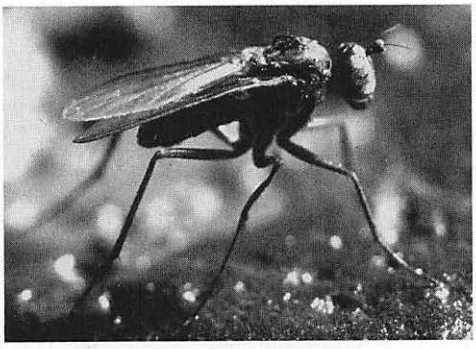
NUMBER 63, 49 pages 15 September 2000

BISHOP MUSEUM OCCASIONAL PAPERS

RECORDS OF THE HAWAII BIOLOGICAL SURVEY FOR 1999

PART 1: ARTICLES

NEAL L. EVENHUIS
AND
LUCIUS G. ELDREDGE, EDITORS



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Cover photograph: *Sigmatineurum englundi*, n. sp., from Waimanu Valley, Hawai'i. Photo by R.A. Englund.

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ISSN 0893-1348

BISHOP MUSEUM
The State Museum of Natural and Cultural History
1525 Bernice Street
Honolulu, Hawai'i 96817-2704, USA

RECORDS OF THE HAWAII BIOLOGICAL SURVEY FOR 1999
Part 1: Articles

Editors' Preface

We are pleased to present the sixth annual compilation of *Records of the Hawaii Biological Survey*. The number and diversity of taxa reported in these issues attest to the continuing value of the *Records* as part of the ongoing effort to inventory the Hawaiian biota accurately.

The Hawaii Biological Survey, established by the Hawaii State Legislature in 1992 as a program of Bishop Museum, is an ongoing natural history inventory of the Hawaiian Archipelago. It was created to locate, identify, and evaluate all native and nonnative species of flora and fauna within the state; and by State Law to maintain the reference collections of that flora and fauna for a wide range of uses. In coordination with related activities in other federal, state, and private agencies, the Hawaii Biological Survey gathers, analyzes, and disseminates biological information necessary for the wise stewardship of Hawai'i's biological resources

Some of the highlights of *Records of the Hawaii Biological Survey for 1999* include:

- an update of numbers of species in Hawai'i;
- a new species of *Sigmatineurum* fly that occurs in seep habitats;
- 216 new nonindigenous species reported from Hawai'i during 1999;
- information on a species of nematomorph worm originally described from the Sandwich Islands in 1898, which came to light in 1999; this species and another are reported in this *Records*;
- a list of cultivated plants that could potentially become weeds;
- new records of plants, insects, and other invertebrates resulting from field surveys and continued curation of Hawaiian collections at Bishop Museum and elsewhere.

An intensive and coordinated effort has been made by the Hawaii Biological Survey to make our products, including many of the databases supporting papers published here, available to the widest user-community possible through our web server. Products currently available include taxonomic authority files (species checklists for terrestrial arthropods, flowering plants, non-marine snails, marine invertebrates, foraminiferans, fossil taxa, and vertebrates), bibliographic databases (vascular plants, non-marine snails, and insects), specimen databases (fungi, fish, invertebrates, portions of the insect collection) and type specimens (entomology; botany—including algae and fungi; and vertebrates), collections data (lists of holdings for select groups of flies as well as Cicadellidae and Pentatomidae), detailed information and/or images on endangered, threatened, and extinct

plants and animals; as well as our staff publication lists. Additional reference databases include: the list of insect and spider collections of the world (based on Arnett, Samuelson & Nishida, 1993, *Insect and spider collections of the world*) with links to institutional web pages where known; and the historical world Diptera taxonomists list with names of over 4,500 authors who have described flies.

Our Main Web Addresses:

Hawaii Biological Survey Home Page
http://hbs.bishopmuseum.org/

Hawaii Biological Survey Databases
http://hbs.bishopmuseum.org/hbsdbhome.html

Hawaii Endangered and Threatened Species Web Site
http://hbs.bishopmuseum.org/endangered/

"Insect and Spider Collections of the World" Home Page
http://www.bishopmuseum.org/bishop/ento/codens-r-us.html

World Diptera taxonomist list
http://www.bishopmuseum.org/bishop/ento/dipterists/

The *Records of the Hawaii Biological Survey for 1999* were compiled with the assistance of George Staples (botany), Robert Cowie (malacology), and Gordon Nishida (entomology), who helped review papers in their disciplines; and was partially supported by funds from the John D. and Catherine T. MacArthur Foundation. Many of the new records reported here resulted from curatorial projects funded by the National Science Foundation and field surveys funded by the David and Lucile Packard Foundation, U.S. Geological Survey Biological Resources Division, U.S. Fish and Wildlife Service, U.S. Department of Defense Legacy Program, and the Hawaii Department of Land and Natural Resources.

We encourage authors with new information concerning flora or fauna occurring in the Hawaiian Islands to submit their data to the editors listed below for consideration for publication in the next *Records*. Submission and format of papers must follow our guidelines. Information on submission of manuscripts and guidelines for contributors may be obtained on the web (via pdf format) at:

http://hbs.bishopmuseum.org/guidelines.pdf

or by mail from: Hawaii Biological Survey, Department of Natural Sciences, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817-2704, USA.

——*N.L. Evenhuis &*
L.G.Eldredge, editors
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Records of the Hawaii Biological Survey for 1999. Bishop Museum Occasional Papers 63: 3–8. (2000)

Numbers of Hawaiian Species. Supplement 5[1]

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This is the fifth supplement to the earlier tabulations of species known from the Hawaiian Islands (Eldredge & Miller, 1995, 1997, 1998; Miller & Eldredge, 1996; Eldredge, 1999). The Hawaiian Islands, by virtue of their geographic isolation, rich volcanic soils, and enormous topographic and climatic diversity, have produced a highly endemic biota, which includes many of the world's outstanding examples of adaptive radiation. The biota includes more than 22,000 species (Table 1). Hawai'i accounts for only about 0.2% of the land area of the United States; it has 31% of the nation's endangered species and 42% of its endangered birds. Of the 1,072 species of native flowering plants, 73 are down to about 20 or fewer individuals in the wild, and nine are down to one. Almost 75% of the historically documented extinction of plants and animals in the United States have occurred in Hawai'i (Allison & Miller, 2000).

Hawaii Biological Survey is continually posting species checklists in searchable interfaces for the Hawaiian biota on our web server at http://www.bishopmuseum.org/. More than 20,000 species are currently available (including terrestrial arthropods, native and alien land and freshwater snails, foraminiferans, marine invertebrates, flowering plants, amphibians, reptiles, birds, and mammals).

This year 2 invertebrate groups are noted. Two species of nematomorph worms have been described: one as early as 1898, the other in 1933. Neither of these species has been collected or reported in decades. The literature on these 2 species is reviewed for the first time. The aberrant arthropod subphylum Pentastomida is noted with 2 species from Hawai'i, one reported without special recognition in 1997 and other known from a specimen deposited at Bishop Museum.

Algae: Rhodophyta

A total of 343 species of marine red algae (Rhodophyta), excluding the crustose coralline algae, are reported by Abbott (1999); 74 of the these species are new records to the Hawaiian Islands.

Flowering Plants

The total of 2,101 species of angiosperms including 1,029 native species [917 endemic (818 dicots and 99 monocots) and 112 indigenous] and 1,072 nonindigenous (766 dicots and 306 monocots) (W.L. Wagner, pers.comm.).

Cnidaria

Solanderia secunda (Inaba) photographed by Hoover (1998) is the first island record for this species; the previously reported *S. minima* Stechow is considered a synonym (Bouillon *et al.*, 1992)

Platyhelminthes

Digenetic trematode metacercaria from reef coral, *Porites compressa*, identified as *Podocotyloides stenometra*; *Plagioporis* sp. of Cheng & Wong (1974), synonym of *P. stenometra* (Aeby, 1998).

Bryozoa

One new species: *Thalamoporella molokaiensis* Soule, Soule, & Chaney, described from Moloka'i, specimens also from O'ahu (Soule *et al.*, 1999).

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1. Contribution 2000-012 to the Hawaii Biological Survey.
2. Executive Secretary, Pacific Science Association, 1525 Bernice Street, Honolulu, Hawai'i 96817-2704, USA.

Table 1. Estimates of numbers of known species of Hawaiian biota (based on Eldredge & Miller, 1995, 1997, 1998; Miller & Eldredge, 1996; Eldredge, 1999, including this paper and other papers in this issue of the Records). Other protists, lichens and fungi, cnidarians, echinoderms, birds, and mammals remain the same as previous editions; other categories are based on upated counts.

Taxon	Total	Endemic	NIS
Algae	885	80+	18
Other protists	1128	2?	?
Fungi and Lichens	2087	240	?
Flowering plants	2105	917	1072
Other plants	763	241	44
Cnidarians	356	75	10
Insects	8311	5433	2848
Other arthropods	1016	349	660
Molluscs	1661	962	90
Annelids	417	80	36
Crustaceans	1206	63+	60+
Echinoderms	283	150	0
Other invertebrates	1347	441	40+
Fishes	1212	149	73
Amphibians	8	0	8
Reptiles	27	0	23
Birds	294	63	46
Mammals	44	1	19
Totals	23,150	9,246	5,047

Nematomorpha

Two previously described species not reported in this series: *Gordius agassizi* Montgomery described from Sandwich Islands by Montgomery (1898), redescribed by de Miralles & Cristina de Villalobos (1993); and *Gordius hawaiiensis* Heinze from Maui by Heinze (1933).

Annelida

Four species of Nereididae (Namanereidinae) have been reported from Hawaiian waters Glasby *et al.* 1998); these are reviewed and 2: *Namalycastis brevicornis* (Audouin & Edwards) and *N. senegalensis* (Saint-Joseph) are questionably added (Glasby, 1999); 2 species of Nerillidae: *Nerilla antennata* O. Schmidt and *Mesonerilla fagei* Swedmark were collected in coarse sand from Honolulu Harbor, both are less than 0.5 mm in length (Bailey-Brock, 1999).

Mollusca

In their phylogeny of the genus *Hypselodoris* (Nudibranchia: Chromodorididae), Gosliner & Johnson (1999) described the following new species: *H. alboterminata, H. bertschi* [= *H. lineata* of Kay & Young, 1969], *H. insulana* (from Midway), *H. paulinae*, and *H. violabranchia*; they also reported the following previously known species from Hawaiian waters: *H. andersoni* Bertch & Gosliner, *H. infucata* (Ruppell & Leuckart), and *H. maridadilus* Rudman; the *Hypselodoris* species of Kay (1979), *Thorunna daniellae* (Kay & Young) [= *H. daniellae* Kay & Young], *Chromodoris vibrata* (Pease) [= *H. vibrata* (Pease)], *H. bertschi* Gosliner & Johnson [= *H. lineata* (Eydoux & Souleyet)]. *Microliotia hawaiiensis* Kase [Gastropoda, Pickworthiidae] described as new (Kase, 1998). *Vexillum* (*Costellaria*) *nodai* Turner & Salisbury [Gastropoda, Costellariidae] described as new (Turner & Salisbury, 1999).

Tardigrada

Several new records have been located. Eight species, new state records, have subsequently been noted: *Echiniscus kerguelensis* Richter, *E. baius* Marcus, *E. marginatus* Binda & Pilato (new species), *Pseudechiniscus jiroveci* Bartos, *Macrobiotus montanus*

Murray, *M. areolatus* Murray, *Ramazzottius horningi* Binda & Pilato (new species) (Binda & Pilato, 1994; McInnes, 1994); *Echiniscus tessellatus* Murray has been newly reported (Dastych, 1997). The total number of species currently is 29.

Pycnogonida

Two newly reported species: *Pigrogromitus timsanus* from Pearl Harbor (Coles *et al.*, 1999a) and *Anoplodactylus arescus* from Barber's Point (Coles *et al.*, 1999b); both species are considered to be introduced.

Arthropoda: Pentastomida

All members of this aberrant arthropod subphylum are modified for total parasitism; their status as a subphylum is not well established. Two species are reported from the Hawaiian Islands: *Raillietiella frenatus* Ali, Riley & Self from the mourning gecko *Lepidodactylus lugubris* was first noted by Goldberg & Bursey (1997) but not specifically reported as a new state record. *Raillietiella affinis* Bovier was collected from the lungs of the marine toad *Bufo marinus* in 1994 and deposited at Bishop Museum [BPBM H74].

Arthropoda: Insecta and Related Forms

Increased activity in documenting arrival of alien species accounted for most of the increase in total numbers of species. Examples of these papers include Beardsley (1999), Beardsley *et al.*, (1999), Jamieson (1999), Taiti (1999), and Takumi (1999a). Revisions and corrections of status as well as new species descriptions (Polhemus, 1999; Schwartz & Polhemus, 1999; Shelley & Lehtinen, 1999; Takumi, 1999b) served to further refine the total number of arthropods (G.M. Nishida, pers. comm).

Arthropoda: Crustacea: Decapoda

Twenty-one Hawaiian species are photographed in color (Debilius, 1999). A new species, *Albunea danai* Boyko [Family Albuneidae], described; *A. speciosa* Dana redescribed from new material, not an endemic as previously believed (Boyko, 1999). Newly collected specimens of the mole crab *Hippa pacifica* (Dana) [Family Hippidae] are reported (Boyko & Harvey, 1999). The family Callianassidae is reviewed; from Hawai'i: *Callianassa parva* Edmondson, *Glypturus lanceolatus* Edmondson [= Callianassa (*Callichirus*) *lanceolata* Edmondson], *Glypturus winslowi* (Edmondson) [= *Callianassa* (*Callichirus*) *winslowi*) Edmondson], *Neocallichirus indicus* (DeMan) [= *Callianassa* (*Cheramus*) *variabilis* Edmondson], and *Neocallichirus* sp. (Rathbun) [= *Callianassa* sp. of Rathbun] (Sakai, 1999). New combination *Thorina maldivensis* (Borradaile) [= *Thor maldivensis* Borradaile] [Family Hippolytidae] (Bruce, 1997). New family record Latreilliidae reported (Williams, 1982), just recognized, new species *Latreillia metanesa* Williams from *Albatross* Hawaiian material; Edmondson (1932) noted that no member of the genus *Latreillia* has been reported from the central Pacific, including Hawai'i. *Garthambrus stellata* (Rathbun) [= *Parthenope* (*Platylambrus*) *stellata* Rathbun] [Family Parthenopidae] reported (Ng & Tan, 1999). *Aethra edentata* Edmondson [Family Parthenopidae] redescribed (Ng, 1999). New species *Progeryon mus* Ng & Guinot [Family Geryonidae] described (Ng & Guinot, 1999). In a revision of the genus *Echinoecus*, the local species *E. pentagonus* (A. Milne Edwards) is redescribed (Chia, *et al.*, 1999). In a revision of the family Dynomenidae McLay (1999) reported *Dynomene hispida* Guérin-Méneville, *Dynemone praedator* A. Milne Edwards (first record for Hawai'i), *Dynomene pilumnoides* Alcock (first record for Hawai'i); and *Metadynomene devaneyi* (Takeda) [= *Dynomene devaneyi* Takeda].

Chordata: Pisces

New species described from Hawaiian waters: *Callionymus comptus* Randall and *Synchiropus rosulentus* Randall [Callionymidae] (Randall, 1999a); *Eviota rubra* Greenfield & Randall and *E. susanae* [Gobiidae] (Greenfield & Randall, 1999); *Eustomias dinema*

Clarke [Melanostomiidae] (Clarke, 1999). New records of fishes from the Hawaiian Islands: *Synodus rubromaculatus* Russell & Cressy [Synodonitidae] known previously from the Great Barrier Reef, Indonesia, Malaysia, Taiwan, and the Philippines (Randall, 1998); the Indo-Pacific *Bathycongrus guttulatus* (Gunther) [Congridae] and endemic *B. aequoreus* (Gilbert & Kramer) now recognized as 2 valid species in Hawaiian waters (Castle & Smith, 1999); *Caranx caballus* [Carangidae], an eastern Pacific endemic, appeared in the Hawaiian Islands during a recent El Niño event, established status unknown (Randall, 1999b; Randall & Carlson, 1999). A third species of seahorse, *Hippocampus fisheri* Jordan & Everman, was recognized as an endemic species (Lourie *et al.*, 1999). *Synchiropus kinmeiensis* resurrected from synonymy with *S. altivelis*; found only in the Hawaiian Islands and southern Emperor Seamounts (Randall, 1999a). The *Gonorhynchus* population in Hawaiian waters is distinct from other populations as a previously described endemic species *G. moseleyi* Jordan & Snyder; since the mid-1940s the Hawaiian *Gonorhynchus* has been included in an Indo-Pacific *B. gonorynchus* (Grande, 1999). An unusual parrotfish collected on O'ahu has been reported as a possible hybrid or possibly a new species, although it is unlikely that a new species of large parrotfish exists in the main Hawaiian Islands (Randall, 1999c). Two freshwater fishes were reported as introduced, the Lake Malawi cichlid *Melanochromis johanni* (Eccles) and the central American cichlid *Parachromis managuensis* (Gunther) [usually reported as *Cichlasoma* managuense] (Fuller *et al.*, 1999). [Thanks to B.C. Mundy for his personal communication for this entire entry.]

Chordata: Amphibia

Three species of Caribbean frogs: *Eleutherodactylus coqui* Thomas, *E. martinicensis* (Tschudi), and *E. planirostris* (Cope) first appeared in Hawai'i around 1990 and were probably inadvertently shipped with plants and soil from plant nurseries (Kraus *et al.*, 1999)

Acknowledgments

Special thanks to the following who assisted in compiling this supplement: T.M. Gosliner [California Academy of Science, nudibranchs], S.J. McInnes [British Antarctic Survey, tardigrades], B.C. Mundy [National Marine Fisheries Service, fish], G.M. Nishida [Bishop Museum, insects], C.M. Smith [University of Hawaii, algae], W. L. Wagner [Smithsonian Institution, flowering plants].

