

**RECORDS OF THE
HAWAII BIOLOGICAL SURVEY
FOR 1997
Part 2: Notes¹**

This is the second of 2 parts to the *Records of the Hawaii Biological Survey for 1997* 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 and papers describing new taxa are treated in the first part of this *Records* [*Bishop Museum Occasional Papers 55*].

Range Extensions for Melastomes in Hawai'i

PATRICK CONANT (Hawaii State Department of Agriculture, 1428 S. King Street, Honolulu, Hawai'i 96814, USA)

***Miconia calvescens* DC**

Range extension

A report of a seedling of *M. calvescens* was received at the Hawaii Department of Agriculture (HDOA), Plant Pest Control Branch (PPC) from A. Brash of Roundtop Drive, Tantalus, O'ahu on 24 April 1997. The 35 cm. tall seedling was confirmed as *M. calvescens* by N. Matayoshi of HDOA-PPC the same day. A visit to the site the next day led to the discovery of a large tree of this species directly across Pu'u Kakea Place. The remnant of black plastic pot was wrapped around the base of the 23 cm diameter tree.

Five immature panicles were removed from the tree. The plant may have been planted by Dr. A. Brash, a well known ornamental plant collector (A. Brash pers. comm.), now deceased. Dr. Brash was acquainted with the Marks family of Old Pali Road in Nu'uano who had a large reproductive tree (see Medeiros *et al.*, 1997) and could have received a plant from them.

Only 3 additional progeny were found at the site after searching the entire property and adjacent government owned land; 2 were seedlings less than 25 cm tall and 1 sapling was 4.5 m tall (2.5 cm DBH), presumably not large enough to reproduce.

Material examined: O'AHU: Tantalus, 439 m, NW of Pu'u Kakea Place; TMK 2-5-18-30; 21° 19'31"N, 157°49'08"W, 19 May 1997, P. Conant *s.n.* (BISH).

***Melastoma candidum* D. Don**

Range extension

A second infestation of this weed on O'ahu has now been confirmed. The first known infestation was in Upper Kalihi Valley (Conant, 1996). This new infestation site is in Maunawili and was first observed by J. Lau (pers. comm.) on 10 August 1990. No specimen was collected at that time. A visit to the site on 30 October 1996 by P. Conant, N. Matayoshi, and R. Fenstermacher, revealed over 100 plants. The age of the plants ranged from seedlings to mature 2 m tall plants with flowers and immature fruit. Some of the

1. All notes in this volume constitute Contribution No. 1998-009 to the Hawaii Biological Survey.

plants appeared to have stems larger in diameter than those removed at the Kalihi infestation site, suggesting this is an older infestation. Birds have probably already spread seeds throughout this Maunawili site from past fruit sets.

Material examined: O'AHU: Ko'olau Poko district, Maunawili, 134 m, at end of Lopaka Way, TMK 1-4-2-63-31 and 1-4-2-63-38, 17 June 1996, R. Fenstermacher s.n. (BISH).

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Conant, P. 1996. New Hawaiian pest plant records for 1995. *Bishop Mus. Occas. Pap.* **46**: 1–2.

Medeiros, A.C., L.L. Loope, P. Conant & S. McElvaney. 1997. Status, ecology, and management of the invasive plant *Miconia calvescens* DC (Melastomaceae) in the Hawaiian Islands. *Bishop Mus. Occas. Pap.* **48**: 23–36.

New Records for Hawaiian Plants. I

DERRAL R. HERBST (Hawaii Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817, USA)

This paper reports 2 new island distributional records for naturalized species of plants, one for a native species, and calls attention to 5 newly naturalized plants in the Hawaiian Islands. It also includes notes on one species for which the scientific name has changed.

Convolvulaceae

Convolvulus erubescens Sims New state record

Perennial vine, glabrous to hairy; leaves variable, lamina ovate to oblong-lanceolate, 1.5–5.5 cm long, 3–35 mm wide; apex acute to rounded, emarginate; margins toothed, lobed to deeply divided; moderate to sparsely hairy; petiole 5–30 mm long. Inflorescence 1–3 flowered; sepals more or less hairy; corolla funnel-shaped, 7–11 mm long, pink. Capsule globose with a persistent style base, 4–6 mm in diameter; seeds warty, glabrous or pubescent. Specimens det. by George Staples.

Material examined: O'AHU: 'Ewa District, near Koa Ridge (north of Kīpapa Gulch, east of H-2 Freeway). In ruderal vegetation abutting on pineapple field, about 100 plants present, 220 m, 27 Jan 1996, *Funk* s.n. (BISH 643255); re-collection of the above, 2 Feb 1996, *Funk* s.n. (BISH 643258).

Cucurbitaceae

Sicyos lasiocephalus Skottsb. New island record

The following collection documents a new island record for the island of Moloka'i. *Sicyos lasiocephalus* formerly was believed to be endemic to the island of Hawai'i, where it is found on the northern slopes of Hualālai and the leeward slopes of the Kohala Mountains (Telford, 1990: 578). Specimens det. by Ian Telford.

Material examined: MOLOKA'I: Kalama'ula, pasture along forestry road, 18 Apr 1979, *Hobby* 490 (BISH); Kalama'ula pasture, 18 Apr 1979, *Hobby* 491 (BISH).

