Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.

Remarks. Male keys to *Delias messalina orientalis* Arora, 1983, and the female to *D. m. messalina* Arora, 1983, in Arora (1983). *D. m. vigasa* is similar to *orientalis*, but easily distinguished by the following characters: ♂ *vigasa* with much broader dark brown wing margins dorsally, and more reduced red and white markings ventrally; ♀ with silvery-white forewing inner marginal patch dorsally (absent in *orientalis*), pale basal half of hindwing dorsally silvery-white (not greenish-yellow), and lacking subterminal rows of several diffuse white spots (present on both wings dorsally in *orientalis*). Both *orientalis* and *vigasa* differ from *m. messalina* in a number of ways, but are most readily distinguished by the hindwing ventral cell spot being much larger and yellow (not white).

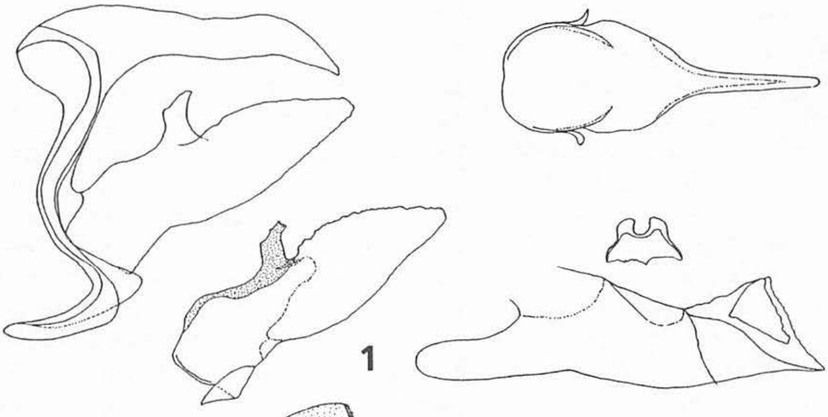
HESPERIIDAE (HESPERIINAE)

Sabera iloda Parsons, **new species** Figs. 1–3, 10, 11

Description. Holotype ♂. Antennal length 10.0 mm, shaft, club and apiculus dark brown, almost black, club ventrally pale yellow; head dark brown, frons with scales that reflect mainly pale orange and pale turquoise; palpi pale creamy-yellow, second segment brown laterally, apical segment dark brown; thorax dark brown, slightly paler brown ventrally, dorsolateral prothoracic tegulae dark brown, fringed with pale yellow; abdomen dark brown, ventrally with some creamy-white scales at margins of segments distally; legs dark brown. FWL/WS 15.75/31.5 mm, costa and termen slightly convex; dorsally dark brown with an obscure pale yellow inner marginal streak from base to median line; narrow dark brown sex-brand as in Fig. 3; ventrally dark brown, but costa, apex, and subapex with a reddish-mauve sheen. Hindwing costa and termen convex and well rounded, tornus slightly produced; dorsally dark brown with an extremely obscure paler brown median patch beyond cell apex; ventrally with a reddish-mauve sheen, except for a contrasting matte dark brown sector from base to termen; between vein 3A and a line bisecting space between veins CuA_2 and 1A + 2A, an obscure, short, pale, median band, sullied by mauve and margined by diffuse dark purple, especially towards inner margin. Cilia of forewing dark brown, but with some creamy-white at tornus; of hindwing longer and creamy-white between tornus and vein M_3, otherwise dark brown.

Type data. Holotype ♂, Kga/11/9 [i.e., requiring the following label data: NEW GUINEA, Kiunga, Fly River, 11 September 1957 W. W. Brandt], (genitalia vial no. ANIC MJP 108); paratype ♂ [rather worn and damaged] Kiunga [i.e., requiring above label data], (genitalia vial no. ANIC MJP 109); in Australian National Insect Collection (CSIRO), Canberra, Australia.

Remarks. Keys to *Sabera bicolor misola* Evans, 1949, in Evans (1949), but distinct from it. Although extremely like all four similar species of the *S. fuliginosa* (Miskin 1890) group, it differs from them by the very obscure median pale patch of the hindwing dorsally and much longer thumb-like process of the dorsal margin of the much narrower valva (Figs. 1 and 2). The male forewing sex-brand (Fig. 3) is also very similar to the brands found in the *fuliginosa* group, but is distinct in shape.



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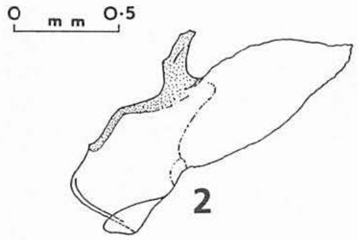

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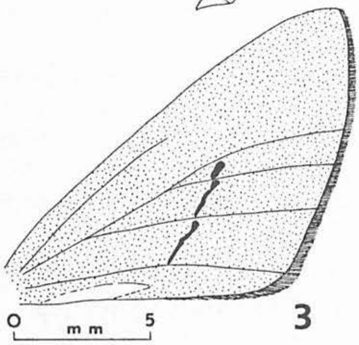

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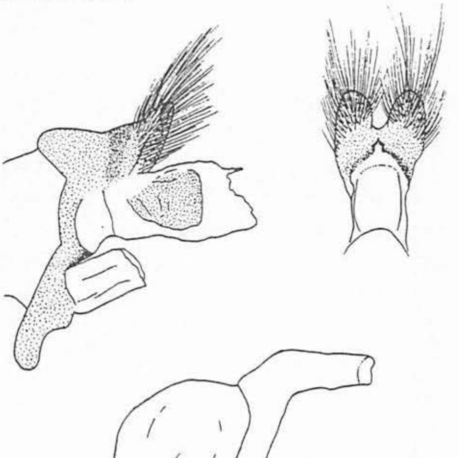

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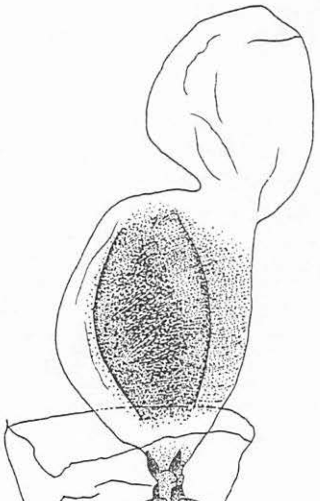

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Figs. 1–5. **1,** *Sabera iloda* HT ♂ genitalia clockwise from upper left, whole genitalia (minus aedeagus) lateral profile, uncus dorsal profile, juxta ventral profile, aedeagus lateral profile, detail of right valva inner lamina. **2,** *S. iloda* PT ♂ detail of right valva inner lamina. **3,** *S. iloda* HT ♂ detail of forewing sex-brand. **4,** *Parantica fuscela* HT ♂ genitalia: clockwise from upper left, whole genitalia (minus aedeagus) lateral profile (note valvae are aberrant and vestigial), uncus dorsal profile, aedeagus lateral profile. **5,** *P. fuscela* PT ♀ genitalia. (HT = holotype, PT = paratype.)

NYMPHALIDAE (DANAINAE)

Parantica fuscela Parsons, **new species** Figs. 4, 5, 12–15

Description. Holotype ♂. Antennae broken (see ♀); head, frons, and palpi damaged (see ♀); thorax dark brown (almost black), sparsely spotted with pure white; abdomen dorsally dark brown, a very diffuse white spot either side of segment 1, ventrally slightly paler creamy-brown, a white suffusion between segments 2 and 3, and 3 and 4; coxae of mid- and hind-legs pure white, otherwise legs dark brown. FWL/WS 36.5/61.0 mm, costa and termen slightly convex; dorsally reddish-brown, patterned as illustrated with creamy-white spots, discocellulars with a small but notable dark brown median spot; ventrally similar, but slightly paler reddish-brown, and more yellowish-brown between costa and cell, veins dark brown, markings suffused with reddish-brown, except row of subterminal spots, which are pure white. Hindwing costa almost straight, termen very convex and well-rounded; dorsally and ventrally patterned as illustrated, and with colors like forewing; subtornal hindwing sex-brand ovate, 5.0 mm long by 2.75 mm wide, divided medially by vein 1A + 2A, gray-brown dorsally, dark brown ventrally. Cilia of both wings very short and dark brown.