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Records of the Hawaii Biological Survey for 1999. Bishop Museum Occasional Papers 63: 9–16. (2000)

New Hawaiian Plant Records for 1999[1]

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These previously unpublished Hawaiian plant records report new state and new island records, nomenclatural changes, and reidentifications of previously misnamed species in Hawai'i. These records supplement information published in Wagner *et al.* (1990, 1999) and in the *Records of the Hawaii Biological Survey* for 1994–1998 (Evenhuis & Miller, 1995, 1996, 1997, 1998; Evenhuis & Eldredge, 1999). All identifications were made by the authors except where noted in the acknowledgments, and all supporting voucher specimens are on deposit at BISH except as otherwise noted.

Agavaceae

Sansevieria trifasciata Prain **New naturalized record**

The snake plant or mother-in-law's tongue has been cultivated in Hawai'i for many decades. Recently, extensive roadside populations have been noticed at several localities around O'ahu, which have probably spread from ornamental plantings. *Sansevieria* has an extensive underground rhizome system and can develop sizeable clonal stands by this means. However, the following voucher specimen was made from plants that were also setting abundant fruits, which adds to the potential for dispersal and establishment away from planted populations; the fleshy, orange-red berries are potentially attractive to fruit-eating birds. Mother-in-law's tongue is quite tolerant of heat, drought, and poor soil and the population documented here is thriving under marginal conditions. The presence of *S. trifasciata* should be investigated on all islands and its reproductive status monitored.

Material examined: **O'AHU**: Ko'olauloa Distr., Sunset Beach area, hot, dry *mauka* side of Kamehameha Hwy in shade of dense thicket of disturbed vegetation just beside area where beach-goers park cars, 2 Oct 1999, *G. Staples & B. Pope 1187.*

Alismataceae

Sagittaria latifolia Willd. **New island record**

Previously documented from Kaua'i, O'ahu, and Maui (Wagner *et al.*, 1990: 1355), *Sagittaria latifolia* was collected as a weed in a flooded taro paddy. It represents the first naturalized collection of this species on Hawai'i.

Material examined: **HAWAI'I**: Hāmākua Dist., Waipi'o Valley, in wetland taro paddy with *Eleocharis radicans, Echinochloa crusgalli,* ca 80 ft, 19 Jun 1999, *C. Imada 99-28.*

Aquifoliaceae

Ilex cassine L. **New naturalized record**

Dahoon holly has been cultivated in Hawai'i since the early 1940s (or earlier) but has not previously been found naturalized in the state. The following 2 collections document its existence outside of cultivation on 2 islands. Collectors are encouraged to seek it on others. This holly fits the profile for bird-dispersed plants with its abundant, rather fleshy, bright red fruits containing multiple seeds contained in a hard pit.

Material examined: **O'AHU**: Whitmore Village, ca 0.5 mi above fence along dirt road, growing among eucalyptus and other exotics, about 25–30 plants seen, all size classes present, 16 Dec 1998, *M. Keir 1.* **HAWAI'I**: Puna Distr, land of 'Ōla'a, along Hwy 11 to Volcano, 17.4 miles from Hilo, 1850 ft, 16 Dec 1975, *D. Herbst & S. Ishikawa 5603;* along Hilo to Volcano Hwy at ca mile marker 18, small but growing naturalized population, 4 Apr 1985, *L. Stemmermann 6931.*

1. Contribution 2000-013 to the Hawaii Biological Survey.

Araceae

Alocasia macrorrhizos (L.) Schott **New island record**

'Ape is a ubiquitous large herb commonly seen growing streamside in mesic valleys, but previously documented as naturalized only on Kaua'i, O'ahu, Moloka'i, and Maui (Wagner *et al.*, 1990: 1356). This collection now documents its presence on Hawai'i. *Alocasia macrorrhizos* was a common understory herb in disturbed secondary forest on the floor of Waipi'o Valley.

Material examined: **HAWAI'I**: Hāmākua Dist., Waipi'o Valley, common along roadside leading into back of valley, ca 80 ft, 19 Jun 1999, *C. Imada 99-31*.

Xanthosoma roseum Schott **New island record**

Previously documented as naturalized from Kaua'i and O'ahu (Staples & Woolliams, 1997), *Xanthosoma* was collected along the dirt road leading into the back of Waipi'o Valley on the Big Island in the company of *Alocasia macrorrhizos*, with which it is often confused. As described by Staples & Woolliams (1997), *Xanthosoma* can be distinguished by its blade angled to the petiole, the apex usually pointing downward (vs blade and petiole forming a smooth arc, pointing upward); petiole and blade underside with a glaucous bloom, upper surface dull green (vs. parts glossy green, not at all glaucous); and open spathe cream flushed pink (vs. whitish to yellowish). Elsewhere in these *Records*, *X. roseum* is documented as naturalized on Maui (Oppenheimer & Bartlett, 2000).

Material examined: **HAWAI'I**: Hāmākua Dist., Waipi'o Valley, along roadside leading into back of valley, ca 80 ft, 19 Jun 1999, *C. Imada 99-32*.

Aristolochiaceae

Aristolochia littoralis Parodi **New island record**

Previously reported as naturalized only on O'ahu (Wagner *et al.*, 1990: 238), this represents the first weedy record of calico flower on Kaua'i.

Material examined: **KAUA'I**: Kapalawai, makai of Hwy 50, vine on large *Prosopis* stump in open *Prosopis/Pithecellobium* forest, 6 Mar 1999, *C. Imada, W. Char & C. Morden 99-5*.

Asteraceae

Emilia coccinea (Sims) G. Don **New island record**

This collection is the first record of *E. coccinea* on Kaua'i. It was previously recorded from O'ahu and Lāna'i (Wagner *et al.*, 1990: 312).

Material examined: **KAUA'I**: Waimea Canyon State Park, Iliau Nature Loop, trailside, ca 2940 ft, 7 Mar 1999, *C. Imada, W. Char & C. Morden 99-11*.

Sphagneticola trilobata (L.) Pruski **New island record**

Syn. *Wedelia trilobata* (L.) Hitchc.

This widely cultivated ground cover had previously been documented as naturalized only on Kaua'i and O'ahu (Wagner *et al.*, 1990: 373). This collection represents the first naturalized record of wedelia on Hawai'i. The species was long known as *Wedelia trilobata* (Wagner *et al.*, 1990: 373) until it was recently transferred to *Sphagneticola* (Pruski, 1996).

Material examined: **HAWAI'I**: Hāmākua Dist., Waipi'o Valley, ground cover on bank in disturbed forest of *Syzygium jambos*, ca 120 ft, 19 Jun 1999, *C. Imada & T. Cummings 99-14*.

Bignoniaceae

Macfadyena unguis-cati (L.) A.H. Gentry **New island record**

Previously documented from Kaua'i, O'ahu, and Lāna'i (Wagner *et al.*, 1990: 388), this collection documents a naturalized population of cat's-claw climber on Hawai'i. It

formed locally dense mats on the ground and twined around trees in disturbed secondary forest with a canopy of *Mangifera indica, Syzygium jambos,* and *Ficus retusa.* Elsewhere in these *Records, M. unguis-cati* is documented as naturalized on Maui (Oppenheimer & Bartlett, 2000).

Material examined: HAWAI'I: North Kohala Dist, Pali Akamoa Gulch, Bond Historical District, ca 560 ft, 1 Sep 1999, *C. Imada & K. Arakaki 99-46.*

Chenopodiaceae

Enchylaena tomentosa R. Br. var. ***tomentosa*** **New state record**

Enchylaena is a genus of 2 species endemic to Australia; it is naturalized in New Caledonia and now Hawai'i, where it presently is known only from the Kanahā Pond area of central Maui. *Enchylaena tomentosa* is a small shrub up to about 1 m tall. Its branches are slender, striate, and somewhat lax; the leaves alternate, simple, entire, sessile, slender, somewhat terete, succulent, 7–20 mm long; and both the leaves and young stems densely woolly with short curly hairs. The flowers are solitary, axillary, sessile, bisexual, with a cup-shaped, 5-lobed perianth, the perianth tube glabrous, its lobes glabrous or pubescent; and the fruiting perianth is depressed-globular, about 5 mm dia, with a flat or sunken apex, green, yellow or red, drying dark brown or black. In Australia, the common name for this plant is ruby or barrier saltbush (Wilson, 1984: 213).

Material examined. MAUI: Kahului, along roadblock near the airport, 1 Apr 1985, *R. Hobdy 2322,* central Maui, near Kahului airport, growing on hot, dry road on a rocky outcrop, 24 Feb 1986, *R. Hobdy 2524;* Kanahā Pond Wildlife Sanctuary, eastern edge of central pond, N 20° 53', W 156° 26', 2 m, 4 Feb 1999, *C. Annable 3893.*

Convolvulaceae

Ipomoea aquatica Forssk. **New island record**

Naturalized populations of swamp cabbage have previously been documented from O'ahu and Maui (Wagner *et al.,* 1990: 555). On the Big Island, it was collected in a fallow wetland taro paddy in Waipi'o Valley, where it was growing with *Nasturtium sarmentosum* and *Polygonum punctatum.*

Material examined: HAWAI'I: Hāmākua Dist., Waipi'o Valley, in wetland taro paddy, ca 80 ft, 19 Jun 1999, *C. Imada 99-27.*

Merremia umbellata (L.) Hallier f. **New naturalized record**

Noted in the *Manual* (Wagner *et al.,* 1990: 563) this species now appears to be fully naturalized on windward O'ahu.

Material examined: O'AHU: Kahalu'u, S. Yogi farm, growing in banana fields and infesting trees and shrubbery, 11 Jan 1999, *R. Heu & R. Hamasaki s.n.* (BISH 658030; duplicates FAU, NY, US).

Cyperaceae

Cyperus involucratus Roxb. **New island record**

Previously documented from Midway, Kaua'i, O'ahu, and Maui (Wagner *et al.,* 1990: 1395; Hughes, 1995; Herbarium Pacificum Staff, 1999), *'ahu'awa haole* was collected in Waipi'o Valley from a large stand growing roadside in marshy land. This represents a new naturalized record for the Big Island. This species was long known as *C. alternifolius;* Strong & Wagner (1997: 41) explain the reason for the nomenclatural change.

Material examined: HAWAI'I: Hāmākua Dist., Waipi'o Valley, alongside road in lower part of valley, in marshy land with *Diplazium esculentum,* ca 40 ft, 18 Jun 1999, *C. Imada 99-26.*

Eleocharis radicans (Poir.) Kunth **New island record**

Previously documented from Kaua'i, O'ahu, and Maui (Wagner *et al.*, 1990: 1403), *E. radicans* has now been documented from Waipi'o Valley on Hawai'i, where it formed dense mats in flooded taro paddies along with *Echinochloa crusgalli*.

Material examined: **HAWAI'I**: Hāmākua Dist, Waipi'o Valley, in wetland taro paddy, ca 80 ft, 19 Jun 1999, *C. Imada 99-30*.

Fimbristylis miliacea (L.) Vahl **New island record**

The presence of this species in the Hawaiian Islands was only recently recognized (Strong & Wagner, 1997: 25). In addition to Kaua'i, *F. miliacea* is now documented from Hawai'i.

Material examined: **HAWAI'I**: Hāmākua Dist., Waipi'o Valley, on wet bank of wetland taro paddy, ca 80 ft, 19 Jun 1999, *C. Imada 99-29*.

Fabaceae

Desmodium intortum (Mill.) Urb. **Range extension**

Previously documented from O'ahu and Hawai'i (Wagner *et al.*, 1990: 667; Herbarium Pacificum Staff, 1998: 9), on O'ahu *D. intortum* has only been documented from Ha'ikū Valley in the windward Ko'olau Mountains. This collection from the Wai'anae Range extends its O'ahu range.

Material examined: **O'AHU**: Wai'anae Range, N rim of Mākua Valley, trailside in open sunny flat area, with *Melinis, Bidens alba*, planted *Pinus, Pteridium*, ca 1800 ft, 28 Feb 1999, *C. Imada 99-3*.

Prosopis juliflora (Sw.) DC. **New island record**

Previously documented as naturalized only on O'ahu (Wagner *et al.*, 1990: 692), this represents the first naturalized collection of this stout-thorned algaroba on Kaua'i. Plants of various ages were scattered along the beach shoreline at Kapalawai above the high tide mark.

Material examined: **KAUA'I**: Kapalawai, makai of Hwy 50, spreading 15 ft tall tree on beach above high tide mark, 6 Mar 1999, *C. Imada, W. Char & C. Morden 99-4*.

Lauraceae

Cinnamomum verum J. Presl **New island record**

Naturalized collections of the cinnamon tree have been documented from Kaua'i, O'ahu, and Maui (Wagner *et al.*, 1990: 846). At the Bond Estate in North Kohala on the Big Island, volunteers have apparently spread from planted populations and are now scattered throughout the alien secondary forest there.

Material examined: **HAWAI'I**: North Kohala Dist., Pali Akamoa Gulch, Bond Historical District, common small tree in secondary forest of *Mangifera, Syzygium* spp., *Ficus, Terminalia*, ca 560 ft, 1 Sep 1999, *C. Imada & A. Allison 99-47*.

Lemnaceae

Spirodela polyrhiza (L.) Schleid. **New island record**

This free-floating plant has previously been documented from O'ahu, Maui, and Hawai'i (Wagner *et al.*, 1990: 1458; Wagner *et al.*, 1997: 59). On Kaua'i, greater duckweed was collected on the pond surface of Kapalawai Pond, where it was growing with *Lemna aequinoctialis* and *Eichhornia crassipes*. The pond was choked with vegetation, including *Schoenoplectus californicus* and *Cyperus involucratus*.

Material examined: **KAUA'I**: Kapalawai, makai of Hwy 50, floating on margin of Kapalawai Pond, 6 Mar 1999, *C. Imada, W. Char & C. Morden 99-7*.

Liliaceae

Asparagus plumosus J.G. Baker **Name change; New island record**

Misapplied: *Asparagus setaceus sensu* St. John (1973: 81), Lorence *et al.* (1995: 40), non (Kunth) Jessop.

There is a pernicious confusion in the horticultural application of 2 names for South African species of *Asparagus.* A widely accepted taxonomic revision of the South African species (Jessop, 1966) recognized 1 species, *A. setaceus* (Kunth) Jessop [synonym *A. plumosus* J.G. Baker]. Most horticultural reference works have followed this classification. However, recently published work revealed that 2 species are involved (Fellingham & Meyer, 1995), which are distinguished by the arrangement of their cladodes: all in 1 plane *(A. plumosus)* or radiating in many planes *(A. setaceus)* (H. Glen, pers. comm.). If this classification is followed, then the plant widespread in cultivation is to be called *A. plumosus;* the genuine *A. setaceus* (Kunth) Jessop is not in cultivation.

Climbing asparagus fern has been cultivated for decades in Hawai'i and has been previously recorded as naturalized on Kaua'i (Lorence *et al.,* 1995: 40). The following collections document the naturalized status of *A. plumosus* on O'ahu; elsewhere in these *Records* it is documented as naturalized on Maui (Oppenheimer & Bartlett, 2000). The plant's rampant climbing habit, thorny stems, enlarged storage roots, and small black, bird-dispersed berries combine to make this a particularly difficult weed to eradicate. Now that it has begun to spread outside of cultivation, every effort should be made to control it.

Material examined: **O'AHU**: Wahiawa area, Schofield Barracks, across highway from McNair Gate, naturalized, scattered over a few acres with *Eucalyptus, Panicum maximum,* 19 Mar 1999, *F. Kraus s.n.* (BISH 655272); above He'eia State Park, in heavily disturbed secondary vegetation along hillside, 20 Dec 1998,*G. Staples, S. Lum & K. Ahsing 1171.*

Melastomataceae

Arthrostemma **Spelling correction**

The spelling of the genus name (as *Arthrostema*) is incorrect in the *Manual* (Wagner *et al.,* 1990: 905) and although the author for the treatment of the Melastomataceae, Frank Almeda, requested that the spelling be corrected, this was apparently missed in the page proofs. Since a number of users of the *Manual* have questioned which spelling is correct, we include this note here to clarify the matter.

Ochnaceae

Ochna thomasiana Engl. & Gilg **New naturalized records**

As recently as 1998 (Herbarium Pacificum Staff, 1998: 12), what had long been called *Ochna kirkii* was reidentified, and its presence as a naturalized species was suggested. Field collections that document its establishment as a *bona fide* weedy element in the Hawaiian flora are now in hand. On Windward O'ahu, *O. thomasiana* is widespread and abundant as an understory shrub in disturbed mesic forests. It is surely much more widespread than the following collections indicate. It will very likely be found on the neighbor islands as well.

Material examined: **O'AHU**: Ko'olaupoko Distr., Kāne'ohe, on ridge not far from Pohai Nani retirement complex, 930 ft, 19 Dec 1998, *B. Waters s.n.* (BISH 653561); above He'eia State Park, disturbed secondary vegetation, 20 Dec 1998, *G. Staples, S. Lum & K. Ahsing 1170;* Kailua, Maunawili Valley, weedy disturbed forest along an unpaved fire access road that enters Maunawili Loop adjacent to #1022, 28 Nov 1999, *G. Staples 1193.* Honolulu Distr., Kuli'ou'ou Valley, in small gully heading up-slope, ca 50 yards from end of Papahehi Pl., 24 Jan 1999, *B. Waters s.n.* (BISH 655126).

