

**RECORDS OF THE
HAWAII BIOLOGICAL SURVEY
FOR 1999
Part 2: Notes¹**

This is the second of 2 parts to the *Records of the Hawaii Biological Survey for 1999* and contains the notes on Hawaiian species of plants and animals including new state and island records, range extensions, and other information. Larger, more comprehensive treatments are treated in the first part of this *Records* [Bishop Museum Occasional Papers 63].

New plant records from Maui, O'ahu, and Hawai'i Islands

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This is the fourth in a continuing series of reports by Maui Pineapple Co./Pu'u Kukui Watershed staff for the *HBS Records* documenting new plant records for the Hawaiian flora. This year, we discuss 35 taxa, all but 1 of which are nonindigenous. There is 1 new state record, 5 new naturalized records, 25 new island records (all but 3 from Maui), and 6 significant range extensions. Many of these species are of little consequence; a few are troublesome (i.e., *Solanum capsicoides*); some are already serious pest plants (e.g., *Passiflora mollissima*), while others are likely to become management problems in the future (*Ficus* spp.). All voucher specimens are deposited at Bishop Museum's Herbarium Pacificum (BISH).

Acanthaceae

***Asystasia gangetica* (L.) T.Anderson New island record**

According to Wagner *et al.* (1999: 168), this taxon has been documented from Midway Atoll, Kaua'i, O'ahu, Moloka'i, and Maui but probably occurs on all of the main islands. It has now been collected on Hawai'i.

Material examined: **HAWAI'I:** North Kona District, Kailua-Kona, roadside weed on Ali'i Drive, flowers purple, 12 m, 28 Nov 1998, *Oppenheimer H119820*; same date and locality, flowers white, *Oppenheimer H119821*.

Amaranthaceae

***Alternanthera pungens* Kunth New island record**

Common on O'ahu, Moloka'i, and Hawai'i (Wagner *et al.*, 1999: 184), Khaki weed is also widespread, at least on West Maui. It has also been documented from Kaua'i (Lorence & Flynn (1999: 3).

Material examined: **MAUI:** West Maui, Wailuku District, North side of Hāna Hwy, West of Kanahā Pond, growing in an empty lot, 6 m, 2 Nov 1998, *Oppenheimer H119810*; South side of Hāna Hwy, South of Kanahā Pond, roadside weed, 6 m, 2 Nov 1998, *Oppenheimer H119811*; Waikapu, parking lot weed near intersection of Routes 30 & 31, 37 m, 28 Aug 1999, *Oppenheimer H89940*; Lahaina District, Mailepai, common roadside weed along HonoaPi'ilani Hwy, North of Kahanā Kai Bridge, near gate to pineapple fields, 18 m, 6 Aug 1999, *Oppenheimer H89909*.

1. All notes in this issue constitute contribution No. 2000-017 to the Hawaii Biological Survey.

Araceae***Xanthosoma roseum* Schott****New island record**

The first documentation of this aroid was by Staples & Woolliams (1997: 13), who cited collections from Kaua'i and O'ahu. Although they reported observations by R. Hobdy on Maui, the following collections are the first from that island.

Material examined: MAUI: East Maui, Makawao District, bad weed spreading down gulch to sea, 27 Feb 1948, *Degener 20,102*; Hāna District, Keanae, North of Hāna Hwy, between the shore and the road around Ke'anae peninsula, flowering, 3 m, 14 Jun 1999, *Oppenheimer H69912*; West Maui, Lahaina District, Honokōhau Valley, growing along a dirt road in the Northern, lower part of the valley, 49 m, 6 Jul 1999, *Oppenheimer H79907*.

Asteraceae***Ageratum houstonianum* Mill.****New island record**

Wagner *et al.* (1999: 256) document this species from the islands of Kaua'i, O'ahu, and Hawai'i. It is now known from Maui.

Material examined: MAUI: East Maui, Hāna District, Nāhiku, common roadside weed along road to shore, North of Hāna Hwy, 98 m, 13 Jun 1999, *Oppenheimer H69910*.

Erigeron bellioides* DC.*Range extension**

This diminutive species was reported from O'ahu and Central and East Maui (Wagner *et al.*, 1999: 314; Nagata (1995: 11). We now cite collections representing a significant range extension to West Maui. An additional population has been observed, but not vouchered, at the Wo Hing Chinese Temple on Front St. in Lahaina, also in a lawn.

Material examined: MAUI: West Maui, Lahaina District, Nāpili, weed in lawn near North end of Nāpili Bay, 9 m, 15 Sep 1999, *Oppenheimer H99911*; Honokahua, lawn weed at Honolulu Store, 61 m, 27 Sep 1999, *Oppenheimer & Bartlett H99917*.

Florestina tripteris* DC.*New state record**

This is the first record of this genus in the Hawaiian Islands. It is native to South-Central Texas and adjacent Mexico (Turner, 1963: 27–46), where it grows mostly along roadsides and disturbed fields, which is consistent with the collection cited here. *Florestina tripteris* is an erect annual, 15–60 cm tall, lower leaves simple and opposite, the upper ones alternate and trifoliate (rarely with 5 leaflets), pubescent; inflorescence densely glandular with short trichomes, a subcorymbose cyme with 5 to numerous heads, these (10) 15–25-flowered, the florets white, distinctly zygomorphic; achenes 3–6 mm long, 4-sided, with appressed hairs; pappus of 8–10 scales to 2 mm long, broadly rounded to truncate at apex, without terminal awns or mucros.

Material examined: MAUI: West Maui, Lahaina District, Ku'ia, growing along an old road in canefield, south of Lahainaluna High School, 159 m, 15 Mar 1999, *Oppenheimer H39908*.

Palafoxia callosa* (Nutt.) Torr. & A.Gray*New island record**

In Hawai'i, this taxon was only known to be naturalized on Moloka'i (Wagner *et al.*, 1999: 346). It has now been collected on Maui.

Material examined: MAUI: West Maui, Lahaina District, Ku'ia, growing along a road in an old canefield, 165 m, 15 Mar 1999, *Oppenheimer H39907*.

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

Previously reported as sparingly naturalized on Kaua'i, Oahu, and Lāna'i (Wagner *et al.*, 1999: 388), the cat's-claw climber is here documented from Maui, where it covers the ground and climbs trees in alien-dominated coastal forest.

Material examined: **MAUI:** West Maui, Lahaina District, Honolua Bay, near the road, 6 m, 24 Aug 1999, *Oppenheimer H89936*.

Buddleiaceae

***Buddleia madagascariensis* Lam.**

New island record

Wagner *et al.* (1999: 416) stated that this species is naturalized on the island of Hawai‘i and cited a collection from Maui (*Ishikawa 201*, BISH, HLA) made in 1972 from cultivated or escaped plants along the Hāna Hwy. One of the specimens cited here was made along the Hāna Hwy from a population that does not appear to be cultivated or escaped, being well removed from any residence and over a half-mile from the nearest State Park. Plants were observed on both sides of the road. It has also recently been documented by Lorence & Flynn (1999: 4) as occurring on Kaua‘i.

Material examined: **MAUI:** East Maui, Hana District, East of Pua‘aka‘a State Park on the South side of Hāna Hwy, 366 m, 14 Jun 1999, *Oppenheimer H69911*; Makawao District, Waiakoa, along Kula Hwy, south of Copp Rd, both sides of Hwy, on the east side growing down in a gully with all non-native taxa, 872 m, 1 Aug 1999, *Oppenheimer H89908*; Waiakoa, along Upper Kula Hwy, near the 8 mile marker, 1067 m, 28 Aug 1999, *Oppenheimer & Perlman H89942*.

Caricaceae

***Carica papaya* L.**

New island record

Sparingly naturalized on Kaua‘i, Moloka‘i, and Hawai‘i, but probably some of the other main islands (Wagner *et al.*, 1999: 497), we report here collections from both East and West Maui.

Material examined: **MAUI:** East Maui, Hāna District, Ka‘uiki, 0–118 m, 21 Oct 1987, *Flynn & Bub 2517*; West Maui, Lahaina District, Honokahua Valley, East side of stream on steep slope, different size classes observed, some on nearly vertical rock faces, 293 m, 21 May 1999, *Oppenheimer H59918*.

Casuarinaceae

***Casuarina glauca* Siebold ex Spreng.**

New island record

Planted by foresters on all the main islands except Ni‘ihau (Wagner *et al.*, 1999: 529) but known to be spreading by root suckers only on Lāna‘i and O‘ahu, we here report a specimen from a Maui population that is also spreading vegetatively.

Material examined: **HAWAI‘I:** North Kohala Dist, Kalala ahupua‘a, Lāhikiola cinder cone, 3000–3300 ft [914–1005 m], small grove on the south side of the cinder cone, spreading by root sprouts, 13 Mar 1989, *P.M. Burch LI07* (BISH 579940). **MAUI:** West Maui, Kealalaloa Ridge, ca. 610 m, pastureland, forming extensive patches by vegetative means, 8 Mar 1988, *W.L. Wagner, C. Imada & W. Takeuchi 5856* (BISH 529839); Lahaina District, Honolua, growing on a slope near a road in pineapple field, forming dense stands, 207 m, 7 Sep 1999, *Oppenheimer H99906*.

Clusiaceae

***Clusia rosea* Jacq.**

New island record

This is a popular and widely planted ornamental tree. Wagner *et al.* (1999: 543) report it as becoming naturalized on Kaua‘i, O‘ahu, and Hawai‘i. Now it is spreading and becoming established outside of cultivation on Maui as well. Seedlings have also been observed, but not collected, at the foot of Kapilau Ridge, Wailuku District, West Maui, at 244–305 m, in secondary forest, and along roadcuts and as epiphytes on *Ficus microcarpa* in Honokahua, Lahaina District, at 12–24 m.

Material examined: **MAUI:** West Maui, Lahaina District, Honokahua, near the intersection of Office Rd and Lower HonoaPi‘ilani Rd, 24 m, beginning as an epiphyte 4 m high in *Prosopis palli-*

da, now rooted terrestrially, 11 Aug 1999, *Oppenheimer H89914*; 2 m tall shrub 79 m, epiphytic on *Coccoloba uvifera*, rooted terrestrially, 17 Aug 1999, *Oppenheimer H89921*; 'Alaeloa, north of Ka'ōpala Gulch, 37 m, volunteer growing in rotting wooden table, 24 Aug 1999, *Oppenheimer H89935*; Honokahua, near intersection of Office Rd and Simpson Way, 67 m, mature fruiting trees in old pineapple field with *Leucaena*, *Melia*, *Schefflera*, *Spathodea*, 1 Sep 1999, *Oppenheimer H99901*; East Maui, Hāna District, seedlings growing on roadcut along Hāna Hwy between Ke'anae and Honomanū, mature fruiting trees observed at Honomanū, 22 Aug 1999, *Oppenheimer H89933*.

Commelinaceae

Tradescantia zebrina Hort. ex Bosse

New island record

First documentation of this taxon as naturalized was by Lorence & Flynn (1997: 10) reporting a specimen from Kaua'i. The collection cited here from Maui is also spreading vegetatively and covering large areas of ground in secondary, alien forest.

Material examined: MAUI: West Maui, Lahaina District, Honolua Bay, between the shoreline and HonoaPi'ilani Hwy, 8 m, 5 Sep 1999, *Oppenheimer H99903*.

Convolvulaceae

Ipomoea cairica (L.) Sweet

New island record

Although Hillebrand (1888: 315) considered this species indigenous, Wagner *et al.* (1999: 555–56) treated it as naturalized and known from all the main islands except Maui. It was reported to be growing wild in the Nahiku-Hana area of East Maui (Kepler, 1995: 70), but the specimen cited here is apparently the first documentation of the taxon from Maui. It is a little anomalous in that the leaves are not as deeply lobed as is typical.

Material examined. MAUI: West Maui, Lahaina District, Honokahua, growing on fences, climbing buildings, and sprawling on the ground, South side of Office Rd, 61 m, 21 Aug 1999, *Oppenheimer & Bartlett H89939*.

Costaceae

Costus speciosa (J.König) Sm.

New island record

First reported as naturalized on Lāna'i (Wagner *et al.*, 1999: 1381), it was later documented as such by Wagner & Herbst (1994: 18) on Kaua'i. Now it is also known from Maui.

Material examined: MAUI: West Maui, Lahaina District, Honokohau Valley, sparingly naturalized shrubs to 2 m tall growing along the stream and a dirt road, 24 m, 16 Feb 1999, *Oppenheimer & Annable H29909*; East Maui, Hāna District, vicinity of Keanae near Hāna Hwy, small populations common in the area, 22 Aug 1999, *Oppenheimer H89932*.

Cucurbitaceae

Coccinia grandis (L.) Voigt

Range extension

The naturalized distribution of this species was known to be O'ahu and Hawai'i (Wagner *et al.*, 1999: 569–70). It was recently documented from Maui by Starr *et al.* (1999: 11–13) and although they only collected specimens on East Maui, they reported observations of *C. grandis* on West Maui and brought to our attention a number of populations there. Nevertheless, the specimens cited here represent previously unknown localities for this species, as well as the first West Maui vouchers.

Material examined: MAUI: West Maui, Lahaina District, Honokahua, sprawling and climbing over plants along a botanical walk in Kapalua Resort, between the Bay Golf Course and the Ridge Villas, 24 m, 11 Aug 1999, *Oppenheimer H89913*; spreading from area used to discard green waste from landscaping, west of Honokahua Valley, 122 m, 17 Aug 1999, *Oppenheimer H89917*.

Euphorbiaceae***Chamaesyce thymifolia*** (L.) Millsp.**Range extension**

Wagner *et al.* (1999: 615, 617) stated this species was naturalized on O‘ahu and Hawai‘i. Later, Lorence *et al.* (1995: 35) reported it from both Kaua‘i and Maui, citing a collection made in Hāna District, East Maui. We have recently made collections on West Maui.

Material examined: **MAUI:** West Maui, Lahaina District, Honokahua, vicinity of Nāmālu Bay, lawn weed near Kapalua Bay Hotel, 18 m, 4 Sep 1999, *Oppenheimer H99902*; Hāwea Pt, near coastal bluffs in shallow, clay soil, mostly native *Scaevola* coastal shrubland, 9 m, 11 Sep 1999, *Oppenheimer H99908*.

Phyllanthus tenellus Roxb.**New island record**

Originally documented from Kaua‘i and O‘ahu (Wagner *et al.*, 1999: 628), we later reported this taxon from Maui (Oppenheimer *et al.*, 1999: 8), with vouchers collected on both East and West Maui. Here we cite a collection from Hawai‘i.

Material examined: **HAWAI‘I:** North Kona District, Kailua-Kona, weed in landscaped area south of the pier, near the ocean, 2 m, 28 Nov 1998, *Oppenheimer & Meidell H119819*.

Fabaceae***Clitoria ternatea*** L.**New island record**

Only known to be naturalized on O‘ahu (Wagner *et al.*, 1999: 656), we now report a small population from Maui.

Material examined: **MAUI:** West Maui, Lahaina District, ‘Alaeloa, southeast of the intersection of HonoaPi‘ilani Hwy and Nāpilihau Rd, flowers blue, many seedlings, 37 m, 15 Sep 1999, *Oppenheimer & Bartlett H99910*.

Crotalaria pumila Ortega**Range extension**

According to Wagner *et al.* (1999: 662) this taxon is naturalized on O‘ahu and Makawao and Pukalani on East Maui. Now it is known from West Maui, as well.

Material examined: **MAUI:** West Maui, Lahaina District, growing on the road to Haelā‘au Cabin, Kaulalewelewe, 790 m, 26 Nov 1998, *Oppenheimer H119813*.

Senna alata (L.) Roxb.**New island record**

Wagner *et al.* (1999: 698) report candle bush as “cultivated and persisting . . . or perhaps escaping at least on Kaua‘i and O‘ahu.” This is consistent with the collection cited here, along with observations of seedlings and flowering plants scattered throughout Kapalua Resort. At least a few of these are in areas where the taxon may have been previously part of resort landscaping.

Material examined: **MAUI:** West Maui, Lahaina District, Honokahua, naturalizing in area used to discard green waste, dozens of fruiting shrubs and seedlings observed, 122 m, 17 Aug 1999, *Oppenheimer H89918*.

Tephrosia candida Roxb. ex DC.**New naturalized record**

We here report a second species of *Tephrosia* as naturalized in the Hawaiian Islands. Native to India, it is used in many tropical countries as a green manure (Neal, 1965: 448). Unlike *T. purpurea*, it is not effective as a fish poison, although cattle apparently will not eat it. It is easily distinguished from *T. purpurea* by its larger (to 3 m) size, densely pubescent leaflets, and much larger pods and flowers (white to reddish). The 2 specimens cited here were both collected at the edge of gulches between pineapple fields about one-half mile apart and surrounded by alien vegetation dominated by *Schinus terebinthifolius* and *Brachiaria mutica*.

Material examined: MAUI: West Maui, Lahaina District, Mo'omoku, 2 m tall shrubs, 366 m, 5 Aug 1998, *Oppenheimer H89820*; south side of Kahana Iki Gulch, 305 m, 10 Dec 1998, *Oppenheimer H129816*.

Liliaceae

Asparagus densiflorus (Kunth) Jessop **New island record**

This South African species (Neal, 1965: 209) is widely planted in resort and home landscaping and was first reported as naturalized by Lorence & Flynn (1999: 4–5). It is naturalized on Maui as well. The voucher is referable to cultivar 'Sprengeri'.

Material examined: MAUI: West Maui, Lahaina District, Honokahua, near Hāwea Pt, on coastal bluffs and in clay soil in *Scaevola* coastal shrubland, 12 m, 12 Sep 1999, *Oppenheimer H99909*.

Asparagus plumosus Baker **New island record**

First documented as naturalized (as *A. setaceus*) in Hawai'i by Lorence *et al.* (1995: 40), elsewhere in this year's *HBS Records* it is reported from O'ahu (Imada *et al.*, 2000), along with the change in name. This is another species of asparagus fern that is commonly cultivated and collectors will undoubtedly discover new escaped populations.

Material examined: MAUI: West Maui, Honokahua, Village Golf Course, 122 m, 30 Apr 1997, *Nagata 4444*; near the intersection of Office Rd and HonoaPi'ilani Hwy, 79 m, 17 Aug 1999, *Oppenheimer H89919*; Honokōhau Valley, along North end of dirt road and steep, rocky slopes, also climbing *Leucaena leucocephala*, 18 m, 6 Jul 1999, *Oppenheimer H79908*; Nāpili, on rocky bluff in gulch between pineapple fields, 122 m, 13 Aug 1999, *Oppenheimer H89915*; 'Alaeloa, volunteer in disturbed area of yard, 12 m, 17 Aug 1999, *Oppenheimer H89922*.

Malvaceae

Sida ciliaris L. **New island record**

This taxon was first reported as naturalized in the Hawaiian Islands by Wagner *et al.* (1997: 59–60), citing collections from several locations on O'ahu. The following voucher documents its occurrence on Maui.

Material examined: MAUI: West Maui, Lahaina District, Wahikuli, lawn and roadside weed at Lahaina Civic Center access road, near the railroad tracks, 6 m, 21 Aug 1999, *Oppenheimer H89923*.

Moraceae

Ficus macrophylla Desf. ex Pers. **New naturalized record**

According to Maui Pineapple Co. records, the Moreton Bay fig was introduced to company lands in the 1920s, along with over a dozen other species of *Ficus*, as part of the Maunalei Arboretum project. Wagner *et al.* (1999: 924) stated that the pollinator, *Pleistodontes froggatti* Mayr, was introduced in 1921. Nishida (1994: 142) does not include any record of this fig wasp from Maui, but this is likely due to collecting bias, as *Ficus macrophylla* is clearly naturalized in areas surrounding the arboretum. This Australian species is a large tree with leaves about 25 cm and purplish, globose fruits 2–3 cm in diameter (Neal, 1965: 313). Although *F. macrophylla* can be terrestrial, in most of the observations it seems to be epiphytic, at least when young. Eventually roots reach the ground, and the host tree will be smothered or broken by the sheer weight. *Ficus macrophylla* seems to favor *Acacia koa*, but small trees have also been noted on *Metrosideros polymorpha* var. *glaberrima*, *Diospyros sandwicensis*, and *Schinus terebinthifolius*. In an informal germination test, fruits were collected and placed on an old, rotting *A. koa* log, and seedlings were observed within 3 months. Control methods are being considered before this taxon becomes more widespread, but its epiphytic habit and preference for native trees as hosts makes herbicide options limited.

Material examined: **MAUI:** West Maui, Lahaina District, on steep slope, 4 m high in *Acacia koa*, west side of Honolua Valley, 396 m, 19 May 1999, *Oppenheimer H59912*; Honokahua Valley, atop a boulder near the streambed, 232 m, 21 May 1999, *Oppenheimer H59919*.

Ficus* cf. *platypoda (A.Cunn. ex Miq.)
A.Cunn. ex Miq.

**New naturalized record;
Reidentification**

Nagata (1995: 12) first documented this species naturalized on O‘ahu as *F. rubiginosa* Desf. According to Berg (*in* Staples & Herbst, *in press*), *F. rubiginosa*, *F. platypoda*, and *F. obliqua* form a species complex and may better be treated as subspecies or varieties. They all share the same pollinator, *Pleistodontes imperialis* Saunders, which was introduced to Hawai‘i in 1922 (Wagner *et al.*, 1999: 924), although Nishida (1994: 142) does not list this wasp from Maui. Berg distinguished all 3 taxa in cultivated voucher material from Hawai‘i that he examined in 1986; his use of “cf.” implies that Hawaiian material is comparable to, but not identical with, wild populations of *F. platypoda*. Nagata’s voucher from O‘ahu in BISH was reidentified as *F. cf. platypoda* in 1990. As far as the West Maui specimens cited here, this taxon shares the same history of introduction and growth habit as *F. macrophylla* (see discussion above), although it occurs in larger numbers of individuals and is more widespread. Seedlings have also been observed on old wooden fenceposts in pastures, indicating probable dispersal by frugivorous birds.

Material examined: **O‘AHU:** Ko‘olauloa District, limestone ridge in hills above Punamanō, 46 m, 27 Dec 1988, *Nagata 3946*. **MAUI:** West Maui, Lahaina District, Honolua Valley, west side of valley near Pu‘u Ka‘eo, 10 m tall tree originally an epiphyte on *Acacia koa*, now rooted terrestrially, 457 m, 21 Aug 1998, *Oppenheimer H89807*; Mokupe‘a Gulch, on *A. koa*, 427 m, 19 May 1999, *Oppenheimer H59911*; East Maui, Hāna District, Ko‘olau F.R., vicinity of Kapā‘ula Gulch, starting as an epiphyte on *Psychotria mariniana*, now rooted terrestrially, 378 m, 22 Aug 1999, *Oppenheimer H89930*; on *Metrosideros polymorpha* var. *glaberrima*, same date and location, *Oppenheimer H89931*.