Euphorbiaceae

Aleurites montana (Lour.) Wilson New state record

Although *Aleurites montana* has been in cultivation in Hawai'i for at least 40 years

(in the Lyon Arboretum, Mānoa Valley, O‘ahu), this is the first collection documenting it as a naturalized tree in Hawai‘i.

Material examined: **HAWAI‘I:** Hamakua District, above Waipio Valley near the river feeding Hakalaoa Falls, off jeep road by an old corral near the boundary of the Hamakua Forest Reserve, trees were naturalized and spreading along a small stream, 1880 ft, 24 Feb 1991, *Motley, Char, Pang, & Imada 1000* (BISH).

Fabaceae

Albizia chinensis (Osbeck) Merr.

New island record

Albizia chinensis is naturalized along roads and in abandon cane fields along the Hamakua Coast from Hilo to Kukuihaele; the trees are not particularly common and most seen are fairly young. This is the first record of the species naturalized on Hawai‘i Island, although it previously had been reported as naturalized on O‘ahu (Geesink *et al.*, 1990: 644).

Material examined: **HAWAI‘I:** Hamakua District, Lalakea, 920 ft, 2 Aug 1996, *Herbst 9794* (BISH).

Vigna speciosa (Kunth) Verdc.

New state record

Snail maunaloa or snail flower has been cultivated in Hawai‘i as a lei flower since at least 1985, and has recently become naturalized on the island of O‘ahu. *Vigna speciosa* is a vigorous vine, climbing up to 12 feet; its lavender-blue flowers have strongly spirally twisted keels; the pods are flat.

Material examined: **O‘AHU:** Kailua, volunteer in yard, 31 May 1996, *Staples 1052* (BISH); Mānoa, volunteer in pots in garden, 28 December 1993, *Kadowaki & Staples 906* (BISH); Pukele, terrestrial vine in weedy *Schinus/Schefflera* brushland, naturalized, 600 ft, 23 Dec 1985, *Takeuchi 2584* (BISH).

Flacourtiaceae

Dovyalis hebecarpa (G. Gardn.) Warb.

New state record

Dovyalis hebecarpa or Ceylon gooseberry is a spiny shrub or small tree, native to Ceylon, that occasionally is grown for its small, velvety-skinned, purplish berries. Although the plant has been cultivated in Hawai‘i since 1939, at least, it apparently has just recently become sparingly naturalized.

Material examined: **HAWAI‘I:** Captain Cook, Greenwell Ranch pastureland below the highway, planted tree becoming naturalized, 14 Jan 1990, *Imada, Char, & Whistler s.n.* (BISH).

Polygonaceae

Cocoloba uvifera (L.) L.

New state record

Cultivated in Hawai‘i at least since 1916, seagrape is often used to landscape coastal areas as it is tolerant of salt spray and can grow in pure sand. Although abundant fruits are produced, seedlings had not been observed. It now is naturalized in the Pyramid Rock Beach area of the Kaneo‘he Marine Base. Abundant plants, ranging from germinating seeds to large, old individuals were observed. The following collection is the first record of the species as naturalized in Hawai‘i. Germinating seeds also were seen, but not collected, along the margins of the golf course pond on the base.

Material examined: **O‘AHU:** Ko‘olau Poko District, Mōkapu Peninsula, Marine Corps Base Hawai‘i, Kaneo‘he, near the radar installation back of Pyramid Rock Beach, 14 Feb 1997, *Herbst 9811* (BISH).

Potamogetonaceae***Coleogeton pectinatus* (L.) Les & Haynes** **Taxonomic change**

In a recent publication, Les & Haynes (1996) elevated *Potamogeton* subgenus *Coleogeton* to the generic level, based upon anatomical and morphological characters. *Coleogeton* differs from *Potamogeton* by the following characters:

Part	<i>Coleogeton</i>	<i>Potamogeton</i>
Stipules	fused, adnate to blade for at least 2/3 length of stipule	not fused, or if fused then adnate less than 1/2 length of stipule
Leaves	submerged leaves opaque, turgid, channeled	submerged leaves translucent, flat, lacking grooves or channels
Peduncle	flexible, hypodermis absent	stiff, hypodermis present
Pollination	occurs underwater or at surface	aerial pollination

The species of Potamogetonaceae treated by Wagner, *et al.* (1990: 1608) as *Potamogeton pectinatus* L. is now referred to *Coleogeton pectinatus* (L.) Les & Haynes.

Vitaceae***Cissus rotundifolia* (Forssk.) Vahl** **New island record**

The following collection documents a new island record for a naturalized ornamental plant on O'ahu. Arabian wax cissus also is naturalized on the island of Kaua'i (Lorence & Flynn, 1997: 12). Two other members of the genus, *Cissus nodosa* and *C. quadrangularis* had previously become naturalized in Hawai'i.

Material examined: O'AHU: Ko'olau Poko District, Mōkapu Peninsula, Marine Corps Base Hawai'i, Kaneo'he Bay, near sea level, succulent vine with pale yellow flowers, purple fruit, growing over *Leucaena* thicket along the southern boundary of the base just west of Mōkapu Gate, common in this area and apparently naturalized, 15 May 1996, *Herbst & Bookless 9764* (BISH).