Poaceae

Andropogon virginicus L. **New island record**

Previously documented from O'ahu, Moloka'i, Lāna'i, Maui, and Hawai'i (Wagner *et al.*, 1990: 1497; Hughes, 1995: 8; Herbarium Pacificum Staff, 1999: 7; Oppenheimer *et al.* 1999: 9), broomsedge was collected at Iliau Nature Loop on Kaua'i in a dry shrubland of *Wilkesia, Dodonaea, Styphelia,* and *Pteridium.*

Material examined: KAUA'I: Waimea Canyon State Park, Iliau Nature Loop, ca 2980 ft, 7 Mar 1999, *C. Imada, W. Char & C. Morden 99-10.*

Leptochloa fusca (L.) Kunth subsp. ***uninervia*** (J. Presl) N. Snow **Taxonomic change**

Syn. *Leptochloa uninervia* (J. Presl) Hitchc. & Chase

Research leading to a recent monograph of the genus *Leptochloa* (Snow 1997) supports taxonomic changes associated with *L. fusca* (L.) P. Beauv., a highly variable taxon common and widespread throughout warm-temperate and tropical areas of the world. Because morphological forms of *L. fusca* appear regionally distinct, they often have been given formal recognition; however, multivariate statistical studies of population samples conducted by Snow indicates a general tendency of the populations to segregate into 4 entities. Snow (1998) has recognized these entities at the subspecific level, including subsp. *uninervia,* a grass naturalized in Hawai'i. We here follow Snow's treatment of the genus, relegating *L. uninervia* (J. Presl) Hitchc. & Chase (O'Connor, 1990: 1558) to synonymy of this taxon.

Recently the Bishop Museum received duplicates of specimens collected in the Hawaiian Islands by Ezechiel Jules Rémy as part of an exchange program with the Museum National d'Histoire Naturelle, Paris. Rémy was a French naturalist and ethnologist who visited Hawai'i twice during an extended trip around the world, 1851–1863. His Hawaiian specimens are dated 1851–1855; specific dates are unknown for most of his collections. We do know that he was on the island of Hawai'i, traveling from Hilo to the summit of Mauna Loa from 13–23 June 1853; on Moloka'i from 24–30 June 1854; and on Maui starting 1 July 1854. Of the 27 Rémy specimens received in this exchange, 5 (all grasses) contribute additional information on the Hawaiian flora. These are listed below.

Agrostis avenacea J.F. Gmelin **New island record**

O'Connor (1990: 1492) stated that this indigenous grass was documented from all the main islands except Ni'ihau and Kaho'olawe. The following Rémy collection documents it from the latter island.

Material examined. KAHO'OLAWE: [without specific locality and date], *J. Rémy 74.*

Briza minor L. **Earlier date of introduction**

Previously, the earliest known documentation of the species in Hawai'i was based upon a collection made by Mann and Brigham on Hawai'i Island in 1864–65 (O'Connor, 1990: 1505). We now know that it had been collected on that island by Rémy at an earlier date.

Material examined. HAWAI'I: [without specific locality and date], *J. Rémy 85.*

Chloris virgata Sw. **Earlier date of introduction**

O'Connor (1990: 1516) reported that the earliest know collection of *Chloris virgata* in Hawai'i was made by Munro in 1903 on the island of Moloka'i. The following specimen documents that this grass was naturalized on O'ahu some 50 years earlier. Herbst & Clayton (1998: 21) recently reported this species as new to the island of O'ahu, as they

were not aware of any specimens previously collected from the island.

Material examined. **O'AHU:** [without specific locality and date], *J. Rémy 76.*

Ischaemum byrone (Trin.) Hitchc. **New island record**

According to O'Connor (1990: 1557), this endemic species of grass had previously been documented from the islands of Moloka'i, Maui, and Hawai'i; it was later reported by Lorence *et al.* (1995: 46) from Kaua'i. The Rémy collection appearing below documents the species from O'ahu. *Ischaemum byrone* has been listed as an endangered species by the U.S. Fish and Wildlife Service (Mehrhoff, 1994).

Material examined. **O'AHU:** [without specific locality and date], *J. Rémy 110.*

Setaria parviflora (Poir.) Kerguelen **Earlier date of introduction**

As reported by O'Connor (as *S. gracilis*, a synonym) (1990: 1592), the earliest known collection of *Setaria parviflora* in Hawai'i was that made by Heller on Kaua'i in 1895. Based on the specimen cited below, it is now known that Rémy collected the species on that island sometime between 1851 and 1855.

Material examined. **KAUA'I:** [without specific locality and date], *J. Rémy 106.*

Rubiaceae

Diodia apiculata (Willd. ex Roem. & J.A. Schultes) K. Schum. **New state record**

Syn. *Diodia rigida* (Willd. ex Roem. & J.A. Schultes) Cham. & Schltdl.

This specimen, long filed as an unidentified Rubiaceae, was recognized by Charlotte M. Taylor as *D. rigida* during a visit to BISH in 1999. According to the nomenclature adopted for the *Flora of North America* (Kartesz, 1994) this name is a synonym of *D. apiculata*. It is the first record for this weedy species in the Hawaiian Islands.

Material examined: **O'AHU:** Ko'olau Mts, Pūpūkea-Paumalu, Ko'olauloa, 400 ft, 6 Dec 1987, *K. Nagata & W. Takeuchi 3748.*

Solanaceae

Physalis angulata L. **New island record**

Known to be a naturalized weed on Kaua'i (Wagner *et al.*, 1990: 1265), this is the first record of the species on O'ahu.

Material examined: **O'AHU:** Waimānalo, weedy 2–3 ft tall herb in fields at the Waimānalo Experiment Station, 14 Jan 1999, *R. Heu & W. Nagamine s.n.* (BISH 658032).

Acknowledgments

We thank the collectors of the cited specimens and our many BISH volunteers for assisting us in making them available for study. The authors are grateful to C.M. Taylor (MO) for determining the *Diodia* voucher specimen. Hugh Glen (PRE) clarified the status of *Asparagus* in southern Africa. Bishop Museum acknowledges the John D. and Catherine T. McArthur Foundation for its support of the Hawaii Biological Survey.

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Records of the Hawaii Biological Survey for 1999. Bishop Museum Occasional Papers 63: 17-20. (2000)

A Reassessment of *Cyrtandra kealiae* and *C. limahuliensis* (Gesneriaceae)[1]

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In the most recent treatment of Hawaiian *Cyrtandra* (Wagner *et al.*, 1990), 2 species were recognized with unique long calyces, lobed 1/4 to rarely more than 2/5 their length that enclose the fruit until it swells at maturity, splitting the calyx. Both occur on the island of Kaua'i. In the 1990 revision *Cyrtandra kealiae* was considered a taxon known from scattered localities in mesic valleys and diverse mesic forest, 275–450 m, in Hanapēpē and Olokele valleys, Wahiawa Mountains, and Ha'upu Ridge characterized by its urceolate calyx. The other taxon of this alliance was referred to as *Cyrtandra limahuliensis*, which grows in generally more southern and western areas of Kaua'i, from the Hoary Head Range to Makaweli Valley but occurs at lower elevations in the Wahiawa area where both species grow, and is characterized by a tubular-funnelform calyx. Soon after the 1990 revision was published Tim Flynn (pers. comm.) pointed out that the type locality of *C. kealiae*, near Keālia was well within the range of the taxon called *C. limahuliensis*. Subsequent examination of the types confirmed that they were conspecific, showing clearly that the name *C. limahuliensis* was misapplied when 2 taxa were recognized in the 1990 treatment.

We here adopt the name *Cyrtandra kealiae* for the plants with the tubular funnelform calyx. St. John (1987, 1988) described a number of other Kaua'i species including 7 others that we here refer to *C. kealiae* as synonyms. During the past decade many new collections of both taxa have been collected, including a number of new localities. Study of them has shown these 2 taxa to be more closely related and harder to distinguish than previously thought. Thus, in describing the taxon with urceolate calyx currently lacking a name, we have concluded that it is more reflective of the variation pattern to recognize 1 species with 2 largely geographically allopatric subspecies. Examination of the types of all 8 names has shown that all of them apply to the taxon currently known as *C. limahuliensis*, leaving the taxon known as *C. kealiae* without a name. Examination of numerous collections over the past decade has shown these 2 taxa to be very closely related, suggesting to us that they are best treated as subspecies of a single species, *C. kealiae*. The taxon formerly known as *C. kealiae* is here described as *C. kealiae* subsp. *urceolata*.

Cyrtandra kealiae Wawra subsp. ***kealiae*** **New synonymy**

Cyrtandra kealiae Wawra, Flora 55: 565. 1872. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: near Kealia, 1869–1870, *H. Wawra 2192* (W [photocopies BISH!, 2 sheets], holotype).

Cyrtandra limahuliensis St. John, Phytologia 63: 489. 1987, syn. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Limahuli Valley, wet dripping pali, 565 m, 27 Sep 1978, *S. Perlman & C. Wichman 223* (BISH-520623!, holotype).

Cyrtandra alaustri St. John, Phytologia 63: 487. 1987, syn. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Wainiha, *B. C. Stone 1489* (BISH, not located, holotype). Apparently St. John intended his epithet to be spelled "claustri". The collection *Stone 1498* (BISH-19700!) may represent the missing holotype as it was collected in Wainiha Valley (near dam) at 800 ft, on 26 Dec 1956, and is a specimen of *C. kealiae*; thus the citation of *1489* may represent a transposition of numbers.

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Cyrtandra henanthe St. John, Phytologia 63: 488. 1987, syn. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Wainiha Valley, side gulch on west side, 1.2 km upstream, 850–1100 ft, 1 Jan 1934, *H. St. John & F. R. Fosberg 13977* (BISH-520595! and BISH-520596!, holotype, mounted on 2 sheets; BISH! 4 sheets, ISOTYPES).

Cyrtandra lumahaiensis St. John, Phytologia 63: 490. 1987, syn. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Lumaha'i Valley, *C. Christensen 207* (BISH-520607!, holotype; BISH! 2 sheets, isotypes). The collection number in the protologue was given as *204*, which is in error since St. John clearly labelled *207* as the holotype and *Christensen 204* is a collection of *Cyanea* according to Christensen's field notes on file at BISH.

Cyrtandra runae St. John, Phytologia 63: 491. 1987, syn. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Anahola Stream, 240 m, 14 Apr 1970, *R. Hobdy 188* (BISH-520487!, holotype).

Cyrtandra spissa St. John, Phytologia 63: 492. 1987, syn. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Waipā Valley, middle of 3 upper streams, 290 m, 2 Jul 1977, *C. Christensen 238* (BISH-520562!, holotype).

Cyrtandra septentrionalis St. John, Phytologia 65: 199. 1988, syn. nov. TYPE: Hawaiian Islands: Kaua'i: Wainiha Valley, wet *Metrosideros* forest, 1000 ft., 26 Dec 1956, *H. St. John 25991* (BISH-526694!, holotype; BISH!, US! isotypes).

Shrubs up to 1.5 m tall; stems apparently few-branched or unbranched; leaves opposite, borne on upper 3–6 nodes, those of a pair slightly unequal and somewhat asymmetrical, chartaceous, broadly elliptic to broadly elliptic-ovate or elliptic, (10–)15–30 cm long, 5–12 cm wide, upper surface moderately pilose, lower surface with veins raised, moderately to densely velvety pilose, the hairs yellowish brown, margins serrulate or denticulate, apex acuminate, base cuneate, sometimes subtruncate, petioles 1.5–10 cm long; flowers solitary in the leaf axils, densely villous throughout, peduncles 3–6 mm long, pedicels 0–3 mm long, bracts narrowly elliptic-ovate to elliptic-lanceolate, 6–14 mm long; calyx nearly actinomorphic, tubular-funnelform, 16–25 mm long, cleft ca. 1/4–2/5 its length, densely villous, the lobes narrowly deltate to linear-deltate, usually somewhat unequal, 4–10 mm long; corolla (only 1 seen) white, tube cylindrical, slightly curved, 16–18 mm long, ca. 4–5 mm in diameter medially, scarcely exserted from calyx, densely villous , externally, upper lobes lanceolate, ca. 3.5–4 mm long, ca. 1.5–2 mm wide, lower lobes narrowly ovate, ca. 4–4.5 mm long; ovary glabrous; berries (only a single smashed one seen) ca. 2 cm long, apparently enclosed by but eventually splitting from the persistent calyx.

DISTRIBUTION: Occurring along streams and from gulches in stunted wet forest at elevations from 240–900 m from the eastern half of Kaua'i, from the northern side in Limahuli along the eastern side to Wailua valleys to the Wahiawa Mountains on the southern side of Kaua'i.

Material examined. **KAUA'I:** Kōloa Dist, Wahiawa Mts, along ridge N of microwave relay towers, 915 m, *Flynn et al. 2231* (PTBG [2]), *Flynn et al. 2232* (PTBG); NW of Wahiawa Bog, along tributary of Wahiawa Stream, 650–730 m, *Kiehn et al. MK-890719-1/10* (PTBG); along ridge ESE of Pu'u Kolo to summit, in gulch on S side of ridge, 365–540 m, *Flynn & Lorence 3163* (PTBG, US); Wahiawa Mts, in shaded areas on windward side of ridge between relay towers and Mt Kāhili, *Flynn 1123* (PTBG); Wahiawa Mts, *Forbes 222.K* (BISH); ridge to Mt Kāhili, flat gully on SW side above microwave relay station, near the summit, 870 m, *Herbst et al. 2485* (BISH), *Herbst et al. 2858* (BISH), *Hobdy 25* (BISH), *Hobdy 26* (BISH); first N fork of Wahiawa Stream, NW of Wahiawa Bog, dense wet forest with moderate *Psidium* growth, 710 m, *Wagner et al. 6056* (BISH), *Wagner et al. 6057* (BISH); Wahiawa Stream, *'ōhi'a* dieback and *Dicranopteris* understory, 680 m, *Wagner et al. 6079* (BISH). Līhu'e Dist, Līhu'e-Kōloa Forest Reserve, Ili'iliula drainage, S of Kamanu and Kalalea, 550–625 m, *Wood & Perlman 3589* (PTBG); Līhu'e -Kawaihau Dist. boundary, headwaters

of N fork of Wailua River, "Blue Hole", 680–700 m, *Lorence et al. 5336* (PTBG), *Lorence et al. 7259* (PTBG); E of Wai'ale'ale summit just under the pali of Wai'ale'ale ("Blue Hole"), *Kiehn et al. 9008232/5* (US), *Kiehn et al. 90082322/6* (US), *Kiehn et al. 9008232/12* (US), *Wagner et al. 6360* (US). Kawaihau Dist., Līhu'e-Kōloa Forest Reserve, along unnamed tributary of N fork Wailua River, 1400–1950 ft, *Flynn et al. 4794* (BISH, PTBG, US); Makaleha Mts, heading NW to Kekoiki Peak, 750 m, *Lorence et al. 7353* (PTBG); Makaleha Mts, central plateau ESE of Makaleha Peak and N of Makaleha Stream, 840–914 m, *Lorence et al. 7396* (PTBG). Hanalei Dist., Wai'oli Valley, 470–530 m, *Wood et al. 2053* (PTBG); Wai'oli Valley, back of valley above mist falls, 720–824 m, *Wood et al. 2292* (PTBG), Wai'oli Valley, E side of upper valley between Wai'opa and Hihimanu, 335–427 m, *Wood & Lorence 2534* (PTBG); Wai'oli Valley, N face of Namolokama Mt, hanging valley above main waterfall, 740–820 m, *Lorence et al. 7292* (PTBG); W side of Lumahai Valley, N of Pu'u Iliahi, 182 m, *Christensen 209* (BISH), *Christensen 211* (BISH [2]); Wai'oli Valley, Hanalei, *Degener 21709* (BISH, NY); Lihue-Koloa Forest Res., Powerline Trail from Wailua to Princeville, 330–580 m, *Flynn et al. 2054* (BISH, US); Limahuli Valley, W side of ridge separating Limahuli and Hanakāpī'ai Valleys, low elevation rain forest, 490–625 m, *Flynn et al. 2645* (PTBG), *Flynn et al. 2649* (BISH, PTBG), *Flynn et al. 2650* (BISH, PTBG [2]); Wai'oli, back of valley, 300–370 m, *Wood et al. 1502* (BISH, PTBG).

Cyrtandra kealiae Wawra subsp. ***urceolata*** W. L. Wagner & Lorence, **subsp. nov.**

TYPE: Hawaiian Islands (U. S. A.). Kaua'i. Līhu'e District. Hoary Head Range [Hā'upu], NNW side of range from canefield up to Omo'e, secondary vegetation dominated by *Psidium, Aleurites, Rhodomyrtus, Lantana, Cordyline, Cyrtandra, Freycinetia, Hedyotis, Hibiscus, Cyanea, Diplazium,* and *Blechnum*, 207–396 m, 19 Nov 1991, *T. Flynn & E. Nelson 4723* (PTBG-011228, holotype; BISH, MO, SING, US, isotypes).

Haec subspecies a subspecie typica limbo calycino urceolato distinguitur.

Shrubs 0.6–2.5 m tall; stems branched; leaves opposite, those of a pair subequal to unequal, nearly symmetrical, chartaceous, elliptic to elliptic-obovate, (4.5–)11–28 cm long, (1.7–) 5–9.2 cm wide, upper surface with veins somewhat impressed, sparsely to moderately pilose, lower surface with veins raised, moderately to densely velvety pilose, the hairs yellowish brown, margins serrulate or denticulate to subentire and very slightly revolute, apex acuminate, base attenuate to cuneate, petioles (0.8–)3–5(–8) cm long; flowers solitary in the leaf axils, peduncles 0–6 mm long, pedicels 4–5 mm long, bracts inconspicuous, lanceolate, 4–7 mm long; calyx slightly zygomorphic, urceolate, 14–25 mm long, cleft ca. 1/4(–2/3) its length, both surfaces very densely shaggy villous, the lobes linear-subulate to narrowly deltate, ca. 3–7 mm long; corolla white, tube cylindrical, 14–20 mm long, probably ca. 4 mm in diameter, very densely shaggy villous, upper lobes lanceolate, ca. 5 mm long, 2.5–3 mm wide, lower lobes lanceolate, ca. 5 mm long, ca. 2–2.5 mm wide; ovary glabrous; style ca. 3 mm long, glabrous; berries broadly ovoid-ellipsoid, 1–1.2 cm long, puberulent, enclosed by the persistent calyx that splits when fruit matures; seeds unknown.

DISTRIBUTION: *Cyrtandra kealiae* Wawra subsp. *urceolata* is known at least historically from scattered localities in diverse mesic to wet forest, 210–450 m, rarely to 820 m in the Wahiawa Mountains, from the northern end of the Hoary Head Mountains [Hā'upu] in the southeastern part of Kaua'i, westward in the Wahiawa Mountains, and to Hanapēpē and Olokele valleys.