Orchidaceae

Arundina graminifolia (D. Don) Hochr.

Range extension

Previously known to be naturalized on Kaua‘i, O‘ahu, East Maui, and Hawai‘i (Wagner *et al.*, 1999: 1471), we report here collections representing a range extension to West Maui.

Material examined: **MAUI:** West Maui, Wailuku District, Waihe‘e Ridge Trail, 7 Jun 1989, *Hobdy 3048*; Lahaina District, along the road to Haela‘au Cabin, Kaulalewelewe, 608 m, 26 Nov 1998, *Oppenheimer H119812*; on narrow ridgetop dividing Kahana and Kahana Iki, 640 m, 6 Aug 1999, *Oppenheimer H89910*.

Passifloraceae

Passiflora mollissima (Kunth) L.H.Bailey

New island record

Wagner *et al.* (1999: 1012) report this taxon only from Kaua‘i and Hawai‘i, although it has been naturalized on Maui for about 20 years. Although banana *poka* has been subjected to efforts by various organizations and individuals to eradicate it from the island, apparently no one has ever collected any voucher specimens from Maui.

Material examined: **MAUI:** East Maui, Makawao District, Waiakoa, climbing roadside alien vegetation, Upper Kula Hwy near mile marker 8, 1067 m, 28 Aug 1999, *Oppenheimer & Perlman H89942*.

Poaceae

Stenotaphrum secundatum (Walter) Kuntze

New island record

This common lawn grass was reported as naturalized on Midway Atoll, Kaua‘i,

O'ahu, Moloka'i, Lāna'i, and Hawai'i (Wagner *et al.*, 1999: 1598). The following specimens document naturalized populations on Maui as well.

Material examined: MAUI: East Maui, Hāna District, Ke'anae, Pauwalu Pt, growing in patches of *Scaevola sericea*, 34 m, 19 Sep 1999, *Oppenheimer H99913*; between Pauwalu Pt. and Paepaemoana Pt, at Pu'u Ola fishpond, seaward side of pond behind rocky berm, 3 m, 19 Sep 1999, *Oppenheimer H99914*.

Portulacaceae

***Talinum paniculatum* (Jacq.) Gaertn. New island record**

Sparingly naturalized at least on Kaua'i, O'ahu, and Hawai'i (Wagner *et al.*, 1999: 1075), it is now known from Maui as well.

Material examined: MAUI: West Maui, Lahaina District, 'Alaeloa, volunteers in yard, 12 m, 29 Oct 1998, *Oppenheimer H109808*.

Rubiaceae

***Coprosma granadensis* (L.fil.) Heads Range extension**

[syn. *Nertera granadensis* (L.fil.)Druce]

According to Wagner *et al.* (1999: 1158), this taxon is known from Kaua'i, O'ahu, Moloka'i, Hawai'i, and Pu'u Kukui, Maui. This last location is on West Maui. Apparently, the East Maui specimens were overlooked during the preparation of the *Manual*; there are far more collections from East Maui than West. Although the genus *Nertera* has been transferred to a section of *Coprosma* (Wagner *et al.*, 1999: 1891; Herbst & Wagner 1999: 31), not all workers in the Rubiaceae accept this change (M. Kiehn, pers. comm.).

Material examined: MAUI: East Maui, North slope Haleakalā, 23 Aug 1919, *Forbes 1236 m*; Kīpahulu, 18 Nov 1919, *Forbes 1676 m*; Lake Wai 'Ele'ele, 1890 m, 17 Aug 1945, *St. John & Mitchell 21,050*; Olinda pipeline road, 1364 m, 25 Dec 1951, *Chock 307*; Makawao F.R., Olinda pipeline, 1311 m, 25 Dec 1955, *Woolford 116*; Olinda flume, Waikamoi, 1219 m, 16 Jul 1964, *Crosby & Anderson 1766*; Waikamoi/Olinda flume area, 1298–1341 m (mixed coll.), 5 Aug 1967, *Bonsey, Iltis, & Iltis H479*; Outer slope of Haleakalā, NE of Palikū cabin, 2073 m, 20 Jun 1969, *Henrickson & Vogl 3593*; Olinda flume trail, 27 Jun 1969, *Henrickson 3786*; Waiho'i Valley, 808 m, 21 Jul 1972, *Harrison & Herbst 2570*; 23 Oct 1972, *Harrison 212*; Hāna Forest Reserve, 2073 m, 29 Jun 1973, *Harrison 275*; 1730 m, 10 Jul 1973, *Harrison 303*; Waikamoi flume, 1280 m, 15 Jan 1983, *W.L. Wagner & Mill 4792*; Kīpahulu Valley, 1158 m, 10 Jul 1983, *A.C. Medeiros 452*; Waiho'i bog, 11 Jul 1986, *Hobdy 2593*; Ko'olau F.R. along road to flume, 1289 m, 19 Dec 1998, *Oppenheimer H129813*.

Solanaceae

***Cestrum nocturnum* L. New island record**

Naturalized at least on Kaua'i and O'ahu (Wagner *et al.*, 1999: 1254–1255), it was also reported to have numerous, viable seeds (Kepler, 1995: 104). The following collections document naturalized populations on Maui.

Material examined: MAUI: East Maui, Makawao District, Papa'anui, wooded area, Pu'u Mahoe, 793 m, 11 Jul 1999, *Oppenheimer H79943*; A'apueo, volunteers 3 m tall in yard, 701 m, 6 Sep 1999, *Oppenheimer H99905*.

***Solanum capsicoides* All.**

New island record

Wagner *et al.* (1999: 1269–1270) list the islands of Kaua'i, O'ahu, Moloka'i, Lāna'i, and Hawai'i as the naturalized range of this taxon in the Hawai'i. We cite here specimens representing its occurrence on Maui also.

Material examined: MAUI: West Maui, Lahaina District, Olowalu Valley, 23 May 1920,

Forbes 2467 m; Honolulu, Pāpua Gulch, near an intermittent stream, 395 m, 4 Feb 1999, *Oppenheimer H29901*; Wailuku District, 'Iao Valley, 29 Aug 1922, *O. Degener s.n.* (BISH 69955); Wailena Gulch, 259–290 m, 15 Jul 1964, *Crosby & Anderson 1838*.

Vitaceae

Tetrastigma pubinerve Merr. & Chun New naturalized record

This is a new record for the genus *Tetrastigma* in the Hawaiian Islands, the only other naturalized Vitaceae being species of *Cissus* (Wagner *et al.*, 1999: 1342, 1898). Although Maui Pineapple Co. records show the area as one of historic plantings of exotic species, *T. pubinerve* does not appear on any map or list of taxa. There are specimens at BISH from cultivated plants (*Staples, Heywood, et al. 581*, O'ahu; *Flynn & Hume 1648*, Kaua'i). It is a high-climbing liana with palmately lobed leaves; fleshy fruits are red to orange, globose, about 5–8 mm in dia. Although a complete survey of the area has not yet been made, the known infestation covers approximately 4 acres, where it climbs into the canopy of mixed non-native trees, sometimes smothering them.

Material examined: MAUI: West Maui, Lahaina District, Honokōhau Valley, along the stream and a dirt road in the Northern end of the valley, 55 m, 16 Feb 1999, *Oppenheimer & Annable H29910*.

Acknowledgments

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New plant records from Midway Atoll for 1999

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The following contributions include new state and island records of plants located on Midway Atoll, Northwestern Hawaiian Islands, Hawai'i. Voucher specimens have been deposited in the Bishop Museum, Honolulu (BISH).

Aizoaceae

Tetragonia tetragonioides (Pallas) Kuntze **New island record**

Native to New Zealand, Tasmania, Australia, Japan, and South America; in Hawai'i, *Tetragonia tetragonioides* (New Zealand spinach) is known from scattered coastal sites on Nihoa, Kaua'i, O'ahu, Maui, and Hawai'i (Wagner *et al.*, 1990, Oppenheimer *et al.*, 1999). On Midway, it is restricted to 2 very small patches on Sand Island. It was found near the Dump Pond and near the cart trail on South Beach. This collection represents a new island record in the Hawaiian Islands.

Material examined: MIDWAY: Sand I, Dump Pond, small patch of plants on roadside, Ramachandran Sudharshan collector, 10 May 1999, *Starr & Martz 990510-5*.

Momordica charantia L.

New island record

Native from tropical Africa to Australia; in Hawai'i, *Momordica charantia* (balsam pear, bitter melon) is reported as widely naturalized in disturbed sites on all of the main islands (Wagner *et al.*, 1990). On Midway, this plant was commonly cultivated and often escaped the confines of the garden. This collection represents the new island record of Midway Atoll.

Material examined: MIDWAY: Sand I, spreading from residential vegetable garden, 21 Apr 1999, *Starr & Martz 990421-11*.

Malvaceae

Sida rhombifolia L.

New island record

A polymorphic, pantropical weed; in Hawai'i, *Sida rhombifolia* (Cuba jute) is naturalized in disturbed areas on all of the main islands (Wagner *et al.*, 1990). On Midway, this plant was restricted to a few individuals on Sand Island near the sea plane hangar. This collection represent the new island record of Midway Atoll.

Material examined: MIDWAY: Sand I, near sea plane hangar, 14 May 1999, *Starr & Martz 990514-2*.

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Poaceae***Bothriochloa pertusa*** (L.) A. Camus**New island record**

Native to the Paleotropics; in Hawai'i, *Bothriochloa pertusa* (pitted beardgrass) is naturalized in open, disturbed sites such as pastures, savannas, and along roadsides on all of the main islands (Wagner *et al.*, 1990). On Midway, it is localized and was found only on Sand Island in the mowed lawns on either side of the runway near the water catchment pond. This collection represents a new island record in the Hawaiian Islands.

Material examined: **MIDWAY:** Sand I, collected from lawn near water catchment pond, 7 May 1999, Starr & Martz 990507-4.

Cenchrus ciliaris L.**New island record**

Native to Africa and tropical Asia; in Hawai'i, *Cenchrus ciliaris* (buffelgrass) is reported from dry areas and sandy soil in a wide variety of habitats on all of the main islands except Ni'ihau (Wagner *et al.*, 1990). On Midway, a few dozen patches were discovered on Sand Island in a grassy lawn area near the sea plane ramp by Turtle Beach. This collection represents the new Hawaiian Island record of Midway Atoll.

Material examined: **MIDWAY:** Sand I, naturalized in grassy lawn near Turtle Beach, 27 Apr 1999, Starr & Martz 990427-1.

Chloris virgata Sw.**New island record**

Native to the neotropics, now widely naturalized; in Hawai'i, *Chloris virgata* (feather fingergrass) is naturalized and common along roadsides and dry pastures on Kure Atoll and all of the main islands except Ni'ihau and O'ahu (Wagner *et al.*, 1990). On Midway, it is restricted to a few plants in a lawn near the northwest corner of the inner harbor. This collection represents the new Hawaiian Island record of Midway Atoll.

Material examined: **MIDWAY:** Sand I, from a lawn near the NW corner of the inner harbor, 7 May 1999, Starr & Martz 990507-5.

Chloris divaricata R. Br.**New island record**

Native to New Caledonia and Australia; in Hawai'i, *Chloris divaricata* (stargrass) is naturalized and common in lawns and dry, disturbed areas of all the main islands except Moloka'i and Hawai'i (Wagner *et al.*, 1990). On Midway, this species is restricted to a few dozen plants on Sand Island in a clearing in the ironwood grove. This collection represents the new Hawaiian Island record of Midway Atoll.

Material examined: **MIDWAY:** Sand I, collected from a clearing in the ironwoods (*Casuarina equisetifolia*) near rusty bucket, 8 May 1999, Starr & Martz 990508-1.

Leptochloa uninervia (K. Presl) Hitchc. & Chase**New island record**

Native to warmer regions of the Americas; in Hawai'i, *Leptochloa uninervia* was first collected on O'ahu in 1967, was reported from Kaua'i, O'ahu, Moloka'i, and Hawai'i by Wagner *et al.* (1990), and has been observed by the authors on Maui. On Midway, a single plant was found on Sand Island in an open, moist site on a hill near the underground hospital. This collection represents a new island record for Midway Atoll.

Material examined: **MIDWAY:** Sand I, on a hill in a moist, grassy site, 7 May 1999, Starr & Martz 990507-3.

Paspalum setaceum Michx.**New state record**

Native to Mexico and the southeastern U.S.; in the Pacific, *Paspalum setaceum* was first recorded from the Marshall Islands in 1956 and was later known from American Samoa, Guam, and the Carolines (Whistler, 1994). It was observed on Wake in 1994 by

Derral Herbst. Previously unknown from Hawai‘i, on Midway it is one of the most common species on the island, occurring wherever there are lawn areas. This collection represents a new state record.

Material examined: MIDWAY: Sand I, common grass collected from fuel farm, 22 Jun 1999, Starr & Martz 990622-1 (BISH).

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We thank the staff of Bishop Museum’s Herbarium Pacificum, particularly George Staples, Derral Herbst, and Chris Puttock, for determination, verification, and curation of vouchers. We also thank Marie Bruegmann for providing information on previous botanical surveys; Robert Shallenberger, Ken Neithammer, and Nancy Hoffman for logistical support while on Midway Atoll; and Lloyd Loope and USGS-BRD for financial support to make the writing of this paper possible.

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Three adventive sphecid wasps new to the Hawaiian fauna (Hymenoptera)

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Specimens of 3 previously unreported adventive species of sphecid wasps were collected during surveys of terrestrial arthropods in disturbed environments that were carried out on several Hawaiian islands during 1994–1998. These specimens represent species in 3 cosmopolitan genera, 2 of which have not been reported previously from Hawai‘i (Nishida, 1994). It is clear that all 3 species represent relatively recent introductions as they are absent from all collections of Hawaiian insects made before 1994. Because all 3 of the genera to which these species belong are widely distributed and contain many described species, and because of our inadequate knowledge of the World sphecid fauna, we have been unable to identify these wasps to species. Their presence in Hawai‘i is recorded here in the hope that someone with the expertise necessary to provide more specific identifications may be inspired to study them. Voucher specimens have been placed in the Bishop Museum and the Hawaii State Department of Agriculture, in Honolulu. Identification to genus was made using keys and other information in Bohart and Menke (1976).

Subfamily Crabroninae

Tribe Crabronini

Rhopalum Stephens

Bohart & Menke (1976) listed 109 species in this cosmopolitan genus. Species of *Rhopalum* are known to use small Diptera and other small insects (Psocoptera, Aphididae, Psyllidae) as prey. Depending on the species, nest burrows are located in the soil or in hollow twigs, etc.

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Rhopalum* sp.*New state record**

Our species is moderately slender in form and averages slightly more than 5 mm in length. It is generally black in color with the mandibles, antennal scape, most of the forelegs and parts of the posterior legs yellow. The gaster is constricted behind the slender, apically nodose first segment, and the posterior part is partially reddish orange.

Material examined: **HAWAII:** Kumuwela at U.H. Res. Stn., ca. 2800–3000 ft, W.D. Perreira, 17.xii.1996 (1♂, 4♀); Volcano Village, along Wright Rd, ca. 3800 ft, W.D. Perreira, yellow sticky board trap, 20.x–3.xi.1995 (1♂).

Subfamily Larrinae**Tribe Miscophini****Genus *Nitela* Latreille**

Bohart and Menke (1976) Listed 42 species in this cosmopolitan genus. Species of *Nitela* nest in hollow twigs, beetle burrows, etc. Prey utilized include Psocoptera, aphids, psyllids and the like (Bohart & Menke, 1976).

Nitela* sp.*New state record**

Our species is a rather compact, shiny black little wasp, about 4 mm long; the smallest sphecid known from Hawai'i. Specimens were sent to Dr. Menke at the U.S. National Museum in October 1995, but he was unable to place it. Presumably, it is not of North American origin.

Material examined: **MOLOKA'I:** nr. Kamalo Bridge, 3 ft, W.D. Perreira, yellow sticky board trap, 2–16.ix.1994 (1♀), 16–30.ix.1994 (1♀), 5–19.i.1996 (1♂); Mapulehu nr. Ili'ili'opae Heiau, 10–40 ft, W.D. Perreira, yellow sticky board trap, 26.iv–10.v.1996 (2♀), 10–24.v.1996 (1♀). **O'AHU:** Pearl Harbor, West Loch, 3 ft, 24.i–1.ii.1998 and 11–25.ii.1998, W.D. Perreira, yellow sticky board trap (2♀).

Tribe Trypoxylonini**Genus *Trypoxylon* Latreille**

Worldwide, about 360 species of *Trypoxylon* are recognized. Species for which habits are known utilize spiders as prey (Bohart & Menke, 1976).

Trypoxylon* sp.*New state record**

This is the third species of the genus reported to be established in Hawaii; all apparently members of the nominate subgenus (Bohart & Menke, 1976). It is slightly smaller (length of available specimens 6–9 mm) and lacks the orange areas of the gaster that are characteristic of the other species known from Hawai'i (see key below). At present it is known from 7 male specimens, all taken on yellow sticky board traps at West Loch, Pearl Harbor.

Material examined: **O'AHU:** Pearl Harbor, West Loch, 1–5 ft, 30.ix–11.x.1997 (1♂), 13–20.xii.1997 (1♂), 3–14.i.1998 (2♂), 11–25.ii.1998 (3♂), W.D. Perreira, yellow sticky board trap.

KEY TO KNOWN HAWAIIAN SPECIES OF *TRYPXYLON*

1. Median longitudinal carina of face above eyes relatively short, unbranched; gaster with pale (orange) coloration on tergites 2 and 3 2
- . Median carina of face Y-shaped, the branches continuous with carina extending around behind ocelli; gaster without pale markings undetermined species
2. Trochanters mostly pale; clypeus at apex about 2.6 × as wide as minimum interocular distance below bases of antennae in female *philippinensis* Ashmead
- . Trochanters black; clypeus at apex about 2.0 × as wide as minimum interocular distance in female.....*bicolor* Smith

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New World *Achradocera* in Hawai'i, Tonga, and French Polynesia, with discussion of the genus (Diptera: Dolichopodidae)

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This paper records the presence of the western Nearctic dolichopodid fly, *Achradocera arcuata* (Van Duzee) on O'ahu, Hawai'i, and the widespread New World *A. barbata* (Loew) in French Polynesia and Tonga. Additionally, it discusses the biogeographical processes that can account for such New World species in the eastern Pacific. Specimens examined derive from the following collections: Australian Museum, Sydney (AMS), The Natural History Museum, London (BMNH), Bishop Museum, Honolulu (BPBM), California Academy of Sciences, San Francisco (CAS), and the U.S. National Museum of Natural History, Washington, D.C. (USNM).

***Achradocera* Becker**

Achradocera Becker 1922: 207. Type species: *Achradocera femoralis* Becker (des. Robinson, 1970: 31).

Discussion. Becker (1922) established *Achradocera* in the subfamily Diaphorinae. He distinguished it primarily on the basis of its basally swollen and elongate male first antennal flagellomere. Although he described 3 South and Central American species as *Achradocera*, he did not refer any other species [such as the widespread *Chrysotus barbatus* (Loew)] to the genus.

Van Duzee (1924) noted Becker's genus in his revision of North American *Chrysotus* but declined to recognize it, claiming that females of the 2 genera were indistinguishable. In contrast, Parent's various works did recognize *Achradocera*, and described Neotropical, Afrotropical, and French Polynesian species in the genus. Parent (1933b) gave a key to all New World species he regarded as *Achradocera* and transferred (but did not explicitly state as new combinations) 7 of Van Duzee's Nearctic and subsequent Neotropical *Chrysotus* species (as well as Loew's *C. barbatus*) to the genus.

Subsequent works treated *Achradocera* differently. Foote *et al.* (1965) did not mention *Achradocera* in their treatment of *Chrysotus*, and indeed, no Nearctic species have been described in the genus. However, Robinson (1970) separated *Achradocera* as a subgenus of *Chrysotus* and listed 12 species (it should be noted that *Chrysotus edwardsi* Van Duzee, an *Achradocera* in Parent's (1933b) key, was listed by Robinson as *Chrysotus* s.s.). *Achradocera* was restored to full generic status by Robinson (1975) and was regarded as such by Dyte & Smith (1980) for the Afrotropical species, and by Ulrich (1981).

Does *Achradocera* warrant separate generic status from *Chrysotus*? Based on the elongate male first flagellomere alone, one must say no, since a wide range of male antennal shapes are present in *Chrysotus* [see figures in Van Duzee (1924)]. However, Robinson (1975) provided an additional character, the white multiseriate and thickened ventral

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postocular setae of males. Although most of the New World species *sensu* Robinson (1970) (and including “*Chrysotus edwardsi*”) have this character, it is not noted in the Afrotropical species descriptions. Possibly the African species belong elsewhere, leaving *Achradocera* as a New World genus with Polynesian extensions. Further, all described *Achradocera* have the male eyes distinctly and sometimes widely separated, whereas most male *Chrysotus* have ventrally holoptic eyes.

Chrysotus itself is a complex, cosmopolitan genus of more than 250 described species with more awaiting description. However, it is not clearly defined with respect to other diaphorine genera (see Bickel, 1996a). Recognizing *Achradocera* will make *Chrysotus* paraphyletic, since it is a clade within the larger genus. However, *Chrysotus* already is probably paraphyletic and possibly polyphyletic. It is simply a generic name used for many small-sized diaphorine species, an agglomeration of scattered and mostly inadequate descriptions. Therefore, since *Achradocera* is an apparent monophyletic group, it should be retained, pending further redefinition of *Chrysotus*.

Robinson (1975) provided a generic description of *Achradocera*. Two male secondary sexual characters (MSSC) provide autapomorphic diagnostic characters for the genus: a) an elongate male first antennal flagellomere which is large at the base and constricted to a narrow tip with an apical arista, b) multiseriate and thickened ventral postocular setae present on males. Additional characters include males eyes widely separated (also possibly an apomorphy, but facial width is highly plastic in the Dolichopodidae), and from genital preparations for only 2 species (Figs. 1a, e), the absence of a setose mound at base of surstylus (most *Chrysotus* have such a mound).