Acknowledgments

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New Naturalized Plant Records for the Hawaiian Islands

TIM FLYNN & DAVID H. LORENCE (National Tropical Botanical Garden, P.O. Box 340, Lawa'i, Hawai'i 96765, USA)

The following collections represent new records based on information published in Wagner *et al.* (1990) and supplemental information published in *Records of the Hawaii Biological Survey* (Evenhuis & Miller, 1995, 1996, 1997). The authors wish to thank D.C. Clayton for the identifications of *Entolasia* and *Eragrostis* and George Staples for the identification of *Centrosema*.

Fabaceae

Centrosema pubescens Benth.

New state record

Known from cultivation, this native of tropical America was found growing up into *Leucaena* adjacent to the UH Agricultural Experiment Station in upper Wailua. The leaves are dark, dull green above, dull, paler below. The corolla purple and cream. It had long been suspected of naturalizing on Kaua'i and the following collections confirm this.

Material examined: **KAUA'I:** Kawaihau District, upper Wailua Homesteads along Hwy 580, ca. 0.5 miles beyond entrance to Ag. Exp. Sta. Secondary vegetation of *Psidium*, *Leucaena*, *Thunbergia*, *Chrysophyllum*, and *Wedelia*, ca 155 m, 19 Apr 1997, T. Flynn *et al.* 6126 (BISH, MO, NY, PTBG, US); Anahola, on unpaved road mauka of Hole-in-the-Mountain Lookout, Dec 1988, Hume & Levine 280 (BISH, PTBG).

Poaceae

Entolasia marginata (R. Br.) Hughes

New state record

Native to Australia, this is the first record of this species and genus as naturalized in the Hawaiian Islands.

Material examined: **HAWAII:** South Kohala District, 'Umipoho gulch area above Koaia sanctuary, *Metrosideros-Cheirodendron* Montane Wet Forest w/ *Clermontia* spp., *Adenophorus* spp., *Dryopteris* spp., *Astelia*, *Coprosma*, ca. 4840–5000 ft [1475–1523 m], 16 Oct 1995, K.R. Wood 4663 (K, PTBG).

Eragrostis parviflora (R. Br.)

New state record

This collection represents the first record of the species naturalized in the Hawaiian Islands.

Material examined: **KAUA'I:** Waimea District, Hanapēpē, Port Allen, just north of Burns Field [airport] at junction of Lokokai Road and Lele Road; secondary vegetation dominated by *Cenchrus ciliaris*, with *Eragrostis*, *Eleusine*, and *Echinochloa*, ca. 35 ft. [11 m], 11 Jan 1995, T. Flynn 5925 (K, PTBG).

Zoysia matrella (L.) Merr. var. *pacifica* Gouds. New state record

This common ornamental grass is naturalized locally above the high water line on coral sand beach, spreading by rhizomes from old lawn areas behind the beach.

Material examined: **KAUA'I:** Koloa District: Allerton Gardens, Lawa'i-Kai at mouth of Lawa'i Str, west side; strand vegetation with *Ipomoea pes-caprae*, *Vigna marina*, *Pluchea indica*, near sea level, 10 Apr 1995, Lorence & Flynn 7651 (BISH, PTBG, US).

Rosaceae*Rubus niveus* Thunb.**New island record**

The following collection represents a new island record for this species, which was previously known from Maui and Hawai'i. State Forester Galen Kawakami discovered a population of 3 plants near the South corner of the Kukui Trail shelter below the Iliau Loop Trail. These plants were subsequently removed by Kawakami and Guy Nagai of the State Department of Agriculture.

Material examined: **KAUA'I:** Waimea District, Waimea Canyon State Park, Kukui Trail shelter, three plants seen at South corner of shelter, 840 m, 18 Aug 1997, *Galen Kawakami s. n.* (PTBG).

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New Plant Records from West Maui

J. SCOTT MEIDELL, H.L. OPPENHEIMER & R.T. BARTLETT (Maui Pineapple Co., Pu'u Kukui Watershed, 4900 Honoapiilani Hwy., Lahaina, Hawai'i 96761, USA)

The following contributions include naturalized range extensions, new island records and a notable rediscovery of plants located on West Maui, Hawai'i. The attendant specimens were collected by Maui Pineapple Company staff in the course of field work mandated by a comprehensive management plan for the company owned, 8,600 acre Pu'u Kukui Watershed.

Rosaceae*Acaena exigua* A. Gray**Notable rediscovery**

According to Wagner *et al.* (1990), this taxon is regarded as extremely rare, with the latest collection from Maui made in 1957 and from Kaua'i in 1870. The subject of intensive searches in montane bogs, *Acaena exigua* was most recently considered by the USFWS as being extinct. In March of 1997, Pu'u Kukui Watershed staff located a single plant in the remote montane bogs of West Maui. In September of 1997, seeds from the plant were forwarded to the Lyon Arboretum for propagation.

Material examined: **MAUI:** Lahaina District, Honokohau 1719 m, among bryophytes in mixed 'Ohi'a Montane Bog, 19 Mar 1997, *Meidell & Oppenheimer 194* (BISH).