Material examined. **KAUA'I:** Līhu'e-Kōloa District, Līhu'e-Kōloa Forest Reserve, along ridge ESE of Pu'u Kolo to summit, gulch on S side of ridge, 506 m, *Flynn & Lorence 3163* (PTBG); Līhu'e-Kōloa Forest Reserve, N of main Wahiawa Stream along unnamed tributary from "dam" towards ridge connecting Hulua and Kapalaoa Peaks, 610–710 m, *Lorence et al. 6661* (PTBG, US); Līhu'e-Kōloa Forest Reserve, NW of Wahiawa Bog, along tributary of Wahiawa Stream, NW of stream and SE of Hulua, 650–730 m, *Flynn et al. 2985* (PTBG); Ku'ia Stream at base of Wahiawa Stream on windward side, 317 m, *Flynn et al. 1943* (PTBG), 350 m, *Flynn et al. 1941* (PTBG);

Līhu'e-Kōloa Forest Reserve, Wahiawa Stream, ESE of main stream heading up 2 unnamed gulches to ridge connecting Kāhili and Kapala'oa Peaks, 730–820 m, *Lorence et al. 6691* (BISH, PTBG, US); Wahiawa Mts, *Lydgate s. n.* (BISH). Līhu'e District. Hoary Head Range, E of Omo'e, 102–260 m, *Flynn et al. 2897* (PTBG); Hoary Head Range, NNW side of range from canefield up to Omo'e, 270 m, *Flynn & Nelson 4721* (BISH, F, MO, PTBG, US); Hi'i Mts, *Forbes 633.K* (BISH); *Forbes 655.K* (BISH); Hā'upu Range, right hand side of Kupu Kai Gap, *Forbes 745.K* (BISH); Kōloa, ridge 3/4 mi N of La'aukahi, NW facing slope, wooded gulch, 300 m, *St. John et al. 23025* (BISH [2]); Hā'upu (Hoary Head Mts), Kīpū steep wooded slope, 300 m, *St. John & Fosberg 13627* (BISH [2]); Hoary Head Range, E of Omo'e, gulch, 210 m, *Wagner & Imada 6003* (BISH [2]); Waimea Dist. Ridge W of Hanapēpē River, *Heller 2543* (BISH, NY); Olokele, *Rock 13053* (BISH [2]); Waimea, Olokele Canyon, *Skottsberg 1051* (BISH); Olokele Ditch Trail, Makaweli, moist gulch 2 mi beyond ditch house, 445 m, *St. John 23076 et al.* (BISH [2]).

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Records of the Hawaii Biological Survey for 1999. Bishop Museum Occasional Papers 63: 21–30. (2000)

New Distribution Records for Non-Endemic Hymenoptera (Insecta) in Hawai'i[1]

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Nishida (1997) listed the known island distributions of all terrestrial arthropod species reported as established in the Hawaiian Islands. The additional records for Hawaiian species of the order Hymenoptera (Insecta) that are listed below are based on specimens found by the senior author in previously unidentified material at the Bishop Museum, and on specimens collected by both authors during 1994–1997, mostly from Moloka'i. Determinations were made by the authors. Voucher specimens are in the Bishop Museum and Hawaii Department of Agriculture collections. Families, genera and species are listed in alphabetical order.

Most recent new records for Midway Atoll are not listed here as these were published previously (Beardsley, 1998a). However, 1 Midway record that was missed earlier is included. The abbreviation YSBT is used below for yellow sticky board trap, a collection device often employed by the authors.

Agaonidae

For corrections and additions to names listed for this family in Nishida (1997), see Beardsley (1998b), except the following:

Josephiella n. sp. **New island records**

The above is a new species being described for the species listed by Nishida (1997) as *Camarothorax* sp., recorded there only from O'ahu. The species, which develops in leaf galls on *Ficus microcarpa*, is now known to occur also in California and the Canary Islands (Beardsley & Rasplus, in press).

Additional material examined: **KAUA'I:** Alexander Dam, 2.ii.1992, A. Asquith, ex galls on *Ficus* leaves (13). **MOLOKA'I:** Mapulehu nr. 'Ili'ili'ōpae Heiau, 40 ft, 22.vii.1994, W.D. Perreira, reared ex leaves of *Ficus microcarpa* (5).

Pleistodontes froggatti Mayr **New island record**

This species, a caprifier of *Ficus macrophylla* (Morton Bay fig), was purposely introduced into Hawai'i from Australia in 1921 (Swezey, 1923), and is listed from Hawai'i, Lāna'i, Kaua'i and O'ahu (Nishida, 1997).

Material examined: **MOLOK'I:** Hālawa Valley, 200 ft, 4–18.viii.1995, W.D. Perreira, YSBT (1).

Braconidae

Acrophasmus immigrans (Beardsley) **New island record**

This species was described from O'ahu (Beardsley, 1961) but is an accidental immigrant known also from the eastern U.S. (Krombein *et al.*, 1979).

Material examined: **KAUA'I:** Koke'e, 4–6.viii.1961, Maa, Miyataki & Yoshimoto (1).

Agathis cincta (Cresson) **New island records**

Agathis cincta is a North American species. Whether this is an accidental or purposeful introduction into Hawai'i has not been determined, but it has been present on O'ahu since about 1966 (Beardsley, unpublished; Nishida, 1997).

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Material examined: MAUI: 'Auahi, 18.iv.1967, N.L.H. Krauss (1); Lower Honea-Pililani Rd., 10 ft, 23.viii–6.ix.1994, W.D. Perreira, YSBT (6). MOLOKA'I: Kalaniana'ole Colony, 3 ft, 21.vii–4.viii.1995, W.D. Perreira, YSBT (3); same data except vii.1995 (3); same data except viii.1995 (1); Kamilo Bridge, 3 ft, ix–x.1994, W.D. Perreira, YSBT; Kapukahehu Beach, 5 ft, 28.x–11.xi.1994, W.D. Perreira, YSBT (1); same data except vii.1995 (4); same data except viii.1995 (1); same data except viii–ix.1995 (5); Mapulehu nr. 'Ili'ili'ōpae Heiau, 10–40 ft, 29.ix–10.x.1995, W.D. Perreira, YSBT (4).

Apanteles trifasciatus Muesebeck **New island record**

This common species which, although described from Hawai'i, probably is an early immigrant from the South Pacific. It is a parasitoid in larvae of microlepidoptera and has been recorded previously from all of the main Hawaiian Islands except Kahoolawe and Moloka'i (Nishida, 1997).

Material examined: MOLOKA'I: Pala'au State Park, ca. 1500 ft, 20.i.1995, J.W. Beardsley & W.D. Perreira, sweeping (8); same data except 10.xi.1995 (3).

Bassus hawaiicola (Ashmead) **New island record**

This species, apparently an accidental immigrant of long standing, has been recorded previously from Kaua'i, Maui and O'ahu (Nishida, 1997). It is a parasitoid in larvae of microlepidoptera; Beardsley (1961) listed the recorded hosts under the name *Agathis hawaiicola* Ashmead.

Material examined: MOLOKA'I: Hālawa Valley, 200 ft, 24.vi–8.vii.1994, W.D. Perriera & M. Fukuda, YSBT (1); Honomuni Stream, 10 ft, 29.ix–13.x.1995, W.D. Perreira, YSBT (2).

Bracon mellitor (Say) **New island record**

This widely distributed parasitoid of larvae of stored product-infesting Lepidoptera has previously been reported from Kaua'i and O'ahu (Nishida, 1997).

Material examined: MAUI: Haleakalā National Park, Hōlua, 9–10.viii.1962, J.W. Beardsley (1); Makawao, 12.viii.1927, M. Maniki (2).

Bracon swezeyi (Bridwell) **New island record**

This species, a parasitoid in larvae of microlepidoptera (Beardsley, 1961), was described from Hawai'i but probably is an accidental immigrant. It has been recorded from Kaua'i and O'ahu.

Material examined: HAWAI'I: Kā'u Dist: Kīlauea , ca. 4000 ft, 22.vi.1966, J.W. Beardsley (2).

Chelonus blackburni Cameron **New island record**

An apparent early accidental immigrant, this egg-larval parasitoid attacks many species of small and medium sized Lepidoptera and is present at low and middle elevations over much of the Hawaiian Islands (Beardsley, 1961).

Material examined: KAHO'OLAWE: Beck's Cove, 11–14.ii.1980, G.M. Nishida, UV light (2); Hakioawa, 0 m, 16–18.iv.1981, W.C. Gagné, Malaise trap (2).

Glyptocolastes texanus Ashmead **New island records**

This species will key to the genus *Leluthia* Cameron in the key by Marsh in Wharton *et al.* (1997). However, we are not aware that a new combination has been formally proposed for it, and it is retained here in *Glyptocolastes* following Nishida (1997). It is an accidental immigrant from North America, previously recorded only from O'ahu (Beardsley, 1961).

Material examined: **HAWAI'I:** Kailua, Kona, 28.ix.1966, W. Von, at light (1). **LANA'I:** 29.vi.1987, no collector, light trap (6).

Heterospilus baeticatus (Provancher) **New island records**

This North American parasitoid of wood-boring beetle larvae was first collected in Hawai'i in 1969; an accidental introduction (Beardsley, 1971). It is listed only from O'ahu (Nishida, 1997).

Material examined: **KAUA'I:** Koke'e Rd. nr. mile marker #9, ca. 3000 ft, 21.x–15.xi.1994, G.K. Uchida & W.D. Perreira, YSBT (1). **MOLOKA'I:** Pala'au State Park, ca. 1500 ft, 2–16.ix.1994, W.D. Perreira, YSBT (2); same data except x.1994 (1); same data except i.1995 (1); Pāpio Stream, 600 ft, xi.1994, W.D. Perreira, YSBT (1).

Heterospilus prosopidis Viereck **New island records**

A parasitoid in larvae of bruchid beetles, this species was purposely introduced into Hawai'i in 1910 (Beardsley, 1961). It has been recorded from most of the main Hawaiian Islands (Nishida, 1997).

Material examined: **KAHO'OLAWE:** Hakioawa Pt, 1km SW, 0–10m, 7–8.xi.1979, no collector, MV light trap (2). **LĀNA'I:** Lāna'ihale, 4.xii.1978, P. Conant, ex trap baited with malathion & methyl eugenol (1).

Macrocentrus calacte Nixon **New island records**

First found in Hawai'i on O'ahu in 1962, this species was described from Fiji (Beardsley 1963a). It is also recorded from Hawai'i Island (Nishida, 1997).

Material examined: **KAUA'I:** Na Pali Coast, Kalalau Trail, 18.xii.1968, W.C. Gagné, *Munroidendron racemosum* (1); Koke'e, ca. 2000 ft, 19.v.1982, J. Takara, light trap (1). **MOLOKA'I:** nr. Honomuni Stream, 10 ft, x.1994, W.D. Perreira, YSBT (2); Mapulehu nr. 'Ili'ili'ōpae Heiau, 10–40 ft, xi–xii.1994, W.D. Perreira, YSBT (1); same data except i.1995 (1); Mapulehu, 10–100 ft, 6.v.1992, J.W. Beardsley, sweeping (2); Pala'au State Park, ca. 1500 ft, 10–24.xi.1995, J.W. Beardsley & W.D. Perreira, YSBT (1).

Microctonus vittatae Muesebeck **New island record**

This species was first collected on O'ahu in 1955; it is an accidental introduction from North America. It develops as a parasitoid in adult chrysomelid beetles, but no specific host is known in Hawai'i (Beardsley, 1961).

Material examined: **HAWAI'I:** Whittington Beach Park, Honu'apo Bay, 3 ft, 20.x–3.xi.1995, W.D. Perreira, YSBT (2).

Mirax sp. **New island records**

This parasitoid of lepidopterous leafminers is an accidental immigrant that was first reported in Hawai'i from O'ahu in 1964, when it was reared from larvae of the endemic gracillarid moth *Philodoria (Eophilodoria) marginistrigata* (Walsingham) (Chong, 1965). A specific name is unavailable for this wasp, and its origin is unknown. Nishida (1997) recorded it only from O'ahu.

Material examined: **KAUA'I:** Alaka'i Swamp, 14.ix.1968, C.M. Yoshimoto (4); Koke'e, ca. 3000 ft, 19.v.1982, J. Takara, *Drosophila* mushroom bait (1); **MOLOKA'I:** Pala'au State Park, ca. 1500 ft, 13.v.1994, J.W. Beardsley & W.D. Perreira, sweeping (1).

Parallorhogas pallidiceps (Perkins) **New island record**

This species, believed to be an early accidental immigrant, is known also from the islands of Fiji and New Zealand. It develops as a parasitoid in cerambycid beetle larvae

(Beardsley, 1961), and has been recorded previously from Nihoa and most of the main Hawaiian Islands (Nishida, 1997).

Material examined: **LANA'I**: Lāna'ihale, 15.xii.1978, P. Conant, from trap baited with malathion and methyl eugenol (1).

Phanerotoma hawaiiensis Ashmead **New island records**

This species, possibly an early introduction for biological control, is a parasitoid of microlepidopterous larvae (Beardsley, 1961) and has been recorded from most of the main Hawaiian Islands and Midway (Nishida, 1997).

Material examined: **KAHO'OLAWE**: Hakioawa Point, 1 km SW, 0–10m, 7–8,xi.1979, G.M. Nishida, M.L. Goff & W.A. Steffan, Malaise trap (1). **MOLOKA'I**: Mapulehu, nr. 'Ili'ili'ōpae Heiau, 10–40 ft, 10.xi.1995, J.W. Beardsley & W.D. Perreira, sweeping (4); Pala'au State Park, ca. 1500 ft, 20.i.1995, J.W. Beardsley & W.D. Perreira, sweeping (2); Pāpio Stream, 600 ft, 2–16.ix.1994, W.D. Perreira, YSBT (1); same data except ix–x.1994 (2); same data except xii.1994 (1).

Phanerotoma myeloisae Fullaway **New island record**

This species, described from O'ahu but believed to be an immigrant of unknown origin, was first collected in Hawai'i by Perkins in 1907. It has been recorded previously only from O'ahu (Nishida, 1997).

Material examined: **MOLOKA'I**: Hālawa Valley, 200 ft, 21,vii–4.viii.1995, W.D. Perreira, YSBT (1); Mapulehu, nr. 'Ili'ili'ōpae Heiau, 10–40 ft, 10.xi.1995, J.W. Beardsley & W.D. Perreira, sweeping (7); Pala'au State Park, ca. 1500 ft, xii.1994, W.D. Perreira. YSBT (1); same data except 20.i.1995, J.W. Beardsley & W.D. Perreira, sweeping (4).

Psyttalia incisi (Silvestri) **New island record**

This parasitoid of tephritid fruit fly larvae was purposely introduced into Hawai'i from southeast Asia, and reported established in 1950 (Beardsley, 1961). It has been previously reported from Kaua'i, O'ahu, Maui and Hawai'i islands (Nishida, 1997).

Material examined: **MOLOKA'I**: Pala'au State Park, ca. 1500 ft, 20.i.1995, J.W. Beardsley & W.D. Perreira, sweeping (1).

Rhaconotus vagrans (Bridwell) **New island record**

This accidental immigrant was first collected in Hawai'i in 1914; origin unknown. It is a parasitoid of larvae of cerambycid beetles (Beardsley, 1961) and has been reported from most of the main Hawaiian Islands (Nishida, 1997).

Material examined: **MOLOKA'I**: Hālawa Valley, 0–100 ft, 6.v.1991, J.W. Beardsley, sweeping (12); Pala'au State Park, ca. 1500 ft, 10.xi.1996, J.W. Beardsley & W.D. Perreira, sweeping (8); Mapulehu, nr. 'Ili'ili'ōpae Heiau, 10–40 ft, 10.xi.1995, J.W. Beardsley & W.D. Perreira, sweeping (2).

Spathius prusius Nixon **New island records**

This accidental immigrant from the western Pacific region was first collected in Hawai'i on O'ahu, in 1962. It develops as a parasitoid on larvae of the anthribid beetle *Araecerus levipennis* Jordon (Beardsley, 1963b).

Material examined: **HAWAI'I**: Whittington Beach Park, Honu'apo Bay, 3 ft, 20.x–3.xi.1995, W.D. Perreira, YSBT (1); **KAHO'OLAWE**: Moa'ula, 1400 ft, 27.iv.1980, W.C. Gagné (1); **KAUA'I**: Mt Kāhili, 19.xi.1968, W.C. Gagné, *Cheirodendron* (1). **MOLOKA'I**: nr. Honomuni Stream, ca. 10 ft, 16–30.ix.1994, W.D. Perreira, YSBT (1); Mapulehu, 10–100 ft, 6.v.1992, J.W. Beardsley, sweeping (1); Mapulehu, nr. 'Ili'ili'ōpae Heiau, 10–40 ft, 24.vi–8.vii.1994, W.D. Perreira & M. Fukuda, YSBT (1); same data except 2–16.ix.1994, W.D. Perreira (1); Pala'au State Park, ca. 1500 ft, 20.i.1995. J.W. Beardsley & W.D. Perreira; sweeping (8); same data except 10.xi.1996 (2);

Pāpio Stream, 600 ft, 2–16.ix.1994, W.D. Perreira, YSBT (1).

Urosigalphus bruchi Crawford **New island record**

This species was purposely introduced into Hawai'i from Texas in 1921 for biological control of bruchid larvae (Beardsley, 1961). Nishida (1997) recorded it from Midway and many of the main Hawaiian Islands. It probably occurs on all of the islands, but there are no records from Hawai'i or Lāna'i.

Material examined: **KAHO'OLAWE:** Hakioawa, 300 ft, 27.iv.1980, S.L. Montgomery (1).

Chrysididae

Trichrysis triacantha (Mocsary) **New island record**

An accidental immigrant of oriental origin that was first collected in Hawai'i in 1964 (Beardsley, 1991), this species was known previously in Hawai'i only from O'ahu (Nishida, 1997).