***Achradocera* in Polynesia**

Most of the volcanic island fauna of the eastern Pacific is thought to have dispersed from a western, ultimately Oriental/Australasian source (Zimmerman, 1948; Gressitt, 1961). I have surveyed large collections of Diaphorinae from Australia, Melanesia, Micronesia, and New Zealand, and although the genera *Chrysotus* and *Diaphorus* are rich in these regions (largely undescribed), I have not found *Achradocera*. Despite this, 2 true *Achradocera* occur in Polynesia. Both have been identified as New World species, suggesting they reached Polynesia either by accidental human introduction or natural dispersal.

***Chrysotus insularis* (Lamb)**

New combination

Achradocera insularis Lamb, 1933: 73.

Achradocera insularis Parent, 1933a: 179.

In an unusual coincidence, both Lamb (1933) and Parent (1933a) independently described a species “*Achradocera insularis*” from Tahiti. These 2 species are both homonyms and synonyms (Bickel & Dyte, 1989). Further, the species is not an *Achradocera* at all but is here recognized as a *Chrysotus* with an elongate male first flagellomere. It will be treated along with other species in a revision of Polynesian *Chrysotus* (Bickel, in prep.).

***Achradocera arcuata* (Van Duzee)**

New state record

Chrysotus arcuatus Van Duzee, 1924: 48.

Type material. Van Duzee described *Chrysotus arcuatus* from a series of 14 males taken in California, Idaho, and Oregon. Arnaud (1979) listed the male holotype as from Alpine, California (CAS, not seen). The basoventral setose mound and distal row of av setae on male femur III are diagnostic. Although Foote *et al.* (1965) listed this species in its original combination, Parent (1933b) regarded it as *Achradocera*, so the combination is not new.

Material examined: O'AHU: ♂, ♀, Waiawa Springs, sea level, sweeping over mud & weeds on stream bank, 3.vi.1998; ♂, ♀, Kalauao Ponds, 0–1 m, stream from watercress farm, 0 ppt saln., 29.vi.1998, K. Arakaki, K. Kami, & G.A. Samuelson, Pearl Harbor Survey (all in BPBM).

Redescription. Male: length: 2.6; wing: 2.3×0.9 .

Head: (Fig.1c) vertex, frons and face metallic green-bronze some grey pruinosity; eyes widely separated across face-clypeus; palp greatly enlarged, yellow with black hairs (MSSC); proboscis brown; antenna dark brown; scape and pedicel short; first flagellomere truncate on pedicel, basally enlarged and spindle shaped, and gradually tapering to narrowing to point; arista arising just slightly dorsad of apex; ventral postcranium with pale postorbitals and with additional rows of pale setae mediad.

Thorax: metallic green with bronze reflections; 12–14 ac pairs of ac and 6 pairs strong dc present; propleuron with 2 pale ventral setae; lateral scutellar setae about 1/4 length of median scutellars.

Legs: coxae and trochanters black; FI yellow with distinct brown dorsal infuscation, FII yellow, and FIII black with only apex yellow; tibiae yellow; tarsi basally yellow, becoming dark brown distally; CI with black distolateral setae; CII with black setae, and with medio-apical, ventrally projecting, black spine-like seta, which is almost hidden from view (MSSC); CIII with strong dorsal and weaker ventral lateral seta; FI with row of short ventral setae (MSSC), and from base with pv row of short setae which becomes posterior distally, with 4–5 strong posterior setae in apical quarter (MSSC); TI with row of short ventral setae (MSSC), ending in apico-ventral seta; It₁ with row of short ventral setae which become stronger in distal third, and with subapical crest of 3–4 posterior setae (MSSC); It₂₋₄ slightly flattened and concave ventrally (MSSC); FII with ventral row of short erect setae (MSSC); TII with strong ad seta at 1/5, and with and much weaker pd near 1/4, and with weak offset ad and pd setae near 3/5, and with strong ventroapical seta; FIII (Fig.1b) with basoventral setose mound which bears group of strong ventral setae, followed distally by row of av setae (MSSC); TIII with short ad setae at 1/5 and 1/2, and with 3–4 short dorsal setae.

Wing: hyaline; R₄₊₅ and M parallel to apex, with M ending at apex; mcu straight; CuAx ratio: 0.7; lower calypter yellow with fan of yellow setae; halter pale yellow.

Abdomen: metallic blue-green with bronze reflections, and covered with short black; hypopygium (Fig.1a) dark brown with yellow cerci; epandrium circular; aedeagus elongate and dorsally serrate; surstylus greatly prolonged, subrectangular, with a few short basal setae, and apically with strong curved dorsal cuticular projection and curved ventral seta; cercus lobate with setae as figured.

Female: similar to male, otherwise as noted: face-clypeus wider; ventral postcranial setae not as dense; antenna (Fig.1d) rounded subtriangular with apical arista; leg color similar; CII without spinelike seta; all femora with unmodified vestiture; TI, and tarsus with unmodified vestiture, and TI with dorsal seta at 1/5; FIII unmodified.

Remarks. *Achradocera arcuata* is readily recognized by several diagnostic male characters: the basoventral setose mound and distal row of av setae on male femur III (Fig.1b), the ventrally setose basistarsis I, the median spinelike setae on CII and the elongate surstyli (Fig.1a).

Achradocera arcuata is known from the western United States, Mexico, and now Oahu, Hawaii. Its presence in the Pearl Harbor district of Honolulu suggests it was accidentally introduced from the west coast of the U.S. and possibly transported in naval vessels.

***Achradocera barbata* (Loew)**

New synonymy

Synarthus barbatus Loew, 1861: 48.

Chrysotus validus Loew, 1861: 63.

Xiphandrium americanus Wheeler, 1896: 154.

Chrysotus apicalis Aldrich, 1896: 330.

Achradocera angustifacies Becker, 1922: 207. **N. Syn.**

Type material. Loew described the male of this species as a *Synarthus* (now a syn-

onym of *Syntormon* Loew) and the female as a *Chrysotus*, both from the “Middle States”. Wheeler described it as a *Xiphandrium* (now a synonym of *Rhaphium* Meigen) from Wisconsin, Illinois and Indiana. Aldrich described a large series as *Chrysotus apicalis* taken from sea level to 1000 ft on St. Vincent, West Indies. Aldrich (1902) discussed the synonymy of all 4 species and noted, “. . . this species has had particular misfortunes at the hands of describers, in which I have indicated my share. If the insect could deceive Loew so completely, certainly the later writers will be pardoned.”

Becker's *Achrdocera angustifacies* from Quillota, Chile (Dresden, not seen) describes this species perfectly, and I have seen male *A. barbata* from as far south as Valdivia, Chile. As such, *Achrdocera angustifacies* is here treated as a junior synonym of *A. barbata*.

Robinson (1975) treated *Achrdocera apicalis* as distinct from *A. barbata*, claiming it has a much shorter male first flagellomere. I do not think this is significant, as I have seen distinct intraspecific antenna length variation in a single series collected from Nuku Hiva, Marquesas (Figs. 1f, g), and all other characters, particularly the distinctive femoral coloration, remain constant.

Additional records. CHILE: Valdivia, Isla de Teja, yellow pans, 6–8.i.1997 (AMS). **FRENCH POLYNESIA: Austral Islands:** Tubuai, Mahu, 0–50m, iii.1977 (USNM, BMNH, BPBM); Riritu, Moeri, 0–150m, xii.1977 (BPBM). **Society Islands:** Bora Bora, Vaitape, 0–100m, ix.1969; Raiatea, Uturoa, 0–100m, iii.1971; Huahine, Fare, 0–100m, iii.1972; Huahine, Haamene, 1–100m, viii.1969; Tahiti, Papeete, iii.1955; Raiatea, Marahi, 0–100m, 29.iii.1971 (BPBM). **Marquesas Islands:** Nuku Hiva: Aotupa Bay, 1–5 m, 14.vi.1984; Nuku Hiva, Toovii Plateau, 830m, 11.vi.1984, ex *Hibiscus*; Nuku Hiva, Taipivai to Toovii, 300–700m 15.vi.1984 (BPBM); Nuku Hiva, Toovii, 800m, 12.vi.1987 (USNM); Hiva Oa, Haniapa Valley, 0–5m, 18.vi.1984, swept from freshwater seepage; Eiso, Vaituba Valley, 200m, 7–8.vii.1988, Coleman lamp (BPBM). **TONGA:** Tongatapu, i.1968 (CAS). (more than 220 specimens examined; all localities confirmed by males).

Diagnosis. Male: length: 2.3–2.4 wing: 2.0×0.7 [this diagnosis is based on specimens from Dominica, West Indies (identified by Robinson as *Achrdocera apicalis*), Chile, and French Polynesia].

Head: vertex, frons, and face metallic green with little pruinosity; face slightly narrowed, but eyes distinctly separated across; palp yellow with black hairs (MSSC); antenna black; scape and pedicel short; first flagellomere truncate on pedicel, basally enlarged and spindle shaped, and gradually tapering to narrowing to point; arista arising slightly dorsad of apex; first flagellomere varies from 1/2–2/3 head height in length (Figs. 1f,g); ventral postcranium with pale postorbitals and with additional rows of pale and often flattened setae (MSSC).

Thorax: metallic green with bronze reflections; 12–14 ac pairs of ac and 6 pairs strong dc present; propleuron with 2 pale ventral setae; lateral scutellar setae about 1/4 length of median scutellars.

Legs: CI black; CII and CIII dark brown; FI yellow with distinct brown dorsal infuscation, FII yellow, and FIII black with only apex yellow; tibiae yellow; tarsi basally yellow, becoming dark brown distally; FI with row of short ventral setae (MSSC), and from base with pv row of short setae which becomes posterior distally, with 4–5 strong posterior setae in apical quarter (MSSC); TI with row of short ventral setae (MSSC), ending in apico-ventral seta; It₁ with row of short ventral setae (MSSC); FII with ventral row of short erect setae (MSSC); TII with very strong ad seta at 1/5, and weaker ad at 1/2, weak pd near 1/4, and with some strong apical setae; FIII with row of short erect ventral setae (MSSC); TIII with ad setae at 1/5, 2/5, and with 5 spaced dorsal setae.

Wing: hyaline; R₄₊₅ and M parallel to apex, with M ending at apex; mcu straight; CuAx ratio: 0.6; lower calypter yellow with fan of yellow setae; halter pale yellow.

Abdomen: somewhat flattened; metallic blue-green with bronze reflections, and covered with short black; hypopygium (Fig.1e) dark brown with yellow cerci; epandrium circular; aedeagus with dorsal papillae near midlength; epandrial lobe appressed near base of surstylus, and bearing 3 setae;

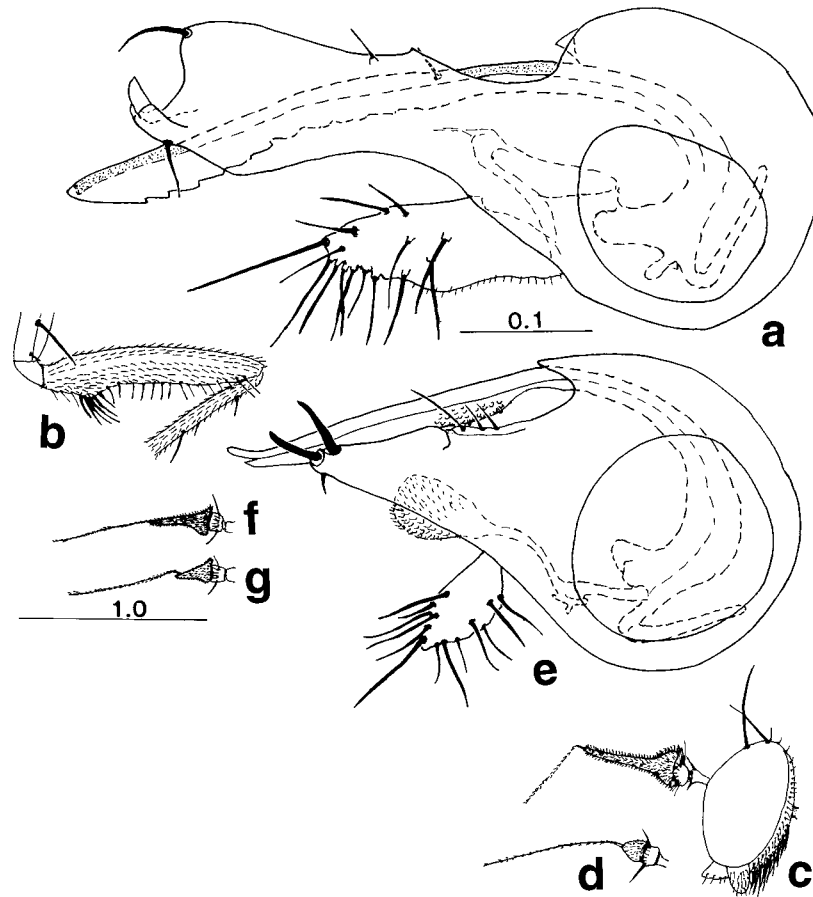


Figure 1. *Achradocera arcuata* (Van Duzee), Pearl Harbor, Hawai'i: **a.** hypopygium, left lateral. **b.** male femur and tibia III, anterior. **c.** male head, left lateral; **d.** female antenna, left lateral. *A. barbata* (Loew), Nuku Hiva, Marquesas: **e.** hypopygium, left lateral. **f., g.** male antenna, left lateral, showing variation.

surstylus tapering and bearing 2 strong apical setae; cercus short and lobate, with setae as figured; subepandrial sclerite apparently with large bulbous internal extension, covered with microtrichia.

Female: similar to male, otherwise as noted: face-clypeus wider; ventral postcranial setae not as dense; antenna rounded subtriangular with apical arista; leg color similar; all femora; TI, and tarsus I with unmodified vestiture; and TI with short dorsal seta near 1/5.

Remarks. *Achradocera barbata* is a widespread and often common New World species. It is recorded from the eastern United States, Arizona, West Indies, Mexico, Ecuador, and southern Chile. In the Pacific it occurs on many islands in French Polynesia (Austral, Society, and Marquesas groups), and west to Tonga.

How did this New World species reach such remote Polynesian islands? Since bio-

geographic processes are largely historical and unobserved, one must deduce probable histories from available evidence. Young, isolated volcanic islands such as those of French Polynesia could only have received their fauna by dispersal or accidental human introduction, or a combination of the two. As discussed previously, the presence of *Achradocera arcuata* in Hawai'i is undoubtedly the result of accidental transport, since it was discovered in disturbed habitats near a large port.

However, the method by which *Achradocera barbata* reached French Polynesia and Tonga is less clear. Both natural dispersal and accidental human introduction are possibilities:

1. Natural dispersal. The transoceanic dispersal capability of dolichopodids is well established, as they are part of the small-sized arthropod fauna carried by wind or on surface flotsam (see Bickel, 1996). Other New World dolichopodids have similar range extensions into the eastern Pacific. For example, the neotropical *Condylostylus longicornis* occurs in both the Galápagos and French Polynesia. Its presence on several isolated archipelagos (Austral, Society, Marquesas, and Tuamotu groups) suggests a prehistoric dispersal event with sufficient time to allow secondary dispersal within French Polynesia. *Achradocera barbata* displays a similar pattern, and not only is widely distributed in French Polynesia but has even reached Tonga.

2. Accidental introduction. The distribution patterns discussed above could also be explained by accidental human introduction. A long-established sailing route into the South Pacific utilizes the Humboldt Current and easterly winds off the coasts of Peru and Ecuador. Ships carrying horticultural specimens or soil ballast could easily transport New World insects to the Galápagos and French Polynesia, and inter-island trade would further facilitate their spread. Therefore the same wind and current patterns are explanations for both natural dispersal and accidental introduction.

Parent (1933b) misinterpreted *Achradocera barbata* and claimed males had tarsomeres 3 and 4 of leg III curved and slightly concave. I have not seen this on specimens, nor is it mentioned in any of the original descriptions. Parent probably based his statement on cited Bolivian and Argentinean specimens he misidentified as *A. barbata*. This material is probably close to the Chilean species *A. chilensis* and *A. edwardsi* (see Van Duzee, 1930), both of which are described as having such modified tarsus III.

Summary

Based on Parent (1933b), Robinson (1970), and the work above, *Achradocera* is now comprised of 12 described New World species (2 of which occur in Polynesia): *A. arcuata* (Van Duzee), *A. barbata* (Loew), *A. chilensis* Van Duzee, *A. contracta* (Van Duzee), *A. edwardsi* (Van Duzee), *A. excavata* (Van Duzee), *A. femoralis* Becker, *A. insignis* Parent, *A. longiseta* Parent, *A. meridionalis* Becker, *A. shannoni* (Van Duzee), and *A. tuberculata* (Van Duzee). The Afrotropical fauna consists of 4 species from Zaire and South Africa: *A. africana* Parent, *A. ealensis* Parent, *A. rutshuruensis* Vanschuytbroeck, and *A. wulfi* Parent.

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Neal Evenhuis initiated this paper and provided editorial encouragement. C.E. Dyte correctly suggested the generic placement of the Hawaiian *Achradocera*. I thank the following institutions and curators for the loan of specimens: Australian Museum, Sydney (M. Moulds); The Natural History Museum, London (J. Chainey); Bernice P. Bishop Museum, Honolulu (N. Evenhuis); California Academy of Sciences, San Francisco (P. Arnaud); National Museum of Natural History, Smithsonian Institution, Washington, D.C. (F.C. Thompson).

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***Wasmannia auropunctata* (Hymenoptera: Formicidae): established on the Island of Hawai‘i**

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Wasmannia auropunctata (Roger)

New state record

This ant was first collected by M. Brazier in Hawaiian Paradise Park (HPP) subdivision near Pahoa, Puna District, on 1 March 1999 and submitted to our laboratory in Hilo. It would not key out in the “Key to the Ants of Hawai‘i” (N. Reimer, unpubl.). We sent specimens of the ant to Reimer in our Honolulu office and he identified them as *Wasmannia auropunctata* (Roger), commonly known as the little fire ant (LFA). It was subsequently confirmed as this species by D. Agosti of the American Museum of Natural History. Hawaiian specimens from the localities discussed in the text are deposited in the insect collection at the Hawaii Department of Agriculture in Honolulu.

This ant is native to Central and South America but has been accidentally introduced to several locations throughout the world including West Africa, New Caledonia, the Galápagos and Solomon Islands (Hayashi, 1999) and Florida (Nickerson, 1983).

The ant is well known for its tiny size yet powerful sting (Creighton, 1950). It has been reported as a nuisance to agricultural workers elsewhere and is causing such problems in a rambutan orchard in Pāpa‘ikou, South Hilo District, as well as in an anthurium farm in Hilo.

The total number of separate and disjunct infestations known on the island is 13. Three of these are closely grouped in Pāpa‘ikou. Two of those were started by the movement of potted palms onto separate properties in the neighborhood. We believe the original infestation in Pāpa‘ikou started by the planting of infested *Caryota* sp. palms as a windbreak in May and June 1995. The anthurium farm in Hilo also appears to have become infested by planting this same species of palm. *Caryota* sp. palms planted on 2 sides of a residential property in HPP again appeared to be the source of a third infestation. The source of all 3 sets of palms appears to be the site of a commercial nursery in Pana‘ewa.

Three other infestations are known in HPP, all belonging to M. Brazier. It is believed this owner accidentally infested her other properties by moving plants with soil from her infested parcel to the others. The original source of this HPP infestation is unclear.

The source of an infestation in Kapoho, Puna District, is likewise unknown. This infestation is a commercial nursery which has been selling potted plants for many years, possibly infested with the ant. At least 2 other nurseries (in Pana‘ewa and Pāpa‘ikou) have been selling possibly infested plants, perhaps for as long as 6 years or longer. The source of those infestations is likewise unknown, nor do we know how or when it originally arrived on the island of Hawai‘i.

Specimens of LFA were also collected at Kalihiwai, Kaua‘i by G. Nagai of the Hawaii Department of Agriculture (HDOA) on 6 October 1999. This infestation had been discovered by tracing a shipment of plants from the island of Hawai‘i to Kaua‘i from at least 1 nursery infested with LFA. The plants had been planted in a large landscaping project at Kalihiwai. The ants have now apparently been eradicated with applications of Amdro ant bait through a cooperative effort of the HDOA and Hawaii Department of Health, Vector Control Branch.

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New Hawaiian Diptera records, with special reference to the Diptera of Kaho'olawe

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Although records from other islands in Hawai'i are intermixed in this paper, many of the new records of Diptera below derive from surveys of Kaho'olawe conducted by Bishop Museum staff in 1979 and 1980 while the island was under the jurisdiction of the U.S. Navy and being actively used as a bombing target. Now that the island has been repatriated back to the native Hawaiians and efforts are underway to restore the island to a more natural state, it was thought that the list below would be of use in adding to our knowledge of the existing insect fauna of that island. Except for those marked as deposited in the University of Hawaii, Mānoa (UHM) or the United States National Museum of Natural History, Washington, D.C. (USNM), all specimens are vouchered in Bishop Museum, Honolulu (BPBM). Authorship of the records below is NLE unless otherwise noted.

Anthomyiidae

Fucellia boninensis Snyder

New island record

Previously known from Midway (introduced) and naturally occurring in the Bonin Islands, this is the first record from the major Hawaiian Islands.

Material examined: MAUI: Makawao, 30 Auoli Dr., 1600 ft, 30 Sep 1999, dead at light fixture, H.K. Loechelt (BPBM). —Neal L. Evenhuis & H.K. Loechelt

Asteiidae

Bryania bipunctata Hardy

New island record

This single specimen is a remarkable record, given that this endemic Hawaiian species is known otherwise only from the Northwestern Hawaiian Islands (previous records from the main Hawaiian Islands are misidentifications of *Stenomicroa orientalis* Malloch). It is possible that this species may have once had a wider distribution throughout the Hawaiian Islands, but has since been extirpated from the other main Hawaiian Islands, possibly through the advent of humans. Since there has been little human habitation on Kaho'olawe during its history, this may be why *Bryania bipunctata* is still surviving there.

Knowledge of its immature biology (other asteiids have been reared from a variety of plant stems and fungi) would be helpful in assessing its status on this island as well as possibly helping us determine why it does not occur elsewhere in the Hawaiian Island chain.

Material examined: KAHO'OLAWA: 1, Beck's Cove, 11–14.ii.80, at UV light, W.A. Steffan (BPBM).

Asteia sabroskyi Hardy

New island record

Nishida (1997) previously recorded this species from all the main Hawaiian islands except Lāna'i and Kaho'olawe.

Material examined: **LĀNA'I:** 3, Auwehi Gulch, 2800 ft, 4.v.1971, reared ex *Charpentiera* stems, S.L. Montgomery (UHM).