Meliaceae*Swietenia macrophylla* King**New island record**

According to the Wagner *et al.* (1990), the genera *Melia* and *Toona* are the naturalized representatives of Meliaceae in this state, with the genus *Swietenia* reported as culti-

vated. However, the apparent naturalization on the island of O‘ahu of *S. macrophylla* has been documented by a collection observed at BISH (*Wood 5084*). The historical records of Maui Pineapple Company indicate that *S. macrophylla* was planted within the Honokohau Arboretum in the mid-1920s and recent surveys of surrounding areas have produced observations of the significant proliferation of this taxon. Hundreds of vigorous individuals, ranging from seedlings to mature fruiting adults, have been noted in steep drainages of Honokohau Valley. It is often observed to be codominant with *Schinus terebinthifolius* and *Syzygium cumini* in disturbed Lowland Mesic Forest.

Material examined: MAUI: Lahaina District, West Maui, 152 m, Honokohau Valley, 5 Jul 1997, *Meidell & Oppenheimer 201* (BISH).

Passifloraceae

Passiflora laurifolia L.

New island record

Wagner *et al.* (1990: 1011) cited the naturalized range of this taxon in Hawai‘i as Kaua‘i, O‘ahu, Moloka‘i and Hawai‘i. Surveys of the ridges between Alaeloa Gulch and Honokohau Valley, West Maui, revealed at least 10 apparently naturalized individuals occupying alien dominated Lowland Mesic Forest at an elevation of 378 m.

Material examined: MAUI: Lahaina District, West Maui, Honokahua, 378 m, 31 Oct 1996, *Meidell & Oppenheimer 129* (BISH).

Passiflora ligularis Juss.

New island record

Cited by Wagner *et al.* (1990: 1011) as naturalized only on Kaua‘i, O‘ahu, Lāna‘i and Hawai‘i, this taxon was located in disturbed ‘*Ohi‘a/Uluhe* Lowland Wet Forest in the vicinity of Kaulalewelewe, West Maui, at 847 m. The remote location of the specimen reasonably precludes the possibility that it is under cultivation or otherwise deliberately introduced.

Material examined: MAUI: Lahaina District, West Maui, Kaulalewelewe, 847 m, 13 Jun 1997, *Oppenheimer 206* (BISH).

Myrsinaceae

Ardisia elliptica Thunb.

Range extension

Wagner *et al.* (1990: 932) report this taxon as naturalized on Kaua‘i, O‘ahu, East Maui and Hawai‘i. Maui Pineapple Co. records indicate that this taxon was introduced to the Maunalei Arboretum near Honolua in the 1920s. Surveys of the Pu‘u Kukui Watershed and adjacent areas indicate that *Ardisia elliptica* has proliferated beyond its original planting site and is now a serious naturalized pest on West Maui that rapidly intergrades with native elements of Lowland Mesic and Wet Forests. Thousands of vigorous individuals of all size classes have been observed.

Material examined: MAUI: Lahaina District, West Maui, Honokahua, 366 m, 5 Jul 1997, *Meidell & Oppenheimer 203* (BISH).

Fabaceae

Acacia melanoxyton R. Br. ex Aiton

Range extension

In their discussion of *Acacia*, Wagner *et al.* (1990: 640), reported the naturalization of *A. melanoxyton* on East Maui. Recent surveys of areas adjacent to State forestry plantings on West Maui have shown a definite proliferation of this taxon well beyond its original planted range. *Acacia melanoxyton* has become dominant in what was only recently intact native shrubland, thus it is viewed by Maui Pineapple Co. staff as a serious threat and intensive control strategies are being investigated to control its spread.

Material examined: MAUI: Lahaina District, West Maui, Mahinahina, 457 m, 14 Feb 1997, Meidell & Oppenheimer 166 (BISH).

Poaceae

Cortaderia jubata (Lemoine) Stapf

Range extension

Regarded as a serious pest on East Maui, Maui Pineapple Co. staff first observed *C. jubata* on West Maui within the Kahakuloa Section of the State of Hawai'i Natural Area Reserve System in September 1995 and most recently in September 1997 on Southern West Maui at 1097 m in the area of Pōhākea Gulch. In view of its apparently rapid establishment in remote and undisturbed locations and its potential as a habitat-modifying weed, *C. jubata* will be subject to intensive monitoring and control efforts.

Material examined: MAUI: Wailuku District, West Maui, Maalaea, Pōhākea, 1097 m, 8 Sep 1997, Oppenheimer & Duvall 236 (BISH).

Acknowledgments

We thank the staff of Bishop Museum / *Herbarium Pacificum* particularly George Staples, Derral Herbst, and Clyde Imada, for their valuable assistance with the handling and verification of vouchers.

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New Hawaiian Plant Records for 1997

HERBARIUM PACIFICUM STAFF (Hawaii Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817, USA)

These previously unpublished Hawaiian plant records report new state and new island records for naturalized species, a notable rediscovery of a native species (*Gouania vitifolia*), a nomenclatural change for a naturalized tree species (*Falcataria moluccana*), and reidentifications of previously misnamed species in Hawai'i. These records supplement information published in Wagner *et al.* (1990) and in the *Records of the Hawaii Biological Survey* (Evenhuis & Miller, 1995, 1996, 1997). All identifications were made by the authors except where noted in the acknowledgments, and all supporting voucher specimens are on deposit at BISH except as otherwise noted.