Material examined: **MOLOKA'I:** Mapulehu nr. 'Ili'ili'ōpae Heiau, 10–40 ft, 21.vii–4.viii.1995, W.D. Perreira, YSBT (1).

Colletidae

Hylaeus albonitens (Cockerell) **New island records**

This Australian species was collected for the first time in the Hawaiian Islands on Kaua'i, in 1994 (Hopper, 1995) and has not been reported previously from any other island.

Material examined: **MOLOKA'I:** Kualapu'u, in coffee field, 750 ft, 15–22.xii.1995, YSBT, W.D. Perreira (1); Mapulehu nr. 'Ili'ili'ōpae Heiau, 40–60 ft, 25.xi–9.xii.1994, YSBT, W.D. Perreira (1). **O'AHU:** Honolulu, U. H. Campus, Mānoa, 60 ft, 1.xi.1991, W.D. Perreira (1); same data except iii.1992, in lab, (2); same data except 9.vi.1996, J.W. Beardsley (1).

Halictidae

Dialictus sp. possibly *nevadensis* (Crawford) **New island records**

This species was previously reported in Hawaiian literature as *Halictus (Chloralictus)* sp. (Beardsley, 1958). It is an apparent accidental immigrant from North America. According to Krombein *et al.* (1979) *Chloralictus* Robertson is a junior synonym of *Dialictus* Robertson. This sweat bee is now common in lowland areas on the major Hawaiian Islands. It has been reported from Hawai'i (Bianchi, 1967), Maui (Anonymous, 1994), Moloka'i (Nakahara, 1979) and O'ahu (Beardsley, 1958).

Material examined: **LĀNA'I:** Keōmuku Village, 2.vi.1971, on *Sida* flowers, J.W. Beardsley (2).

Heloridae

Helorus ruficornis Förster **New island records**

This parasitoid of chrysopid larvae, an accidental immigrant of Eurasian origin that was first collected in the Hawaiian Islands in 1985, has been reported in Hawai'i only from O'ahu (Beardsley, 1986, 1990).

Material examined: **KAUA'I:** Koke'e, Pu'u o Kila, 4,100 ft, 23.viii.1987, W.D. Perreira (1). **MAUI:** Waikamoi Forest Reserve, 4000 ft, 2–3.i.1986, W.D. Perreira (1). **MOLOKA'I:** Hālawa Valley, 200 ft, 24.vi–8.vii.1994, W.D. Perreira, YSBT (1); Pala'au State Park, 1500 ft, 16–30.ix.1994, W.D. Perreira, YSBT (1).

Ichneumonidae

Anomalon californicum (Cresson) **New island record**

This species was accidentally introduced from North America and first collected in

Hawai'i in 1945 (Townes, 1947). Nishida (1997) listed it from Hawai'i, Ni'ihau and O'ahu. It probably occurs on all of the main Hawaiian Islands; however, we have seen no specimens from Kaua'i, Maui, or Moloka'i.

Material examined: **LĀNA'I:** Shipwreck Beach, 3.ix.1961, L. Lofgren (1). **MIDWAY:** Sand I, x.1997, Malaise trap (2).

Barichneumon californicus Heinrich **New island records**

This species is an accidental immigrant from western North America that was first collected in the Hawaiian Islands in 1975 (Beardsley, 1977a). Nishida (1997) listed it from Kaua'i and O'ahu.

Material examined: **HAWAI'I:** Mauna Ke'a SSE side, 13,200 ft, 5.v.1982, alive on snow patch, W.C.Gagné (1); **KAHO'OLAWE:** Hakioawa, 25.iv.1980, F.G. Howarth (1); **LĀNA'I:** Lāna'ihale summit, 20.v.1981, at MV light, W.C. Gagné (1); **MAUI:** Haleakalā National Park, 2438m, 7.iv.1980, on *Styphelia,* W.C. Gagné (1); **MOLOKA'I:** Kawela, 10 ft, 1.ix.1978, S.L. Montgomery (1).

Casinaria infesta (Cresson) **New island record**

This species has been listed from all of the main Hawaiian Islands except Lāna'i and Kahoolawe (Nishida, 1997). Swezey (1926) stated that this parasitoid of pyralid moth larvae was accidentally introduced from North America and was first seen in Hawai'i in 1921.

Material examined: **LĀNA'I:** Maunalei, 18.ii.1965, N.L.H. Krauss (3).

Diadegma pattoni (Ashmead) **New island record**

This is an accidental immigrant from North America first found in Hawai'i in 1973 (Beardsley, 1977b). Nishida (1997) listed it from Hawai'i, Kaua'i, Maui and O'ahu.

Material examined: **MOLOKA'I:** Kaluako'i, 10 ft, 13.v.1994, sweeping *ilima* and weeds, J.W. Beardsley & W.D. Perreira (2).

Diplazon laetatorius (Fabricius) **New island records**

Although this common parasitoid of aphidophagus syrphid larvae has probably been present on all of the Hawaiian islands for many years, it was not listed previously from Kaua'i or Moloka'i (Nishida 1997).

Material examined: **KAUA'I:** Awa'awapuhi, 10.vi.1922, E.H. Bryan (2). **MOLOKA'I:** above Waikolu Valley, 1400 m, 28.iv.1955, C.R. Joyce (1).

Eriborus sinicus (Holmgren) **New island record**

This species was purposely introduced into the Hawaiian Islands in 1928 from China, under the name *Dioctes chilonis* Cushman (a synonym), to combat the rice borer *Chilo supressalis* (Walker). It was found established in 1929 (Fullaway, 1931). Nishida (1997) listed it from Hawai'i, Kaua'i, Maui and O'ahu.

Material examined: **MOLOKA'I:** Pēpē'ōpae, 4600 ft, vii.1959, D.E. Hardy (1).

Gelis tenellus (Say) **New island record**

This is a hyperparasitoid in cocoons of Braconidae, Ichneumonidae, and Chrysopidae that is widely distributed in North America (Krombein *et al.*, 1979). In the Hawaiian Islands it is presumed to be an accidental immigrant, and is listed from Hawai'i, Kaua'i, Maui and O'ahu (Nishida, 1997).

Material examined: **LANA'I:** Kānepu'u, 24.ix.1988. W.D, Perreira (1). **MOLOKA'I:** Pu'u Kolokole, 9.vi.1971, M. Delfinado (1).

Gotra sp. **New island record**

This species, for which no specific name is yet available, apparently originated from the Philippine Islands and was first collected in the Hawaiian Islands in 1974 (Beardsley 1974). Nishida (1997) listed it from Kaua'i and O'ahu.

Material examined: **MOLOKA'I:** Maunaloa, 1200 ft, W.D. Perreira (1).

Ichneumon cupitus Cresson **New island records**

This species is widespread in western North America (Krombein *et al.*, 1979) and may have been introduced purposely into Hawai'i by Koebele to combat armyworms. Previously it was recorded only from Hawai'i Island (Nishida, 1997).

Material examined: **MAUI:** Haleakalā, upper Kīpahulu Valley, west camp, 1920 m, 7–15.vii.1983, F.G. Howarth & W.C. Gagné (3); Pu'u Kukui, 900 m, 9–31.x.1971, Malaise trap, J.L. Gressitt (9). **MOLOKA'I:** Pu'u Kolekole, 17.iii.1964, D.E. Hardy (2); above Waikolu Valley, 1400 m, 28.iv.1955, C.R. Joyce (2). **O'AHU:** Mt Ka'ala, 4.x.1973, P. Corves (5); Mt Tantalus, 8.iv.1978, C.W. Mills (1).

Ichneumon sp. nr. *laetus* Brullé **New island records**

This species is listed as *I. laetus* by Nishida (1997). However, we are not aware that the specific identity has been confirmed. This species also may have purposely introduced into Hawai'i by Koebele. Nishida (1997) listed it from Hawai'i Island only.

Material examined: **KAUA'I:** Koke'e, 11–17.ix.1965, C.M. Yoshimoto (1). **O'AHU:** Konahuanui, 6.viii.1941, B.A. Sherman (1); Poamoho Trail, 790m, 6.xii.1974, F.G. Howarth (3); Mt Ka'ala, 15.viii.1967, D. Tsuda (3).

Ichneumon purpuripennis Cresson **New island records**

Krombein et al. (1979) listed this species only from California. It may have been introduced into Hawai'i by Koebele to combat armyworms. Nishida (1997) recorded this species from Hawai'i Island only.

Material examined: **MAUI:** Haleakalā crater, 25.viii.1929, P. St. Sure (1); Hale'au, West Maui Mts, 7.ix.1932, N.L.H. Krauss (1). **O'AHU:** Mt Ka'ala, 14.x.1966, C.M. Yoshimoto (1).

Megastylus flavopictus (Gravenhorst) **New island record**

This Holarctic species, an accidental immigrant, was first reported in Hawai'i in 1982 from Kaua'i, and is a parasitoid of the larvae of Mycetophilidae (Diptera) (Beardsley & Kumashiro, 1988b).

Material examined: **HAWAI'I:** Pōhakuloa Training Area, Bobcat Trail, MBRC site 17156, 1700 m, 26.v.1994, crawl cave, deep zone, F.G. Howarth & F.D. Stone (2).

Mesostenus gracilis Cresson **New island record**

This accidental immigrant from North America, first collected in the Hawaiian Islands in 1966, was listed by Nishida (1997) from Hawai'i and Maui islands, although the original note on its discovery in Hawai'i (Beardsley & Kumashiro, 1988a) also listed the O'ahu record cited below.

Material examined: **O'AHU:** Koko Head, 27.ii.1982, C.H. Chu (1).

Pachysomoides stupidus (Cresson) **New island record**

This species, an accidental immigrant of wide distribution in North and South America, develops as a parasitoid in larvae of *Polistes* wasps. It was first found in the Hawaiian Islands in 1970 (Beardsley, 1971) and is recorded from Kaua'i, Maui and O'ahu (Nishida, 1997).

Material examined: **MOLOKA'I:** Mapulehu nr. 'Ili'ili'ōpae Heiau, 10–40 ft, 20.i.1995, sweeping, J.W. Beardsley & W.D. Perreira (1).

Pristomerus spinator (Fabricius) **New island record**

This species was purposely introduced into Hawai'i from Texas in 1942 to combat armyworms, under the name *Pristomerus appalachianus* (Viereck), a synonym (Funasaki *et al.*, 1988). It has been reported as established on Kaua'i, Maui and O'ahu (Nishida 1997).

Material examined: **MOLOKA'I:** Kualapu'u, in coffee field, 750 ft, 2–16.ix.1994, W.D. Perreira, YSBT (1).

Spilichneumon superbus (Provancher) **New island record**

Swezey (1909), who redescribed this species under the synonym *Amblyteles koebelei*, stated that it was introduced purposely into Hawai'i by Koebele to combat armyworms. It is widespread in North America (Krombein *et al.*, 1979), and is listed from Hawai'i, Maui, Moloka'i, Ni'ihau and O'ahu (Nishida, 1997).

Material examined: **KAUA'I:** Koke'e, 28.viii.1921, O.H. Swezey (1); 11–17.ix.1965, C.M. Yoshimoto (2); Nualoa, 4.viii.1925, O.H. Swezey (1).

Tromatobia ovivora (Boheman) **New island records**

This species was first reported as an accidental immigrant, under the name *Tromatobia rufopectus* (Cresson), in 1932. It is a widely distributed species the larvae of which develop as predators in the egg sacs of argiopid spiders (Rosa, 1932). Nishida (1997) listed it from Hawai'i, Kaua'i and O'ahu.

Material examined: **LĀNA'I:** Lānai Mts, xi.1947, ex egg case of *Argiope avara*, N.L.H. Krauss (8). **MOLOKA'I:** Pala'au State Park, 1500 ft, 20.i.1995, sweeping, J.W. Beardsley & W.D. Perreira (1).

Venturia sp. **New island records**

This species is listed only from Kaua'i and Kure islands (Nishida, 1997). It probably occurs on all the islands of Hawaii, but in the past has been confused with, and often misidentified as *Venturia canescens* (Gravenhorst), which also occurs here. This species is bisexual and males are common, whereas *V. canescens* apparently is uniparental. It appears to be an accidental introduction into Hawai'i of unknown origin.

Material examined: **HAWAI'I:** Hawaii Volcanoes National Park, 1200 m, 25.iii.1961, L. Quate (1); Kohala, 13.viii.1954, (no collector)(1). **LĀNA'I:** Maunalei Gulch, 28.x.1947, N.L.H. Krauss (9). **MAUI:** Ha'ikū, 12.xi.1931, N.L.H. Krauss (2). **MOLOKA'I:** Kamiloloa, 15.vii.1971, on *Reynoldsia*, D.E. Hardy (1); Kaunakakai-Hālawa, 16.vi.1962, K. Yano (3). **NI'IHAU:** X.1945, Chock & Au (1). **O'AHU:** Mānoa, iii.1928, E.H. Bryan (1); Mānoa, 23.vi.1928, N.L.H. Krauss (6).

Vulgichneumon diminutus (Matsumura) **New island record**

This species was first collected in Hawai'i in 1980. It is a parasitoid of pyralid moth larvae with a widespread oriental distribution (Beardsley, 1990). In the Hawaiian Islands it was previously reported from Maui and O'ahu (Nishida, 1997).

Material examined: **MOLOKA'I:** Pāpio Stream, 600 ft, 2–16.ix.1994, W.D. Perreira, YSBT (1).

Sphecidae

Chalybion bengalense (Dahlbom) **New island record**

This wasp is an accidental immigrant that is widely distributed in the Palearctic and Oriental Regions. It was first found in Hawai'i in 1947 (Weber, 1948), and is listed by Nishida (1997) from Hawai'i, Moloka'i and O'ahu.

Material examined: **KAUA'I:** Līhu'e Airport, 120 ft, 21.X.1994, G.K. Uchida & W.D. Perreira (1).

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A New Species of *Sigmatineurum* (Diptera: Dolichopodidae) From Seeps in Waimanu Valley on the Big Island of Hawai'i[1]

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Sigmatineurum Parent is a relatively rare endemic Hawaiian hyrophorine genus occurring on all the main islands in the archipelago. Evenhuis & Polhemus (1994) provided the first review of the genus including descriptions of 4 new species, gave observations on their behavior and habitat preferences, and helped define the taxonomic limits of the genus. Since then Evenhuis (1997) further refined the limits of the genus, described an additional 3 species, and provided an updated key to all species. In the present paper, an interesting new species is described from the Kohala Mountains of the Big Island of Hawai'i found on vertical seeps at relatively low elevations (all other species in the genus have been collected on boulders and rocks in the splash zone of mountain streams above 300 m).

Specimens examined in this study are deposited in the Bishop Museum, Honolulu (BPBM). Terminology follows Evenhuis (1997).

Sigmatineurum englundi Evenhuis, **n. sp.** Figs. 1–5

Sigmatineurum new sp.: Englund & Preston, 1999: 13–14, 16, 18, 24, 26.

Diagnosis. Keys to *S. parenti* Evenhuis using the key to species in Evenhuis (1997), but differs from that species by the different setation pattern of the mid leg and the smaller size of the pulvilli of the mid and hind legs.

Figure 1. *Sigmatineurum englundi* Evenhuis, **n. sp.**, female. Photo D.J. Preston & R.A. Englund

1. Contribution 2000-016 to the Hawaii Biological Survey.

Male. Body length: 4.2–6.0 mm. Wing length: 3.2–5.0 mm. *Head.* Front, face, and vertex dark brown with bluish reflections; occiput dark brown to black; clypeus slightly produced, brown, with coppery to brassy reflections; inner eye margins parallel-sided from level of antenna to level of upper margin of clypeus; palp and proboscis brown; antenna brown, flagellomere length ca. 2 × width, arista length slightly less than head height.

Thorax. Mesoscutum and scutellum brown with green reflections, some coppery reflections anterolaterally; notopleural area shining green and brassy; anepisternum with brassy green (anteriorly) and magenta (posteriorly) reflections; remainder of pleura brown, withsome green reflections; thoracic setae black to dark chocolate brown: 5 *dc*; 2 *np*; 1 *ph*; 1 *pa*; 1 *sc*; *ac* absent.

Legs. Brown, green reflections on CI and basal two-thirds of FI and FII. FI predominantly bare, sparse hairs ventrally; TI straight with hairs along ventral surface (MSSC). It1 4 × length of It_2. It_{2-5} unmodified. IItr with small thorn-like process. FII (Fig. 1) with row of small, short, peg-like setae ventrally, single strong setae subapically (MSSC). TII slightly sinuous, with subbasal notch and strong hairs and setae on apical half of ventral surface, setae longest at apical 1/5. IIt1 slightly bowed, with patch of dense setae basally. IIt_{2-5} unmodified. Leg III unmodified except for single strong setae near midlength of TIII (MSSC). Pulvilli of mid and hind legs ca. 1/2 length of claws.

Wing. Subhyaline throughout, pale brown color strongest at extreme base; crossvein m-cu bent slightly at middle, not S-shaped; CuA_1 reaching wing margin as faint trace of vein; CuAx 2.0; halter white.

Abdomen. Dark brown with green and brassy reflections dorsally, reflections brassy green laterally; black hairs posterolaterally on tergite I; sternite 4 process (Fig. 4) small, stublike. Hypopygium brown with pale brown cerci.

Female. As in male except for lack of MSSC, shorter antennal flagellomere, and darker green anepisternum; legs normal, without modifications.

Types. Holotype ♂ (BPBM 16,349) and 3♂,3♀ paratypes from: Hawaiian Islands: Hawai'i: Waimanu Stream, 350 ft [106 m], 11.xii. 98, on seep, R.A. Englund. *Other paratypes*: Hawai'i: 2♂,2♀, Alakahi Stream, 1220 ft [372 m], 9.xii.98, on seep, R.A. Englund; 8♂,4♀, Waimanu Stream, 300 ft [91 m], 11.xii.98, on seep, R.A. Englund; 4♂,11♀, same data except 380 ft [116 m]; 1♂,1♀, Waimanu Stream, Waihīlau tributary, 300 ft [91 m], R.A. Englund; 1♂,1♀, Waimanu Falls, 300–340 ft [91–104 m], on small seeps, M. Richardson (all in BPBM).