***Sigaloessa hillifera* Sabrosky**

New state record

This species was previously known in the literature only from its type locality in Costa Rica. It was recorded from O'ahu by Beardsley *et al.* (1999: 52) as *Sigaloessa* sp. Examination by me of identified and undetermined material in the USNM and comparison with the O'ahu specimens confirmed that this species is *S. hillifera*.

This is the only known species of the genus with sexual dimorphism in the banding of the legs. *Sigaloessa hillifera* was previously only known from females. Collections with associated males show that this species is more widespread in Central and South America than previously thought. The locality data in Beardsley *et al.* (1999) can be consulted for the new state record of this species. The material examined below constitute new records for this species in the Americas.

New American records: **PANAMA:** 2, S. of Panama City, 15–30.vii.79, E.C. Broadhead, monsoon canopy fogging, tree #14; 2, E. Shore Gatun Lake nr. Colón, 2–14.vii.79, E.C. Broadhead, monsoon canopy fogging, [tree #] 2; 3, Playa Santa Clara, 2.vii.76, W.W. Wirth, Malaise trap; 1, Chiriqui, 3–5 km W. Puerto Vidal, Rio Tabasara, 20.vi.73, E.C. Heed, C. Am. Exped. 73 (all USNM). **VENEZUELA:** 1, Aragua, 2 km N. Ocumarc, 31.iii–2.iv.81, A. Menke, L. Hollenberg (USNM).

Chironomidae

***Polypedilum nubiferum* (Skuse)**

New island record

This adventive species was previously known from populations on the islands of Kaua'i and O'ahu. It has been present on Maui since at least 1996 (Hurley, T., 1996, *Maui News* 22 March: 1) as a nuisance species in the Keālia Pond NWR and Kīhei area but never has been formally recorded in the scientific literature. A recent unpublished report by Howarth (1998) examined the biology of the species and possible solutions to the swarming problem that exists in the Keālia area.

Material examined: **MAUI:** 12, Keālia Pond NWR, 14.iii.96, M. Nishimoto.

—Neal L. Evenhuis & F.G. Howarth

***Pontomyia* sp.**

New state record

This is the first record for this flightless marine genus in the Hawaiian Islands. In other areas of the Pacific, adults and immatures have been taken in association with the marine sea grass, *Halophila ovalis*.

Only females of this species were collected in a plankton tow from the research ship, *Townsend Cromwell* approximately 1 mile [1.2 km] west of Kahe Point, O'ahu. The 4 known species in this genus are found primarily in areas of the central and western Pacific (*viz.*, Japan, Australia, Singapore, Palau, Enewetak, Taiwan, and Samoa). This is the easternmost Pacific record of this genus; however, an undetermined species has been recorded from Belize (Bretschko, 1982) and another population has been reported from Florida (J. Epler, pers. comm.). Although adult males were not collected, the females possess characters such as relatively long mid and hind legs and different postabdominal structures not found in any of the 4 known species, which may mean it is an undescribed species.

Material examined: **O'AHU:** [uncounted hundreds of thousands of specimens], 1 mi [1.2 km] W of Kahe Point, 24.vi.1986, surface collection [plankton tow], TC-8604, L1N1, 2105 h, station 008 (BPBM).

Chloropidae***Rhodesiella sauteri*** (Duda)**New island record**

This adventive species was previously known in Hawai'i from Kaua'i and O'ahu. This record marks the first time it has been noted from Maui.

Material examined: MAUI: 5, Makawao, 30 Au'oli Dr, 1600 ft, 10 Oct 1999, trap in tangerine tree, H.K. Loechelt (BPBM). —Neal L. Evenhuis & H.K. Loechelt

Chyromyidae***Gymnochyromyia hawaiiensis*** Hardy**New island record**

This endemic species was previously known in the Hawaiian Islands from O'ahu, Maui, and Hawai'i.

Material examined: KAHO'OLAWE: 10, Beck's Cove, 11–14.ii.80, at UV light, W.A. Steffan (BPBM).

Dolichopodidae***Campsicnemus ridiculus*** Parent**New island record**

This species was previously known only from the unique type specimen from east Moloka'i. An unpublished report by Englund & Filbert (1996) recorded it from a stream on Maui, which extends its distributional range to that island.

Material examined: MAUI: 1, West Maui Mts, North Fork Waiehu Stream, 800–1060 ft, 24 Sep 1996, R. Englund & R. Filbert (BPBM). —Neal L. Evenhuis & R.A. Englund

Drosophilidae***Drosophila melanogaster*** Meigen**New island record**

This virtually cosmopolitan species was previously known in Hawai'i from all the main islands except Kaho'olawe and Lāna'i.

Material examined: KAHO'OLAWE: 2, 1 km SW Hakioawa Pt., 0–100 m, 7.xi.79, Malaise trap, G.M. Nishida, M.L. Goff, W.A. Steffan (BPBM)

Drosophila sulfurigaster bilimbata Bezzi**New island record**

This widespread immigrant species was previously known in Hawai'i from all the main islands except Kaho'olawe. This is the species that has been misidentified in the literature as *Drosophila nasuta* Lamb. In the Hawaiian Islands, the nominate subspecies is known only from the islands of Maui and Hawai'i

Material examined: KAHO'OLAWE: 4, 1 km SW Hakioawa Pt., 0–10 m, 7.xi.79, Malaise trap, G.M. Nishida, M.L. Goff, W.A. Steffan; 2, Smuggler's Cove, 0–20 m, 8–9.xi.79, Malaise trap, G.M. Nishida, M.L. Goff, W.A. Steffan (BPBM).

Scaptomyza (Bunostoma) sp.**New island record**

This is the first record of the genus *Scaptomyza* from Kaho'olawe. Due to the paucity and condition of the material at hand, it was not possible to identify the specimen to species level.

Material examined: KAHO'OLAWE: 1, Beck's Cove, 11–14.ii.80, at UV light, W.A. Steffan (BPBM).

Phoridae***Chonocephalus pallidus*** Beyer**New island record**

Previously known in Hawai'i from Kaua'i and O'ahu.

Material examined: MAUI: 1, Makawao, 30 Au'oli Dr, 1600 ft, 9 Jan 1999, baited fly trap, H.K. Loechelt (BPBM). —Neal L. Evenhuis & H.K. Loechelt

Conicera formosensis* Brues*New island record**

This nonindigenous species was previously known in Hawai'i from Kaua'i, O'ahu, and Hawai'i.

Material examined: MAUI: 1, Makawao, 30 Au'oli Dr, 1600 ft, 10 Oct 1999, baited fly trap in peach tree, H.K. Loechelt (BPBM). —Neal L. Evenhuis & H.K. Loechelt

Megaselia furcatilis* Beyer*New island record**

This endemic species was previously known in Hawai'i only from O'ahu.

Material examined: MAUI: 12, Makawao, 30 Au'oli Dr, 1600 ft, 10 Oct 1999, baited fly trap in peach tree, H.K. Loechelt (BPBM). —Neal L. Evenhuis & H.K. Loechelt

Sarcophagidae***Blaesoxipha rufipes* Macquart****New island record**

This species was listed in Hardy (1981) as *B. filipjevi* Rohdendorf. It was purposefully released for biological control of grasshoppers on O'ahu in 1970 but not known to have become established. Nishida (1992) did not list it under either *filipjevi* or *rufipes*. Nishida (1994) cross-referenced *B. filipjevi* to *B. rufipes* in the index but inadvertently omitted the species from the checklist proper. The species is missing altogether from Nishida (1997). Pape (1996) listed it from the Hawaiian Islands as introduced.

It has a natural distribution throughout Africa, southern Europe and Asia to Japan, Australia, and the Melanesian Islands. It was introduced into California but is not known to be established. The record below constitutes the first specimens of this species from an island in Hawai'i other than the lab-reared record from O'ahu and the first indication that it may have become established in the Hawaiian Islands.

Material examined: KAHO'OLAWE: 3, 1 km SW Hakioawa Pt, 0–10 m, 7–8.xi.1979, Malaise trap, G.M. Nishida, M.L. Goff, W.A. Steffan; 1, Beck's Cove, 25–500 m, 11–14.ii.1980, W.A. Steffan (all BPBM).

Sarcophaga africa* (Wiedemann)*New island record**

This species, previously recorded by many authors under the misidentified name *Bercaea haemorrhoidalis*, was listed in Nishida (1997) from Kaua'i, O'ahu, Moloka'i, and Hawai'i. Lopes (1989) corrected the misidentification to *Bercaea cruentata* Meigen. Pape (1996) considered *cruentata* a new synonym of *Sarcophaga africa* (Wiedemann) but inadvertently omitted the Hawaiian Islands in his distribution of this species.

Material examined: KAHO'OLAWE: 1, 1 km SW Hakioawa Pt, 0–10 m, 7–8.xi.1979, Malaise trap, G.M. Nishida, M.L. Goff, W.A. Steffan; 2, Smuggler's Cove, 0–20 m, 7–8.xi.1979, G.M. Nishida; 1, Beck's Cove, 25–500 m, 11–14.ii.1980, W.A. Steffan (all BPBM).

Blaesoxipha plinthopyga* (Wiedemann)*New island record**

Previously recorded in Hawai'i from all the main islands (as far west as Ni'ihau) except Kaho'olawe.

Material examined: KAHO'OLAWE: 1, west end of Hanakaneae, 18.ii.31, E.H. Bryan, Jr. (BPBM).

Scatopsidae***Coboldia fuscipes* (Meigen)****New island record**

This adventive species was previously known in the Hawaiian Islands from O'ahu and Hawai'i (Nishida, 1997).

Material examined: MAUI: 12, Makawao, 30 Au'oli Dr, 1600 ft, 10 Oct 1999, baited fly trap in peach tree, H.K. Loechelt (BPBM). —Neal L. Evenhuis & H.K. Loechelt

Scenopinidae***Scenopinus adventicius* Hardy** **New island record**

Previously known in Hawai'i from O'ahu and Moloka'i.

Material examined: MAUI: 1, Makawao, 30 Au'oli Dr, 1600 ft, 10 Oct 1999, trap in tangerine tree, H.K. Loechelt (BPBM). —Neal L. Evenhuis & H.K. Loechelt

Syrphidae***Syrpitta orientalis* Macquart** **New island record**

This adventive species was previously known in the Hawaiian Islands from Kaua'i, O'ahu, and Hawai'i (Nishida, 1997).

Material examined: MAUI: 1, Makawao, 30 Au'oli Dr, 1600 ft, 3 Jan 1999, H.K. Loechelt (BPBM). —Neal L. Evenhuis & H.K. Loechelt

Tipulidae***Styringomyia didyma* Grimshaw** **New island records**

This adventive species was previously recorded (Nishida, 1997) in the Hawaiian Islands from O'ahu, Moloka'i, Maui, and Hawai'i.

Material examined: KAHO'OLAWE: 1, 1 km SW Hakioawa Pt, 0–100 m, 7.xi.79, Malaise trap, G.M. Nishida, M.L. Goff, W.A. Steffan (BPBM). KAUA'I: 1, Ahukini, 13.vii.28, Taro, E.H. Bryan; 1, Barking Sands, 19.i.69, light trap [no collector] (BPBM).

Ulidiidae

The Ulidiidae were previously treated either as a subfamily within the Otitidae or as a separate family from Otitidae. As a family-group name, Ulidiidae Macquart, 1835 has priority over Otitidae Aldrich, 1932 [see Sabrosky (1999) for further historical details]. I follow Kamaneva & Korneyev (1994) in treating Ulidiidae as the valid family-group name for taxa previously treated within Otitidae.

***Acrosticha apicalis* (Williston)** **New island record**

Previously recorded from all the main Hawaiian Islands except Kaho'olawe.

Material examined: KAHO'OLAWE: 1, Beck's Cove, 11–14.ii.80, at UV light, W.A. Steffan (BPBM).

Acknowledgments

I thank Hans K. Loechelt, U.S. Food and Drug Administration, Seattle, for bringing many of the Maui records to my attention and for his generous donation of voucher specimens to the Bishop Museum collections.

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Rediscovery of *Drosophila heteroneura* on the Island of Hawai‘i

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Drosophila heteroneura Perkins is a rare picture-wing pomace fly endemic to the Island of Hawai‘i and part of a group of picture-wing *Drosophila* that are currently being listed by the Fish and Wildlife Service as Threatened or Endangered under the Endangered Species Act. *Drosophila heteroneura* is one of the most intensively studied native arthropods in Hawai‘i and research on the species has helped to unravel the patterns and mechanisms of speciation that has led to the formation of more than 800 species of Hawaiian *Drosophila* (e.g., Carson & Kaneshiro, 1976; Carson & Yoon, 1982, Carson, 1992). Three decades ago, when researchers first focused attention on picture-winged *Drosophila*, *D. heteroneura* was widespread, with 73 historical collection records from 16 localities over 4 of the 5 major volcanoes on the island (U.S. Fish & Wildlife Service, 1995). The extirpation of smaller populations was first reported from the Ola‘a Forest of Hawaii Volcanoes National Park (HVNP) in 1980 (Carson, 1986; Foote & Carson, 1994). Subsequently, *D. heteroneura* disappeared from sites in the southern and western parts of the island at locations where the species had traditionally yielded larger collections. Records maintained as part of the Hawai‘i *Drosophila* Project indicate that the last collection of *D. heteroneura* occurred in 1993 at Hualālai. Since this time, concerted efforts to relocate *D. heteroneura* at historical sites have failed.

Drosophila heteroneura Perkins **Rediscovery; Range extension**

On 16–17 November 1999 specimens of *Drosophila heteroneura* were collected in a recently established National Wildlife Refuge, north of Waiea Rd in South Kona. This represents a new population or subpopulation not previously discovered. The specimens were taken as part of a rapid biological assessment of invertebrates occurring in the Kona Forest Unit (KFU) of the Hakalau National Wildlife Refuge conducted by the Pacific

Island Ecosystem Research Center, U.S. Geological Survey. Survey work was focused along four 500–700 m transects following elevational contours at 762, 1067, 1372, and 1676 m, respectively, extending north from the southern boundary of the refuge. Sponges containing a combination of yeast-fermented banana and mushroom bait were placed every 50 m along each transect and surveyed twice over a period of 24 hr. A total of 29 picture-wing *Drosophila* were observed and collected, including 2 female and 4 male *D. heteroneura*. All of the picture-winged species were found on the 1372 m elevation transect with the exception of 1 *Drosophila sproati* at 1067 m. *Drosophila silvestris* was equally abundant at this location and, together with *D. heteroneura*, comprised 42% of the picture-wings collected.

Drosophila heteroneura is completely sympatric with *D. silvestris* throughout its historical range between about 1000 and 1600 m altitude in montane rain forests (Carson & Yoon, 1982). The KFU observations occur approximately 12 km S of the nearest historical population of Pauahi and fall within the southern most area of the predicted range for *D. silvestris* (Carson, 1982). The habitat at the KFU 1372 m transect is *Metrosideros/Cibotium* tree fern forest with a dense understory that includes large *Clermontia clermontioides* (both subspecies, *C. c. clermontioides* and *C. c. rockiana*, occur in the refuge). *Clermontia clermontioides* is a recorded host plant of *D. heteroneura* and appears to be relatively common throughout the refuge between approximately 1200 and 1700 m elevation, including *Acacia/Metrosideros* forests with former pasture lands kept open by feral cattle. The range of *D. heteroneura* at KFU will be determined as part of the ongoing invertebrate inventory through December 2000.

Material examined: HAWAII: Hakalau National Wildlife Refuge, Kona Forest Unit, along 1372 m transect, 100–600 m from S. Boundary Rd, 16–17 Nov 1999, D. Foote, *et al.* [all vouchers currently in culture at the laboratory of Dr. Donald Price, University of Hawaii at Hilo].

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Notes on recently introduced Heteroptera (Insecta)

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This paper lists 1 newly introduced rhyparochromid from Hawai'i and provides a new island record for a previously documented introduced nabid, as well as clarifying the date of introduction for the latter species. Voucher specimens are housed in the Bishop Museum (BPBM) and the National Museum of Natural History, Smithsonian Institution (USNM).

Rhyparochromidae***Brentiscerus australis*** (Bergroth)**New state record**

This small rhyparochromid was first collected in Hawai'i in 1992, although its initial date of entry may well have been earlier, since the first records came from upland native forest areas of the West Maui Mountains. It may be easily recognized among the current suite of Hawaiian lygaeoids by its small size, reddish brown coloration, and relatively thick antennae.

In Australia *Brentiscerus australis* is known to prey on *Eucalyptus* seeds, and the fact that it is commonly taken on 'ohi'a (*Metrosideros polymorpha*) in Hawai'i suggests that it may be able exploit the seeds of this native tree as well, since both *Metrosideros* and *Eucalyptus* are in the family Myrtaceae. The potential for this species to become a significant seed predator on the dominant canopy tree of Hawaiian native forests is a cause for concern.

The records cited below represent the earliest dates of capture I can find for this species on the islands listed. *Brentiscerus australis* seems to be easily capable of invading native upland forest ecosystems and appears to be rapidly spreading its range throughout the islands.

Material examined: **MAUI:** 1♂, 4♀, West Maui Mtns., Kaulalewelewe Cabin at Pu'u Kukui trailhead, 950 m. [3115 ft.], 14 May 1992, D.A. Polhemus (BPBM); 1♀, West Maui Mtns, forest along Pu'u Kukui trail above Kaulalewelewe Cabin, 1000 m. [3280 ft.], 14 May 1992, D.A. Polhemus (BPBM); 2♂, 2♀, West Maui Mtns., reservoirs nr. Mt Hana'ula, 1220 m. [4000 ft.], 10 May 1993, D.A. Polhemus (BPBM); 2♂, 1♀, West Maui Mtns., Mt Lihau summit area, 1220 m. [4000 ft.], 8–9 May 1993, D. A. Polhemus (BPBM). **MOLOKA'I:** 1♂, 1♀, rain forest at Kolekole Cabin, TNCH Kamakou Preserve, 1190 m. [3900 ft.], 15 May 1992, D.A. Polhemus (BPBM). **O'AHU:** 1♂, Nānākuli Valley, 26 October 1994, A. Asquith (BPBM); 1♂, Mt Ka'ala summit, 4 July 1994, A. Asquith (BPBM). **HAWAI'I:** 2♂, 2♀, Hawaii Volcanoes Natl. Park, along Mauna Loa Strip Road below Kīpuka Kī, 4100 ft, 24 Oct 1996, fogged from canopy of *Metrosideros polymorpha*, D.A. Polhemus and D. Gruner (USNM).

Nabidae***Alleorhynchus maculosus*** Kerzhener**New island record; Revised date of first introduction**

This species was first reported from Hawai'i by Polhemus & Kumashiro in Kumashiro & Heu (1997, *Bishop Museum Occas. Pap.* 49: 19–21) based on specimens taken at Pauka'a, Hawai'i, in 1996. A specimen from O'ahu has now been located in the Bishop Museum collection that demonstrates the species was present in the islands over a decade earlier.

Material examined: **O'AHU:** 1♀, Honolulu, Kalihi, 1 Nov 1982, F.G. Howarth (BPBM).

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I thank Dr. James Slater of the University of Connecticut, a world authority on the taxonomy of lygaeoid bugs, for kindly providing the determination of *Brentiscerus australis*.

Rediscovery of the introduced mayfly *Caenis nigropunctata* (Ephemeroptera: Caenidae) in Waimānalo Stream, O'ahu

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The aquatic insect fauna of the Hawaiian Archipelago is represented by taxa derived from groups that typically exploit marine littoral environments (such as Diptera in the families Ephydriidae, Canacidae, and Chironomidae) or are derived from ancestral stock that had the ability to disperse over considerable distances, such as the Odonata (Howarth & Polhemus, 1991). Other groups well-represented in continental settings are absent: no native Ephemeroptera, Plecoptera, or Trichoptera are found in the Hawaiian Islands. Taxa in these orders characteristically have short-lived terrestrial adult life stages that limit their ability to disperse over the great distances required for mid-ocean colonization.

This paper details the rediscovery of the introduced mayfly, *Caenis nigropunctata* (Klapálek) in Hawai'i. Voucher specimens are deposited in Bishop Museum (BPBM).

Ephemeroptera in Hawai'i

Although at least 3 species have been introduced to Hawai'i, the status of mayflies in the Hawaiian Islands has been uncertain for some time. Two heptageniid species, *Nixe rosea* (Traver) and *Epeorus lagunitas* (Traver) were deliberately introduced to Koke'e and Kawai'oi streams, which originate in the Alaka'i swamp area of Kaua'i (Usinger, 1972). The source material for the introductions was from eggs collected from gravid females found in Waddell Creek of the Santa Cruz Mountains, central California. Approximately 98,600 *N. rosea* eggs and 65,000 *E. lagunitas* eggs were transported to the Koke'e area in 3 shipments in July and August 1961 (Usinger & Needham, 1960, 1961, 1962). The introductions were to serve as a food source for introduced rainbow trout (*Onchorynchus mykiss*) which were stocked (and continue to be stocked) for sportfishing in the region. These introduced mayflies have not been found in recent collections and appear to have died out (Howarth & Polhemus, 1991; Englund *et. al.*, 1998).

Ephemeroptera: Caenidae

Caenis nigropunctata (Klapálek)

Rediscovery

Larvae observed and collected in September 1997 and again September 1999 in pool habitat on silt-covered basaltic cobble substrate in lower Waimānalo Stream, O'ahu.

The specimens described here represent the rediscovery of the introduced aquatic insect order Ephemeroptera in the Hawaiian Islands. *Caenis nigropunctata* apparently was an accidental introduction. The first specimens found of this species were recorded in 1944 in Honolulu. By 1948 they were recorded from Pearl City to Mānoa Valley and in Kailua on the windward side of O'ahu where adults were reported to be abundant near lights (Zimmerman, 1957). Since that time, no published records or museum specimens were located confirming the occurrence of *C. nigropunctata* in Hawai'i. The Bishop Museum collection contains a single specimen, an adult from the Kailua area collected in 1948. Some previous publications regarding *C. nigropunctata* in Hawai'i used the generic name *Caenodes* for this species; however, Malzacher (1993) now places the species in the genus *Caenis*.

Caenis nigropunctata is a tropical species from the southern Hemisphere; its range includes Java, Sumatra, Bali, the Philippines, and China (Zimmerman, 1957; Dudgeon, 1999). Caenids are small, typically less than 10 mm in length. Many caenids possess

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abdominal gills that are morphologically adapted to rhythmically beat and create a flow of water; this specialization allows exploitation of organically enriched and silty habitats. The lower reaches of Waimānalo Stream exhibit these characteristics; it is highly modified with an artificially straightened channel, a high silt load, and significant organic pollution. Although it is not known why this species has apparently become rare, it is likely that *C. nigropunctata* may be found in similarly degraded aquatic habitat elsewhere on O'ahu.