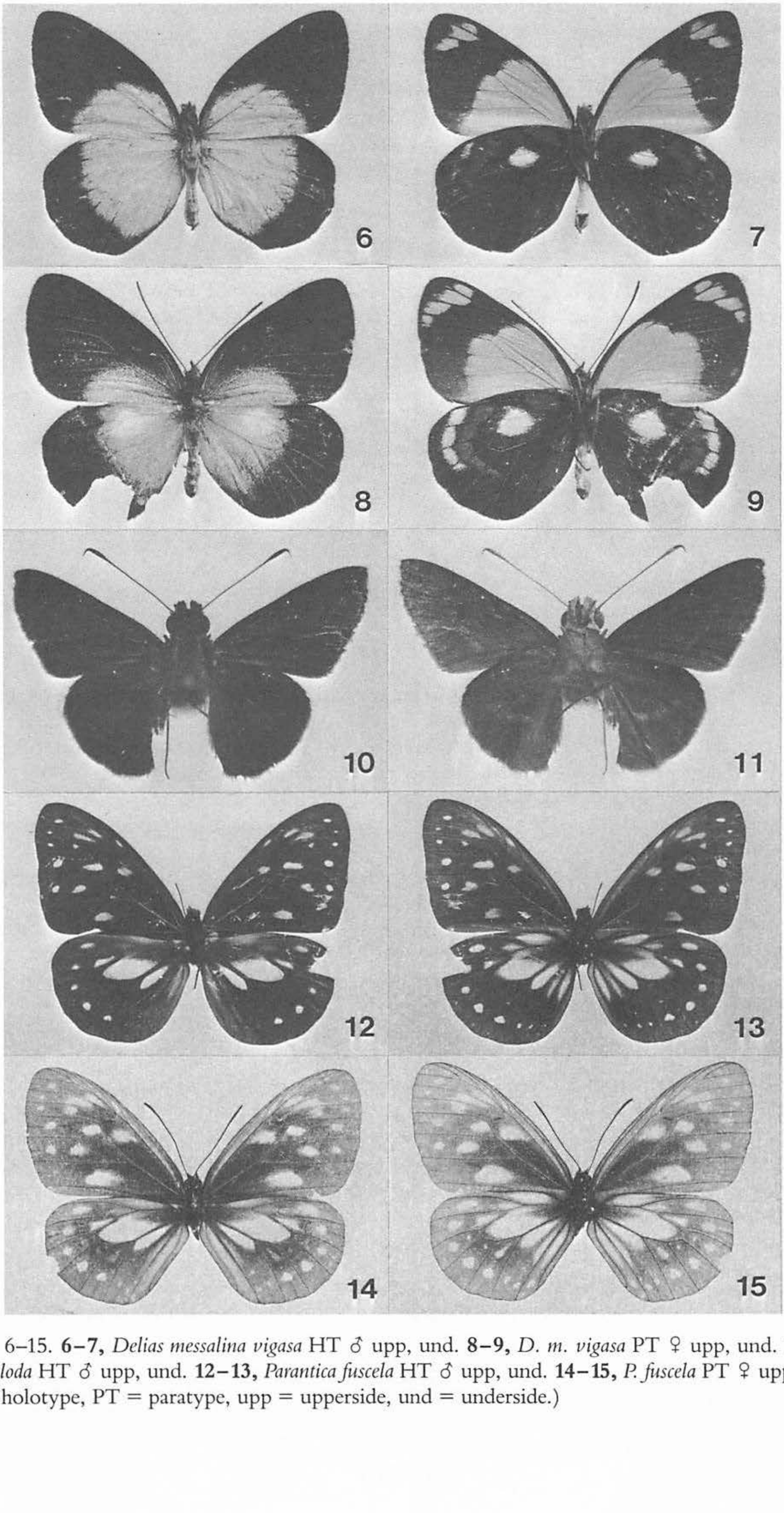
Paratype ♀. Antennal length 18.0 mm, shaft and club black; head and frons dark brown with white adjacent to eye, including 3 white spots; palpi with white basal segment and other 2 segments longitudinally striped with white and dark brown. FWL/WS 39.5/67.0 mm. Similar to male, but thorax with a white middorsal longitudinal stripe, wings with much paler reddish-brown ground color and larger pale markings, dark brown forewing discocellular spot more obvious on both surfaces, abdomen creamy-white ventrally.

Type data. Holotype ♂, PAPUA NEW GUINEA: NEW BRITAIN: Upper Warrongoi Riv, 1,000 m, 5. XII.1962, J. Sedlacek (genitalia vial no. BBMH MJP 038); paratype ♀, PAPUA NEW GUINEA: NEW BRITAIN: Upper Warrongoi Riv, 1,300 m, 4. XII.1966, J. Sedlacek (genitalia vial no. BBMH MJP 039); in Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.

Remarks. In Ackery & Vane-Wright (1984) keys to the Biak Island (Irian Jaya) endemic, *Parantica marcia* (Joicey & Talbot, 1916), but distinct from it. *P. fuscela* is most similar to *P. marcia* and *P. rotundata* (Grose-Smith 1890), but differs from both in its much redder-brown ground color; more restricted pattern of pale markings; more apically acute forewing; broader hindwing; and its possession, in the male, of a discrete hindwing subtornal sex-brand. The new species is thus distinct from all other *Parantica* within the New Guinea Region (most of which were illustrated with color photographic plates by D' Abrera 1971, 1978). The uncus and aedeagus (Fig. 4) are typical for the genus, but the remainder of the genitalia are obviously aberrant (malformed), especially in the lack of valvae. The aedeagus is without any large cornuti in the vesica, but the latter is clothed in minute cornuti near the distal orifice. The genitalia of the paratype female (Fig. 5) are also typical of *Parantica*.

DISCUSSION

Kiunga is a locality in the Western Province of mainland PNG where William Brandt collected some remarkable butterflies (now mostly housed in the Australian National Insect Collection). The Warrongoi, or Warangoi, River flows northwards (approximately in line with Rabaul) from its headwaters on Mount Biririnia in the East New Britain Province of the island of New Britain. The locality visited by J. Sedlacek on the upper reaches of the river apparently represents a very poorly collected area that may reward entomologists with further new endemic insect species. The presence of *D. messalina* and *P. fuscela* in New Britain is unexpected; the former was previously known only from the Solomon Islands. Only *P. rotundata* was thought to represent *Parantica* in New Britain, and *P. fuscela* is a distinctive species. Furthermore, *D. messalina vigasa* is interesting in that it is phenotypically closer to the Santa Ysabel and



Figs. 6–15. **6–7,** *Delias messalina vigasa* HT ♂ upp, und. **8–9,** *D. m. vigasa* PT ♀ upp, und. **10–11,** *Sabera iloda* HT ♂ upp, und. **12–13,** *Parantica fuscela* HT ♂ upp, und. **14–15,** *P. fuscela* PT ♀ upp, und. (HT = holotype, PT = paratype, upp = upperside, und = underside.)

Guadalcanal (Solomon Islands) subspecies than to the nominotypical Bougainville Island (North Solomons Province, PNG) subspecies (see discussion on "discontinuous subspecies" in the nymphalid genus *Tellervo* by Ackery 1987: 223). Thus the distinctive subspecies *m. messalina* is geographically positioned between two equally distinctive but mutually similar subspecies. The discovery of *P. fuscela* parallels the case of *Tiradelphe schneideri*, a monobasic genus described by Ackery & Vane-Wright (1984) from just two females collected on Mount Popomatseu, Guadalcanal Island. These island endemics would appear to be very rare, or highly localized.

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Changes in Classification and Names of Hawaiian Pyraloidea since the Publication of *Insects Of Hawaii*, Volume 8, by E.C. Zimmerman (1958) (Lepidoptera)

Eugene Munroe[1,2]

ABSTRACT

Changes in taxonomy and new records of Hawaiian Pyralidae (s.l.) published since 1958 are collated, some errors are corrected, and new changes are introduced. Genera affected are *Hellula* Guenée, *Uresiphita* Hübner, *Pseudopyrausta* Amsel (ex *Blepharomastix* Lederer), *Hyperectis* Meyrick, *Terastia* Guenée, *Nomophila* Hübner, *Ategumia* Amsel (ex *Bocchoris* Moore and *Blepharomastix*), *Herpetogramma* Lederer, *Salbia* Guenée (ex *Syngamia* Guenée), *Spoladea* Guenée (ex *Hymenia* Hübner), *Glyphodes* Guenée and *Stemorrhages* Lederer (ex *Margaronia* Hübner), *Omiodes* Guenée (for *Hedylepta* Lederer), *Udea* Guenée (for *Oeobia* Hübner), *Conogethes* Meyrick (ex *Dichocrocis* Lederer), *Eudonia* Billberg (ex *Scoparia* Haworth), *Cryptoblabes* Zeller, *Paramyelois* Heinrich, and *Assara* Walker. The Pyralidae as understood by Zimmerman are divided, following Minet, into two families Pyralidae and Crambidae; a key is given to these higher taxa as found in Hawai'i. One new synonym is noted, the status of 5 taxa is revised, and 123 new combinations are made. No new taxa are described, and no unpublished species records are added to the Hawaiian list. The origin, geographical distribution, and affinities of some taxa are discussed.

INTRODUCTION

A number of changes in names and placement of Hawaiian Pyralidae have been made since the appearance of Volume 8 of *Insects of Hawaii* (Zimmerman 1958). Some of these have been published explicitly, though not always in very obvious places; others are implicit in published work on genera or on other faunas. Also, a few additional species have been reported. The object of this paper is to collate the changes and additions as a basis for the checklist of Hawaiian insects in preparation by the Bishop Museum. I have taken the opportunity to add some unpublished changes, but new taxa and unreported species are reserved for other publications. Substantial work of revision will have to be done on most of the large genera and some of the small ones; except for some changes in synonymy, I have not attempted to anticipate this in the present paper.