Acanthaceae

Pseuderanthemum fasciculatum (Oerst.) Leonard

New state record

Native to Central America, this species was recently reported as spreading in a South Carolina greenhouse (J. Nelson, TAXACOM mailing list comm.). This is the first report of the species in Hawai'i, and it bears watching as it apparently spreads easily as a nursery weed. This low herb has white flowers with a lavender tint; blackish anthers; and slender, dehiscent capsules. We thank Dr. R.K. Nishimoto (Department of Horticulture, University of Hawaii at Mānoa) for bringing the specimen in for identification.

Material examined: O'AHU: Honolulu, Kapahulu orchid nursery, herb 6 in. tall, appearing in nursery pots around base of cultivated plants, 17 Oct 1996, G. Staples 1128.

Apiaceae***Peucedanum sandwicense*** Hillebr.**New island record**

Previously known from Kauaʻi, Molokaʻi, West Maui, and Keōpuka Islet off East Maui (Wagner *et al.*, 1990), *makou* has now been recorded from Oʻahu.

Material examined: OʻAHU: Waiʻanae Range, off Keaʻau-Mākaha ridge crest on the Keaʻau side, 890 m, 16 Apr 1990, J. Obata & S. Perlman *s.n.* (BISH 580065, 580066, 580067), K. R. Wood, S. Perlman & J. Obata 297.

Bignoniaceae***Tecoma castanifolia*** (Don) Melch.**New naturalized record**

First vouchered in BISH in 1954 as a planted tree in Honouliuli Forest Reserve, Oʻahu, this shrub or small tree from Ecuador was recently noted to be reproducing and spreading in Lualualei Valley. Typical of many members of the Bignoniaceae, this species has pods containing many winged seeds adapted for wind dispersal.

Material examined: OʻAHU: Waiʻanae Mtns., Honouliuli Forest Reserve, Puʻu Kaʻua, beside road to gate 5 growing in pasture, 350 m, 8 Mar 1954, Landgraf *s.n.* (BISH 43016); Kauhīʻuhi Valley, Lualualei Naval Magazine, trees seemed randomly scattered in an area ca. 100 m², 2 Jul 1996, D. Preston & F. Howarth *s.n.* (BISH 646673).

Brassicaceae***Sinapis arvensis*** L.**Reidentification, new state record**

The presence of this species in Hawaiʻi is based on a redetermination of a voucher by Dr. I. Al-Shehbaz, previously incorrectly identified as *Brassica campestris* L. [= *B. rapa* L.]. One character that can be used to separate *Sinapis* from *Brassica* is the presence of 3–7 nerves on each silique valve in *Sinapis*, while in *Brassica* the valves have only 1 prominent midnerve (Rollins, 1993).

Material examined: MOLOKAʻI: Hoʻolehua, 1 plant seen in weedy field, 4 Apr 1928, O. & I. Degener 35830, *ibid.*, 35833.

Combretaceae***Terminalia myriocarpa*** Van Heurck &**New island record**

Muell. Arg.

This sterile collection represents a new Oʻahu naturalized record for the species. Native to India, China, and Indonesia, *jhalna* was previously documented as naturalized on Kauaʻi, Maui, and the Big Island (Wagner *et al.*, 1990). Between 1928 and 1958 over 26,000 trees were planted on Kauaʻi, Oʻahu, Maui, and Hawaiʻi, including over 7,000 on Oʻahu (Skolmen *n.d.*), many of which can still be seen as large trees with spreading canopies. Scattered trees of different sizes were noted in Haiku Valley.

Material examined: OʻAHU: Haʻikū Valley, along H-3 access road fronting foot access path to Haʻikū Stairs, single tree 10 ft. tall, 19 May 1997, C. Imada, W. Char & T. Motley 97-002.

Fabaceae***Desmodium intortum*** (Mill.) Urban**New island record**

This sterile collection represents a new Oʻahu island record for this species. It was previously known to be naturalized only on the Big Island (Wagner *et al.*, 1990).

Material examined: OʻAHU: Haʻikū Valley, locally dominant along H-3 access road fronting foot access path to Haʻikū Stairs, 19 May 1997, C. Imada, W. Char & T. Motley 97-001.

Falcataria moluccana (Miquel)**Taxonomic change**

Barneby & Grimes

Syn. *Albizia falcataria* (L.) Fosb., *A. moluccana* Miquel, *Paraserianthes falcataria* (L.) I. Nielsen; Misapplied: *A. falcata* sensu auctores Hawaiian.

In a recent study of *Pithecellobium* and related genera, Barneby & Grimes (1996) revised several generic concepts. *Paraserianthes*, in their view, is a monotypic genus. Three species formerly placed there were removed to the new genus *Falcataria*. This results in a name change for a widely planted legume that is also naturalized in the Hawaiian Islands.

Senna multijuga (L. C. Rich.) Irwin &**New naturalized record**Barneby var. *multijuga*

A neotropical species native to the northern half of South America, *S. multijuga* has been cultivated in Hawai'i since at least the 1920s; the oldest specimen at BISH is from a cultivated shrub collected at 'Ālewa Heights, O'ahu in 1926 (*A. F. Judd 61*). The species is now naturalizing on Kaua'i.

Material examined: **KAUAI:** Kōloa Dist., E of new Halfway Bridge, near Hwy 50 along turnoff into canefield just N of highway, tree 5 m. tall, spreading from grove of 5 large planted trees, 31 Oct 1990, *D. Lorence & T. Flynn 6626* (PTBG, US).