Material examined: O'AHU: 2, lower Waimānalo Str. nr. Saddle City Rd bridge, 20 ft [6 m], 26 Sep 1997 (BPBM Acc. 1999.097); 1, same location, 30 Sep 1999, G. Smith.

Acknowledgments

Thanks to R.A. Englund for pointing out the significance of these specimens, and thanks to D. Polhemus for confirming their identification; P. Chong, L. Harrington, and W. Haight assisted with field work. This work was funded by Clean Water Act 604(b) funds in support of Total Maximum Daily Load studies for Waimānalo Stream.

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Additions and corrections to the spider fauna of Hawai'i

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New collections from the Hawaiian islands by J.W. and E.R. Berry, J.A. Beatty, Dean Jamieson, and G.M. Nishida, along with examination of previously unidentified specimens in collections of the American Museum of Natural History (AMNH) and the Bishop Museum (BPBM), have yielded many new state and island records of various spider species. These records are presented here along with corrections of names and comments on the new records. Vouchers are Department of Zoology, Southern Illinois University at Carbondale unless otherwise noted.

Anapidae

Pseudanapis aloha Forster

New island record

Previously recorded from O'ahu and Hawai'i.

Material examined: **KAUA'I:** near Kāhili Mountain Park (near Kōloa), Norfolk Island pine grove, 1000 ft, litter, 11 Jan 1998, 1 ♀ (J. & E. Berry).

Araneidae

Neoscona crucifera (Lucas)

New state record

This species, formerly known as *Neoscona hentzi*, had been reported from Hawai'i on the basis of misidentified specimens. It was recently deleted from the Hawaiian fauna (Roth & Nishida, 1997). Authentic specimens are now available.

Material examined: **KAUA'I:** Koke'e, beating vegetation, 1 Mar 1993, 1 ♂ (D. Jamieson); same locality, 4 Oct 1993, 1 ♂ (D. Jamieson).

Clubionidae

Clubiona alveolata L. Koch

New state record

This species is widespread in the Pacific, from Tonga to the Marquesas.

Material examined: **HAWAI'I:** Manukā State Park mesic forest, 1750 ft, 11 Feb 1995, 1 ♂ 2 ♀ 3 imm (J. & E. Berry). Manukā State Park nature trail, 19 Feb 1995, 1 ♀ 3 imm (J. & E. Berry). Isaac Hale Beach Park, Puna District, *Pandanus* litter, 24 Feb 1995, 2 ♀ (J. & E. Berry). **MIDWAY:** Eastern I, bark of *Casuarina* stump, 12 May 1973, 1 ♂ (W.C. Gagné) (BPBM).

Corinna cetrata (Simon)

New island records

A widespread Pacific species, previously recorded from Kaua'i and O'ahu.

Material examined: **HAWAI'I:** milepost 17–18, Hwy 137, breadfruit litter, 31 Jan 1997, 1 ♂ 16 imm (J. & E. Berry). Ka'u District, Nā'ālehu, on hill in forest litter, milepost 66, Hwy 11, 1100 ft, 2 Feb 1997, 1 ♂ 1 ♀ 28 imm (J. & E. Berry). Hilo, Kino'ole St., 21 Feb 1995, 1 ♀ (J. & E. Berry). **MIDWAY:** Eastern I, 20 Nov–15 Dec. 1971, 1 ♂ (J.A. Richardson).

Meriola arcifera (Simon)

New state record

This South American species is also introduced in California.

Material examined: **HAWAI'I:** Mauna Ke'a, at visitor center in clump of Ranunculaceae, 9200 ft, 9 Feb 1995, 3 ♂ 4 ♀ 11 imm (J. & E. Berry). Mauna Ke'a, in mullein & grass clumps, 8020 ft, 9 Feb 1995, 1 ♀ 3 imm (J. & E. Berry). Mauna Ke'a State Park, 6000 ft, 10 Feb 1995, 1 ♂ (J. Berry). Mauna Ke'a summit, Lake Waiau, on rocks in bog, 13020 ft, 11 Feb 1997, 4 ♀ (J. & E. Berry). Mauna Ke'a summit, grass clumps in lava field, 13000 ft, 11 Feb 1997, 1 ♀ 2 imm (J. & E. Berry). Mauna

Ke'a summit, Lake Waiau, 13020 ft. on rocks by lake, 12 Feb 1997, 1♂2♀ 2 imm (J. & E. Berry). Mauna Ke'a State Park, grassland, 6600 ft, 13 Feb 1997, 2♂ 7 imm (J. Berry). Mauna Ke'a road, near Saddle Road, under rocks in cow pasture, 7500 ft, 13 Feb 1997, 1♂4♀ 1 imm (J. & E. Berry).

Dictynidae

Dictyna calcarata Banks

New state record

A common North American species adventive at higher elevations in Hawai'i.

Material examined: **HAWAI'I:** Mauna Ke'a, in mullein and grass clumps, 8020 ft, 9 Feb 1995, 1♀ 1 imm (J. & E. Berry). Mauna Ke'a State Park, under rocks, 6500 ft, 10 Feb 1995, 2♀ (J. & E. Berry). Mauna Ke'a State Park, in sedge clumps in webs about 1 inch above soil, 6600 ft, 13 Feb 1997, 1♂1♀ 14 imm (J. & E. Berry).

Gnaphosidae

Camillina elegans (Bryant)

New island record

Previously reported from O'ahu, Moloka'i, Lāna'i, Maui, Hawai'i and Midway.

Material examined: **KAUA'I:** Kaula County Airport, under rocks in field near beach, 21 Jan 1998, 1♂ (J. Berry).

Scotophaeus blackwalli (Thorell)

New state record

This is a European species, introduced also into mainland United States. It is common in California.

Material examined: **O'AHU:** Waimānalo Beach Park, under bark of *Casuarina*, 10 Jan 1998, 1♀ (J. Beatty).

Trachyzelotes jaxartensis (Kroneberg)

New island record

Previously known from O'ahu and Moloka'i.

Material examined: **KAUA'I:** 'Ele'ele, in abandoned lot, 25 Jan 1998, 1♂ (J. & E. Berry).

Zelotes reformans Chamberlin

New island record

Previously recorded from O'ahu, Moloka'i and Hawai'i.

Material examined: **KAUA'I:** Salt Pond Co. Park, under rock at shore, 25 Jan 1998, 1♀ (J. & E. Berry).

Linyphiidae

Erigone autumnalis Emerton

New island record

Known previously only from Hawai'i.

Material examined: **KAUA'I:** Mākaha Ridge Road, pine forest litter, 2000 ft, 23 Jan 1998, 2♂5♀ (J. & E. Berry).

Erigone dentosa Cambridge

New island record

Reported previously from O'ahu and Hawai'i.

Material examined: **KAUA'I:** Waitā Reservoir near Kōloa, under rock, 3 Feb 1998, 1♂ (J. Berry & D. Jamieson); Koke'e State Park, Alaka'i Swamp Trail, shaken from vegetation, 4000 ft, 26 Jan 1998, 1♀ (J. & E. Berry).

Lepthyphantes tenuis (Blackwall)

New state record

This European species has been recorded also as introduced in New Zealand. In the Hawaiian islands it has been found only at high elevations on Hawai'i.

Material examined: **HAWAI'I:** Summit of Mauna Ke'a, 13400 ft, 11 Feb 1997, 2♀ (J. & E. Berry, D. Correa). Summit of Mauna Ke'a, Lake Waiau, in webs under large rocks, 13020 ft, 12 Feb

1997, 1 ♂ 2 ♀ (J. & E. Berry). Mauna Ke'a Road near Saddle Road, 7500 ft, under rocks in cow pasture, 13 Feb 1997, 1 ♂ 1 ♀ (J. & E. Berry).

***Microbathypantes palmarius* (Marples) New island records**

Reported previously from Maui and Moloka'i as *Priscipalpus palmarius*. The description of the genus *Microbathypantes* antedates description of the synonymous genus *Priscipalpus*.

Material examined: **HAWAII:** Puna District, mile 17–18, Hwy 137, coconut trash pile, 21 Jan 1997, 1 ♂ 19 ♀ (J. & E. Berry). Ka'u District, Nā'ālehu, Hwy 11, milepost 66, hillside forest, 1100 ft, shaken from trees, 8 Feb 1997, 3 ♀ (E. Berry). Ka'u District, Nā'ālehu, Hwy 11, milepost 66, hillside forest, 1100 ft, in litter, 8 Feb 1997, 5 ♂ 8 ♀ 4 imm (E. Berry). **KAUA'I:** near Kāhili Mountain Park, Norfolk Island pine grove, 1000 ft, litter, 11 Jan 1998, 3 ♂ 2 ♀ 4 imm (J. & E. Berry).

***Nesioneta lepida* Millidge New state record**

Known previously from the Marshall and Caroline Islands.

Material examined: **HAWAII:** Puna District, 1 mile W. of MacKenzie St. Park, *Casuarina* litter, 31 Jan 1997, 1 ♀ (J. & E. Berry). MacKenzie State Park, 3 Feb 1997, 2 ♀ (J. & E. Berry). Lava Tree State Park, 25 Feb 1995, 11 ♂ (J. & E. Berry). Ka'u District, South Point, in grass clump at Green Sand Beach, 9 Feb 1997, 1 ♀ (J. & E. Berry). Nā'ālehu, milepost 66, 1000 ft, litter, 8 Feb 1997, 1 ♀ (J. & E. Berry). **KAUA'I:** near Kōloa, Hwy 520, milepost 4.5, litter near stream, 200 ft, 10 Jan 1998, 1 ♂ (J. Berry); Kaua'i County Airport, under rock in field near beach, 21 Jan 1998, 1 ♀ (J. Berry).

Loxoscelidae (or Sicariidae)

***Loxosceles rufescens* (Dufour) New island record**

Previously recorded from Kaua'i, O'ahu, Lāna'i and Maui.

Material examined: **HAWAII:** Near Waimea, 1500–2000 ft, under rocks in field, 17 Feb 1997, 2 ♀ 4 imm (J. & E. Berry). Near Waimea, 2000 ft, *Casuarina* litter, 17 Feb 1997, 1 ♀ (J. & E. Berry). milepost 62, Hwy 19, near Waimea, 1500 ft, under rocks in grassland, 9 Feb 1997, 1 ♀ 8 imm (J. & E. Berry).

Mysmenidae

***Mysmenella* cf. *samoensis* (Marples) New state record**

This is the first record for the family from the Hawaiian Islands. A very small spider found moderately commonly in litter on Hawai'i.

Material examined: **HAWAII:** Puna District, milepost 17, Hwy 130, coconut palm trash, 31 Jan 1997, 2 ♂ 7 ♀ 1 imm (J. & E. Berry). Kalōpā State Park, grass/*Eucalyptus* litter, 13 Feb 1995, 1 ♂ 15 ♀ 3 imm (J. Berry). **KAUA'I:** Waitā Reservoir near Kōloa, under rock, 3 Feb 1998, 1 ♂ (J. Berry & D. Jamieson).

Ochyroceratidae

***Theotima* cf. *radiata* (Simon) New island records**

Previously known from O'ahu and Maui.

Material examined: **HAWAII:** Puna District, 20.5 mm, Hwy 137 'Ohi'a scrubland, litter, 1 Feb 1997, 21 ♀ & imm (J. & E. Berry). **KAUA'I:** National Tropical Botanical Garden, Lawa'i, in litter, 21 Jan 1998, 1 ♀ (J. Berry). **MIDWAY:** Sand I, W of inner harbor, in soil at base of *Casuarina*, 14 Feb 1997, 2 ♀ (G.M. Nishida) (BPBM).

Oecobiidae

***Oecobius* cf. *cellariorum* (Duges) New state record**

This species resembles *Oecobius cellariorum*, but is not certainly identifiable at present.

Material examined: **HAWAII:** Ka'u District, on lava at shoreline, 6 Feb 1997, 1 ♀ (E. Berry). Honokōhau Harbor, in litter, 16 Feb 1995, 1 ♂ 2 ♀ (J. Berry). Hwy 19, milepost 62, 1500 ft, under rocks in grassland, 19 Feb 1997, 1 ♀ (J. & E. Berry).

Oonopidae

Except for the new state records, the Oonopidae listed here were previously reported from the Hawaiian Islands only from O'ahu.

Gamasomorpha lalana Suman

New island records

Material examined: **HAWAII:** Puna District, 1 mi W of MacKenzie State Park, *Casuarina* litter, 31 Jan 1997, 1 ♂ 3 ♀ (J. & E. Berry). **KAUA'I:** Kuaehu Point, Moloa'a Beach, 11 Jan 1988, 1 ♀ (J. Berry). E. of Poipu near beach, under rocks at roadside, 25 ft, 18 Jan 1998, 1 ♂ 2 ♀ (J. & E. Berry, J. Beatty).

Ischnothyreus omus Suman

New island record

Material examined: **KAUA'I:** Hā'ena State Park, almond-*Ficus* forest, litter, 15 Jan 1998, 4 ♂ 3 ♀ (J. & E. Berry).

Oonopinus hunus Suman

New island record

Material examined: **HAWAII:** 1 mi W. of MacKenzie State Park, *Casuarina* litter, 31 Jan 1997, 2 ♂ 5 ♀ (J. & E. Berry). **KAUA'I:** Waimea Canyon Road, *Eucalyptus* forest, litter, 3000 ft, 17 Jan 1998, 4 ♀ (J. & E. Berry, J. Beatty).

Oonopinus kilikus Suman

New island records

Material examined: **HAWAII:** Puna District, MacKenzie State Park, in litter, 3 Feb 1997, 2 ♀ (J. & E. Berry) **KAUA'I:** National Tropical Botanical Garden near Poipu, 20 ft, 20 Jan 1998, 1 ♀ (J. & E. Berry).

Opopaea lena Suman

New island records

Material examined: **HAWAII:** Puna District, 1 mi. west of MacKenzie State Park, *Casuarina* litter, 31 Jan 1997, 2 ♂ 4 ♀ (J. & E. Berry). **KAUA'I:** 'Ele'ele, litter in abandoned lot, 25 Jan 1998, 1 ♂ 2 ♀ (J. & E. Berry).

Orchestina sp.

New state record

This is the first record of this genus from the Hawaiian Islands. The species is not yet determined.

Material examined: **HAWAII:** Ka'u District, South Point at Green Sand Beach in grass clump, 9 Feb 1997, 1 ♂ (J. & E. Berry). **KAUA'I:** along Makaweli River near Waimea, 17 Jan 1998, 2 ♂ 2 ♀ 1 imm (J. & E. Berry, J. Beatty).

Triaeris lepus Suman

New island records

Material examined: **HAWAII:** Waipi'o Valley, 18 Feb 1997, 6 ♀ (J. & E. Berry). **KAUA'I:** 'Ele'ele, litter in abandoned lot, 25 Jan 1998, 1 ♂ 1 ♀ (J. & E. Berry).

Pholcidae

Hedypsilus culicinus Simon

New island records

Known previously from O'ahu.

Material examined: **HAWAII:** Ka'u District at South Point, on lava, 9 Feb 1997, 1 ♂ (J. & E. Berry). **KAUA'I:** near Māhā'ulepū Beach, under rock in cornfield, 19 Jan 1998, 1 ♂ (J. & E. Berry); Port Allen Harbor causeway, 26 Jan 1998, 2 ♀ 1 imm (J. & E. Berry).

Pholcus ancoralis* L. Koch*New state record**

This species is common throughout most of the Pacific islands.

Material examined: **HAWAI'I:** Puna District, Hwy 137, milepost 17–18, on building, 2 Feb 1997, 1 ♀ (J. & E. Berry).

Smeringopus pallidus* (Blackwall)*New island record**

Previous records are from Kaua'i, O'ahu, Maui and Lisiansky.

Material examined: **HAWAI'I:** Puna District, Hwy 137, milepost 17–18, on building, 2 Feb 1997, 2♂2♀ 2 imm (J. & E. Berry).

Salticidae***Bavia aericeps* Simon****New island record**

Previously known from O'ahu and Hawai'i.

Material examined: **MAUI:** 'Ulumalu, 7 Jan 1998, 1 ♀ (D. Taketa) (BPBM).

Epocilla calcarata* (Karsch)*New state record**

Introduced species. Its normal range is from China to Indonesia.

Material examined: **O'AHU:** Honolulu, wall, 1 May 1950, 1♂ (L. Chilson) (AMNH). Honolulu, Univ. of Hawaii campus, 7 Jul 1957, 1♂ (A.M. Nadler) (AMNH). Honolulu, 17 Feb 1961, 1♀ (E. Schlinger) (AMNH).

Habronattus tarsalis* (Banks)*New island record**

This may be the species previously reported from Moloka'i as *H. mustaciata* (Chamberlin & Ivie).

Material examined: **HAWAI'I:** Ka'u District, on road near Green Sand Beach, 5 Feb 1997, 1♂ (J. & E. Berry).

Menemerus bivittatus* (Dufour)*New island record**

Previously reported from Kaua'i and O'ahu.

Material examined: **HAWAI'I:** Puna District, Hwy 137, milepost 17–18, on building, 2 Feb 1997, 1♂3♀ 3 imm (J. & E. Berry).

Messua* cf. *felix* (Peckham & Peckham)*New island records**

Previously known from Kaua'i and O'ahu.

Material examined: **HAWAI'I:** Parker Ranch, 5 mi. S. of Waimea, in grass, 17 Feb 1995, 3♂3♀ 8 imm (J. & E. Berry). **MAUI:** Hāna, 8 Jan 1961, 2♀ (N.L.H. Krauss) (BPBM). **MIDWAY:** Sand I, 13–15 Feb 1997, 1♂1♀ (G.M. Nishida) (BPBM).

Phidippus audax* (Hentz)*New island record**

Previously reported from O'ahu, Maui and Hawai'i.

Material examined: **KAUA'I:** Nohili Point, Barking Sands, in retreat under rock at beach, 15 May 1996, 1♀ (D. Jamieson).

Phintella versicolor* (C.L. Koch)*New island records**

Previously known from O'ahu and Hawai'i.

Material examined: **MIDWAY:** Sand I, 4 Feb 1957, 2♀ (Y. Oshiro) (BPBM); Sand I, 16 Feb 1997, 1♂ (G.M. Nishida) (BPBM). **KAUA'I:** Menehune Ditch, 21 May 1964, 1♀ (J. Aoki) (BPBM).

Plexippus paykullii* (Audouin)*New island record**

Previously recorded from Kaua'i.

Material examined: **MIDWAY:** Eastern I, Nov–Dec 1971, 1 ♂ 1 ♀ 5 imm (J. Richardson); Sand I, 13–15 Feb 1997, 2 ♂ (G.M. Nishida) (BPBM).

Plexippus petersi* (Karsch)*New state record**

A common synanthropic species of the West Pacific, Asia, and Africa.

Material examined: **O'AHU:** Honolulu, in building, 20 Jun 1985, 1 ♂ (F. Howarth) (BPBM); Bishop Museum, Oct 1966, 1 ♂ (H. Tong) (BPBM); Honolulu, Salt Lake, 14 Aug 1977, 1 ♂ (J. Nishioka) (BPBM).

Rhene rubrigera* (Thorell)*New state record**

Introduced species. It ranges from India to Sumatra.

Material examined: **HAWAI'I:** Kealakoloa, 24 Apr 1944, 1 ♂ (N.L.H. Krauss) (AMNH). **O'AHU:** Mānoa, 22 Jan 1930, 1 ♀ (N.L.H. Krauss) (BPBM); Mānoa, 5 Nov 1933, 2 ♂ (N.L.H. Krauss) (BPBM).

Thiania suboppressa* Strand*New state record**

Introduced species. It is found in China and Viet Nam.

Material examined: **O'AHU:** Mt Tantalus, Mar 1950, 1 ♂ (D.E. Hardy) (AMNH). Honolulu, 10 May 1950, 2 ♂ 1 ♀ 1 imm (D.E. Hardy) (AMNH). Honolulu, Apr 1950, 2 ♂ (D.E. Hardy) (AMNH).

Zenodorus microphthalmus* (L. Koch)*New island records**

Previous records Kaua'i and O'ahu.

Material examined: **HAWAI'I:** Manukā State Park nature trail, 19 Feb 1995, 1 ♂ (J. & E. Berry); **MAUI:** Waihe'e, 16 Mar 1967, 1 ♂ (N.L.H. Krauss) (BPBM).

Scytodidae***Scytodes striatipes* (L. Koch)****New island records**

Previously recorded from O'ahu, Kure, Lisiansky, Necker.

Material examined: **HAWAI'I:** W. of Waimea, Hwy 19, milepost 62, 1500 ft. under rocks in grassland, 19 Feb 1997, 1 ♂ 5 ♀ (J. & E. Berry). **KAUA'I:** Salt Pond County Park, under rock along shore, 25 Jan 1998, 1 ♀ (J. & E. Berry).

Tetrablemmatidae***Tetrablemma* sp.****New island record**

The earlier record of this genus was from Lāna'i, specimens tentatively identified by Roth & Nishida (1997) as *Tetrablemma deccanensis* (Tikader), an Indian species. Most species of this family have restricted ranges (Lehtinen, 1981). The Hawaiian specimens are unlikely to be *T. deccanensis* unless that species has been introduced. Male specimens from Hawai'i are needed to allow certain identification of this species.

Material examined: **O'AHU:** outer slope of Diamond Head, under board, 25 Dec 1997, 1 ♀ (J. Beatty).

Tetragnathidae***Tetragnatha nitens* (Audouin)****New island record**

This species was previously recorded from Kaua'i and Laysan.

Material examined: **MIDWAY:** Sand I, 16 Feb 1997, 2 ♂ 1 ♀ (G.M. Nishida) (BPBM).

Theridiidae***Achaearanea acoreensis* (Berland)****New state record**

This is a widespread species found in both Old and New World (Levi, 1967).

Material examined: **HAWAII:** Hakalau NWR, Pua 'Ākala, 5000 ft, in litter, 1 ♀ (J. Berry). Hakalau NWR, Pua 'Ākala, 5000 ft, among grass, 1 ♂ (J. & E. Berry). Hakalau NWR, Pua 'Ākala, 5000 ft, in small tangled web on roadside, 1 ♂ (J. & E. Berry); **KAUA'I:** Waimea Canyon Road, *Eucalyptus* forest, 3000 ft, sweeping and shaking, 17 Jan 1998, 1 ♀ 1 ♂ (J. & E. Berry, J. Beatty).

***Achaearanea* cf. *saxatilis* (C.L. Koch) New state record**

These specimens are not identified with certainty, but they resemble the widespread Palearctic species *A. saxatilis*.