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SUPERFAMILY PYRALOIDEA

The superfamily Pyraloidea has been restricted by Minet (1982, 1983, 1985, 1986). The Pterophoridae and Alucitidae, included in Pyraloidea by Zimmerman, are now referred to separate superfamilies, which are not considered in detail in the present paper. I follow Minet's division of the Pyralidae in the broad sense, as understood by Zimmerman, into two families, the Crambidae—represented in Hawai'i by the subfamilies Scopariinae, Crambinae, Nymphulinae, Glaphyriinae, and Pyraustinae—and the Pyralidae in the sense of Minet, comprising in Hawaii the subfamilies Pyralinae, Galleriinae, and Phycitinae. The Pterophoridae, the Alucitidae, and the two families of Pyraloidea can be separated in the Hawaiian fauna by the following key:

Key to Pyraloidea, Alucitidae, and Pterophoridae in Hawaii

1. Wings in Hawaiian species partly divided by deep sinuses into plumelike lobes; proboscis naked; maxillary palpus, ocellus, and chaetosema absent; abdomen without tympanic structures at base 2

   Wings not divided by sinuses into plumelike lobes: proboscis if present scaled at base; in Hawaiian species maxillary palpus always, ocellus usually, and chaetosema often, present; abdomen with well-developed tympanic organ ventrally at base . . . . superfamily **Pyraloidea, 3**

2. Wings narrow, tip of abdomen far exceeding anal angle of extended hindwing; in Hawaiian species forewing divided by 1 sinus into 2 lobes, and hindwing by 2 sinuses into 3 lobes. . . . . superfamily **Pterophoroidea,** family **Pterophoridae**

   Wings wide, tip of abdomen reaching to about anal angle of extended hindwing; in Hawaiian species fore- and hindwings each divided by 5 deep sinuses into 6 lobes . . . . superfamily **Alucitoidea,** family **Alucitidae**

3. Tympanic apparatus without praecinctorium (a median, sagittal, simple or bilobed flap extending ventrad into space between thorax and abdomen); transparent tympanum and translucent conjunctiva coplanar; tympanic cases anteriorly almost closed . . . . family **Pyralidae**

   Tympanic apparatus with distinct praecinctorium; transparent tympanum and translucent conjunctiva in distinct, intersecting planes, meeting at a strong angle along their boundary; tympanic cases anteriorly widely open . . . . family **Crambidae**

For convenience, I discuss taxa of Pyraloidea in the sequence given by Zimmerman, but the following order is taxonomically better:

- Superfamily Pyraloidea
  - Family Pyralidae
    - Subfamily Pyralinae
    - Subfamily Galleriinae
    - Subfamily Phycitinae
  - Family Crambidae
    - Subfamily Scopariinae
    - Subfamily Crambinae
    - Subfamily Nymphulinae
    - Subfamily Glaphyriinae
    - Subfamily Pyraustinae

FAMILY CRAMBIDAE

SUBFAMILY GLAPHYRIINAE

Genus ***Hellula*** Guenée, 1854. Zimmerman placed this genus in the Pyraustinae, but I subsequently transferred it to the Glaphyriinae (Munroe 1964). Although the subfamily is predominantly American, this genus is widely distributed in the warmer parts of both hemispheres. As I pointed out in the review of Zimmerman's Volume 8 (Munroe 1960), Zimmerman correctly identified the Hawaiian species as *H. undalis* (Fabricius 1794), described from Europe, and figured the moth and the male and female genitalia. However, he overlooked the separation of the American population as *H. rogatalis* (Hulst 1886) by Capps (1953). Consequently, he referred to *H. undalis* as "a widespread species," which it is, but only in the Old World. He cited illustrations by Peterson (1948) of larval structures actually referable to *H. rogatalis.*

H. rogatalis has been recorded from Hawai'i by Mau (1977) on the basis of collections from Chinese cabbage on Lāna'i. However, on investigation it turns out that (*a*) the Lāna'i material has not been preserved, and (*b*) all *Hellula* material in the Hawaii State Department of Agriculture collection had been placed under the name *H. rogatalis* on the basis of an identification by the late E.L. Todd, unsupported by genitalia dissection. I have dissected specimens from Hawai'i, O'ahu, Kaua'i, and Midway, all of which proved to be *H. undalis*, including specimens from the State Agriculture Dept. collection identified as *H. rogatalis.* Although there is as yet no hard evidence of the occurrence of *H. rogatalis* in the state, it is indistinguishable externally from *H. undalis*, so its presence, now or in the future, could be detected only by examination of genitalia. It is recommended, therefore, that samples of *Hellula* be dissected from time to time and compared with Capp's excellent figures.

A second American species, *H. phidilealis* (Walker 1859) has been recorded from Kure Island by Butler and Usinger (1963). This record was supported by examination of genitalia. *H. phidilealis* is distinguished by external characters and easily by genitalia (see Munroe in Dominick *et al.* 1972, 1973).

SUBFAMILY PYRAUSTINAE

Genus ***Uresiphita*** Hübner, [1825] 1816. Zimmerman correctly referred *Mecyna virescens* Butler, 1881, to this genus. He synonymized it with the European *U. polygonalis* ([Denis & Schiffermüller] 1775). Clarke (1971: 73) raised it to the status of a subspecies, pointing out that the Hawaiian *U. polygonalis virescens* differs substantially from European, New Zealand, and Rapa populations in coloration. I provisionally follow Clarke's arrangement. Though the whole question of variation in this complex needs further study, the Hawaiian specimens I have seen certainly fall outside the range of variants found elsewhere, and they are at least subspecifically distinct. Zimmerman thought that the species was introduced to Hawai'i from Europe, but the distinctive maculation argues against this. From material I have examined, it seems possible that there are distinct local populations on different Hawaiian islands, but this remains to be verified. Zimmerman did note the comment by Perkins (1914: clx) that biologically and distributionally *virescens* has all the appearance of an endemic insect. Assuming that the Hawaiian populations are endemic, their origin presents an interesting and not easily solved problem. If their ancestors were introduced by humans, why is the genus found only in Hawai'i and Rapa in the eastern Pacific, and not again until New Zealand, Australia, and Japan on the western Pacific rim? If, on the other hand, they arrived naturally by oversea dispersal, why do the Hawaiian and Rapa populations not look more like the species from North America, the closest potential source area? Habits tell us little, one way or the other. On the one hand, the early stages are readily dispersed on woody legumes and might have been carried by early Polynesians or modern nurserymen; on the other hand, the adults are active fliers and well-known migrants and might well have made long transoceanic jumps.

Although placed by Zimmerman next to *Udea* ("*Oeobia,*" see below), *Uresiphita* belongs to the separate tribe Pyraustini, along with the introduced genus *Pseudopyrausta*; however, the two genera are not very closely related within the tribe. It may be noted that *Mecyna*, in which Butler described *virescens*, was originally a manuscript name of Guenée's, intended to apply to *polygonalis* and its relatives. In addition to being antedated by *Uresiphita*, *Mecyna* was actually first published by Doubleday ([1849] 1850) for a species not congeneric with *polygonalis*. For many years, however, while *Uresiphita* and other generic names from Hübner's *Verzeichniss* were considered *nomina nuda*, and while Doubleday's obscure publication and its consequences had not yet become widely known, this generic name was used for *polygonalis* and species associated with it.

Genus ***Pseudopyrausta*** Amsel, 1956. (Not in Zimmerman.) *Pseudopyrausta acutangulalis* (Snellen 1875) was released for control of *Lantana* in O'ahu in 1953 (Weber 1954), in Kaua'i and Moloka'i in 1954 (Weber 1955), again in O'ahu and in Maui and Hawai'i in 1965 (Davis & Krauss 1966). Establishment has not been reported. The Hawaiian reports give the genus as *Blepharomastix*, but *acutangulalis* belongs to a different tribe and is the type species of *Pseudopyrausta*. There are additional neotropical and southern nearctic species related to *acutangulalis*, and the group requires revision. For a brief discussion see Munroe in Dominick *et al.* (1976: 16).

Genus ***Hyperectis*** Meyrick, 1904. The synonymy given by Zimmerman for the species is correct. As I noted (Munroe 1960), Zimmerman was correct in his surmise that *Hyperectis* is not closely related to *Erecta* Walker, 1859, but *Hyperectis* is very close to *Hydriris* Meyrick, 1885 = *Spanista* Lederer, 1863, not Foerster, 1862 = *Antierecta* Amsel, 1956, formerly considered a synonym of *Erecta*. *Hydriris* has several species and is widely distributed in tropical and warm temperate countries. The nearctic and Central Asian *Choristostigma* Warren, 1892 = *Namangania* Amsel, 1952, and the Floridian *Geshna* Dyar, 1906, are also structurally similar to *Hyperectis*. *Tatobotys vibrata* Meyrick, from the Marquesas, was compared by Zimmerman to *Hyperectis*, but the figures published by Clarke (1986) show that it is a true *Tatobotys* and that its similarity to *Hyperectis* is superficial.