Moraceae***Ficus nota*** (Blanco) Merrill**New naturalized record**

Native to the Philippines and northern Borneo, around 25,000 trees of *F. nota* were planted on Kaua'i, O'ahu, and Hawai'i between 1922 and 1932, the majority (over 21,000 trees) on the Big Island (Skolmen, n.d.). It appears that the species is reseeding itself and spreading. The species is dioecious, with sandpapery, elliptic to obovate leaves 6–14 in. long and \pm asymmetrical at the base; the pear-shaped figs are 0.6–1.4 in. in diameter and produced on cauliflorous branchlets up to 1 ft long on the trunk and larger branches.

Material examined: **O'AHU:** Pūpūkea, lower forest, planted and reseeding itself, 8 May 1967, *O. & I. Degener 31910*; Waiāhole ditch trail, 1190 ft., scattered along the trail, 26 Aug 1972, *T. Herat 252*; Waiāhole Valley, near water tunnel entering Uwao Stream, 240 m., 2 Dec 1984, *W. L. Wagner et al. 5499*. **HAWAI'I:** Hāmākua District, Kawiki forest reserve above 'Akaka Falls, *Eucalyptus*-strawberry guava forest, 1900 ft., tree naturalized and spreading into native 'ōhia forest, 24 Jul 1992, *W. Takeuchi et al. 7540*.

Malvaceae***Malva neglecta*** Wallroth**New state record**

This species is known from mostly temperate climates in Europe and Asia, and is extensively naturalized in North America (Fryxell, 1988). This is the first record of its presence in Hawai'i. *Malva neglecta* can be distinguished from *M. parviflora* L. (cheese weed) by the following characters: *M. neglecta* has petals 6–11 mm long, notably exceeding the calyx ($\pm 2 \times$ the length of the calyx), and fruits with a circular outline, mature mericarps 12–15, smooth or faintly reticulate, sometimes slightly ridged dorsally, but not winged; *M. parviflora* has petals 4–5 mm long, not or scarcely exceeding the calyx, and fruits with a crenate outline, mature mericarps ca. 10, prominently rugose dorsally and winged at the angle between the dorsal and lateral walls (Fryxell, 1988).

Material examined: **MAUI:** Haleakalā National Park, roadside, M. chlorination unit, 2160 m, 17 Oct 1982, *A. C. Medeiros 292*.

Nymphaeaceae

No members of the Nymphaeaceae were treated as naturalized in Wagner *et al.* (1990). In the 7 years since publication of that flora, 2 introduced African species of *Nymphaea* L. have been collected in the Hawaiian Islands outside of cultivation. Collectors are encouraged to look out for waterlilies and to make collections to document the identity, distribution, and abundance of this new element in the naturalized flora. Given the recent upsurge in interest in water gardening, there are likely to be more escaped aquatic plants added to the naturalized flora.

The nomenclature for *Nymphaea* is exceedingly complex, with a morass of synonyms and misapplied names that must be waded through. We have maintained the traditional taxonomic concepts for the African blue-flowered waterlilies (Conard, 1905), despite Verdcourt's recent merger (Verdcourt, 1989) of African *N. caerulea* and *N. capensis* with the Indian species, *N. nouchali* Burm. fil. It remains to be seen whether this sweeping reclassification, which recognizes 5 varieties of a single polymorphic species, will be accepted or not.

Nymphaea caerulea Savigny

New state record

In 1992 a single collection of this species was made on the Big Island that appears to represent an escaped, naturalized population. The plants have leaves with entire margins, the undersides pale green dotted purplish; the flowers are day-blooming and stand well above the water, with 14–20 deep blue petals and 50–75 stamens; the sepals are dark green densely lined purplish. The species is native to northern and tropical Africa. Further collections and monitoring are needed to establish the extent of its distribution in Hawaiian freshwaters.

Material examined: **HAWAII:** North Kohala Distr., Hāwī Quadrangle, Parker Ranch, stock pond in vicinity of Kehena Reservoir, 2,400 ft., floating submergent growing along the shore and in standing water, 8 Jun 1992, A. Engilis, Jr. & F. A. Reid 92–12 (BISH, US).

Nymphaea capensis Thunb.

New state record

A sizable population of this African waterlily has become established in a muddy stream in a livestock pasture on Kaua'i. This is the only known station for the species in the Hawaiian Islands, but searches in other suitable habitats may turn up further localities. *Nymphaea capensis* is recognized by its day-blooming flowers that stand well above the water's surface, with 12–27 petals and 30–250 stamens. The species typically has vivid blue petals, although shades of mauve, pink, or white have also been recorded; Kaua'i plants have uniformly deep pink flowers that are strongly fragrant.

Hawaiian plants have been identified as *N. capensis* var. *zanzibariensis* (Caspary) Conard, which is distinguished by toothed to lobulate leaf margins and 120–250 stamens.

Material examined: **KAUAI:** Kawaihau Distr., between Kamalu Road and Pu'uōpae Rd., in slow-moving, shallow stream in cattle pasture, common in area, 1 May 1989, L. Hume 378 (3 sheets BISH, PTBG).