Material examined: **HAWAII:** Hakalau NWR, Pua 'Ākala, 5000 ft, among trash metal, 1 ♂ 6 ♀ 3 imm (J. Berry).

***Argyrodes argentatus* O. Cambridge New state record**

This common species often occurs as inquiline in orb-weaver webs. It is similar to *A. argyrodes* and may have been mistaken for it in Hawai'i.

Material examined: **HAWAII:** Waipi'o Valley, along stream, 14 Feb 1995, 1 ♂ 4 ♀ 3 imm (J. & E. Berry). **KAUA'I:** trail to Kāhili Mountain, 1700, 12 Jan 1998, 1 ♂ 3 ♀ 1 imm (J. & E. Berry).

***Chrysso* sp. New state record**

This is the first record of this genus from the Hawaiian Islands. The species is not yet identified.

Material examined: **HAWAII:** Waiākea Forest Reserve, Stainback Highway, at Treeplanting Road, 2100 ft, 23 Feb 1995, 1 ♀ (J. & E. Berry).

***Coleosoma floridanum* Banks New island record**

Previously recorded from O'ahu and Lisiansky.

Material examined: **HAWAII:** Waipi'o Valley, 18 Feb 1997, 10 ♂ 16 ♀ 9 imm (J. & E. Berry).

***Dipoena alta* Keyserling New state record**

A Central and South American species.

Material examined: **HAWAII:** Hwy 130, milepost 3, shaken from tree, 1 Feb 1997, 1 ♀ (J. & E. Berry). MacKenzie St. Park, 2 Feb 1997, 1 ♂ 2 ♀ 9 imm (J. & E. Berry). **KAUA'I:** Kāhili Mt., 5 mi. N. of Kōloa, 920 ft, mixed forest, 11 Jan 1998, 2 ♂ 2 ♀ 2 imm (J. & E. Berry).

***Latrodectus hesperus* Chamberlin & Ivie New island records**

Previous records from O'ahu, Moloka'i, Maui, Midway and French Frigate Shoals.

Material examined: **HAWAII:** Hwy 19, milepost 62, W. of Waimea, 1500 ft, under rocks in grassland, 19 Feb 1997, 1 ♂ 1 ♀ 1 imm (J. & E. Berry); **KAUA'I:** Nohili Point, Barking Sands, in low *naupaka* at beach, 15 May 1996, 1 (D. Jamieson).

***Steatoda erigoniformis* (O. Cambridge) New island records**

Previous record only from Maui.

Material examined: **HAWAII:** Ka'u District, South Point, among sedum and grass, 9 Feb 1997, 7 ♂ 14 ♀ 5 imm (J. & E. Berry). **O'AHU:** Kahe Point Beach Park near Nānākuli, in beach rubble, 9 Jan 1988, 1 ♀ (J. & E. Berry). **KAUA'I:** near Kōloa, milepost 4.5, Hwy 520, 200 ft, litter near stream, 10 Jan 1998, 1 ♂ (J. & E. Berry); Waimea Canyon Drive, Waimea, under rock, 5 Feb 1998, 1 ♀ (J. Berry).

***Steatoda grossa* (C.L. Koch) New island record**

Previously reported from Maui and Hawai'i.

Material examined: **KAUA'I:** Koke'e State Park, Nu'alolo Trail, 3000 ft, in tree crevice, 6 Feb 1998, 1 ♂ 3 ♀ 5 imm (J. Berry, D. Jamieson).

***Theridion adamsoni* Berland** **New state record**

A virtually cosmopolitan species (Levi, 1967).

Material examined: **HAWAII:** Kolekole Co. Park, near Hilo, tree shaking, 21 Feb 1995, 1 ♂ 2 ♀, 2 imm (J. & E. Berry). **KAUA'I:** Kaua'i Mem. Garden Cemetery, shaken from vines, 24 Jan 1998, 1 ♀ (J. & E. Berry). **MIDWAY:** Sand I, 18 Feb 1997, 1 ♀ (G.M. Nishida) (BPBM).

***Theridion melanostictum* O. Cambridge** **New island records**

Previously recorded from O'ahu and Lāna'i.

Material examined: **HAWAII:** Honokōhau Harbor beach, among beach grass, 12 Feb 1995, 3 ♂ 3 ♀, 13 imm (J. Berry). **KAUA'I:** Polihale State Park, on beach rocks, 12 Jan 1988, 1 ♂ 2 ♀ (J. & E. Berry). **MIDWAY:** Sand I, 14–18 Feb 1997, 2 ♂ 3 ♀ (G.M. Nishida) (BPBM).

***Theridion rufipes* (Lucas)** **New island record**

Previously recorded from O'ahu, Hawai'i, and Lisiansky.

Material examined: **KAUA'I:** Līhu'e, Wilcox Hospital, 15 Sep 1996, 1 ♂ 1 ♀ (D. Jamieson).

Uloboridae***Zosis geniculatus* (Olivier)** **New island record**

Previously reported from O'ahu and Hawai'i.

Material examined: **KAUA'I:** Kapa'a, Kauaihau Road, around house, 13 Jan 1988, 2 ♂ 8 ♀ (J. & E. Berry).

Zodariidae***Zodarion trispinosum* Suman** **New island record**

Previously recorded from O'ahu.

Material examined: **HAWAII:** Honokōhau Harbor, in litter, 16 Feb 1995, 1 ♀ (J. Berry).

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The centipede order Scolopendromorpha in the Hawaiian Islands (Chilopoda)

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Introduction

This contribution is the first of 3 works on Hawaiian representatives of the class Chilopoda, all of which are introduced, with the possible exceptions of 2 geophilomorphs, *Marsikomerus pacificus* Attems and *M. lanaius* (Chamberlin) (Schendylidae), which appear to be endemic to the islands of Hawai'i and Lāna'i, respectively (Hoffman & Pereira, 1991). Four of the 5 living orders occur in Hawai'i, the exception being Craterostigmomorpha, comprised of 1 family, 1 genus, and at most 2 species, which is

confined to Tasmania and the South Island of New Zealand (Chamberlin, 1920; Lewis, 1981). Papers on the Lithobiomorpha and Geophilomorpha will be coauthored with European colleagues specializing in these orders; the Scutigermorpha will not be covered because it lacks a reliable specialist. Wood (1862) described *Scutigera straba*, originally placed in the genus *Cermatia* Illiger, from O'ahu, which was subsequently recorded by Silvestri (1904) and Chamberlin (1920); Attems (1914a) reported, with a question mark, *S. lesueurii* Lucas, described from Australia, from the islands in general. Nishida (1994) also cited *S. straba* from O'ahu and categorized it as an adventive species, but to my knowledge, *S. lesueurii* has not been reported again from the archipelago. Future workers will have to determine the native area of *S. straba*, whether this name is synonymous with an older species, and whether 2 scutigermorphs actually occur in the islands.

The Scolopendromorpha are characterized by 21 or 23 pairs of legs and pedal segments (only the former occurs in Hawai'i, but a representative of the latter, a species of *Newportia*, has been intercepted in quarantine (Chamberlin, 1930)), 17 or more antennal articles, a low degree of tergite heteronomy, and epimorphic development. It contains the large, aggressive, intimidating centipedes, which are known to the general public and can inflict a painful bite on humans. The order comprises 2 families, both represented in the Hawaiian Islands: Scolopendridae, with 4 ocelli on each side of the cephalic plate lateral to the bases of the antennae, and Cryptopidae, which lacks ocelli. The Hawaiian scolopendromorph fauna, all of which have been introduced by humans, is not as diverse as the lithobiomorph and geophilomorph faunas; at least 3 species inhabit the islands, but the exact composition cannot be stated because of the absence of a revision of the genus *Otostigmus* Porat. One species, *Scolopendra subspinipes* Leach, grows to around 6 inches in length and is particularly widespread, occurring on 6 of the major islands plus Midway Island. It was first recorded from the islands by Gervais (1847) in the description of *S. sandwichiana*, which was based on a specimen collected on O'ahu or Maui. Wood (1862) cited *S. sandwichiana* and proposed *S. repens* for specimens from O'ahu or Kaua'i and the "Sandwich Islands" in general. Kohlrausch (1881) placed *S. sandwichiana* in synonymy under *S. subspinipes*, and Attems (1930) listed it under the nominate subspecies. Karsch (1880) cited *S. septemspinosa* Brandt from Waiehu (spelled as "Waichu"), Maui, and Honolulu, and suggested that *S. sandwichiana* might be a synonym. Kraepelin (1903) regarded *S. septemspinosa* as a synonym of *S. subspinipes*, but Attems (1930) listed it as an indiscernible species. As there is no evidence that 2 species of *Scolopendra* occur in the islands, I regard these as records of *S. subspinipes*. Kraepelin (1903) also placed *S. repens* in synonymy under *S. subspinipes* with a question mark, indicating a degree of uncertainty, but Silvestri (1904) retained it as a valid species. Chamberlin (1920) and Attems (1930) repeated Kraepelin's synonymy, and I here confirm it based on examination of the type specimen at the ANSP (see following list of abbreviations). Silvestri (1904) reported *S. subspinipes* from Honolulu, and Attems (1914b) and Chamberlin (1920, 1944) recorded it from O'ahu. Shelley (1991) recorded *S. subspinipes* from Kaho'olawe, Maui, O'ahu, and Hawai'i, and Nishida (1994) cited it from O'ahu, Hawai'i, and Midway islands, listing it as an adventive species.

Other important references on Hawaiian scolopendromorphs include the description of *Opisthemea insulare* Meinert (1886), a synonym of *Theatops spinicaudus* (Wood), from the islands in general, which was subsequently cited by Kraepelin (1903), Silvestri (1904), Attems (1914a, 1930, 1938), Chamberlin (1920), and Lewis (1981). This chilopod actually occurs in the southeastern continental United States (Shelley, 1997), so Shelley (1991) deleted it from the Hawaiian fauna. Attems (1938) proposed *Cryptops nana* for a specimen collected in compost in Honolulu, which Nishida (1994) cited from O'ahu in general and listed as a questionably adventive species; I here place this name in synonymy

under *C. hortensis* Leach. Nishida (1994) also reported *Otostigmus scaber* Porat from O'ahu, the first formal Hawaiian record of this species, genus, and the subfamily Otostigminae.

I present herein accounts of the Hawaiian scolopendromorphs with synonymies, published records from the islands, and new ones discovered in American repositories; diagnoses are provided for 2 species and published illustrations are referenced where possible. Scolopendromorphs reported from quarantine interceptions, which actually do not occur in the islands, are deleted in the concluding section. Abbreviations of sources of preserved specimens are as follows: AMNH - American Museum of Natural History, New York; ANSP - Academy of Natural Sciences, Philadelphia; BPBM - Bishop Museum, Honolulu; BYU - Monte L. Bean Life Science Museum, Brigham Young University, Provo; CAS - California Academy of Sciences, San Francisco; FMNH - Field Museum of Natural History, Chicago; MCZ - Museum of Comparative Zoology, Harvard University, Cambridge; MNHN - Museum National d'Histoire Naturelle, Paris; NCSM - North Carolina State Museum of Natural Sciences, Raleigh; PMNH - Peabody Museum of Natural History, Yale University, New Haven; SEM - Snow Entomological Museum, University of Kansas, Lawrence; UCR - University of California, Riverside; USNM - National Museum of Natural History, Smithsonian Institution, Washington, DC; WSU - James Entomological Museum, Washington State University, Pullman.

Family Cryptopidae

Subfamily Cryptopinae

Cryptops hortensis Leach

New island records

Cryptops hortensis Leach, 1815: 384.

Cryptops nana Attems, 1938: 374–76, figs. 7–9. **New Synonymy.**

Diagnosis. Length 9 mm, width 0.4 mm; ocelli absent; anterior margin of prosternum without elongate, coarsely toothed plates; 1st tergite overlapping head; ultimate legs slightly thicker than penultimate legs.

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

Published records (all as *C. nana*). O'ahu in general (Nishida, 1994), Honolulu (Attems, 1938).

New records. **HAWAII:** Hawaii Volcanoes Natl. Park, moss and ferns 25 ft below surface of vent #9, 21 Oct 1970, M.L. Goff (BPBM). **MAUI:** 'Āao Valley St. Pk., 4 Aug 1993, R.W. Baumann (BYU). Pu'u Ahulili, 100 m, leaf litter, 24 Jul 1980, W.A. Steffan (BPBM). Kīpahulu Valley, Pua'alu'u Stream, 1400 ft, in moss on *Metrosideros*, 22 Jul 1980, W.C. Gagné, G. Young (BPBM). Olinda, Waihou Spring Trail, 1200 m, wet pine forest tree litter, 27 Jun 1997, S.F. Swift (BPBM). **O'AHU:** Hālawa Valley, W side of tunnel, 25 Feb 1996, V. & B. Roth (BPBM). Honolulu, Mānoa, under bark of *Acacia koa*, 4 Jul 1928, N.L.H. Krauss (BPBM). Ko'olau Range, Kaumuhonu Pk. ca. 2 km NE Mt. Tantalus, 525 m, on ground under *koa*, 18 May 1982, G.A. Samuelson (BPBM). Lualualei, Halona Valley, Camp #1, 460 m, sifted soil litter, 8 Apr 1996, S.F. Swift (BPBM).

Remarks. I believe that *C. nana*, known only from the holotype, is a synonym of *C. hortensis*, a European species widely established in North America. It has also been intercepted in quarantine in Hawai'i, in debris with orchids from England (Whitney, 1932).

The taxonomy of *Cryptops* is greatly tangled because of the descriptions of numerous species from quarantine interceptions and the tendency of many older authors to base species solely on the sutural patterns of the tergites 1–3, ignoring the rest of the body. Important features like the spurs on the caudal legs have received little attention, and even well known species like *C. hyalinus* Say, in the eastern continental United States, need to be redefined. In my view, scanning electron microscopy should be employed to examine these legs and other parts of the body, and there should be a moratorium on new species

proposals until the existing names can be reevaluated using this modern taxonomic tool; the work of Pichler (1987) on Austrian representatives is exemplary in this regard. Little purpose is served by proposing more unrecognizable species of *Cryptops* when there is such a wealth of poorly known taxa that no one can identify. This is exemplified by the 4 species Chamberlin established for Hawaiian quarantine interceptions (see concluding section).

Family Scolopendridae

Subfamily Scolopendrinae

Scolopendra subspinipes Leach

New island record

Scolopendra subspinipes Leach, 1815: 383. Kohlrausch, 1881: 96–100. Kraepelin, 1903: 256–60. Chamberlin, 1920: 30–31; 1944: 184. Attems, 1930: fig. 43. Williams, 1931: fig. 148. Nishida, 1994: 30–31.

Scolopendra sandwichiana Gervais, 1847: 276. Wood, 1862: 30–31.

Scolopendra repens Wood, 1862: 31–32.

Scolopendra subspinipes subspinipes: Attems, 1930: 29–30.

Diagnosis. The largest Hawaiian scolopendromorph, dimensions varying depending upon age and maturity but typically growing to around 6 inches in length (maximal body length (excluding caudal legs) of specimens available to me, ca. 105 mm (4.25 in), maximal width ca. 8.5 mm); with 4 ocelli on each side of cephalic plate lateral to bases of antennae; spiracles valvular, tripartite; first tergite without curved, transverse, cervical groove; ultimate legs with 0–3 spurs on ventral surfaces of prefemora; penultimate, antepenultimate, and more anterior legs without dorsal prefemoral and femoral spurs. Full length drawings are provided by Attems (1930: fig. 1) and Williams (1931: fig. 148); the arrangement of spurs on the ventral surface of the caudal legs in 1 variant is shown by Attems (1930: fig. 43).

Notes on synonymies. I examined the type of *S. repens* (ANSP) and can confirm that this name is a synonym of *S. subspinipes*. The types of *S. sandwichiana* could not be located at the MNHN (J.-P. Mauriès, *in litt.*), but there is little doubt that this name is also a synonym. Samples at this institution from the “Sandwich Islands”, collected in 1875 by M. Ballieu, are *S. subspinipes*, so this species was established on the islands well back into the 19th century.

Occurrence in Hawai‘i. Kaho‘olawe, Kaua‘i, Lāna‘i (new record), Maui, O‘ahu, Hawai‘i, and Midway.

Published records. Islands in general (Wood, 1862; Adamson, 1932); island uncertain, O‘ahu or Maui (Gervais, 1847), O‘ahu or Kaua‘i (Wood, 1862); O‘ahu in general (Attems, 1914b, Chamberlin, 1920; Shelley, 1991; Nishida, 1994), Honolulu (Karsch, 1880; Silvestri, 1904), Kahuku Point (Goff, 1992); Kaho‘olawe in general (Shelley, 1991); Maui in general (Shelley, 1991), Wai‘ehu (Karsch, 1880); Hawai‘i in general (Shelley, 1991; Nishida, 1994); Midway (Suehiro, 1960; Nishida, 1994).

New records. **HAWAI‘I:** Mauna Loa, 13 Jun 1901 (USNM). Napo‘opo‘o, 10 Apr 1919, Stokes (BPBM). Hawaii Volcanoes Natl. Park, Halapē Beach, 20 Aug 1967, G.R. Ballmer (UCR). Kawaihae Park, 30 Jul 1967, G.R. Ballmer (UCR). **KAHO‘OLAWE:** Beck’s Cove, 12 Feb 1980, M.L. Goff (BPBM). 1.2 km W Lua Makika, 430m, 19 Apr 1989, J. Lazell (MCZ). **KAUA‘I:** 2 mi E Barking Sands, 21 May 1994, R.W. Baumann (NCSM). Hanapēpē, 20–26 May 1992, R.W. Baumann, M.L. Nelson, H. Spafford (BYU). Kāhili Mountain Park, 22 May 1992, R.W. Baumann (BYU). Kalihiwai Bay Lookout, along Hwy 56, 28 May 1992, T. & H. Johnson (BYU). 2 mi. SE Lawa‘i. 22 May 1992, R.W. Baumann, M.L. Nelson (BYU). Moalepe Trailhead, 29 May 1992, R.W. Baumann, H. Spafford (BYU). Palikū Pt., along Hwy. 56, 29 May 1962, R.W. Baumann, M.L. Nelson (BYU). **LĀNA‘I:** Garden of the Gods, 27 Apr 1994, R.W. Baumann, C.E. Campora (BYU). **MAUI:** Kahului, along

Hwy 38, 9 Sep 1993, R.W. Baumann, R. Ochoa (BYU). Lahaina, Lahainaluna High School, 4 Aug 1993, R.W. Baumann, R. Ochoa (BYU). Mā'alaea, along Hwy 30, 5 Aug 1993, R.W. Baumann, R. Ochoa (BYU). 1.5 mi. N Makena, May 1957, A.G. Smith (CAS). Wailuku Heights, 11 Aug 1993, R.W. Baumann, R. Ochoa (NCSM). **MIDWAY**: Sand I, Halsey Ave, under 4 × 4 board, 18 Dec 1997, G.M. Nishida (BPBM); and under rotting log beneath ironwood tree, 1 Feb 1999, M.G. Klein (NCSM). **O'AHU**: 'Ēkahanui Gulch, 18 Oct 1944, H. S. Dybas (FMNH). Hale'iwa, along Hwy 83, 20 May 1994, R.W. Baumann, C.E. Campora (NCSM). Honolulu, [sites/streets not specified], Jun 1901, W. Ashland (USNM), 15 Apr 1915, G. Grant (FMNH), 6 Mar 1922, S.C. Ball (BPBM), 10 Oct 1923, Workmer (BPBM), Oct 1925, G. Arnold (BPBM), 27 May 1963, G.W. Byers (SEM); Bishop Museum grounds and building, 2 Aug 1951, C. Nebres (BPBM), 2 Aug 1963, Wilson (BPBM), 12 Jan 1968, H. Rodriguez (BPBM), 1 Feb 1991, Nam (BPBM), room 30, 18 May 1956, Edmondson (BPBM); 'Ālewa Hts., Jan 1968, J.L. Gressitt (BPBM); Fernandez St., 9 Oct 1923 (BPBM); Fort Schafter, Jun 1945, AWS (USNM); Hau'ula, 0–30 m, 14 Feb 1981, W.C. Gagné (BPBM), Kahalu'u, Mar 1986, S. Samuelson, 2 May 1987, G.A. Samuelson (BPBM); Makalapua Pl., 16 Feb 1966, C.V. Cardenas (BPBM); 1924-B Mānoa Rd, crawling on sidewalk, C. Mitchell (BPBM); slopes of the Punchbowl, 8 Nov 1967, P. Schaefer (BPBM); and University of Hawaii Mānoa campus, crawling on grass, Mar 1986, S.F. Swift (BPBM). 2 mi. SW Honolulu, 11 Dec 1920, S.V.H. Jones (FMNH). Kailua, Kawainui Swamp, on leaf of banana plant, 30 Oct 1967 (BPBM). Kualoa Pt., base of cliffs of Ko'olau Range, 8 Jul 1942, R.A. Schneider (AMNH). Koko Head, 7 Jan 1945, C.L. Remington (PMNH), 23 Jan 1945, F.N. Young (USNM). La'ie, Kōloa Gulch, 21 Apr 1994, R.W. Baumann, C.E. Campora (BYU). Liliha, dead on grass, 14 May 1997, S.F. Swift (BPBM). Mākaha, 31 May 1969, P. Chapman (BPBM). Mōkapu Pt, Kāne'ohe Marine Base, 19 Nov 1967, R. Spadoni (BPBM). Pali Lookout along Pali Hwy, 25 Jun 1985, R.S. Zack (WSU), and below Pali Tunnel, windward side, 14 Feb 1965, T. Suman (BPBM). Pearl Harbor, "coconut grove", 9 Jan 1945, A.F. Zeno (FMNH). "Above" Pearl Harbor, 28 Dec 1962, E.S. Ross, D.Q. Cavagnaro (CAS).

Remarks. *Scolopendra subspinipes* is a common centipede that has been introduced throughout the world and is abundant on tropical islands; it is frequently intercepted at continental American ports in quarantines of plants and foods from the tropics. Kraepelin (1903) and Attems (1930) recognized 7 subspecies based in part on the number and arrangement of ventral prefemoral spurs on the caudal legs (*s. subspinipes*, *s. mutilans* L. Koch, *s. japonica* L. Koch, *s. multidentis* Newport, *s. dehaani* Bandt, *s. hardwickei* Newport, and *s. spinosissima* Kraepelin), but in my opinion, their validities as true geographic races, as opposed to simple variants, have never been unequivocally established. As widely as these variants have been spread today by humans, it may not be possible to determine subspecies anymore, because the native areas may be masked. At a minimum, massive amounts of work are needed to resolve this issue, and there is no one available to do so. I therefore combine all variants under *S. subspinipes*. Adamson (1932) reported that *S. subspinipes* is abundant in the Hawaiian Islands, but he did not know its time of arrival. However, he later quoted from Buxton & Hopkins (1927), who suspected that the centipede was carried throughout the Pacific by the Polynesians during their migrations. This supposition is plausible, because Gervais' record shows that *S. subspinipes* was in Hawai'i before 1847, which is too probably early to be explained by commercial introductions of the "western world".