Genus ***Terastia*** Guenée, 1854. As mentioned in Munroe (1960), the Old World forms previously referred to *T. meticulosalis* Guenée, 1854, belong to the distinct species *T. subjectalis* Lederer, 1863, which lacks the dark triangular costal patch that precedes the orbicular spot of the forewings in *T. meticulosalis*, and which is distinct also in male and female genitalia. Larvae of both species bore in pods and shoots of *Erythrina*. Unfortunately, Zimmerman figured the moth and the male and female genitalia from Mexican specimens of *T. meticulosalis*. *T. subjectalis* seems not to have been taken in Hawai'i since the 1920s.

Genus ***Nomophila*** Hübner, [1825] 1816. The Hawaiian species is correctly given by Zimmerman as *N. noctuella* ([Denis & Schiffermüller] 1775), but, as I pointed out (Munroe 1960, 1973), this species is not cosmopolitan, as was long supposed, but is restricted to Europe, Africa, and Asia. The nearctic species is distinct, as are several tropical and south temperate ones. I have given a number of Hawaiian records (Munroe 1973: 188).

Genus ***Ategumia*** Amsel, 1956, type species *matutinalis* (Guenée 1854), described in *Samea* Guenée, 1854. The species resembles *Samea* and related genera in external appearance, but the male genitalia of *Ategumia* are strikingly different, lacking the uncus and much of the tegumen. The species are found in the tropics and subtropics of both the Old and New Worlds, and the larvae so far as is known feed on Melastomaceae. Since Zimmerman's publication, three species have been introduced to the state of Hawai'i as biological control agents against melastome pests. These were reported as follows:

a. "*Bocchoris fatualis* Munro" by Davis (1960: 246). *Botys fatualis* Lederer was described in 1863. It was omitted by Hampson (1899) from his revision of the Pyraustinae, but I designated a lectotype from Java (Munroe 1958a: 511). The species was placed in the collection of the British Museum (Natural History), London, under *Bocchoris*. The genitalia are closely similar to those of the neotropical *Ategumia matutinalis* (Guenée 1854), and the species is hereby transferred to *Ategumia* as *Ategumia fatualis* (Lederer 1863), new combination. Stock of this species from Paeta, Laguna Province, Philippine Islands, was introduced in 1957 to combat

Melastoma malabathricum Linnaeus, and was found to be established at Knudson Gap, Kaua'i, in 1959. The reference in the published report to "Munro" as author of the species is a mistake.

b. "*Bocchoris adipalis* Zeller" by Davis & Krauss (1966: 202, 205). *Botys adipalis* Lederer, 1863, was transferred by Hampson (1896: 286) to *Bocchoris*, but it is misplaced there. It is closely related to *Botys fatualis* and like it must be transferred to *Ategumia* Amsel, where it becomes *A. adipalis* (Lederer 1863), new combination. Davis and Krauss wrongly gave "Zeller" as the author of the species. I designated a lectotype for *Botys adipalis* (Munroe 1958a: 511). The stock introduced to the island of Hawai'i in 1964 was from Kuala Lumpur, Malaysia, and from Singapore, but no recoveries had been reported by 1966. The taxonomy of the Old World species of *Ategumia* has not been critically studied, and the identities of the various introductions require confirmation. Specimens have been collected in Kaua'i and O'ahu that look somewhat different from the material introduced as *B. fatualis*; their identity, too, is doubtful.

c. "*Blepharomastix*" *ebulealis* (Gunée 1854) by Davis (1971: 61; 1972: 189; 1974: 357), by Nakao and Funasaki (1976: 329), and by Fujii (1977: 394, 398, 406, 409). Both larvae and adults were liberated in O'ahu to combat Koster's curse, *Clidemia hirta* (L.), in 1969–72, and the species was reported established by 1974. I transferred *Botys ebulealis* Guenée from *Blepharomastix* Lederer, 1863, to *Ategumia* in the North American checklist (Munroe, in Hodges *et al.* 1983) because it has closely similar genitalia and external structure and basically similar maculation to *A. matutinalis* and other American and paleotropical species. It is immediately recognizable, however, by its small size, the erect termen of the forewing, and the bright yellow ground with narrow, evenly dark terminal band.

Genus ***Herpetogramma*** Lederer, 1863. (Not in Zimmerman.) *H. licarsisalis* (Walker 1859), a species originally described from Sarawak but widespread in tropical and subtropical Asia and in the islands of the western Pacific, was recorded by Davis for LaPlante (1968) as "Pyralidae sp." and by Au (1968) as *Pachyzancla licarsisalis* (Walker). The current generic assignment was reported by LaPlante and Au (1968). Native species of *Herpetogramma* occur in the Marquesas, though not in Hawaii, and the genus is widespread in the Old and New Worlds.

Genus ***Salbia*** Guenée, 1854. (Not in Zimmerman.) *S. haemorrhoidalis* Guenée, 1854, was released for control of lantana in O'ahu, Moloka'i, Maui, and Hawai'i in 1956 (Chong 1957, Weber 1957) and rapidly became established (Davis 1958). It has been reported as *Syngamia haemorrhoidalis* in the Hawaiian literature, but it is not congeneric with *S. florella* (Stoll 1781), the typespecies of *Syngamia* Guenée, 1854. In the North American checklist I placed it in *Salbia* Guenée, 1854 (Munroe in Hodges *et al.* 1983).

Genus ***Spoladea*** Guenée, 1854, replacing *Hymenia* Hübner, [1825] 1816. Moths of these two genera are very similar in external structure and appearance, but their genitalia are different. In *Spoladea* the uncus is short and rounded, without a constricted stem, whereas in *Hymenia* the uncus has a slender stem and its expanded tip reaches the apex of the valve. *Spoladea* has several species in the Old World tropics and subtropics, including a mimetic species in New Guinea (Munroe 1974) and giant species in Micronesia and New Caledonia (unpublished data). These differ only slightly in genitalia, though their external appearance and/or secondary sexual characters are different. Apparently there is only one species, perhaps introduced, in the New World. Conversely, *Hymenia* appears to have a single species of very uniform appearance in the Old World, whereas New World populations are more diverse, though their status as species or otherwise has not been critically assessed. The Hawaiian representative, *S. recurvalis* (Fabricius 1775) (wrongly dated as 1787 by Zimmerman) is the type species of *Spoladea*. The combination has been used by several authors, and I adopted it (Munroe in Hodges *et al.* 1983).

Genera ***Glyphodes*** Guenée, 1854, and *Stemorrhages* Lederer, 1863, replacing *Margaronia* Hübner, [1825] 1816. Zimmerman (1958: 59) wrote of *Margaronia*, "As the genus is now constituted, however, I believe that it is composite. It appears to me that the two Hawaiian species may belong to two genera." I suggested (Munroe 1960) that the above genera should be used for *cyanomichla* (Meyrick 1899) and *exaula* (Meyrick 1888), respectively. *Margaronia* in fact is a junior objective synonym of *Palpita* Hübner, [1808] 1806, which differs in both male and female genitalia from *Glyphodes* and *Stemorrhages*. *Glyphodes cyanomichla* has a complex pattern of bands on the wings closely similar to that of *G. stolalis* Guenée, 1854, the type species of the genus. The translucent green *Stemorrhages exaula* resembles *Stemorrhages sericea* (Drury 1773) from Africa and Madagascar in appearance and genital structure, but lacks the expansion of the male antennal shaft found in that species. Several additional related species occur in the Old World tropics, including: (*a*) *Stemorrhages marthesiusalis* (Walker 1859), n. comb., from "Hindustan" [India], described in *Margaronia* = *S. nereis* (Meyrick 1887), n. comb., from "Ceylon" [Sri Lanka], described in *Margarodes* Guenée, 1854, but not the same as *Margarodes lustralis* Guenée, 1854, with which it has wrongly been synonymized, but which belongs to a different genus, so far unnamed; (*b*) *Stemorrhages amphitritalis* (Guenée 1854), n. comb., from "Silhet" [India], described in *Margarodes*; (*c*) *Stemorrhages titanicalis* (Hampson 1918), n. comb., from the Solomon Islands, described in *Margaronia*; (*d*) *Stemorrhages oceanitis* (Meyrick 1886), n. comb., from "New Hebrides" [Vanuatu] and Fiji, described in *Maragarodes*; (*e*) *Stemorrhages thetydalis* (Guenée 1854), n. comb., described in *Margarodes*, from Tahiti; and *Stemorrhages euthalassa* (Meyrick 1934a), from the Marquesas, described in *Margaronia*, but transferred to *Stemorrhages* by Clarke (1986). All the nominal species referred to in this paragraph were listed by Klima (1939) in *Diaphania* Hübner, 1818, which Klima used inclusively to replace *Glyphodes* and *Margaronia* in the broad sense in which these names were successively employed by Hampson.