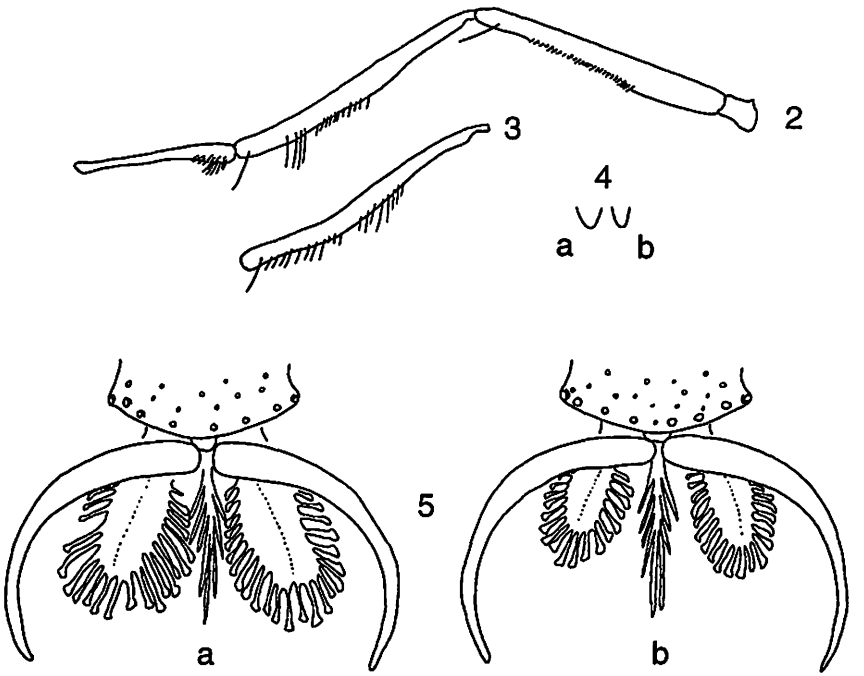
Habitat. Most *Sigmatineurum* species have been collected from boulders in the splash zone in the middle of fast moving mountain streams. It is interesting that this species has only been collected from seeps away from the splash zone of the streams.

The first collection of this species was at roughly the 370 m elevation of Alakahi Stream. The seep was ca. 1 m above the stream bed and measured about 15 m high by 30 m long. Flies were captured all along the length of this seep.

The second set of collections of this species were made in the on the main tributary of the Waimanu Stream (Waihīlau Stream), known as the "Keyhole" area due to the 1000 m sheer valley walls forming a spectacular and almost circular bowl, into which 2 waterfalls plunge from over the cliffs. The combination of the geological formation of this "bowl", the frequent wind, the porous nature of the rock wall, and the amount of water from the falls, makes virtually the entire bottom of this amphitheater a huge seep. The flies were captured at various points throughout the amphitheater at elevations from 91–116 m.

Discussion. There may be a correlation between the seep habitat of this species and the size of the pulvilli of the mid and hind legs (see Fig. 5). Species found on stream boulders have pulvilli subequal in length to the claws, which may be correlated with being able to successfully hold onto substrata when in a riffle habitat. The pulvilli of *S. englundi* has these pulvilli reduced to ca. 1/2 the length of the claws. More study will have to be done on other species to confirm this correlation throughout the genus.

Etymology: This species is named for the Ron Englund, who has continually provided significant observations to the knowledge of *Sigmatineurum* in Hawai'i.



Figures 2–5. 2, ***Sigmatineurum englundi*** Evenhuis, n. sp., midleg. **3,** ***S. parenti*** Evenhuis midleg. **4,** ***S. englundi*** Evenhuis, n. sp., sternite 4 process, a: caudal view. b: lateral view. **5,** hind claws of ***Sigmatineurum*** species. a: ***S. mnemogagnei*** Evenhuis; b: ***S. englundi*** Evenhuis, n. sp..

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The Centipede Order Lithobiomorpha in the Hawaiian Islands (Chilopoda). I. The Epigean Fauna

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Introduction

The chilopod order Lithobiomorpha comprises short-bodied anamorphic forms with strong tergite heteronomy, 15 segments and leg pairs in adults (6–8 of each in 1st stadia), and more than 14 antennal articles. Twelve epigean species occur in Hawai'i, most unquestionably introduced; Williams (1931) provides a dorsal view of a specimen of *Lithobius* sp., which shows the general form of representatives of this order. The Hawaiian lithobiomorphs have not been examined in detail, but our knowledge of them is relatively advanced because of Eason's study (1977) of *Lithobius hawaiiensis* Silvestri. He redescribed and illustrated this species, summarized Hawaiian representatives of the Lithobiidae, and briefly recounted their literature, thus forming the basis for the present contribution. Eason (1992) classified the Lithobiomorpha and recognized 2 families, Lithobiidae and Henicopidae, the former with 4 subfamilies and the latter with 2; both families occur in Hawai'i and are readily distinguished by the presence (Lithobiidae) or absence (Henicopidae) of spurs on the legs. Although others placed the Hawaiian species of *Bothropolys* Wood in the family Ethopolidae, but we agree with Eason (1992) that this taxon warrants only subfamilial status under the Lithobiidae.

This work summarizes literature records of epigean Hawaiian lithobiomorphs, with synonymies for the 7 species whose literature is complex, and provides new ones from the collection of the first author (MZ); the British Museum of Natural History, London, United Kingdom (BMNH); the National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM); the Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah (BYU); and the Bishop Museum, Honolulu (all samples not otherwise labeled). A study of forms inhabiting laval tubes is in preparation by the first author. More Hawaiian samples undoubtedly exist in American repositories, but the second author has not attempted to record them during visits to these institutions. We invite future students to issue supplements to our work as additional material is discovered.

Family Henicopidae
Subfamily Henicopinae

Lamyctes africana (Porat) **New island records**

Lamyctes hawaiensis (sic): Attems, 1938: 366, 370.

Lamyctes africana: Attems, 1940: 279, figs. 9–15, 17, 19–22.

Diagnosis. Up to 10.0 mm long; antennae with 24–29 articles, usually 28; only single large ocellus on each side; prosternal teeth 2+2, lateral prosternal prominence present; all tergites without posterior projections; coxal pores small, circular, mostly 2,2,2,2, sometimes 2,3,2,2 or 2,3,3,2, separated from each other by more than their own diameter; anterior tarsal articulations absent in 1st–12th legs; 15th tarsus slender, about 6–10 × longer than broad; all legs with 2 accessory apical claws, both about 1/2 as long as principal claw; tibia of 1st–12th legs with sharp distal projection on anterior edge; 15th legs long and slender; female gonopods with 2+2 conical spurs, claw narrow, without lateral denticles.

Occurrence in Hawai'i. Kure, O'ahu, Maui (all new island records), and Hawai'i.

Published records. Island of Hawai'i, Nauhi Gulch, Mauna Ke'a (Attems, 1938, 1940).

Material examined. **HAWAI'I:** 3♀, Saddle Rd, Pu'u Huluhulu, under stones, 28 Jul 1979, F.G. Howarth; 1♀, Slopes of Mauna Ke'a, 8000–9000 ft, 24 Aug 1966, T. Symon; 2♀, Hawaii Volcanoes Natl. Park, Mauna Loa Trail, isolated *Metrosideros* with *Coprosma montana, Styphelia, Vaccinium*, 8100 ft, 21 Jul 1970, F.J. Radovsky, duff; 1♀, Hawaii Volcanoes Natl. Park, Mauna Loa Summit Trail, bomb zone, 2150 m, 14 Jun 1979, M.L. Goff & F.J. Radovsky; 1♀ juv, same locality, leaf litter, 2220 m, 20 Oct 1970, M.L. Goff; 36♀,5♀ juvs, 3 juvs, 2 larvae, Hawaii Volcanoes Natl. Park, Mauna Loa Summit Trail, *Metrosideros* cone, *Styphelia, Vaccinium, Coprosma, Dubautia*, 2286–2316 m, Sep 1971–Jul 1972, J. Jacobi. **KURE:** 1♀, 21 Apr 1978, Dallas Grady. **O'AHU:** 1♀, Koko Head, 3 Jan 1985, V. & B. Roth; 4♀, Mt Ka'ala, in culvert on road, 1200 m, 3 Oct 1975, F.G. Howarth. **MAUI:** 1♀,1♀ juv, Haleakalā, Halemanu Trail, 8000 ft, 30 Apr 1945, E.C. Zimmerman.

Remarks. Lamyctes africana occurs in southern Africa and Madagascar, it is also known in southwestern Australia, the Juan Fernandez Is, and St. Paul Is (Atlantic Ocean), where it is considered introduced (Attems, 1940). A female from Mauna Loa Summit Trail has 1+1 short spurs on the gonopods.

Lamyctes emarginatus (Newport) **New synonymy; Lectotype designation**

Lamyctes fulvicornis var. *hawaiiensis* Silvestri, 1904: 325, figs. 1–2. Attems, 1909: 8; 1914: 48, 56, 93; 1928: 61. **syn. nov.**

Lamyctes fulvicornis hawaiiensis: Chamberlin, 1920: 71. Nishida, 1994: 26.

Diagnosis. Up to 11.5 mm long; antennae usually with 25–28 articles; only single ocellus on each side; prosternum with anterior margin narrow, armed with 2+2 teeth; all tergites without triangular projections at posterior angles; 1–3 coxal pores separated by more than their own diameter, usually 2,2,2,1 (2,3,3,1; 3,3,3,2) in males, 2,2,3,2 (2,2,2,2; 2,3,3,2; 2,3,3,3; 3,3,3,3) in females; anterior tarsal articulations absent in 1st–12th legs; all legs with 2 accessory apical claws; tibia of 1st–11th legs with sharp distal projection on anterior edge; 15th legs long, slender, 1st tarsal joint of 15th legs about 7–10 × longer than wide; female gonopods with 2+2 conical spurs, claw narrow, without lateral denticles.

Occurrence in Hawai'i. Kure, Maui, Midway, and the island of Hawai'i.

Published records. Hawaiian Islands in general (Attems, 1914, 1928). Island of Hawai'i (Nishida, 1994), Kona (Silvestri, 1904; Attems, 1909; Chamberlin, 1920).

Material examined. **HAWAI'I:** 2♀, Above Pu'ula'au, under rock, 8900 ft, 24 Feb 1975, "H.J."; 4♂, Kaluakakauka (Douglas Monument), 6040 ft, 26 Mar 1962, G.E. Haas; 1♀ **(here designated as Lectotypus of** *Lamyctes fulvicornis hawaiiensis* Silvestri), 2♀ (here selected as Paralectotypi of *Lamyctes fulvicornis hawaiiensis* Silvestri) labelled "*Lamyctes fulvicornis* (Mein.) var. *subproximus* Silv., cotypi!, Kona, Hawaii, 4000 ft, Perkins, VIII.1892", "Kona, Hawaii, 4000 ft., Perkins, VIII.1892" "04–10.28.3–5", "1904.X.28.3–5", together with the anonymous comment "This is apparently the specimen described in *Fauna Hawaiiensis* as var. *hawaiiensis*" (BMNH); 1♀, 1 juv. "*Lamyctes fulvicornis* (Mein) var. *subproximus* Silv., Kona, Hawaii, 4000 ft., Perkins, VIII.1892" (handwritten in china ink by F. Silvestri). **KURE:** 1♀, 19 Mar 1979, R. Grady (MZ). **MAUI:** 1♀, Haleakalā, 8000 ft, 4 Mar 1965, leaf litter, J.W. Beardsley; 1♂, Haleakalā, Kahalaku overlook, 2740 m, 28 Nov 1992, *Andropogon* litter and dirt, S.F. Swift; 1♂, nr. Pu'uhuau, Haleakalā, 5500 ft, 27 Apr 1945, E.C. Zimmermann (MZ); 1♂, Waipoli road jct, paved 6 sections, 10 Aug 1993, R.W. Baumann (BYU). **MIDWAY:** 13♀, Sand I, under leaves, 29 Jan 1955, C.F. Clagg.

Remarks. Attems (1928) thought *Lamyctes fulvicornis hawaiiensis* should be reexamined; later he (Attems, 1938) thought it was probably identical with *L. castanea* Attems from South Africa, or *L. neozelandica* Archey from New Zealand. Finally, Attems (1940) synonymized *L. f. hawaiiensis* under *L. africana*. The characters showed by the type specimens of *L. f. hawaiiensis*, here reexamined, falls however in the variation of *Lamyctes emarginatus* as redescribed by Archey (1937), especially for the distal sharp projection on anterior edge of the tibia which is present only on 1st–11th legs and not, as the original

description of *L. f. hawaiiensis* stated, also on 12th legs. Therefore, the synonymy proposed by Attems (1940) is here rejected and the new synonymy of *L. emarginatus* is proposed. *Lamyctes emarginatus* has been recorded from New Zealand, Kermadec I, and Chatham I (Archey, 1937); it is also known from Tasmania were it has been introduced (Mesibov, 1986). Two females from Midway have 3+2 spurs on gonopods.

Lamyctes coeculus (Brolemann)

Lamyctinus coeculus: Silvestri, 1909: 39. Chamberlin, 1920: 72. Attems, 1928: 62; 1938: 366. Nishida, 1994: 26.

Diagnosis. Up to 5.0 mm long; antennae usually with 24 articles; ocelli absent; prosternal teeth 3+3–4+4, lateral prosternal spine absent; all tergites without posterior projections; anterior tarsal articulations absent in 1st –12th legs; all legs with 2 accessory apical claws; tibia of 1st–11th legs with a distal sharp projection on its anterior edge; 15th legs long and slender; female gonopods with 2+2 conical spurs, claw narrow, without lateral denticles.

Occurrence in Hawai'i. O'ahu and Hawai'i.

Published records. Islands in general (Attems, 1938). O'ahu in general (Chamberlin, 1920; Nishida, 1994); Mt Tantalus, Honolulu (Silvestri, 1909; Attems, 1928).

Material examined. **HAWAI'I:** 2 juv, Mauna Ke'a, upper Wailuku Riv, under silversword, date and collector unknown. **O'AHU:** 1 ♀, Stream along Nu'uanu-Pali Drive, Norfolk Pine Grove, 17 Feb 1985, V. & B. Roth; 1 ♀, Lualualei, Halona Val., soil under shade, 465 m, 8 May 1996, S.F. Swift.

Remarks. Recorded from Afrotropical and Neotropical areas, this species is also present in Europe, were it is exclusively synanthropic (Eason, 1982). *Lamyctes coeculus* was originally described in *Lamyctinus*, which was synonymized under *Lamyctes* by Brolemann (1932). Several specimens were also taken at an unspecified Hawaiian location in soil with plants from Tahiti (Chamberlin, 1930).

Pleotarsobius heterotarsus (Silvestri)

Lamyctes heterotarsus Silvestri, 1904: 42, figs. 3–4.

Pleotarsobius heterotarsus: Attems, 1909: 12; 1914: 48, 56, 94; 1928: 63; 1938: 366. Chamberlin, 1920: 73. Nishida, 1994: 26.

Diagnosis (from Silvestri, 1904). Approximately 7.0 mm long; number of ocelli unknown; antennae with 19 articles; prosternal teeth 2+2, lateral prosternal spine absent; all tergites without posterior projections; anterior tarsal articulations absent in 1st –12th legs; coxal pores 1–2; all legs with 2 accessory apical claws; tibia of 1st–11th legs with a distal sharp projection on its anterior edge; 15th metatarsus plurisegmented (about 15 segments).

Occurrence in Hawai'i. Hawai'i.

Published records. Island of Hawai'i in general (Attems, 1928, 1938; Nishida, 1994), Kona (Silvestri, 1904; Attems, 1909, 1914; Chamberlin, 1920).

Material examined. None.

Remarks. Pleotarsobius heterotarsus is known only from the type specimen and has not been collected since 1892. It may be an endemic Hawaiian species, as it is not known to occur elsewhere.

Family Lithobiidae
Subfamily Ethopolinae

Bothropolys maluhianus Attems

Lithobius asperatus: Attems, 1903: 92. Silvestri, 1904: 323.

Bothropolys asperatus: Attems, 1914: 48. Nishida, 1994: 26.

Bothropolys maluhianus Attems, 1914: 48, 57, 99; 1938: 366. Nishida, 1994: 26.

Bothropolys oahuanus Chamberlin, 1920: 78.

Diagnosis (from Attems, 1903, 1914). About 20.0 mm long; antennae with 20 articles; about 20 ocelli on each side; prosternal teeth 7+7, prosternal spine lateral to lateral tooth; tergites 7, 9, 11 and 13 with posterior projections; 10–20 coxal pores irregularly arranged in about 3 rows; without VaC spine on 14th and 15th legs, latter without accessory apical claw; female unknown.

Occurrence in Hawai'i. O'ahu.

Published records. Islands of Hawai'i in general (Attems, 1914, 1938; Chamberlin, 1920). O'ahu in general (Silvestri, 1904; Nishida, 1994), Maluhia (Attems, 1903, 1914).

Material examined. None.

Remarks. This species is based on a single male that Attems (1903) first recorded as *L. asperatus* L. Koch. Attems (1914), recognizing that his specimen belonged to a different species, proposed *maluhianus* for it, and Chamberlin (1920), unaware of Attems' (1914) action, proposed *oahuanus* for the same specimen (see also Eason, 1972). Eason (1977) synonymized *oahuanus* under *maluhianus*. While possibly being an endemic Hawaiian species, he thought it might prove to be *B. rugosus* (Meinert), which has been recorded in the Hawaiian Islands and is native to China, Korea, Japan, and Philippines. Eason (1992) again suggested that *Bothropolys* may have been introduced to the Hawaiian Islands. No other records exist aside from the single male described by Attems (1903).

Bothropolys rugosus (Meinert)

Lithobius rugosus Meinert, 1872: 306. Silvestri, 1904: 323. Eason, 1974: 20, figs. 6–7.
Lithobius xanti: Stuxberg, 1875: 10. Silvestri, 1904: 323. Attems, 1938: 366.
Bothropolys rugosus: Attems, 1914: 48, 57, 99.
Ethopolys rugosus: Chamberlin, 1920: 78. Attems, 1938: 366.