Ochnaceae

Routine identification of voucher specimens of *Ochna* in the BISH herbarium during the course of the *In Gardens of Hawai'i* project revealed that at least 4 species are cultivated in the Hawaiian Islands. One of these has been incorrectly identified in local botanical literature (Neal, 1965; St. John, 1973; Wagner *et al.*, 1990), while another is a newly recorded naturalized species for the state.

The fleshy, oily drupelets of the “Mickey Mouse plant” are attractive to frugivorous birds and eagerly eaten by them. Seedlings of these 2 *Ochna* species frequently volunteer near homes and gardens and it seems inevitable that they will eventually reach native forests, if they have not already done so. *Ochnas* in general should be monitored closely for their invasive potential.

***Ochna serrulata* (Hochst.) Walp.**

New state record

Seemingly rare in cultivation (based on voucher specimen representation in BISH) in Hawai‘i, *O. serrulata* is the first *ochna* to be conclusively demonstrated to be naturalized here. Known to be planted at Manukā State Park (based on *Flynn et al. 3940*), *O. serrulata* was collected in 1997 approximately 1 mi away in dry ‘*ohia* forest, where it appears to be naturalized.

Ochna serrulata is a diffuse shrub to 3.3 dm tall with copiously lenticellate twigs and branchlets; oblong, sessile leaf blades with serrulate margins; and usually 5 or less drupelets. The native range is the eastern Cape of Good Hope region in South Africa (Palgrave, 1988).

Material examined: **HAWAI‘I:** Manukā State Park, naturalizing in forest behind park, 26 May 1990, *T. Flynn et al. 3940*; Manukā Natural Area Reserve, in ‘*ohia* forest on a‘a flow, ca. 730 m, probably naturalized from plantings in wayside, Jan 1997, *B. Stevens 2* (BISH 647633).

***Ochna thomasiana* Engl. & Gilg**

Reidentification

O. kirkii sensu Neal (1965), St. John (1973), Clay & Hubbard (1977), Wagner *et al.* (1990).

Mentioned in a note in Wagner *et al.* (1990) as escaping from cultivation on O‘ahu, this species has long been called *O. kirkii* D. Oliver in Hawaiian botanical literature. Voucher specimens for cultivated plants were reidentified by Dr. N.K.B. Robson. *Ochna thomasiana* may be recognized by its lenticellate twigs and branchlets; broadly elliptic leaf blades, more or less cordate at the base and clasping the stem; and the 5–8 prominent, long cilia on the margin of the blade in the basal half. There are up to 12 glossy black drupelets borne erect on the red, waxy receptacle with reflexed red sepals.

There are no bona fide vouchers from naturalized plants, though this is surely due to sampling bias. Field collectors are encouraged to look for this and other *Ochna* species to better document their distribution and abundance in the Hawaiian Islands.

Cultivated material examined: **O‘AHU:** Bishop Museum grounds, 18 Nov 1985, *J. Lau 1645*, [same locality] 11 Jul 1990, *T. Phillips 1*; University of Hawaii Mānoa campus, 10 Feb 1962, *V. J. Krajina 6292*, [same locality] 14 Feb 1962, *V. J. Krajina 62251*; Honolulu, Nāhua Place, 15 Sep 1948, *M.C. Neal s.n.* (BISH 61004); Waipahu, O‘ahu Sugar Co., 13 Aug 1959, *Mrs. C.E.S. Burns, Jr. s.n.* (BISH 61005). **MAUI:** Ha‘ikū, Board of Agriculture and Forestry nursery, Aug 1946, *A. Suehiro s.n.* (BISH 448730).

Rhamnaceae

***Gouania vitifolia* A. Gray**

Rediscovery

Known historically from only 7 collections from O‘ahu, West Maui, and Hawai‘i, *G. vitifolia* was considered probably extinct by Wagner *et al.* (1990) until rediscovered on O‘ahu in 1990 (Obata, 1992; Herbarium Pacificum Staff, 1996). On the Big Island, the species was previously known from a single collection made by Jules Rémy in 1853 (*Rémy 588, P*) from the land section of Kea‘ā, Ka‘ū, near the southern end of the Big Island (St. John, 1969). It has not been collected since, until Bryon Stevens, a state Natural Area Reserves specialist, recently rediscovered a population of at least 3 plants in South

Kona, vigorously growing into a canopy of *Psidium* and *Metrosideros*. Although sterile, this voucher is unequivocally *G. vitifolia*.

Material examined: **HAWAII:** Manukā Natural Area Reserve, “Olopuā Kipuka,” old growth ‘ōhia/olopua forest, growing into upper branches of large guava tree, ca. 760 m., covers about 1000 ft² area, 18 Apr 1997, *B. Stevens* 2 (BISH 649003).

Solanaceae

Solanum linnaeanum Hepper & P. Jaeger **New island record**

Previously recorded as naturalized from O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i (Wagner *et al.*, 1990), apple of Sodom is now also recorded from Kaho‘olawe.

Material examined: **KAHO‘OLAWA:** E slope of Moa‘ula, 1350 ft., 25 Apr 1980, *G. Clarke & C. Corn* 414.