Genus ***Omiodes*** Guenée, 1854, replacing *Hedylepta* Lederer, 1863. Zimmerman (1958) correctly pointed out that the Hawaiian species related to *Botys accepta* Butler are not congeneric with the type species of *Lamprosema* Hübner, 1823, *Nacoleia* Walker, 1859, *Semioceros* Meyrick, 1884, or *Phostria* Hübner, [1819] 1816, though they have their own nominal genus, *Loxocreon* Warren, 1892, which is a subjective synonym of *Hedylepta* Lederer, 1863. However, Zimmerman was wrong in saying that these species are not related to the type species of *Omiodes*. Actually they are as close to it as to the type species of *Hedylepta*. *Omiodes* has priority and should be reinstated for the Hawaiian species. Fortunately, every nominal species from Hawai'i has already been cited in *Omiodes*, and in fact many were described in it. Consequently, no new combinations are involved.

Genus ***Udea*** Guenée, 1854, replacing *Oeobia* Hübner, [1825] 1816. *Oeobia* was suppressed for the purposes of the Law of Priority, but not those of the Law of Homonymy, by the International Commission on Zoological Nomenclature in its Opinion 536. Consequently the Hawaiian species placed here by Zimmerman must be moved to *Udea*. I noted this (Munroe 1960), but I did not explicitly transfer any species. All the nominal species listed by Zimmerman, 49 in all, some cited as subspecies or synonyms, are hereby transferred to *Udea* as new combinations (see Table 1).

Genus ***Conogethes*** Meyrick, 1884. (Not in Zimmerman.) *Conogethes punctiferalis* (Guenée 1854), the type species of the genus, has been reported from Hawaii twice in the literature. Pupae were taken from a pine tree in the conservatory of a Japanese ship at Honolulu in 1921 (Ehrhorn 1922), and Fullaway (1928) exhibited a moth reared from fruit or seeds of the longan, *Nephelium longanum*, "gathered on the tree." The locality and circumstances of the latter collection were not given, but the difference in habits from the previously recorded collection was noted. The species referred to *C. punctiferalis* are known to be a complex, and the two records probably refer to different species. Both records were given under the generic name *Dichocrocis* Lederer, 1863, following Hampson's classification, but the type species of that genus is very different in structure, and *Conogethes* must be separated.

Table 1. New combinations in Hawaiian *Udea*, genera in which originally described and specific synonymy according to Zimmerman (1958).

New combination	Author, date	Described in	Synonym or subspecies of
Udea argoscelis	Meyrick, 1888	*Scopula*	
U. aurora	Butler, 1881	*Anemosa*	
U. brontias	Meyrick, 1899	*Pyrausta*	
U. bryochloris	Meyrick, 1899	*Pyrausta*	
U. calliastra	Meyrick, 1899	*Phlyctaenia*	
U. caminopis	Meyrick, 1899	*Phlyctaenia*	
U. campylotheca	Swezey, 1946	*Phlyctaenia*	*U. despecta* [syn.]
U. cataphaea	Meyrick, 1899	*Protaulacistis*	
U. chalcophanes	Meyrick, 1899	*Phlyctaenia*	
U. chloropis	Meyrick, 1899	*Pyrausta*	
U. chytropa	Meyrick, 1899	*Phlyctaenia*	
U. conisalias	Meyrick, 1899	*Loxostege*	
U. constricta	Butler, 1882	*Scopula*	
U. despecta	Butler, 1877	*Rhodaria*	
U. dracontias	Meyrick, 1899	*Pyrausta*	
U. dryadopa	Meyrick, 1899	*Pyrausta*	
U. endopyra	Meyrick, 1899	*Phlyctaenia*	
U. ennychioides	Butler, 1881	*Mecyna*	
U. ephippias	Meyrick, 1899	*Phlyctaenia*	
U. eucrena	Meyrick, 1888	*Scopula*	
U. exigua	Butler, 1880	*Scopula*	*U. despecta* [syn.]
U. helioxantha	Meyrick, 1899	*Loxostege*	
U. heterodoxa	Meyrick, 1899	*Phlyctaenia*	
U. hyacinthias	Meyrick, 1899	*Phlyctaenia*	*U. calliastra* [subsp.]
U. iocrossa	Meyrick, 1899	*Phlyctaenia*	*U. micacea* [syn.]
U. lampadias	Meyrick, 1904	*Phlyctaenia*	
U. leucozonea	Hampson, 1913	*Pionea*	*U. eucrena* [syn.]
U. liopis	Meyrick, 1899	*Phlyctaenia*	
U. litorea	Butler, 1883	*Scopula*	
U. melanopis	Meyrick, 1899	*Loxostege*	
U. metasema	Meyrick, 1899	*Phlyctaenia*	
U. micacea	Butler, 1881	*Aporodes?*	
U. monticolans	Butler, 1882	*Locastra*	
U. nigrescens	Butler, 1881	*Mecyna*	
U. ommatias	Meyrick, 1899	*Phlyctaenia*	
U. pachygramma	Meyrick, 1899	*Phlyctaenia*	
U. phaethontia	Meyrick, 1899	*Pyrausta*	
U. phyllostegia	Swezey, 1946	*Phlyctaenia*	
U. platyleuca	Meyrick, 1899	*Phlyctaenia*	
U. poliochroa	Hampson, 1913	*Pionea*	*U. litorea* [syn.]
U. psychropa	Meyrick, 1899	*Pyrausta*	
U. pyranthes	Meyrick, 1899	*Phlyctaenia*	
U. rhodias	Meyrick, 1899	*Phlyctaenia*	*U. liopis* [subsp.]
U. stellata	Butler, 1883	*Melanomecyna*	
U. swezeyi	Zimmerman, 1951	*Protaulacistis*	
U. synastra	Meyrick, 1899	*Phlyctaenia*	*U. calliastra* [subsp.]
U. thermantis	Meyrick, 1899	*Pyrausta*	
U. thermantoidis	Swezey, 1913	*Pyrausta*	
U. violae	Swezey, 1933	*Phlyctaenia*	

SUBFAMILY SCOPARIINAE

Genus **Eudonia** Billberg, 1820, replacing *Scoparia* Haworth, 1811. I noted (Munroe 1960) that the Hawaiian species belong to *Eudoria* Chapman, 1912, rather than to *Scoparia*. Subsequently Whalley (1966) showed that the correct name for the group to which I referred is *Eudonia*, proposed 90 years earlier. I mentioned this name in connection with the Hawaiian species in *The Moths of America North of Mexico* (Munroe in Dominick *et al.* 1972), but I did not transfer any species by name. I now transfer all the nominal species cited by Zimmerman, a total of 66, to *Eudonia* as new combinations (see Table 2). I know more than 100 Hawaiian species of *Eudonia*, many unnamed, forming about 20 species groups. Most of this work is not yet published, but the following changes affect already named species:

a. Eudonia macrophanes is a good species, not a subspecies of *bucolica* as given by Zimmerman. Zimmerman designated a neotype for this taxon, but the holotype was later rediscovered and figured (Munroe 1969), and the International Commission on Zoological Nomenclature in its Opinion 977 set aside the neotype (Melville 1972). The holotype is not conspecific with Zimmerman's neotype, and both are grey moths specifically distinct from the brown *E. bucolica*. *E. macrophanes sensu* Zimmerman is still unnamed.

b. E. pyreseutis Meyrick, also placed by Zimmerman as a subspecies of *bucolica*, is likewise specifically distinct, having more extensive light-colored scaling on the forewing and less distinct transverse lines, with the postmedial line more shallowly excurved opposite the cell.

c. Eudonia nectarias is not a synonym of *E. ianthes* Meyrick. *E. ianthes* is one of several orange-tinted species, mostly restricted to single islands, maintaining a distinct appearance from one another in series, despite their general resemblance. It is common on Kaua'i, where it coexists with an undescribed species with more rounded forewing apex and a larger and more conspicuous pale patch in the forewing cell. *E. nectarias*, from Lāna'i and Maui, has a more uniform and less orange ground, has the antemedial line more strongly oblique, has the pale cell spot of the forewing reduced, lacks the pale oblique streak on the costa basad of the postmedial line, and has only a weak indentation on the postmedial line at the cubital fold.

Table 2. New combinations in Hawaiian *Eudonia*, genera in which originally described and specific synonymy according to Zimmerman (1958) and current.