Williams (1931) reported that *S. subspinipes* attains a body length of around 6 in and that its bite may cause pain, localized swelling, and erythema that can last for a few hours and be accompanied by vomiting, irregular pulse, dizziness, and a headache. Turk (1951) reported that the bite of Brazilian specimens caused intense pain, blistering, local inflammation, and subcutaneous hemorrhaging; he cited 1 instance where the victim experienced shortness of breath, sweating, and palpitations. L.W. Quate (Anonymous, 1963) reported that a lady in Hawai'i was bitten in March 1962 and that the bite was milder than

a bee sting. The next morning, the 2 puncture wounds made by the “fangs” were evident and were surrounded by a swollen reddened area that was hard, tender, and itchy. In a straight line behind these holes were 10 evenly spaced punctures about 0.25 in apart, which were claw marks from the legs on 1 side; these itched when touched. Tenderness and irritation at the bite site increased for 48 h then subsided, and there were no other symptoms, like a headache, fever, nausea, or general discomfort. The hard lump under the bite area was still present 10 days later and was about the size of a pea, and 8 of the 10 leg punctures were still visible. Seven weeks later, the bite area was still reddish and painful under moderate pressure, but the leg spots had disappeared. In discussing the effects of centipede bites on man, Lewis (1981) noted that Remington (1950) found that of *S. subspinipes* in the Philippines to be initially unbearable, that the pain diminished in 20 mins, and that mild pain persisted for 3 weeks; the axillary region of the arm was swollen the day after the bite. In 3 cases of bites in Sarawak, Malaysia (on the island of Borneo), there was intense pain but no other symptoms. The available data show that the effects of scolopendromorph bites vary with the species and that *S. subspinipes* is particularly unpleasant; the extracts of 2.5 glands killed an adult pigeon and a guinea pig within 8–16 h (Bücherl, 1846).

Like most chilopods, *S. subspinipes* is nocturnal and, during daytime, hides under stones, boards, in trash and crevices, beneath loose bark of trees, and behind loose leaf sheaths of palm trees. It can enter buildings, especially after rains, and can even swim (Lewis, 1980).

Scolopendra subspinipes was observed feeding on maggots on an abandoned human corpse at Kahuku Point, O‘ahu that was wrapped in blankets and securely tied (Goff, 1992). It has also been found in exposed carrion (Early & Goff, 1986). Lawrence (1934) suggested that the centipede could feed on slugs, certain kinds of fruit pulp, and some Orthoptera. According to Funasaki *et al.* (1988), *S. subspinipes* is one of many prey items of the toad, *Bufo marinus* (L.) in the Hawaiian islands.

In addition to specimens collected on the islands, an individual was intercepted at quarantine at an unspecified site in Hawai‘i on *Pachyrhizus* sp. from China (Chamberlin, 1930).

Scolopendra polymorpha Wood

New state record

Diagnosis. Spiracles valvular, tripartite; first tergite with curved, transverse, cervical groove.

Occurrence in Hawai‘i. ?O‘ahu.

Published records. None.

New record. Island not specified (?O‘ahu), in pineapple fields (introduced from California), 1 spm, Jun 1958 (USNM).

Remarks. *Scolopendra polymorpha* is a new record for the Hawaiian Islands.

Subfamily Otostigminae

Otostigmus spp.

New island records

Diagnosis. Length ca. 44–47 mm, maximal width 3.5–4.5 mm; spiracles not valvular, atria fully exposed; 7th pedal segment without spiracles.

Occurrence in Hawai‘i. Kaua‘i (new record), Maui (new record), and O‘ahu.

Published records (all as *O. scaber* Porat). O‘ahu in general (Nishida, 1994) and the following sites in Honolulu — Nu‘uanu Valley, Kalihi, Punchbowl, Mānoa (Anonymous, 1947).

New records. **KAUA‘I:** Kukuio Lono Park S of Kalāheo, 20 May 1992, R.W. Baumann, M.L. Nelson (NCSM). **MAUI:** along ‘Īao Stream, ‘Īao Valley State Park, 4 Aug 1993, R.W. Baumann

(NCSM). Kīpahulu Valley, Pua'alu'u Stream, 700 ft, 6 Jun 1980, S.L. Montgomery (BPBM). O'AHU: Honolulu, Bishop Museum floor, 8 Apr 1937, E.H. Bryan (BPBM).

Remarks. The first Hawaiian record of *Otostigmus* (Anonymous, 1947) concerned a specimen collected in 1946 in Nu'uānu Valley, Honolulu, that was exhibited at a meeting of the Hawaiian Entomological Society. It was subsequently identified as *O. scaber*, a Chinese species, by R.V. Chamberlin. At a later meeting in 1946, specimens, ostensibly of this species, were exhibited that had been collected at Kalihi Uka, and a member reported seeing them in abundance 10 years earlier in the Punchbowl and Mānoa, as well as Nu'uānu and Kalihi, where they were associated with *S. subspinipes* and "a short brown species", probably a lithobiomorph. A species of *Otostigmus*, identified as *O. scaber*, was intercepted in quarantine with debris in a plant shipment from the Philippines (Whitney, 1932).

The present state of knowledge of *Otostigmus* does not allow reliable determinations to species; the only key is that by Attems (1930), which does not include the species proposed in the past 68 years. Chamberlin must have used Attems' key to identify the 1946 specimen; I checked recently collected specimens and none keyed out to *O. scaber*. There appear to be 2–3 species of *Otostigmus* in the Hawaiian islands, but nothing more definitive can be stated at present. Reliable determinations require working through the many published descriptions and comparisons with type specimens, all of which are beyond the scope of the present study. Hawaiian species could come from Australasia or the Neotropics, so one would have to review descriptions from the entire generic range to identify a single individual. This situation is one of many among myriapods where a person would have to revise an entire genus to accurately identify a single specimen, and the problems with *Otostigmus* are complicated by the names that have proposed for specimens taken in quarantines, whose native areas are unknown; 2 of these are from the Hawaiian Islands and are listed below.

Deletions

Nine Hawaiian scolopendromorph records represent samples taken in quarantines of plants from distant parts of the world, and 6 new species were inadvisedly proposed for intercepted specimens. These records show the ease with which exotic arthropods are unknowingly and accidentally brought into the islands, where they escape and establish reproducing populations. As there is no evidence that any of these species have become established, I officially delete them from the Hawaiian fauna.

Family Cryptopidae

Subfamily Cryptopinae

1. *Paracryptops weberi* Pocock, 1891. An individual was found at Honolulu in soil from "Straits Settlement", Singapore (Chamberlin, 1930), and another was found in soil from the Orient (Whitney, 1932). According to Attems (1930), this cryptopid is native to the islands of Flores and Java.
2. *Cryptops navis* Chamberlin, 1930. Chamberlin (1930) proposed this species for a specimen taken at Honolulu in soil from "Straits Settlement", Singapore.
3. *Cryptops melanotypus* Chamberlin, 1941. Chamberlin (1941) proposed this species for an individual taken at Honolulu in packing with "*Den.*" *superbum* from the Philippines. Wang (1951) repeated the citation.
4. *Cryptops religens* Chamberlin & Wang, 1951. This species was proposed for a specimen taken at Honolulu on *Grammatophylum* from the Philippines (Wang, 1951); authorship was jointly assigned to Chamberlin & Wang.
5. *Cryptops sinesicus* Chamberlin, 1940. Chamberlin (1940) proposed this species, which

is anatomically similar to *C. navis*, for an individual taken at Honolulu in soil with *Litchi chinensis* D. from China.

Subfamily Scolopocryptopinae

6. *Newportia* sp. An unidentifiable specimen, without the caudal legs, of this neotropical genus was taken at an unspecified site in soil with plants from Panama (Chamberlin, 1930). Like all representatives of the Scolopocryptopinae, species of *Newportia* have 23 pairs of legs and pedal segments.

Family Scolopendridae

Subfamily Otostigminae

7. *Otostigmus sinicolens* Chamberlin, 1930. Chamberlin (1930) proposed this species for an individual taken at an unspecified site on *Eleocharis tuberosa* from China.

8. *Otostigmus mians* Chamberlin, 1930. Chamberlin (1930) proposed this species for 2 specimens taken at an unspecified site from *Dioscorea* sp. from China.

9. *Otostigmus feae* Pocock, 1891. An individual of this species was taken at Honolulu in soil with plants from the Botanical Gardens in Bogor (formerly Buitenzorg), Java. (Chamberlin, 1922). According to Attems (1930), it is native to Myanmar.

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The milliped family Haplodesmidae in the Hawaiian Islands, with records of *Prosopodesmus jacobsoni* from Florida and Louisiana (Diplopoda: Polydesmida)

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Introduction

The milliped order Polydesmida in the Hawaiian Islands is represented by the families Paradoxosomatidae: *Oxidus gracilis* (C.L. Koch), *Asiomorpha coarctata* (Saussure), and *Akamptogonus novarae* (Humbert & Saussure); and Pyrgodesmidae: *Aporodes minus wallacei* Silvestri and *Cryptocorypha ornata* (Attems) (Shelley *et al.*, 1998; Adis *et al.*, 1998). We place on record *Cylindrodesmus laniger* Schubart and *Prosopodesmus jacobsoni* Silvestri (Haplodesmidae), both new to the islands' fauna, and report 5 localities of the latter from Florida and Louisiana. Repository abbreviations are as follows: BPBM - Bishop Museum, Honolulu; FSCA - Florida State Collection of Arthropods, Gainesville; NCSM - North Carolina State Museum of Natural Sciences, Raleigh.

***Cylindrodesmus laniger* Schubart New state record**

Diagnosis. Minute, pallid polydesmoids, dorsum covered with moderately long, articulated setae. SEM photos of the dorsum and a seta are provided by Enghoff (1993, figs. 5–6).

Occurrence in the United States. Hawai'i, Palmyra.

New record: O'AHU: Honolulu, Judd St. Cave, 30 m, on wood in twilight zone, 21 May 1972, F.G. Howarth (BPBM).

Remarks. To the best of our knowledge, this is only the second record of *C. laniger* from the United States, either a state or territory, the other being Palmyra in the Pacific (Chamberlin, 1954; Enghoff, 1978). It also occurs in Brazil, Panama, Guadeloupe, the Cape Verde Islands, and Tanzania (Enghoff, 1978, 1982, 1993; Mauriès, 1980a). Another widespread species, *C. hirsutus* Pocock occurs in Ecuador, the Seychelle Islands, Christmas Island, Indonesia, the Philippines, New Caledonia, and French Polynesia (Silvestri, 1939; Attems, 1940; Enghoff, 1978; Mauriès, 1980b; Golovatch & Korsós, 1992). Mauriès (1980a, b) suggested that the 2 names may be synonymous.

***Prosopodesmus jacobsoni* Silvestri** **New state record**

Diagnosis. Minute pallid polydesmoids, dorsum covered with lobes and pustules, sides of tergites extending strongly ventrad, collum completely covering and obscuring head in dorsal view. An SEM photo of the collum and anterior segments is provided by Enghoff (1993, fig. 4).

Occurrence in the United States. Florida, Hawai'i, Louisiana, Puerto Rico, Virgin Islands.

New records in Hawai'i: **KAUAI:** Kōloa, Knudsen Cave #1, 45 m, dark and twilight zones, 23 Jun 1972, F. G. Howarth (BPBM). Kōloa Cave #2, 50 ft., rotting wood, dark zone, 11 Aug 1971, F. G. Howarth (BPBM). **MAUI:** Hāna, Offal Cave, 90 m, on log, 20 Jul 1972, F. G. Howarth, W. C. Gagné (BPBM). *Other new records:* **FLORIDA:** Citrus Co., along Crystal R., 11 Jun 1983, R. M. Shelley, J. L. Staton (NCSM). Dade Co., Miami, 10 Mar 1961, R. E. Woodruff (FSCA). Pasco Co., along Withlacoochee R., 23 May 1963, [collector unknown] (FSCA). Volusia Co., DeLeon Sprgs., 12 Jun 1983, R. M. Shelley, J. L. Staton (NCSM). **LOUISIANA:** Orleans Parish, New Orleans, 533 Henry Clay, 30 Dec 1974, M. R. Cooper (NCSM).

Remarks. *Prosopodesmus jacobsoni* has been previously reported from Puerto Rico; St. John, U.S. Virgin Islands; and Miami, Dade County, Florida (Loomis, 1970). It also occurs in Brazil, Panama, Haiti, St. Eustatius, the Cape Verde Islands, Tanzania (Zanzibar), India, and Indonesia (Attems, 1940; Loomis, 1970; Enghoff, 1993). A second species, *P. panporus* Blower and Rundle, was discovered in the Royal Botanic Gardens, Kew, England (Blower & Rundle, 1980).

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New records of Hawaiian prostigmatid mites (Acari: Prostigmata)

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Hawaiian mites are still poorly known despite earlier work (Jacot, 1934) and more recent comprehensive studies (Swift & Goff, 1987; Swift, 1996; Swift & Norton, 1998). Many general habitats such as grassland, lowland forests and agricultural areas and microhabitats such as arboreal and other nonsoil habitats (Aoki, 1967) are virtually uncollected. The islands' littoral habitats with growths of algae and other littoral vegetation are known to harbor mites (R. Schuster, pers. comm.). So far, only the species *Spinibdella hygrotes* Swift & Goff, 1986 (Bdellidae) has been reported from this habitat at Cape Kīna'u, Maui (Swift & Goff, 1986).

Specimens from mite collections at the Bishop Museum revealed 2 families of prostigmatid mites not previously reported from the Hawaiian Islands. The family Teneriffiidae represented by the genus *Teneriffia* Hirst is reported from littoral ecosystem. From the cool, high elevation habitats of Mauna Ke'a and Haleakalā National Park, the primitive and relatively rare family Adamystidae represented by the genus *Adamystis* Cunliffe is likewise reported.

Family Teneriffiidae

Teneriffia cf. *mortoni* (Luxton)

New state record

Members of this poorly-known family are represented by 11 species from North and South America, Europe, North Africa, Central Asia, Australia, and the Far East (Judson, 1994). Only 4 species have been previously described in the genus *Teneriffia* Thor. These are *T. marina* (Hirst) collected from under rocks and stones half submerged in sea water of Malaysia (formerly Federated Malay States), *T. mortoni* (Luxton) from littoral rocks in Hong Kong, *T. quadripappilata* Thor, collected on the beach of Orotowa, Tenerife, Canary Islands, and *T. mexicana* McDaniel *et al.* from tide pool beach, Sonora, Mexico. The genus *Heteroteneriffia* Hirst was synonymized with *Teneriffia* by McDaniel *et al.* (1976). When Luxton (1993) described *Heteroteneriffia mortoni*, he overlooked the synonymy previously established by McDaniel *et al.* (1976), which led Judson (1994) to conclude that Luxton did not intend to revalidate the genus *Heteroteneriffia*. Placement of this Hawaiian species in *Teneriffia* follows McDaniel *et al.* (1976) and their *Teneriffia-Heteroteneriffia* species complex specific to semi-marine habitat.

Material examined: MAUI: Cape Kīna'u, on algal covered rocks, 22.i.1975, F.G. Howarth *et al.* (1 ♀); O'AHU: Makapu'u, 28.viii.1988, W.D. Perriera (2 females).

Family Adamystidae

Adamystis n. sp.

New state record

A primitive family reported from North America, South and southwestern Africa, and France, adamystid mites are represented by 7 species in the world. They are small, delicate mites with length ranging from 450–800 microns. Coineau (1979) gave an excellent description of the morphology of the family and pointed out the primitive characteristics that make the family unique among the prostigmatic Acari. A character that distinguishes this family from other families in the Prostigmata is the presence of about 14 pairs of lens-like structures arranged in 2 rows on the propodosomal lateral sides that runs into the venter. This is the first report of this family in the Pacific Rim area.

Material examined: HAWAII: Mauna Ke'a, Pu'u Hōlei, 2620 m, 22.vi.1991, on ash, F.G. Howarth & D. Preston (2 ♂); MAUI: Haleakalā National Park, West Slope, Kalahaku Area, just north of Kalahaku Overlook, 2743 m, viii.1985, collected by pitfall trap, substrate mostly cinder with scat-

tered *Styphelia* bushes present, R. Cole & L. Loope (3♀, 9♂) (NA1 8-85, NA1 B1 8-85); same as above except collected at 2073-2195 m (A2 8-85) (2♂).

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New records of alien land snails and slugs in the Hawaiian Islands

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Survey work during 1999 led to the following new records of alien snails and slugs not previously reported by the Hawaii Biological Survey (Cowie, 1996, 1997, 1998a, b, 1999).

Helicarionidae

Ovachlamys fulgens (Gude)

New state record

This land snail species is only provisionally identified (D.G. Robinson, pers. comm.) but is worthy of reporting because it appears to be spreading rapidly, not only in the Hawaiian Islands but elsewhere, and because no specialist is currently available to provide a definitive identification. Described from the Ryukyu Islands of Japan, *O. fulgens* (assuming correct identification) has been transported around the world, frequently via the horticultural trade, from Japan, through Thailand, and to Costa Rica, where it is now a horticultural pest. It is increasingly regularly intercepted entering the U.S., mostly from Costa Rica, on a wide variety of plants (such as *Croton*, *Codiaeum*, *Dracaena*, etc.) (Robinson, 1999; D.G. Robinson, pers. comm.). Similar specimens were found in American Samoa in 1998 (Cowie & Cook, 1999).

Material examined: O'AHU: Wa'ahila Ridge, approx. 900 ft [274 m], 16 Apr 1999, R.H. Cowie (BPBM Malacology 256238). HAWAII: South Hilo District, Stainback Highway, 670 ft [204 m] to

1560 ft [475 m], 18–19 May 1999, R.H. Cowie & R.J. Rundell (BPBM Malacology 256544–256552); 27 May 1999, F.G. Howarth & D.J. Preston (BPBM Malacology 256553–256554); North Kohala District, near Kapa'au, Bond Historic District, 31 Aug 1999, R.H. Cowie (BPBM Malacology 257517–257520).

Subulinidae

Beckianum beckianum (Pfeiffer)

New island record

This distinctive Central and South American and Caribbean island land snail (Clench, 1970) has previously only been recorded in the Hawaiian Islands from Kaua'i, the first record being in 1914 (Cowie, 1997). Cowie (1997), treating it in the genus *Opeas*, suggested that the record from Kaua'i might have been based on a misidentification. Additional study has now confirmed that the identification of the material from Kaua'i as *B. beckianum* is correct. This species has not been recorded anywhere else in the Pacific (Cowie, 2000). Probably it has been on O'ahu for a long time, but simply not reported. It was found on Wa'ahila Ridge from immediately above Dole Street up to about 600 ft [183 m] elevation in dry, scrubby vegetation and was abundant.

Material examined: O'AHU: Wa'ahila Ridge, 26 Apr 1999, R.H. Cowie (BPBM Malacology 256231–256236); 30 Apr 1999, R.H. Cowie (BPBM Malacology 256237).

Philomycidae

Meghimatium striatum Hasselt

New island record

This medium-sized slug is Asian in origin (Solem, 1959). It is very variable in color, from whitish to pale grayish, to brown, but generally exhibits 2 longitudinal darker stripes running the entire length of the body. It has previously been recorded from the Hawaiian Islands only from Kaua'i and O'ahu, but has been present since at least 1846 (Cowie, 1997). The names *australis* Bergh, 1870 and *bilineata* Benson, 1842 have been treated as junior synonyms but their true status deserves further research (Cowie, 1997). This species is probably more widespread in the Hawaiian Islands than these records indicate.

Material examined: HAWAII: Stainback Highway, 1760 ft [536 m] to 2700 ft [823 m], 22–23 Apr 1999, R.H. Cowie & R.J. Rundell (BPBM Malacology 256581–256587).

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Implications of a new Hawaiian host record from blue-lined snappers *Lutjanus kasmira*: is the nematode *Spirocamallanus istiblenni* native or introduced?

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New distributional records are usually thought to increase our understanding of the zoogeography of both free living animals and parasites. However, in some instances, these reports may raise new questions about animal distributions and cast doubt on prior knowledge concerning their sources of origin and patterns of dispersion. A case in point pertains to the distribution and host specificity of the roundworm parasite *Spirocamallanus istiblenni* Noble in Hawai'i. We report our discovery of *S. istiblenni* in blue-lined snappers, *Lutjanus kasmira* (Forsskål) collected near Hilo, and discuss the implications of this new host record with regard to the origin and evolution of this parasite and the conservation of Hawaiian fish hosts.

Spirocamallanus istiblenni was originally described from *Istiblennius zebra* (Vaillant & Sauvage) (zebra blenny) from tidepools on O'ahu (Noble, 1966). Because of the extreme ecological isolation of the Hawaiian Archipelago and the occurrence of many endemic species of free living organisms in the islands as well as many endemic helminth parasites in Hawaiian marine fishes (Yamaguti, 1968, 1970), it was reasonable to assume that *S. istiblenni* was also endemic. However, Hasegawa *et al.* (1991) reported the discovery of *S. istiblenni* in Okinawa and listed marine fishes belonging to 8 families as hosts (but see Rigby & Font, 1997). The broad distribution and host specificity of *S. istiblenni* in the Pacific Ocean was further documented by Rigby & Font (1997) who found that additional marine fishes, including blue-lined snappers, in Fiji and Moorea served as hosts for this roundworm. These reports changed the status of *S. istiblenni* from being restricted to Hawai'i to being indigenous to a broad expanse of the Pacific Ocean including Hawai'i but did not raise the question that *S. istiblenni* might not be native to the archipelago. However, when we found the report of Randall (1987) that blue-lined snappers were introduced to Hawai'i in 1958, we realized this fish introduction might be the actual source for the presence of *S. istiblenni* in Hawaiian fishes and considered the possibility that this parasite may not be native to Hawai'i.