Diagnosis. Up to 21.0 mm long; antennae with 20 articles; 18–23 ocelli on each side; prosternal teeth 7+7, lateral prosternal spines small and posteriolateral to lateral tooth; posterior projections feeble on T.6, broad but not prominent on T.7, and prominent and narrow on TT.9, 11, and 13; 13–23 coxal pores irregularly arranged in about 3 rows; VaC spine present on 15th legs; anterior tarsal articulations present in all legs; 15th legs without accessory apical claws; prefemur of 15th legs of male with a very feeble narrow dorsal sulcus, femur with a more distinct dorsal sulcus in his distal half, female gonopods with 2+2 conical spurs, claw narrow, without lateral denticles.

Occurrence in Hawai'i. O'ahu, Maui, Hawai'i.

Published records. Hawaiian Islands in general (Stuxberg, 1875; Silvestri, 1904; Attems, 1938). O'ahu in general (Meinert, 1872; Silvestri, 1904; Attems, 1914; Chamberlin, 1920; Eason, 1974).

Material examined. **HAWAI'I**: 1♀, Mauna Loa, primarily Stainback Hwy, *Metrosideros* to lower elevation, 6–8 Sep 1974, J. Jacobi. **MAUI**: 1♀, 'Iao Valley, Dec 1927, collector unknown; 1♀, Waihe'e, 16 Mar 1967, N.L.H. Krauss. **O'AHU**: 1♂, 1♀, Mt Tantalus, rotten log, 8 Nov 1923, S.C. Ball (MZ); 1♀, juv., Mt Tantalus, dead *koa*, 13 May 1928, E.H. Bryan, Jr.; 2♂, Mt Tantalus, 8 Jul 1928, N.L.H. Krauss; 1♂, Honolulu, slopes of Mt Tantalus, 10 Dec 1939, R.P. Currie (USNM); 1♀, Honolulu, Waikīkī, in yard, Jul 1964, M. Roth; 2♀, Pearl City, 28 Mar 1968, B. Chambers; 1♂, Nu'uanu, 18 Mar 1984, S.F. Swift. 4♀, Wai'anae Mts, 700 ft, 13 Apr 1933, E.H. Bryan; 2♂, Kamananui Val, 1 Oct 1933, N.L.H. Krauss.

Remarks. This species, also known from China, Korea, Japan, and the Philippines, properly belongs in *Bothropolys*, as *Ethopolys* is confined to an area west of the Rocky Mountains in the continental United States (Eason, 1992). Eason (1974, 1977) suggested that *B. rugosus* had been introduced in the Hawaiian Islands from either Japan or the mainland of eastern Asia.

Subfamily Lithobiinae

Lithobius (Lithobius) hawaiiensis Silvestri

Lithobius hawaiiensis Silvestri, 1904: 324. Eason, 1977: 485, figs. 1–6. Nishida, 1994: 26.
Archilithobius hawaiiensis: Attems, 1914: 48, 57.
Kauabius hawaiiensis: Chamberlin, 1920: 78.
Lithobius hawaiensis: Attems, 1938: 366.

Diagnosis. Up to 20.0 mm long; lateral marginal interruptions of head distinct; antennae with 27–29 articles; ocelli 17–19 on each side; prosternal teeth 2+2, lateral prosternal spine setiform; 1st tergite narrower than head; all tergites without posterior projections; anterior tarsal articulations distincts, 15th accessory apical claw well developed; VaC spine present on 14th and 15th legs; 15th legs of males longer and more slender than those of female, with a feeble dorsal distal setose protuberance on the femur; female gonopods with 2+3 or 3+3 spurs and tridentate claws.

Occurrence in Hawai'i. Kaua'i, Maui, O'ahu, and Hawai'i.

Published records. Islands of Hawai'i in general (Attems, 1914, 1938). Kaua'i in general (Nishida, 1994), Makaweli and Kahōluamano (Silvestri, 1904; Chamberlin, 1920; Eason, 1977).

Material examined. **HAWAI'I:** 1♀, "Kona, Hawaii, 3000 ft, Perkins, 9.1892" (printed), "*Lithobius hawaiiensis* Silv., Juvenos, Kona, Hawaii, 3000 ft, Perkins, IX.1892" (handwritten, china ink, ?Silvestri's hand). **KAUA'I:** 1♂, Jul–Aug 1917, C.N. Forbes; 1♂, Halemanu, 8 Nov 1919, Cooke (MZ). **MAUI:** 1♀, "coll. Perkins, ? Maui" (printed), "? *Lithobius hawaiiensis* Silv., Defectous example !, Maui, Perkins" (Silvestri's hand); 1♂,1♀, Haleakealā Natl. Park, ridge E of Kīpahulu Valley, moss, 6100 ft, 24 Jun 1981, W.C. Gagné. **O'AHU:** 3♂, 1♀, Ko'olau Mts, Poamoho Trail, 2 Jun 1977, litter nr. summit, F.G. Howarth (MZ); 1 , Kawailoa Forest Res., 75 m, 25 Aug 1973, mossy leaf litter, W.C. Gagné; 1♂, Konahuanui, 3000 ft, 9 May 1943, E.C. Zimmerman; 2♂, Mt Ka'ala, 3500–4000 ft, beating vegetation, 11 Apr 1948, C.H.S. Dybas; 1♀ imm, Mt Ka'ala, 4000 ft, moss on tree, 19 Apr 1966, C.M. Yoshimoto; 1♂,2♀ imm, Mt Ka'ala, on moss, 21 Jun 1967, C.M. Yoshimoto; 1♀ imm, Mt Ka'ala, moss on tree, 1700 m, summit, 18 Jan 1983, F.G. Howarth.

Remarks. Lithobius hawaiiensis was proposed by Silvestri (1904) for 2 specimens collected on Kaua'i by R.C.L. Perkins and is known only from the Hawaiian Islands. The species was redescribed by Eason (1977) based on the types, the only specimens previously known. In the present material are 2 females, 1 from Maui and 1 from the island of Hawai'i, that belong to the Perkins's original series. They were identified as *L. hawaiiensis* by Silvestri, tentatively so for the female from Maui but were not included in his 1904 paper. Both specimens are in poor condition but correspond well with Eason's (1977) redescription; that from Maui bears 3+3 gonopodal spurs.

Regarding the other specimens we examined, those from O'ahu are 11.0–12.0 mm long; they have 22–26, frequently 23, articles on the antennae; and the ocelli are 1+4,4,4, 1+4,4,5, 1+4,5,4,3 or 1+4,5,5. The male from Kawailoa Forest Reserve has 3+2 prosternal teeth because of a small internal supranumeral tooth on 1 side; the coxal pores 3,4,4,3; 3,5,4,4; 4,6,6,4; or 5,5,4,4; the VaC spine is present on the 14th and 15th legs or only on the latter; the female gonopods have 3+3 spurs; and the male gonopods are large, with only 1 article bearing 2 long apical setae. The specimen from Konahuanui has no VaC spine; females from Mt Ka'ala has 2+2 or 2+3 spurs on gonopods.

Eason (1977) concluded that this species is probably neither endemic nor indigenous to the Hawaiian Islands. He suggested that it is an immigrant from an unknown area in eastern Asia, where the chilopod fauna is still poorly known.

Lithobius (Lithobius) forficatus (Linnaeus)

Lithobius forficatus: Attems, 1938: 366.

Diagnosis. Up to 30.0 mm long; lateral marginal interruptions of head distinct; antennae with

35–43 articles; ocelli 20–30 on each side; prosternal teeth 5+5, 6+6, 6+7, lateral prosternal spine setiform; T.1 narrower than head; TT.9, 11, 13 with prominent posterior projections; anterior tarsal articulations distinct; 15th accessory apical claw absent; VaC spine absent; 15th legs long, slender in both sexes; female gonopods with 2+2 conical spurs, claws tridentate.

Occurrence in Hawai'i. Hawaiian islands in general, no specific island has been recorded.

Published records. Hawaiian islands in general (Attems, 1938).

Material examined. None.

Remarks. This west Palaearctic chilopod has also been introduced to Newfoundland, North and South America, and St. Helena (Eason, 1964). Also recorded from Singapore and New Zeland (Attems, 1914). The only Hawaiian record is the general citation by Attems (1938), and *L. forficatus* does not appear to be established in the archipelago.

Lithobius (Lithobius) obscurus Meinert **New state record**

Diagnosis. Up to 19.0 mm long; lateral marginal interruptions of head distinct; antennae with 26–28 articles; ocelli 14–18 on each side; prosternal teeth 2+2, lateral prosternal spine setiform, irregular shoulders present lateral to spine; TT.9, 11, 13 with triangular posterior projections; anterior tarsal articulations distinct; 15th accessory apical claw present but very small; VaC spine absent; 15th legs with 1 or 2 supplementary posterior prefemoral spines; male with 15th femur bearing prominent wart-like outgrowth arising from shallow circumscribed depression; female gonopods with 2+2 conical spurs, claws tridentate.

Occurrence in Hawai'i. The island of Hawai'i.

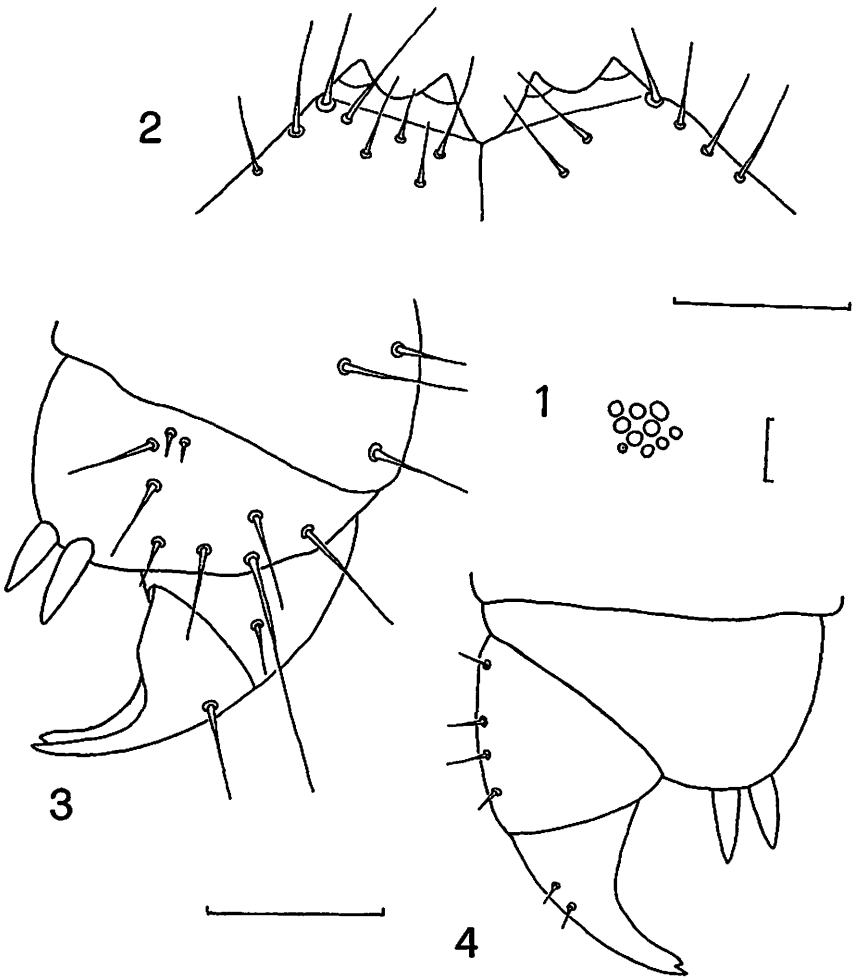
Published records. None.

New records. **HAWAI'I:** 1 ♂, Hāmākua Forest Reserve, 0.25 mi E of Waikoekoe, 28 Aug 1963, *'ōhi'a*-fern debris, 2200 ft, G.E. Haas.

Remarks. This species is naturally widespread in Canary Islands, Azores, Morocco, and southern Spain; it has been introduced to Bermuda, South America, New Zealand, Australia, and South Africa (Eason, 1973, 1974, 1991; Eason & Ashmole, 1992). Attems (1914) erroneously recorded it from Philippines. The single immature male reported here is the first record for the Hawaiian Islands.

Lithobius (Lithobius) sp. **New state record**

Description. (Figs. 1–4). Size 13.0 mm long and 1.6 mm broad at T.10. Color pale brown with narrow longitudinal, feebly pigmented area in middle of tergites. Head smooth, almost as long as broad, broader than T.1, posterior border feebly sinuate, with median thickening, projection of lateral marginal interruptions distinct. Antennae 5.1–5.2 mm long, with 25–29 articles, all slightly elongated, last article 2.5 × longer than broad. Ocelli (Fig. 1) 1+3,3,2 (left side), 1+2,3,2 (right side) not well pigmented, arranged in irregular rows, principal ocellus large, suboval, posterosuperior ocellus smaller than principal ocellus but larger than secondary ones. Organ of Tömösváry (Fig. 1) smaller than secondary ocellus, close to ocelli. Prosternum (Fig. 2) with 2+2 teeth, porodont setiform, free borders slope obliquely without shoulders lateral to porodont. Tergites smooth, T.1 narrower than T.3, trapeziform, posterior border straight; lateral borders of TT.3, 5, 8, 10 slightly convergent posteriorly, those of TT.12, 14 convergent posteriorly, those of T.7 parallel; posterior borders of TT.3, 7 straight, those of TT.5, 8, 10, 12 slightly sinuate or sinuate, those of T.14 concave; posterior angles of TT.3, 5, 8, 10 rounded, those of T.7 blunt, those of TT.12, 14 angulate; posterior borders of TT.2, 4, 6, 9, 11, 13 straight; lateral borders of TT.2, 4 rounded, those of TT.6, 9, 11, 13 parallel; posterior angles of TT.2, 4, 6 blunt, no triangular projections at posterior angles of TT.9, 11, 13 whose posterior angles are blunt in TT.9 13 and angulate in T.13. Coxal pores 3,5,5,5, circular, small, separated from each other by own diameter or less; diameter of 1–2 proximal pores smaller than that of distal ones. Tarsal articulations of 1st–13th legs not fused; 14th legs 3.5 mm long, not swollen; 15th legs



Figs. 1-4. *Lithobius (Lithobius)* **sp. 1, left ocelli and organ of Tömösváry. 2, dental margin of prosternum, ventral view. 3, left female gonopod, ventral view. 4, left female gonopod, dorsal view. Scale bar = 0.2 mm.**

5.0 mm long, not swollen, apical claw long, accessory apical claw present, 1/2 as long as apical claw; glandular pores on internal side of 13th–15th legs. Spinulation in Table 1. Gonopods (Figs. 3–4) with 2+2 cylindro-conical unspaced spur, claw long, with distinct lateral denticle on internal side; dorsolateral setae smaller than general setae, 4 in a line on 2nd article, 2 smaller ones on 3rd.

Occurrence in Hawai'i. O'ahu.

Published records. None.

Table 1. Spinulation of *Lithobius* sp.

	Ventral					Dorsal				
	C	t	P	F	T	C	t	P	F	T
1	-	-	p	am	m	-	-	mp	p	a
2	-	-	p	amp	m	-	-	mp	ap	a
3-6	-	-	p	amp	m	-	-	mp	ap	ap
7-11	-	-	mp	amp	am	-	-	amp	ap	ap
12	-	-	mp	amp	am	-	-	amp	p	p
13	-	m	amp	amp	am	a	-	amp	p	p
14	a	m	amp	amp	am	a	-	amp	p	p
15	a	m	amp	amp	m	a	-	amp	p	-

Material examined. **O'AHU:** 1♀, Ko'olau Mts, Wiliwilinui Range, 2500 ft, 13 Jan 1970, sweeping *Ilex anomala* at night, W.C. Gagné.

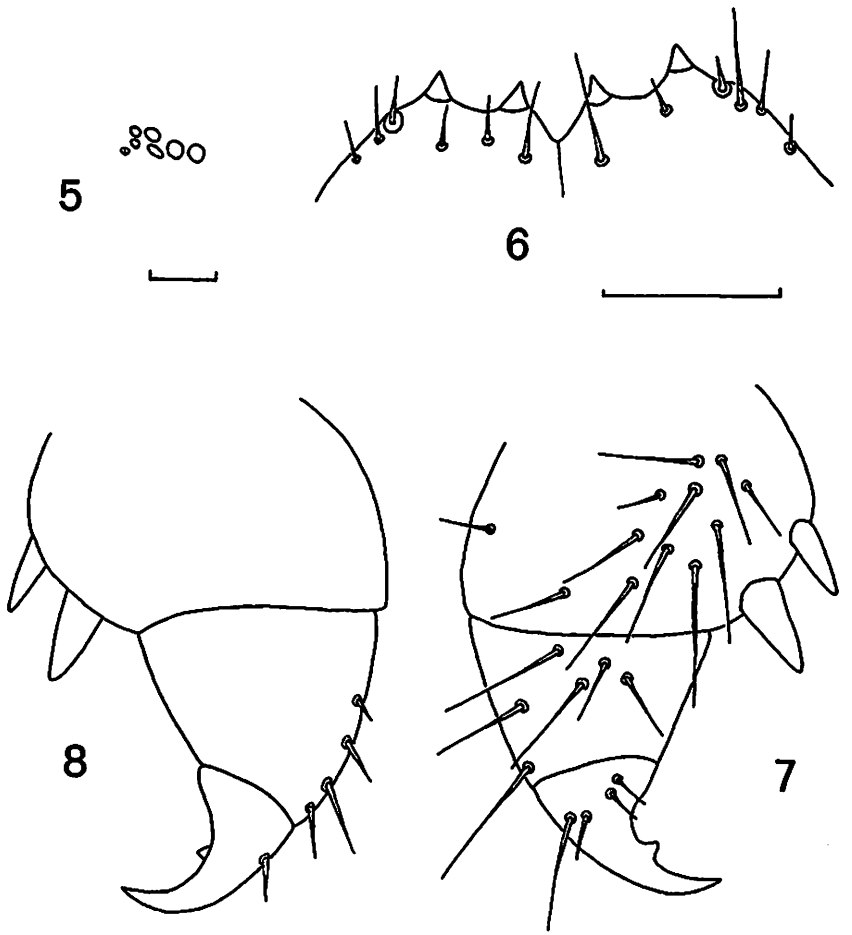
Remarks. This specimen is quite different from any of the species listed in this paper and does not seem to belong to any of those included in Attems's (1914) or Chamberlin's (1920) catalogues of the Indo-Australian fauna. It is not referrable to any of the species recorded by Chamberlin (1930, 1931, 1938, 1940, 1941, 1944) as occasionally intercepted in quarantine in the Hawaiian islands. As no more specimens of either sex are available, we cannot establish its identity.