New combination	Author, date	Described in	Synonym or subspecies of: Zimmerman (1958)	Current
Eudonia actias	Meyrick, 1899	*Scoparia*		
E. aeolias	Meyrick, 1899	*Scoparia*		
E. amphicypella	Meyrick, 1899	*Scoparia*		
E. antimacha	Meyrick, 1899	*Scoparia*		
E. balanopis	Meyrick, 1899	*Scoparia*		
E. bucolica	Meyrick, 1899	*Scoparia*		
E. catactis	Meyrick, 1904	*Scoparia*	*ombrodes* (syn.)	*ombrodes* (syn.)
E. clonodes	Meyrick, 1899	*Scoparia*		
E. crataea	Meyrick, 1899	*Scoparia*		
E. cryerodes	Meyrick, 1899	*Scoparia*		
E. dactyliopa	Meyrick, 1899	*Scoparia*		
E. demodes	Meyrick, 1888	*Xeroscopa*		
E. empeda	Meyrick, 1899	*Scoparia*		
E. epimystis	Meyrick, 1899	*Scoparia*		
E. erebochalca	Meyrick, 1899	*Scoparia*		
E. formosa	Butler, 1881	*Scoparia*		
E. frigida	Butler, 1881	*Scoparia*		

New combination	Author, date	Described in	Synonym or subspecies of:	
			Zimmerman (1958)	Current
E. geraea	Meyrick, 1899	*Scoparia*		
E. gonodecta	Meyrick, 1904	*Scoparia*		
E. gymnopis	Meyrick, 1904a	*Scoparia*	*oenopis* (syn.)	*oenopis* (syn.)
E. halirrhoa	Meyrick, 1899	*Scoparia*		
E. halmaea	Meyrick, 1899	*Scoparia*	*meristis* (subsp.)	[good sp.]
E. hawaiiensis	Butler, 1881	*Scoparia*		
E. ianthes	Meyrick, 1899	*Scoparia*		
E. ischnias	Meyrick, 1888	*Xeroscopa*		
E. isophaea	Meyrick, 1904a	*Scoparia*		
E. jucunda	Butler, 1881	*Scoparia*		
E. loxocentra	Meyrick, 1899	*Scoparia*		
E. lycopodiae	Swezey, 1910	*Scoparia*		
E. macrophanes	Meyrick, 1888	*Scoparia*	*bucolica* (subsp.)	[good sp.]
E. marmarias	Meyrick, 1899	*Scoparia*		
E. melanocephala	Meyrick, 1899	*Scoparia*		
E. melanopis	Meyrick, 1888	*Xeroscopa*	*montana* (syn.)	*montana* (syn.)
E. melichlora	Meyrick, 1899	*Scoparia*		
E. meristis	Meyrick, 1899	*Scoparia*		
E. mesoleuca	Meyrick, 1888	*Xeroscopa*		
E. miantis	Meyrick, 1899	*Scoparia*		
E. montana	Butler, 1882	*Scoparia*		
E. nectarias	Meyrick, 1899	*Scoparia*	*ianthes* (syn.)	[good sp.]
E. nectarioides	Swezey, 1913	*Scoparia*		
E. nyctombra	Meyrick, 1899	*Scoparia*		
E. oenopis	Meyrick, 1899	*Scoparia*		
E. ombrodes	Meyrick, 1888	*Xeroscopa*		
E. omichlopis	Meyrick, 1899	*Scoparia*	*probolaea* (syn.)	[good sp.]
E. orthoria	Meyrick, 1899	*Scoparia*		
E. oxythyma	Meyrick, 1899	*Scoparia*		
E. pachysema	Meyrick, 1888	*Xeroscopa*		
E. parachlora	Meyrick, 1899	*Scoparia*		
E. passalota	Meyrick, 1899	*Scoparia*		
E. pentaspila	Meyrick, 1899	*Scoparia*		
E. perkinsi	Zimmerman, 1958	*Scoparia*	*ombrodes* (subsp.)	*catactis* (syn.)
E. peronetis	Meyrick, 1899	*Scoparia*		
E. platyscia	Meyrick, 1899	*Scoparia*		
E. probolaea	Meyrick, 1899	*Scoparia*		
E. pyrseutis	Meyrick, 1899	*Scoparia*	*bucolica* (subsp.)	[good sp.]
E. religiosa	Meyrick, 1904	*Scoparia*		
E. rhombias	Meyrick, 1899	*Scoparia*		
E. siderina	Meyrick, 1899	*Scoparia*		
E. struthias	Meyrick, 1899	*Scoparia*		
E. tetranesa	Meyrick, 1899	*Scoparia*		
E. thalamias	Meyrick, 1899	*Scoparia*		
E. thyellopis	Meyrick, 1899	*Scoparia*		
E. triacma	Meyrick, 1899	*Scoparia*		
E. tyraula	Meyrick, 1899	*Scoparia*		
E. venosa	Butler, 1881	*Scoparia*		
E. zophochlora	Meyrick, 1899	*Scoparia*		

d. E. omichlopis Meyrick is clearly distinct from *E. probolaea* Meyrick. Though both are narrow-winged species of relatively large size from Kaua'i, *E. omichlopis* has the costa of the forewing more rounded, especially near the apex, the termen more oblique, the ground more uniform and pinkish rather than bluish grey, the markings much less strongly dark-shaded, and the antemedial line acutely, not obtusely, angled at the middle of the wing. Good series of the two species are available, and they show no tendency to intergrade.

e. Zimmerman, like Meyrick (1904), noted that *E. ombrodes* splits rather evenly into lighter and darker forms. Meyrick applied the name *catactis* Meyrick to the darker form, but Zimmerman showed that the holotype of *catactis* actually belongs to the lighter form. Zimmerman therefore proposed the name *perkinsi*, intended to apply to the dark form, and treated it as a "subspecies," even though the dark form is widely sympatric with light-colored *ombrodes*. It turns out that this action involved two further errors. First, *ombrodes* is sexually dimorphic (the light individuals are males, the dark ones females), so that a new name is not required at all. Second, the holotype of *perkinsi*, from the island of Hawai'i, belongs not to *ombrodes* but to the related but slightly larger *E. crataea* Meyrick, endemic on the island of Hawai'i, so *perkinsi* must be sunk as a synonym of *crataea* (new synonymy).

FAMILY PYRALIDAE

SUBFAMILY PHYCITINAE

Genus ***Crytoblabes*** Zeller, 1848. Zimmerman (1972: 433) synonymized *C. aliena* Swezey, 1909, treated under that name by Zimmerman (1958), with *C. gnidiella* (Millière 1867). Heinrich (1956: 10) recorded *C. gnidiella* from Hawaii, but did not establish the synonymy of *C. aliena*. *C. gnidiella* should stand as the valid name, with *C. aliena* as a synonym.

Genus ***Paramyelois*** Heinrich, 1956. (Not in Zimmerman.) Swezey (1948: 204) reported as *Myelois venipars* Dyar, [1914], a specimen of *Paramyelois transitella* (Walker 1863) reared from an orange with black rot found in a Honolulu fruit store. The species was not mentioned by Zimmerman, and there is no evidence that it became established.

Genus ***Elasmopalpus*** Blanchard, 1852. (Not in Zimmerman.) *Elasmopalpus lignosellus* (Zeller 1848) was discovered on Kaua'i, O'ahu and Maui in 1986 (Heu 1988). This economic pest, whose official name is the lesser cornstalk borer, is widely polyphagous, especially on grasses and legumes. Larvae bore in the stems of hosts and may also feed on leaves. The species is of American origin, ranging from Canada, Massachusetts, and California through Bermuda, the West Indies, and Central and South America to Argentina and Chile. Heinrich (1956: 163) gave a full synonymy and listed a number of hosts.

Genus ***Assara*** Walker, 1863. (Not in Zimmerman.) *Assara albicostalis* Walker, 1863, was reported by Howarth (1982: 12) and Howarth and Sattler (1982: 14) as established on O'ahu. The species was described from Sarawak and is widespread in tropical Asia and the western Pacific region.

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General

Research papers must include an ABSTRACT (200 words) immediately preceding the text. Text is often organized as INTRODUCTION, MATERIALS AND METHODS, RESULTS, and DISCUSSION, but deviation from this format may be necessary depending on the subject treated. ACKNOWLEDGMENTS come after the text, preceding LITERATURE CITED.

Headings

Refer to the headings used in this guide as examples of heading styles.

Numbers and Measurements

As a general rule, cardinal numbers (1, 2, etc.) are not written out unless they begin a sentence. Ordinal numbers are treated as for cardinal numbers (e.g., 4th, 31st). Use commas with numbers of 4 or more digits (e.g., 1,000, 35,000). For quantities less than 1, a zero should be set before the decimal point (e.g., 0.1, $P = 0.05$).

Use of the 24-h time system (e.g., 0830 not 8:30 a.m.; 2030 not 8:30 p.m.) is preferred. Use of the SI metric system is required; where it is advantageous, authors may give metric measures with English equivalents, e.g., "at intervals of 7.6 m (25 ft)."

Express dates as in the following examples: on 15 June 1985 (no punctuation); during the 1960s (*not* 1960's), but EC_{50}'s; from 1920 *to* 1921, but in the winter of 1920–21; 20th century (*not* twentieth century); A.D. 870, but 500 B.C.

Foreign Words

Italicize foreign words and give proper diacritical marks. Appropriate diacritical marks must be used for all Hawaiian words. For Hawaiian, the following may be used as authorities: *Hawaiian Dictionary* (Pukui & Elbert, 1986, Univ. of Hawaii Press, Honolulu); *Place Names of Hawaii* (Pukui, Elbert & Mookini, 1974, Univ. of Hawaii Press); *Reference Maps of the Islands of Hawai'i* (Univ. of Hawaii Press), and *Pacific Island Names* (Motteler, 1986, Bishop Museum Press). Where American and British orthography differ, the former is followed (e.g., "color" not "colour," "while" not "whilst"). Do not italicize commonly used or anglicized non-Hawaiian foreign words or abbreviations such as ad hoc, a priori, et al., and ibid.