Materials and Methods

We purchased specimens of blue-lined snapper from the Farmers' Market in Hilo, Hawai'i in June 1997. The vendor was the fisherman who had caught the fish the previ-

ous day and confirmed that they were caught in Hilo Bay. Fish were on ice in good condition and parasites were still alive when we recovered them. Intestines were placed in physiological saline and examined with a Nikon SMZ-2T stereomicroscope. Living worms were killed by 15 second immersion in Berland's fluid (9 parts glacial acetic acid: 1 part 100% formalin) and stored in 70% ethanol plus 5% glycerin. For microscopical examination and morphometric analysis, worms were slowly infiltrated with 100% glycerin using standard parasitological techniques prior to study with differential interference contrast optics. Voucher specimens have been deposited in the United States National Parasite Collection.

Results

We compared our specimens from blue-line snappers, with specimens of *S. istiblenni* that we had previously obtained from the type host, *Istiblennius zebra* (zebra blenny) and other hosts, *Entomacrodus marmoratus* (Bennett), marbled blenny, *Eleotris sandwicensis* Vaillant & Sauvage ('o'opu akupa), as well as with specimens of *S. monotaxis* Olsen, the only other species of *Spirocamallanus* that has been reported from Hawai'i (Olsen, 1952). We were able to distinguish between these 2 species on the basis of the spatial distribution of the 2nd preanal papillae of adult males. All specimens from *L. kasmira* in Hawai'i were identified as *S. istiblenni*.

Of the 10 specimens of blue-lined snappers, 5 were infected (prevalence = 50%). Parasites were found in mid intestine and pyloric caeca, firmly attached to host mucosa by the sclerotized buccal capsule. Abundance (average number of parasites per host) of *S. istiblenni* was 1.6, mean intensity (average number of parasites per infected host) was 3.2, with a range of intensity from 1–9 parasites per infected fish.

Discussion

The blue-lined snapper, *L. kasmira*, is a known host for the roundworm *S. istiblenni* elsewhere in the Pacific Ocean (Rigby and Font, 1997), and the discovery of this parasite in this host in Hawai'i is of significance to the conservation of native Hawaiian fishes. Although not universally true, it is well documented that parasites, when introduced by humans into new geographic areas, often produce greater pathogenicity in new hosts than they do in natural hosts within their native range. Because of the enhanced disease potential of introduced parasites, we have been asked by the State of Hawai'i, Division of Aquatic Resources to identify helminth parasites of Hawaiian stream fishes and determine which of these species are native to Hawai'i and which have been introduced. We have been successful in characterizing the 13 species of helminths parasitizing the 5 species of native gobioid fishes in Hawaiian streams as either natives or human introductions. Furthermore, we have determined that the greatest threats to these native fish populations are associated with 3 helminths, the roundworm *Camallanus cotti*, the tapeworm *Bothriocephalus acheilognathi* and the leech *Myzobdella lugubris* (Font & Tate, 1994; Font 1997, 1998) all introduced to Hawai'i with exotic fish hosts introduced by humans. The marine nematode *Spirocamallanus istiblenni* infects one of these endemic gobioids, the sleeper *Eleotris sandwicensis* ('o'opu akupa) because this fish may inhabit estuarine areas of stream mouths adjacent to habitats occupied by parasitized tidepool and near-shore marine fishes.

The occurrence of *S. istiblenni* in an introduced snapper known to host this parasite on other Pacific islands raises the question of the origin of this roundworm in the Hawaiian Islands. It is now clear that *S. istiblenni* did not originate in Hawai'i and remain only in this archipelago (i.e., it is not endemic to Hawai'i). What is unclear is whether *S. istiblenni* should be regarded as an indigenous native or an introduced species. Carlton

(1996) has categorized such organisms as cryptogenic species and provides as a definition “. . . a species that is not demonstrably native or introduced.”

At present, we are unable to determine whether or not *S. istiblenni* is native to Hawai‘i or is introduced, but we can suggest 2 disparate avenues of approach that may provide an to answer this question. Advances in molecular genetics have proceeded to the point that population genetic differences may be reliably examined. These differences may be used to construct a population phylogeny, showing how the populations are related. This will not, however, reveal whether or not *S. istiblenni* is introduced. Introduced populations may also suffer a bottleneck effect, with reduced genetic variation in subsequent generations. If *S. istiblenni* is introduced, genetic variability may be expected to be lower in Hawai‘i than other populations, at least temporarily. Reduced genetic variability may also have other causes; e.g., small population size.

As the above molecular techniques may not definitely answer this question, and nematodes of this family contain substances that interfere with using some molecular techniques (Rigby, 1999), we propose an alternative approach to the study of the cryptogenic species, *S. istiblenni* in Hawai‘i. Because the date of introduction of the blue-lined snapper into Hawaiian waters in 1958 is so precisely documented (Randall, 1987), it may be possible determine whether this parasite was introduced by examining specimens of native Hawaiian fishes deposited in natural history museums prior to that date for the presence of *S. istiblenni*. If these museum specimens are found to be infected, then it is clear that *S. istiblenni* was present in Hawai‘i prior to the introduction of blue-lined snappers. It could then be concluded that its occurrence in Hawai‘i is a natural phenomenon, either because the original speciation event occurred here, or through natural dispersal by an infected pelagic fish originating elsewhere in the Pacific Ocean.

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Helminth records for the house gecko, *Hemidactylus frenatus* (Gekkonidae) from Hawai'i

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The house gecko, *Hemidactylus frenatus* Duméril & Bibron, is widely distributed and is known from Africa, Asia, Australia, Polynesia, Mexico, and Central America (Welch *et al.*, 1990). It is thought to have arrived in Hawai'i as a stowaway during or just after World War II (McKeown, 1996). New host and locality records for helminths of *H. frenatus* from Hawai'i are given in this note.

Between 1988 and 1993, 254 *Hemidactylus frenatus* were collected from 3 Hawaiian Islands: Hawai'i (n = 8), Kaua'i (n = 3), O'ahu (n = 243). The body cavity was opened by a longitudinal incision from vent to throat and the gastrointestinal tract was removed. It, as well as the body cavity, were examined for helminths. Cestodes were stained with Delafield's hematoxylin and mounted in Canada balsam for study. Nematodes and pentastomes were placed in glycerol on glass slides, allowed to clear and examined under a light microscope. Voucher specimens were placed in vials of alcohol and deposited in the Bishop Museum, Honolulu (BPBM) and the U.S. National Parasite Collection (USNPC), Beltsville, Maryland.

Cestoda: Linstowiidae

Oochoristica javaensis Kennedy, Killick & Beverly-Burton **New state record**

Oochoristica javaensis was described from the small intestines of geckos, *Gehyra mutilata*, *Cosymbotus platyurus*, and *Hemidactylus frenatus* from Java, Indonesia (Kennedy *et al.*, 1982). This report extends the range of *O. javaensis* ca. 8800 km eastward to Hawai'i. Prevalence (number infected hosts/number hosts examined): 175/243 (72%); mean intensity (mean number parasites per infected host): 2.9 ± 3.6 SD; range (lowest to highest number of parasites present): 1–25.

Material examined: O'AHU (BPBM F211 ;USNPC 89648).

Nematoda: Pharyngodonidae

Spauligodon hemidactylus Bursey and Goldberg **New island records**

Spauligodon hemidactylus was originally described from the large intestine of *Hemidactylus frenatus* from American Samoa by Bursey & Goldberg (1996) who also reported it from *H. frenatus* of other Pacific Islands: Fiji, Guam, Hawai'i (O'ahu), Marshall Islands, Palau, Philippines, Western Samoa, Solomon Islands, Society Islands, Vanuatu as well as Thailand. Hanley *et al.* (1998) was the first report of *S. hemidactylus*

in *H. frenatus* of O'ahu. These are the first records from the islands of Hawai'i and Kaua'i. Prevalence: Hawai'i 3/8 (38%), Kaua'i 1/3 (33%), O'ahu 66/243 (27%); mean intensity Hawai'i 3.3 ± 2.1 ; Kaua'i 25; O'ahu 2.7 ± 3.1 ; range Hawai'i 1–5; Kaua'i 25; O'ahu 1–16.

Material examined: HAWAII (BPBM F213); KAUA'I (BPBM F212); O'AHU (USNPC 89650)

Nematoda: Seuratidae

Skrjabinelazia machidai Hasegawa

Skrjabinelazia machidai was originally described from the intestine of the gekko, *Gekko japonicus* from Okinawa Island, Japan (Hasegawa, 1984). It was first found in *Hemidactylus frenatus* in O'ahu by Hanley *et al.* (1998). Prevalence: 41/243 (17%); mean intensity: 2.0 ± 1.4 range 1–7.

Material examined: O'AHU (BPBM F214, USNPC 89649).

Nematoda: Physalopteridae

Physaloptera sp. (larvae in intestinal lumen)

Physalopterid nematodes require 2 hosts. They occur as adults in the stomachs of mammals, snakes, and a few lizard species; larvae are common in amphibians and some lizard species (Anderson, 1992). Embryonated eggs are passed with the feces and hatch when eaten by intermediate hosts, various species of insects; infection is acquired by ingesting insects containing infective third-stage larvae (Anderson, 1992). *Physaloptera muris-brasilensis* Diesing, a parasite of rats, and *Physaloptera praeputialis* Linstow, a parasite of cats, have been reported from Hawai'i, although specific locations were not given (Alicata, 1964). Physalopterid larvae were first reported from *Hemidactylus frenatus* on O'ahu by Hanley *et al.* (1998). This is the second report of physalopteid larvae from *H. frenatus*. Because these larvae were found in the intestinal lumen, they are considered non-parasites, a byproduct of diet, which pass from the intestine without further development. Prevalence: (9/243) 4%; mean intensity 2.0 ± 1.1 ; range 1–4.

Material examined: O'AHU (BPBM F215).

Nematoda: Gongylonematoidae

Gongylonema sp. (larvae in intestinal lumen)

Gongylonematid nematodes embed in the mucosa and submucosa of the anterior intestinal tract of birds and mammals; insects serve as intermediate hosts (Anderson, 1992). *Gongylonema ingluvicola* Ransom, a parasite of chickens, *Gongylonema neoplasticum* (Fibiger and Dittersen), a parasite of rats, and *Gongylonema pulchrum* Molin, a parasite of cattle have been reported from Hawai'i, although specific locations were not given (Alicata, 1964). Gongylonematid larvae were first reported from *Hemidactylus frenatus* (O'ahu) by Hanley *et al.* (1998). This is the second report of gongylonematid larvae from *H. frenatus*. Like the physalopterid larvae, they were found in the intestinal lumen and are considered non-parasites, a byproduct of diet. Prevalence (3/243) 1%; mean intensity 1; range 1.

Nematoda: Spirocercidae

Ascarops sp. (larvae in cysts on coelom wall) **New host and state record**

Adults of *Ascarops* occur in the stomachs of swine, rats, and mice, in the esophagus of ruminants, and in the crop of chickens (Olsen, 1974). Embryonated eggs are passed with the feces and hatch when eaten by intermediate hosts, typically coleopterans (Anderson, 1992). *Ascarops strongylina* Rudolphi has been reported from swine in Hawai'i (specific location not given) by Alicata (1964). Because *H. frenatus* is insectivo-

rous (McKeown, 1996), these nematodes are acquired through diet. Development to adults does not occur in reptiles; however these larvae migrate into the stomach wall and cysts are formed. Subsequent development of larvae in such cysts has not been studied. Because these larvae occur in cysts, the possibility of *H. frenatus* as a paratenic (transport) host must be considered. This is the first report of *Ascarops* sp. from a Hawaiian lizard. Prevalence 1/243 (0.4%); mean intensity 1; range 1.

Nematoda: Spirocercidae

Physocephalus sp. (larvae in cysts on coelom wall) **New island record**

Adults of *Physocephalus* occur in the stomachs of swine, horses, cattle, and rabbits; infective larvae have been recovered from dung beetles and are found in the tissues of amphibians, reptiles, birds and mammals which have ingested infected beetles (Anderson, 1992). *Physocephalus sexalatus* Molin has been reported from feral pigs in Hawai'i (Alicata, 1964). Development to the adults stage does not occur in reptiles. Because these larvae occur in cysts, the possibility of *H. frenatus* as a paratenic host must be considered. Larvae of *Physocephalus* sp. were first reported from O'ahu by Hanley *et al.* (1998). Prevalence: Kaua'i (1/3) 33%; O'ahu(9/243) 4%; mean intensity Kaua'i 1; O'ahu 1.5 ± 1.1; range: Kaua'i 1, O'ahu 1–4. The report from Kaua'i is the first record from that island.

Material examined: O'AHU (BPBM F216).

Pentastomida: Cephalobaenidae

Raillietiella frenatus Ali, Riley & Self

Raillietiella frenatus was originally described from the lungs of *H. frenatus* collected in Malaysia by Ali *et al.* (1981) who reported it from the same host from the Philippine Islands, South Vietnam, Taiwan and Thailand. *Raillietiella frenatus* was first reported from Hawai'i (O'ahu) by Hanley *et al.* (1998). Prevalence: Hawai'i (1/8) 13%; O'ahu (45/243) 19% mean intensity: Hawai'i 4, O'ahu 3.0 ± 2.7 range: Hawai'i 4, O'ahu 1–13. The report from the island of Hawai'i is the first record from that island.

Material examined: O'AHU (BPBM H73, USNPC 8965).

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New records of Ascidiacea (Urochordata) in the marine invertebrate fouling community of O‘ahu, Hawai‘i

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Ascidians were collected from the fouling communities in the harbors and basins along the south shore of O‘ahu during November 1998. The purpose of the survey was to create a species list of ascidians present in the marine fouling communities associated with harbor environments of the south shore of O‘ahu. The ascidian fauna of Hawai‘i was previously compiled in Abbott *et al.* (1997) and was also included in recent fouling community surveys of Pearl Harbor (Coles *et al.*, 1997) and Honolulu Harbor and its adjacent embayments (Coles *et al.*, 1999). The new records reported below were identified during the November 1998 collection by the 2 authors with the assistance of C. Lambert and R. DeFelice. Vouchers of all ascidian species collected were deposited at Bishop Museum, Honolulu.

Aplousobranchia: Didemnidae

***Didemnum perlucidum* Monniot**

New state record

Françoise Monniot first described this species in 1983 from Guadeloupe in the Lesser Antilles. The species has since been recorded from French Polynesia and New Caledonia (Monniot & Monniot, 1987; F. Monniot, 1995), the eastern tropical Atlantic (Monniot & Monniot, 1994), southeastern Brazil (Rocha & Monniot, 1995), the western Pacific and Southeast Asia (Monniot & Monniot, 1996), and in the Gulf of Mexico off the coast of Texas (J. Culbertson, pers. comm.). *Didemnum perlucidum* was not included in Abbott *et al.* (1997) and was not recorded in Coles *et al.* (1997, 1999).

Material examined: O‘AHU. Ke‘ehi Lagoon, floating docks at Ke‘ehi Marine Center Nov 1998 (Godwin & DeFelice), Sep 1999 (Godwin).

Stolidobranchia: Styelidae

***Botrylloides simodensis* Saito & Watanabe**

New state record

Described originally by Saito *et al.* (1981) from Shimoda, Japan. Also recorded from the islands of Chuuk [= Truk], Ponape, and Majuro (Nishikawa, 1984). The genus *Botrylloides* has proven problematic when trying to differentiate between species. Previous descriptions of this genus in Hawai‘i have all been lumped into *Botrylloides* spp.

(Abbott *et al.*, 1997) and recent species surveys have also followed this convention (Coles *et al.*, 1997). This species was positively identified during November 1998 from what appears to be a variety of species existing in Hawai'i and was then included in Coles *et al.* (1999).

Material examined: O'AHU. Nov 1998 (G. Lambert, C. Lambert).

Stolidobranchia: Styelidae

Eusynstyela aliena Monniot

New state record

Claude Monniot described this species originally from New Caledonia but because it was collected only from harbor buoys he believed it might not be an indigenous species there, thus the reason for the species name. Its occurrence in Hawai'i is only its second known location. This species was abundant in Pearl Harbor but was not recorded in a recent fouling community survey conducted at the location (Coles *et al.*, 1997). *Eusynstyela aliena* was also abundant in Honolulu Harbor, where it was recorded by Coles *et al.* (1999) after identification during the November 1998 ascidian survey. Abbott *et al.* (1997) includes only 1 species in this genus, *Eusynstyela transversalis* Tokioka, 1963, as part of the ascidian fauna of Hawaii; it was dredged off Maui in 1902.

Material examined: O'AHU. Pearl Harbor, from pier piling at the USS *Missouri* Memorial and the hull of AFDM-8 dry-dock in decommission anchorage, Nov 1998 (Godwin); Ke'ehi Lagoon, floating docks at Ke'ehi Marine Center, Nov 1998 (Godwin & DeFelice).

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The fang-toothed blenny, *Omobranchus ferox*, from Pearl Harbor, O‘ahu, a probable unintentional introduction to the Hawaiian Islands

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A potentially harmful species of fish previously unknown from the Hawai‘i was found in Pearl Harbor during extensive Bishop Museum surveys of the south and west shore O‘ahu streams. Native to the Philippines and South China Sea region, the fang-toothed blenny, *Omobranchus ferox* (Herr) was found only in a restricted area of lower Hālawā Stream (the east bank, immediately upstream of the Kamehameha Highway bridge). This species appears to have only recently become established, as it only was found in ca. 15 m of rocky mangrove habitat lining lower Hālawā Stream. Intensive searches for *O. ferox* in other areas of Hālawā Stream and throughout the south and west shores of O‘ahu from Ka‘ena to Makapu‘u Points failed to locate any additional individuals.

Blennidae

***Omobranchus ferox* (Herr)**

New state record

Surveys of the lower reaches of south and west shore O‘ahu streams and estuaries started in December 1997 and ended in May 1999. A fine-mesh, 5-meter long seine was used to assess fish species composition, and dip nets were also used to sample areas not accessible to seines. Salinity was also recorded for each stream location sampled.

Omobranchus ferox (Fig. 1) has become established in Pearl Harbor. Nine individual *O. ferox* were captured in the lower tidal reaches of Hālawā Stream. Extensive surveys of all stream mouth, estuarine, and spring areas in the East, Middle, and West Lochs of Pearl Harbor have failed to locate additional populations of *O. ferox*. Additional surveys conducted in estuarine and lower stream areas from Ka‘ena to Makapu‘u Points also failed to locate any additional *O. ferox* specimens.

All individuals were found within a small 15-meter shoreline region of Hālawā Stream. The habitat of *Omobranchus ferox* consisted of a rocky shoreline interspersed with small mangroves (*Rhizophora mangle*) and stream substrate consisted of deep silt covering cobble and small boulders. Fish were usually captured in the vicinity of mangrove roots and also on the partially submerged surface of boulders that were coated with thick layers of fine silt. *Omobranchus ferox* were found in salinities ranging from 35–36 ppt. *Omobranchus ferox* was also usually captured along with the introduced molly, *Poecilia mexicana*, the most common fish in lower Hālawā Stream. The native estuarine goby, *Oxyurichthys lonchotus* was the main native fish species commonly captured with *O. ferox* at Hālawā Stream. All stomachs sampled (n = 6) were empty except for one, which contained 11 small grains of sand.

The currently restricted range of this species indicates it is a recent Pearl Harbor



Figure 1. *Omobranthus ferox*, collected from Hālawā Stream.

introduction, however our collection of a wide range of size classes indicates it has successfully reproduced. Fish ranged in size from 18.5–56 mm standard length (SL) and 0.13–2.19 g total weight. Of the 6 fish that were dissected, 3 were females, and 3 were males. Gonadosomatic indices ($GSI = \text{gonad weight/body weight} \times 100$) were calculated for those fish from which gonads were removed. Two of the males, uncatalogued specimen 3 (29 mm SL) and BPBM 38453-3 (24.5 mm SL) had minimal gonad development ($GSI = 1.62$ and $GSI = 1.76$, respectively) and were believed to be juveniles or subadults.

The mechanism for the introduction of *O. ferox* into Pearl Harbor is likely through some type of seaborne transport such as ballast water or sea chest fouling. This assumption is based upon the current limited distribution of this species adjacent to heavily trafficked areas in Pearl Harbor, and records of species in the same genus being collected from the hulls of ships. For example, in Apra Harbor Guam, 3 species of blennies, including *Omobranthus elongatus*, were collected from the hull of a U.S. Navy drydock that was towed from Subic Bay, Philippines (R.F. Myers, pers. comm.). None of the blennies found on the drydock were native to Guam. *Omobranthus elongatus* is closely related to *O. ferox* and also inhabits stream mouth areas, having a brackish water habitat preference similar to that of *Omobranthus ferox* (Springer & Gomon). Another closely related blennioid fish found in both Pearl Harbor and Kāneʻohe Bay is *Omobranthus rotundiceps obliquus* (Garman). This fish was formerly known in Hawaiʻi as *Omobranthus elongatus* and is a possible introduction as it was first found in tanks holding *Tridacna* at Coconut Island (Strasburg, 1956) and has not yet been observed outside of Oʻahu (J.E. Randall & J.P. Hoover, pers. comm.).

In its native habitat, *O. ferox* inhabits a wide range of shallow estuarine and freshwater habitats, ranging from mangrove swamps to rivers and freshwater lakes in the

Philippines (Springer & Gomon, 1975). This adaptable species represents a potential threat not only to the ecologically similar indigenous *Oxyurichthys lonchotus* but also to other native freshwater and estuarine fish and invertebrates. Unfortunately, little is known about the impact of small, cryptic fishes on marine and estuarine ecosystems in general, although similar introductions of 3 gobiid species have occurred in the San Francisco Bay area, presumably carried in the fouling on ship bottoms. One of these Bay Area species, *Tridentiger bifasciatus* Steindachner, has been shown to be in direct competition there with the endangered native tidewater goby, *Eucyclogobius newberryi* (Girard) because of the dietary and habitat preferences of the invader (Matern & Fleming, 1995). We believe that *O. ferox* may be capable of having similar negative impacts in Hawai'i.

Material examined: O'AHU: BPBM 38451, 1 spm, 41.5 mm SL, Hālawā Stream at Kamehameha Highway Bridge, 11 May 1998, sea level (D.J. Preston, R. Wolff); BPBM 38452, 2 spms, 18.5–46.5 mm SL, Hālawā Stream at Kamehameha Hwy Bridge, 15 May 1998, sea level (R.A. Englund, D.J. Preston, R. Wolff); BPBM 38453, 3 spms, 22.5–24.5 mm SL, Hālawā Stream at Kamehameha Hwy Bridge, 19 May 1998, sea level (R.A. Englund, D.J. Preston); uncatalogued, 3 spms, 29–56 mm SL, Hālawā Stream at Kamehameha Hwy Bridge, 20 Oct 1998, sea level (D.J. Preston, R. Wolff).

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