Lithobius (Sigibius) sp. cfr. ***bullatus*** Eason **New state record**

Description (Figs. 5–8). Size 8.5 mm long, 1.5 mm broad at T.10. Color light brown. Head smooth, 1.1 mm broad, as broad as long, as broad as T.1 and T.5, posterior border straight, posterior marginal ridge with median thickening, projection of lateral marginal interruption distinct. Antennae 2.0–2.5 mm long, left antenna damaged at 20th article, right antenna with 27 articles; 1st 3 articles of each antenna large, longer than broad, intermediate articles smaller, as long as broad, last 3 articles of left antenna elongate, distal articles of right antenna as long as broad; terminal article of right antenna 2 × as long as broad. Ocelli (Fig. 5) 1+6 on each side, pigmented, arranged irregularly, close to each other; principal ocellus followed posteriorly by another ocellus equal in size; other 5 ocelli smaller, forming main mass. Organ of Tömösváry (Fig. 5) small, smaller than 1 small ocellus, close to main ocellar mass. Prosternum (Fig. 6) broad, with 2+2 teeth, porodont setform, stout; borders sloping obliquely lateral to porodont, without shoulders but with trace of convexity. T.1 smooth, narrower than T.3, trapeziform with posterior border straight; other large tergites smooth, posterior borders of TT.3, 7 straight, those of TT.5, 8, 10 slightly sinuate, those of TT.12, 14 emarginate, posterior angles of TT.3, 5, 8 rounded, those of TT.10, 12, 14 are slightly rounded, those of T.7 angulate, lateral borders of TT.3, 5, 7 parallel, those of TT.8, 10, 12, 14 progressively convergent posteriorly; TT.9, 11, 13 with posterior angles rounded, without posterior triangular projections. Intermediate tergites with lateral borders parallel, posterior angles blunt, posterior borders straight. Coxal pores 5,5,5,4, circular, separated from each other by own diameter. Legs 1st–12th with tarsal articulation fused; 13th legs missing;14th legs 2.5 mm long, slightly swollen; 15th legs 3.0 mm long, slightly swollen, accessory apical claw present. Glandular pores on internal side of 14th and 15th legs. Spinulation in Table 2. Female gonopods (Figs. 7–8) with 2+2 conical spaced spurs, slightly elongate, claw broad, with proximal lateral denticle on external side; dorsolateral setae as stout as general setae on 2nd article, 4 in a line, slightly shorter distal 5th more medially placed, 3 smaller on 3rd.

Occurrence in Hawai'i. O'ahu.

Published records. None.



Figures 5–8. *Lithobius (Sigibius)* sp. cf. *bullatus* Eason, 1993. 5, left ocelli and organ of Tömösváry. 6, dental margin of prosternum, ventral view. 7, right female gonopod, ventral view. 8, right female gonopod, dorsal view. Scale = 0.2 mm.

Material examined. O'AHU: 1 ♀, Stream along Nu'uanu-Pali Dr, Norfolk Pine Grove, 17 Feb 1985, V. & B. Roth.

Remarks. Lithobius bullatus was proposed by Eason (1993) on the basis of a male and 2 females collected in Hong Kong. The species also occurs in southern China (Eason, 1992). As *Sigibius* Chamberlin is essentially a west Palaearctic subgenus, the species is considered to be introduced to east Asia (Eason, 1993). There is little doubt that *L. bullatus* has been introduced by commerce at the Hawaiian Islands.

The female from O'ahu agrees well with the original description, but the prosternum is more prominent and the teeth are sharper, and the spur of the gonopods seems to be

Table 2. Spinulation of *Lithobius* sp. cf. *bullatus* Eason, 1993; 13th legs damaged: spines in parentheses are hypothesized.

	Ventral					Dorsal				
	C	t	P	F	T	C	t	P	F	T
1	-	-	p	am	m	-	-	p	a	a
2	-	-	p	am	m	-	-	p	ap	a
3	-	-	p	am	m	-	-	p	ap	ap
4-7	-	-	p	am	am	-	-	ap	ap	ap
8	-	-	p	amp	am	-	-	ap	ap	ap
9-10	-	-	mp	amp	am	-	-	ap	ap	ap
11	-	-	mp	amp	am	-	-	amp	ap	ap
12	-	-	mp	amp	am	-	-	amp	p	ap
13	-	?	?	?	?	a	(-)	(amp)	(p)	?
14	-	m	amp	am	-	a	-	amp	p	-
15	-	m	amp	am	-	a	-	amp	p	-

more elongate (cf. Eason, 1993: figs. 16, 18). Other differences include: 1+6 ocelli instead of 1+5, coxal pores 4–5 instead of 5–6 (in females), single dorsolateral seta on 3rd article of the gonopod instead of 5 smaller than those of 2nd article. Since the main diagnostic features of *L. bullatus* are on the male 15th femur (with a dorsal depression) and tibia (with a dorsal sulcus and a distal node), the identity of this specimen cannot be determined with certainty until more material of both sexes is available.

Lithobius* (*Monotarsobius*) *moananus (Chamberlin) **New combination; New island records**

Onebius moananus Chamberlin, 1926: 92. Attems, 1938: 366. Butler & Usinger, 1963:239. Nishida, 1994: 26.

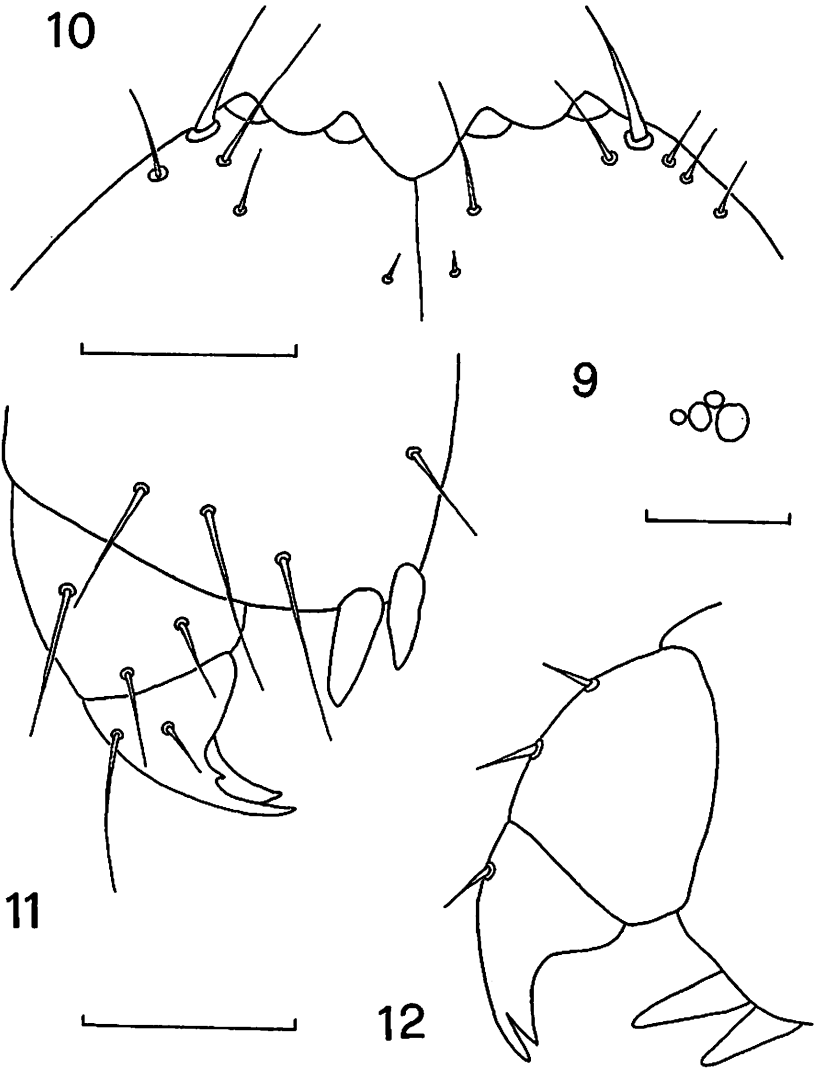
Diagnosis (Figs. 9–12): 5.5 mm long; lateral marginal interruptions of head distinct; antennae with 20 articles; ocelli 5–6; prosternal teeth 2+2, lateral prosternal spine setiform; all tergites without posterior projections; anterior tarsal articulations not distincts; 15th accessory apical claw absent; VaC spine absent; female gonopods with 2+2 spurs and tridentate claws.

Occurrence in Hawai'i. Kure, Maui, Midway, Moloka'i, and O'ahu.

Published records. Islands of Hawai'i in general (Attems, 1938). Kure (formerly Ocean) Island (Chamberlin, 1926; Butler & Usinger, 1963; Nishida, 1994).

New records. **KURE**: 3♀, "Ocean I, 9.23, 4.18.23", "D.T. Fullaw. coll." (printed), "*Onebius moananus* Chamb. 22" (china ink, handwritten by R.V. Chamberlin). **MAUI**: 1♂, West Mountains, 7 Jan 1932, N.L.H. Krauss. **MIDWAY**: 2♀, Eastern I, 15 May 1997, under rocks, G.M. Nishida (MZ). **MOLOKA'I**: 1♀, Pu'ulilolilo, 3000 ft, Mar 1965, T. Suman. **O'AHU**: 1♀, Ko'olau Mts, Poamoho Trail, litter nr. summit, 2 Jun 1977, F.G. Howarth.

Remarks. Chamberlin (1926) erected the genus *Onebius* to accommodate this species. Eason (1977) thought that *O. moananus* was identical with *Monotarsobius sasanus* Murakami from Japan but, since *M. sasanus* is characterized by the structure of the male 15th leg, he did not proposed a formal synonymy. The single male from Maui, here identified as *moananus*, cannot be used to clarify the identity of the species because the 15th legs are missing. Eason (1992) further suggested that *Onebius* is a synonym of *Monotarsobius* Verhoeff; however, he did not formally associate this names. Although Nishida (1994) cited *O. moananus* as an endemic Hawaiian species, we follow Eason (1977) in considering *O. moananus* as probably an immigrant from Japan, since Kure is



Figs. 9-12. *Lithobius (Monotarsobius) moananus* (Chamberlin, 1926). **9**, left ocelli. **10**, dental margin of prosternum, ventral view. **11**, right female gonopods, ventral view. **12**, right female gonopod, dorsal view. Scale bar = 0.2 mm for fig. 9; 0.4 mm for figs. 10-12.

Table 3. Spinulation of *Lithobius moananus* (Chamberlin, 1926), from Kure, female 6.0 mm long.

	Ventral					Dorsal				
	C	t	P	F	T	C	t	P	F	T
1	-	-	-	-	m	-	-	-	-	a
2-3	-	-	-	-	m	-	-	-	a	a
4-8	-	-	-	-	m	-	-	-	ap	a
9-11	-	-	-	am	m	-	-	-	ap	ap
12	-	-	p	am	m	-	-	-	ap	ap
13	-	-	mp	am	m	-	-	mp	p	a
14	-	m	mp	m	-	-	-	mp	-	-
15	-	m	mp	m	-	a	-	mp	-	-

the most outlying Hawaiian islet and is only 4000 km east of Yokohama.

This species seems also close to *Nipponobius cepeus* Chamberlin especially in the general size, the number of ocelli, the number of coxal pores, the spinulation of 14th and 15th legs, and the general arrangement of the female gonopods, although 15th accessory apical claw is present in *N. cepeus*. It was proposed for a single female taken in quarantine (see Deletions) at Honolulu in plant material from Japan (Chamberlin, 1940).

In the material from Bishop Museum examined here are 3 female from Kure identified as *Onebius moananus* by R.V. Chamberlin. As Chamberlin's original description is brief and without illustrations, and since these specimens seems to belong to the original series, although not designed as type, we redescribe them below.

Desription: Size 4.0–6.0 mm long and 0.7 mm broad at T.10. Color light brown. Head smooth, as long as broad (0.6 mm), larger than T.1, posterior border straight, with median thickening, projection of lateral marginal interruptions present even if not well evident. Antennae 1.0–1.2 mm long, with 18–19 articles, last article elongate. Ocelli (Fig. 9) 1+2,2, 1+2,1 or 1+3, pigmented, in 1 or 2 rows, principal ocellus of same size or slightly larger than other, posterosuperior ocellus of same size as secondary ocelli. Organ of Tömösváry not visible. Prosternum (Fig. 10) with 2+2 small teeth, porodont setiform, lateral borders sloping obliquely, without shoulders. T.1 smooth, slightly narrower than T.3, trapeziform, posterior border straight; other large tergites smooth, with posterior borders slightly sinuate in TT.3, 5, 8, 10, straight in T.7, 12, 14, lateral borders parallel in TT.3, 7, 5, progressively posteriorly convergent in TT.8, 10, 12, 14; posterior angles rounded in TT.3, 5, 8, 10, blunt in T.7, angulate in TT.12, 14; lateral borders parallel in TT.2,4, 6, posterior angles angulate in TT.2, 4, rounded in T.6, posterior borders straight in TT.2, 4, 6; TT.9, 11, 13 with parallel lateral borders, posterior angles rounded, without posterior projections, posterior borders straight. Coxal pores 1,2,2,2, circular, those of 13th–15th legs separated by more than their diameter. Tarsal articulations fused in 1st–13th legs;14th legs 1.2 mm long, slightly swollen; 15th legs 2.0 mm long, slightly swollen (presence/absence of accessory apical claw not remarkable because all specimens have 15th legs missing or damaged); glandular pores on internal side of 13th–15th legs. Spinulation in Table 3. Gonopod (Figs. 11–12) with 2+2 conical spur, internal one smaller, claw wide, tridentate, with lateral denticles equal in size; dorsolateral setae almost as stout as general setae, 2 in line on 2nd article, single seta on 3rd.

Deletions

A number of Hawaiian lithobiomorph records represent samples taken in quarantines of plants from distant parts of the world, and 7 new species were inadvisedly proposed for intercepted specimens. These records show the ease with which exotic arthropods are unknowingly and accidentally brought into the Hawaiian islands, where they escape and

establish reproducing populations. There is no evidence that any of these species have become established (Eason, 1977), so we officially delete them from the Hawaiian fauna. In addition to these species, unidentifiable forms of *Lithobius* and *Lamyctes* have been discovered in soil with plants from China and Japan, respectively (Chamberlin, 1930).

Family Henicopidae
Subfamily Henicopinae
1. *Lamyctes fulvicornis* Meinert. *Lamyctes fulvicornis*, probably an Australian species, has been introduced throughout temperate parts of North America, plus Greenland, New Foundland, the Canary and Azores Islands, Iceland, Faroe Islands, Europe, north and east Africa, and the Near East; its wide dispersal is attributed to its ability to reproduce parthenogenetically (Eason, 1992). Chamberlin (1930) recorded *L. fulvicornis* from an unspecified Hawaiian location in soil with plants from Los Angeles, California. It has not been encountered in a Hawaiian environment, and we therefore delete it from the islands' fauna.
Family Lithobiidae
Subfamily Ethopolyinae
1. *Bothropolys migrans* Chamberlin. Chamberlin (1930: 69) proposed this species for 4 specimens taken at an unspecified site on *Dioscorea* sp. from China.

Subfamily Lithobiinae
2. *Nipponobius sinensis* Chamberlin. Chamberlin (1930: 68) proposed this species for 2 adult males taken at an unspecified site on *Lillium* sp. from China.
3. *Nipponobius cepeus* Chamberlin. Chamberlin (1940: 50) proposed this species for a specimen taken at Honolulu in packing with *Vandateres grandiflora* from Japan.
4. *Nipponobius australis* Chamberlin. Chamberlin (1944: 64) proposed this species for a female taken at Honolulu in packing with *Epidendrum* sp. from Australia.
5. *Lithobius borealis* Meinert. This species was encountred at an unspecified site in packing with orchids from England (Chamberlin, 1930: 68).
6. *Oabius pylorus* Chamberlin. This species was encountred at an unspecified site in soil with chives from San Francisco (Chamberlin, 1930: 68).
7. *Tidabius vector* Chamberlin. Chamberlin (1931: 190) proposed this species for a male taken at Honolulu in packing with orchids from Mexico.
8. *Tidabius emporus* Chamberlin. Chamberlin (1941: 3) proposed this species for a female taken at Honolulu in packing with *Rhynchostylis retusa* from Japan.
8. *Australobius* (*Malayobius*) *vians* Chamberlin. Chamberlin (1938: 628) proposed this species, erecting the subgenus *Malayobius* to accommodate it, for a female possibly a molt short of maturity, which was taken at an unspecified site from the "Malay States". A male of a second species of this "group" was taken at Honolulu a year later, but he chose not to describe it.

Acknowledgments
We thank Sabina Swift (BPBM), Janet Margerison (BMNH), Jonathan Coddington (USNM), and Richard W. Baumann (BYU) for loaning samples in their charge. The second author also thanks Dr. Swift for arranging travel to Hawai'i, to examine the Bishop Museum's chilopod holdings and for numerous courtesies and kindnesses extended during this time.

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Records of the Hawaii Biological Survey for 1999
Part 1: Articles

Table of Contents

(Records of the Hawaii Biological Survey for 1999. Part 2: Notes, are in *Bishop Museum Occasional Papers* 64).