Mathematical Copy

Whenever possible, formulae should be set on 1 line using the solidus (/) or ÷ rather than set on 2 or more lines using the horizontal rule, e.g., $(a + b)/(ac + d)$. Underline (to be italicized) all letters that represent mathematical variables.

Quotations

Quotations of fewer than ca. 50 words should be run in with the text, with author, year, and page numbers following the quote in parentheses. Example: He concluded that ". . . words speak for themselves . . ." (Bernstein 1971:11). Longer quotations should be set off from the text as a paragraph, indented, without quotation marks, double-spaced, with literature citations as indicated:

> Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary parts. This requires not that the writer make all his sentences short . . . but that every word tell. (Strunk & White 1979:xiv)

Abbreviations and Symbols

Define all nonstandard symbols and abbreviations when they first appear in text. Use the same abbreviations for singular and plural, without periods, except as noted. Leave a space between the numeral and the unit of measure (e.g., 23 °C, 12 m). The standard abbreviations and units shown in Appendix 1 may be used without explanation. Other standard abbreviations may be found in the 2 style manuals cited under "Editorial Policy."

Literature Citations in the Text

Designate literature citations in the text by name of author(s) and year of publication and arrange chronologically: (Benjamini et al. 1960, 1963; Audy 1961; Sako & Yamane 1962a,b). Note the absence of comma between author and date. For personal communication and "in litt." citations, give initials and date if possible, e.g. (R. Smith, pers. comm. 1982).

Footnotes

Footnotes to title, author(s), and items in text should be indicated by consecutive numerals (not symbols) set as superscripts. Avoid footnotes to text items if possible; parenthetical insertions are preferable. Footnotes to tables are indicated by superscript symbols in the following sequence: *, **, ***, †, ††, †††, §, etc.

LITERATURE CITED SECTION

This section includes published references, papers in press, and unpublished theses. It should not list papers in preparation or personal communications, which should be cited in the text only. Cite as "in prep." manuscripts that have not yet been accepted for publication and as "in press" manuscripts that have been accepted for publication. Style for literature cited generally follows Style B of *The Chicago Manual of Style* (Section 16.5 and following). Arrangement is strictly alphabetical. Note the following in the examples below: use of initials for first and middle names with 1 space between initials (close up 3 initials); capitalization of only the 1st letter of the main title, the subtitles, and any proper nouns for titles of books and articles; abbreviation of titles of journals, series, and proceedings; no underlining of titles; use of an ampersand between authors' names; deletion of repeated page numbers (e.g., 214–22); and that authors' names are not repeated. Periodical title abbreviations follow the *Serial Sources for the BIOSIS Data Base* and the *International Standard ISO 833.* If references not cited in the text or unpublished materials (e.g., diaries, letters) are included, the section should be titled REFERENCES.

Journal Article

Baldwin, P.H. 1945a. The Hawaiian Goose: Its distribution and reduction in numbers. Condor 47:27–37.

——. 1945b. The Laysan Rail. Audubon Mag. 47:343–48.

Book

Weaver, W.R. 1963. The theory of probability. 2nd ed. Doubleday, Garden City, N.Y. 329 p.

Portion of Book

Kaiser, E.E., L.M. Jones & C.P. Ready. 1964. The literature of Harlem. In: J. H. Clarke, ed., Harlem: A community in transition, p. 210–50. Citadel Press, New York.

Series

Bartram, E.B. 1933. Manual of Hawaiian mosses. Bishop Mus. Bull. 101. 275 p.

Proceedings

Vogl, R.J. & S. Bear. 1969. The role of fire in the evolution of the Hawaiian flora. In: R. J. Smith, ed., Proc. Annu. Tall Timbers Fire Ecol. Conf. Vol. 2, p. 5–60. Tallahassee, Fla., 10 Apr. 1969. Viking Press, New York.

Unpublished Thesis or Dissertation

Davidson, K.T. 1983. Contributions to the biology of the lousewort. M.S. thesis, Cornell Univ. xi + 387 p.

Newspaper Article

Daily Pacific Commercial Advertiser. 1885. 2 May.

Krauss, B. 1978. Our island style. Honolulu Advertiser, 12 Oct.

Government Agency

U.S. Department of Commerce. Market Research and Service Division. 1973. Shellfish: Market review and outlook. GPO, Washington, D.C. 302 p.

TABLES

The cost of publishing tables compared to text is very high. Do not construct a table for data that can be more concisely expressed in the text; similarly, a table should not repeat data already given in the text or figures. Type tables double-spaced, each on a separate sheet, and each with a caption above the table body. Designate tables with arabic, not roman, numerals. Guidelines for preparation are as follows:

General

- Place horizontal lines above and below the boxhead and at the bottom of the table. Use no vertical lines.
- For easier comparison of data and economy of space, tables should be organized so that like data read down, not across.
- Very complicated tables with mathematical formulae, diagrams, sub- and superscripts, etc. should be prepared as camera-ready copy after approval by editor.

Column Headings

- Do not repeat column headings in the table title.
- Capitalize only the 1st word (and proper nouns) in headings.
- If all entries are in the same unit (e.g., m, days, °C), the unit should be shown in column heading and not repeated in column.
- Use abbreviations whenever possible to reduce length of headings.

Body of Table

- For "no data" use "—"; for "not applicable" leave blank; and for quantities equal to zero, type "0."
- Avoid tables with only 2 columns.

Footnotes to Tables

- Place footnotes on the same page as the table.
- Indent explanations of footnotes at the bottom of the page.
- See section on "Footnotes" for symbols to be used in tables.

Statistics

- Standard symbols are sample size, *n*; arithmetic mean, $\bar{x}$; standard deviation, SD; standard error, SE; probability, *P*; nonsignificant, NS. These need not be defined.
- For quantities less than 1, a zero should be set before the decimal point (e.g., 0.1).
- Letters following numbers to denote significance should not be sub- or superscripts, should be lower case, and should be separated from the number by a space (e.g., 12.5 ab).

ILLUSTRATIONS

General

- Design figures to fit size and layout of page. *Line drawings* are best planned for ⅓ reduction; generally they should not have to be reduced to less than ½ of original size. Ideally, photographs, washes, and other art to be *halftoned* should be submitted exact size, to be neither reduced nor enlarged.
- Submit original line illustrations, when possible, affixed to mounting board. High-quality glossy prints and PMTs are also acceptable.
- Identify each illustration on back with figure number, author's name, ms. title, and top of figure. Use a gummed label or felt tip; do not use pencil, ballpoint, or any tool that might indent or mar the art.
- Type or print figure captions together on a page separate from text. Do not type captions on plates.

Mounting and Labeling

- Number consecutively as figures all photographs, graphs, drawings, and maps.
- In the case of composite figures, parts should be identified by letters only; do not repeat figure number. For example, if Fig. 1 has several parts, letter the parts as A, B, C (not 1A, 1B, 1C). Do not number a single figure on its face.
- Do not combine line drawings and halftones on the same plate.
- Photos mounted together should be of similar contrast and abutting so that no space shows between. The printer will engrave a white hairline between photos to set them off.

- Labeling must be neat and attractive.
- Typed labeling is unacceptable.
- Lettering should be large enough to withstand reduction but not so large as to overwhelm figure.
- Labels must be designed so that letters on different figures will be approximately the same size after reduction.
- Avoid excessively bold characters and very thin lines.
- Scale lines on figures should be either vertical or horizontal.
- Use press-on letters cautiously. Be sure they are not prone to flake. To guard against later loss or flaking, lightly spray clear fixative over letters.
- Special symbols used in an illustration should be explained in a legend included as part of the illustration itself. If you must define symbols in the caption, use only standard symbols, such as open and closed circles, triangles, and squares.

SYSTEMATICS ARTICLES

All systematics papers must follow international rules of nomenclature. The following are intended as general guidelines applicable to taxonomic papers in both botany and zoology.

Names

Authors of scientific names should be included at first mention in the text. Omit authors of scientific names from the title and abstract. For author citations of botanical names, refer to *Taxonomic Literature*, 2nd edition, volumes I–VI. Author citations of zoological names are spelled out. Linnaeus (L.) and Fabricius (Fabr.) can be abbreviated. Authorities following species names should be written with a comma between author and date (e.g., *Trechoblemus* Ganglbauer, 1892).

Common names of invertebrates and plants are not capitalized. For all vertebrate groups, vernacular names referring to species or subspecies, with the exception of common domesticated species, are capitalized and follow recent authoritative sources.

Headings

Headings for order, family, and genus should be centered. Species headings should be flush left, with figure numbers on the same line. Author's name is included in species heading, even for new species. Designations of "n. sp." and "n. gen.," or comparable terminology, must be used with names of new taxa preceding their description; they may be omitted thereafter.

Synonymies

References should be arranged chronologically, and identical combinations should not be repeated. Some flexibility is allowed to accommodate various styles for synonymies used in different disciplines; it is important to be consistent with the pattern selected. The following are examples of full and abbreviated synonymies:

Abbreviated Synonymy

Geomydoecus geomydis (Osborn) Fig. 32
Trichodectes geomydis Osborn, 1891: 54; 1892: 23.—Smith 1897: 131.
Trichodectes signis: Baker 1902: 23 (misident.).
Geomydoecus geomydis (Osborn): Ewing 1929: 38.

Full Synonymy

Cyrtandra fauriei H. Lév. Fig. 2A–3D
Cyrtandra fauriei H. Lév., Repert. Spec. Nov. Regni Veg. 10: 123. 1911. TYPE: U.S.A., Hawai'i, Moloka'i, Puko'o, V.1910, *U. Faurie 632* (P, holotype; BISH, BM, isotypes).
Cyrtandra lysiosepala (A. Gray) C. B. Clarke var. *fauriei* (H. Lév.) Rock, Am. J. Bot. 6: 50. 1919.
Cyrtandra rotata St. John, Pac. Sci. 25: 56. TYPE: U.S.A., Hawai'i, Maui, 1.XII.1919, *C.N. Forbes 1740.M* (BISH, holotype).

Descriptions

Diagnoses and descriptions must be in telegraphic style. If measurements are included separately, they may be listed in a paragraph following the descriptive text and headed by "Measurements."

Material Examined

The description is followed by a section presenting type data (if new species) and/or a "Specimens examined" section. Listing of data should approximate the house style. Note in the examples below: (1) order of data presented; (2) that geographic entries run from largest to smallest; (3) correct form for dates; (4) that collectors and depositories are in parentheses; and (5) that only surnames of collectors are repeated. Holotypes of new species must be deposited in recognized scientific institutions.

Example for New Species

Type data. Holotype ♀, MALAYSIA: SARAWAK: Gunong Matang, 120 m, 15.IX.1958, on tree trunk (J. L. Gressitt) (BPBM 10552). Allotype ♂, same data as holotype, except 20. IX.1958. 3♀, 1♂ paratypes, LAOS: Vientiane Prov: Phou Khao Khouei, 800 m, 16.IV.1965, secondary forest (Gressitt). Holotype, allotype, and 1 paratype in BPBM; 2 paratypes in USNM; 1 paratype in author's collection.

Example for Species Not New

Specimens examined. PHILIPPINE IS; 23♀, Mindanao I: Masawan, 28.XII.1962, ex *Tupaia palawanensis*, BBM-PI 1462 (M. Thompson) (BPBM): 1♂, Balabac I: Palawan Bay, 22.IV.1962, ex Cacatua sp. (Thompson). HAWAIIAN IS: 1♀, Oʻahu I: Mānoa Val, ex *Rattus rattus* (J. Tenorio); Hawaiʻi I, Kamuela, 488 m, ex nest of *Mus* (J. Jacobi) (USNM).

Remarks

This section should contain a statement differentiating the species from its nearest relatives. It may also contain discussion of systematic changes and problems, morphological variation, etc. Patronyms should be acknowledged here.

Keys

Keys should have a title (centered), with scope clearly denoted. They should be telegraphic, with phrases separated by semicolons. The dichotomous bracket key is preferred, with backrun numbers for long keys. Distribution and hosts, if included, should be enclosed in parentheses and separated from character portion of key by points of ellipsis. Omit genus-group names before species-group names if key is to 1 genus-group only. New species, new combinations, new names, etc., should be designated as such in the key.

Key to Species of *Rattus* in New Guinea

1. Large urban rats (HB > 200 mm); ears small; tail shorter than HB . . . (introduced) . . .
. . . . **norvegicus**
Not as above 2
2(1). Large lowland rats; fur spiny; feet white; tails white-tipped . . . (New Guinea, Queensland)
. . . . **leucopus**
Not as above 3

Place Names

Major geographic headings in material examined sections should follow most recent usage, e.g., Irian Jaya (not Netherlands New Guinea) and Zimbabwe (not Rhodesia). It is the author's responsibility to use full and correct diacritical marks in Hawaiian place names. Appendix 2 lists geographical/political abbreviations that should be used in place names; no periods are used unless needed to avoid ambiguity.

Acronyms

When several collections are treated, acronyms should be used to make reference to them. The "Materials and Methods" section should include a list of acronyms if there is not a standard list commonly in use in the discipline. Refer to acronyms *Index herbariorum I* (1981) of botanical repositories.

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The Editor, Bishop Museum Press
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Honolulu, Hawai'i 96817–0916, USA

APPENDIX 1

SELECTED STANDARD ABBREVIATIONS AND UNITS

alternating current	AC	meter	m
average	avg. (tables)	micrometer (=micron)	µm
centimeter	cm	mile	mi
circa (about)	ca.	miles per hour	mph
confer (compare)	cf.	milligram	mg
correlation coefficient	*r*	milliliter	ml
counts per minute	cpm	millimeter	mm
day	spell out	minute	min
degrees Celsius	°C	molar	*M*
degrees of freedom	df	month	mo (tables)
department	dept.	normal	*N*
diameter	diam	number	no. (tables)
dram	dr	numbers	nos. (tables)
elevation	elev.	number (sample size)	*n*
et alia (and others)	et al.	page(s)	p.
et cetera (and so forth)	etc.	parts per million	ppm
exempli gratia (for example)	e.g.	personal communication	pers. comm.
figure	fig.	pint	pt
figures	figs.	pound	lb
foot	ft	probability	P
gallon	gal	relative humidity	RH
gram	g	revolutions per minute	rpm
gravity	*g*	second	s
hectare	ha	*sensu lato* (in the broad sense)	s. lat.
hertz	Hz	*sensu stricto* (in the strict sense)	s. str.
hour	h	species	sp., spp.
id est (that is)	i.e.	standard deviation	SD
in correspondence	in litt.	standard error	SE
inch	in.	subspecies	ssp., sspp.
kilogram	kg	unpublished	unpubl.
kilometer	km	versus	vs.
kilometers per hour	km/h	*videlicit* (namely)	viz.
liter	spell out	volt	V
lux	lx	volume	vol
magnification	×	watt	W
male, female	♂, ♀ (tables, lists, collection data)	week	wk
		weight	wt (tables)
mean, arithmetic	$\bar{x}$	year	yr (tables)

APPENDIX 2

GEOGRAPHICAL AND POLITICAL ABBREVIATIONS FOR USE IN PLACE NAMES

Archipelago	Arch	Islands	Is	Province	Prov
County	Co	Lake	Lk	Range	write out
Creek	Crk	Mountain	Mt	Road	Rd
Department	Dept	Mountains	Mts	River	Riv
District	Dist	Peninsula	Pen	Station	Sta
Fort	write out	Plateau	Plat	Stream	write out
Harbor	Hbr	Point	Pt	Valley	Val
Island	I	Port	write out	Village	Vill

NOTES TO CONTRIBUTORS

For more detailed instructions on preparing manuscripts, see *Occasional Papers* vol. 29: 213–220 (1989).

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Manuscripts must be typed or printed on 21.6 x 28 cm (8½ x 11 in.) nonerasable bond paper, leaving 2.5 cm (1 in.) margins, and all text (including references, tables, and footnotes) must be double-spaced. All pages should be numbered consecutively. Tables and captions for illustrations should be typed or printed on sheets separate from the text and placed at the end of the manuscript.

In general, papers should conform to the latest editions of *The Chicago Manual of Style* and the *CBE Style Manual*. Diacritical marks are required in all Hawaiian words and place names. Authors using Hawaiian words should consult the *Hawaiian Dictionary* (Pukui & Elbert 1986), *Place Names of Hawaii* (Pukui, Elbert & Mookini 1974), *Reference Maps of the Islands of Hawai'i* (Univ. of Hawaii Press), and *Pacific Island Names* (Motteler 1986).

All measurements should be expressed using the SI metric system; English equivalents may be included parenthetically. Cardinal and ordinal numbers should be expressed as numerals, e.g., 2, 3, 2nd, 3rd. Dates should be written as day, month, year, e.g., 20 June 1985. Use of the 24-hour time system is preferred (e.g., 2030 h, not 8:30 p.m.).

Reference or Literature Cited should be listed alphabetically at the end of the paper following style B, § 16.5, of *The Chicago Manual of Style*, 13th edition (1982). Literature citations in the text should consist of author and year of publication, with citations arranged chronologically; when enclosed in parentheses, author and date should have no comma intervening (e.g., Smith 1980).

Accompanying line art, maps, and photographs should be numbered consecutively as figures, and each should be clearly identified on its reverse side. Photos to be mounted together must be abutted squarely so that no space shows between; the parts should be identified, preferably with upper-case letters (e.g., A, B). The author should indicate in the margin of the manuscript the approximate placement of figures as they should appear in the published paper.

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