Verbenaceae

Citharexylum spinosum L. **New state record**

Long cultivated in the Hawaiian Islands as a flowering shade tree (Neal, 1965; St. John, 1973) and often used today as a street tree, *C. spinosum* was omitted from the *Manual* (Wagner *et al.*, 1990) as a naturalized species. At that time there were no vouchers to document it as a weed, yet in a mere 6 years the population of this tree species has seemingly exploded on O‘ahu, particularly on the windward side. Actually, the population has probably been steadily increasing for some time, and only after numerous individuals attained tree-size and underwent their characteristic foliage color change during the winter months did people suddenly notice how widespread *C. spinosum* had become.

Native to the Lesser Antilles and northern South America, fiddlewood is a tree up to 50 ft. tall with elliptic, firmly chartaceous blades pointed at both ends, up to 8 in. long and 4 in. wide, with orange-yellow petioles; the racemes are drooping, simple or branched at the base, and up to 12 in. long; the fruits are globose, 0.25 in. in diameter, and orange or red, turning black when ripe. The leaves characteristically turn russet gold between February and May. The flowers are functionally unisexual and the trees are dioecious (Tomlinson & Fawcett, 1972; Tomlinson, 1980).

The spread of *C. spinosum* is achieved by frugivorous birds that eat the fleshy black fruits and thereby disperse the seeds; the species also suckers profusely. It is rapidly becoming a pest species and the continued cultivation, at least of the fruit-bearing female trees, should be discouraged. Male trees might still be grown for shade and their sweetly fragrant flowers. This is apparently the first record of it as a weed. The 2 naturalized *Citharexylum* species in Hawai‘i are occupying distinct habitats. *Citharexylum caudatum* L. is well established in mesic valleys (Mānoa, upper Nu‘uanu) and wet slopes on windward O‘ahu. In contrast, *C. spinosum* is spreading in drier habitats such as the hills above Lanikai and Kailua and on the Mōkapu peninsula.

Material examined: **O‘AHU:** Hāmākua Marsh inland from Kailua, Hāmākua Drive, ca. 40 ft., scattered trees upland from the marsh, distinctive for the orange-tinted leaves, 4 Apr 1992, *C. Imada et al.* 92–4.

Duranta erecta L.

New island record

Previously recorded as naturalized only on Kaua‘i (Lorence *et al.*, 1995), this collection is the first that documents the occurrence of the golden dewdrop as a naturalized species on O‘ahu. Readily dispersed by birds, this species will surely become more wide-

ly naturalized in the future, if it has not already done so.

Material examined: O'AHU: North Shore, Nihea Gulch ranch house ca. 1 mi inland from coast, 31 Jul 1990, K. Thorne & H. Black 7862 (BISH, BRY).

Acknowledgments

These records were compiled by the staff of Herbarium Pacificum (BISH) at Bishop Museum. In alphabetical order, the contributors were K. Anderson, D. Herbst, C. Imada, B. Kennedy, and G. Staples. We thank R.K. Shannon and W.L. Wagner of the Department of Botany, Smithsonian Institution, for preparing the entries for *Senna* and *Nymphaea caerulea*. The ongoing curation of the BISH herbarium was supported by National Science Foundation grant BSR 8912364 and the John D. and Catherine T. McArthur Foundation. We thank the following for identification of vouchers: I. Al-Shehbaz (MO, *Sinapis*), R. Barneby (NY, *Senna*), C.C. Berg (BG, *Ficus*), W. Char (*Desmodium*), P. Fryxell (TEX, *Malva*), N.K.B. Robson (BM, *Ochna*), D. Wasshausen (US, *Pseuderanthemum*), and J. Wiersema (BARC, *Nymphaea*); we also thank B. Stevens, State Division of Forestry & Wildlife, for providing additional field observations for his collections.

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A New Naturalized Plant Species in Windward O‘ahu, Hawai‘i

PAULINE SATO (The Nature Conservancy of Hawaii, Honolulu, Hawai‘i 96813, USA)

Dilleniaceae

Dillenia suffruticosa (Griff.) Martelli

New state record

This collection represents a new state record for the naturalized flora of the Hawaiian Islands. *Dillenia suffruticosa* (common name, “shrubby simpoh”) is a tree, 7–10 ft (2–3 m) tall, with smooth, dark green leaves displaying “winged” petioles. Flowers are yellow, 4–5 in (10–18 cm) in diameter; fruits are capsules that open in a star shape containing several orange-red seeds. Approximately 25 plants were seen growing along the dirt road through the back of Waihe‘e Valley in disturbed moist forest. Further surveys in the forest will likely result in more findings of this species. Neal (1965: 581) reported that this tree is an ornamental shrub from Borneo. It is suspected that this plant has escaped from cultivation.

Material examined: O‘AHU: Ko‘olaupoko district, Waihe‘e Valley, first specimen noted ca. 50 m beyond the Board of Water Supply gate at the end of Waihe‘e Road in moist, disturbed forest. Possible ornamental escape, 29 Aug 1997, *H. Fraiola s.n.* (BISH 649596).

I thank George Staples and Clyde Imada of the Bishop Museum for their assistance in identifying and pressing the voucher.

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Notes on Hawaiian *Melicope* (Rutaceae)

WARREN L. WAGNER & ROBYNN K. SHANNON (Department of Botany, National Museum of Natural History, Smithsonian Institution, MRC-166, Washington, DC 20560)

Although all published names for Hawaiian angiosperms were included in Wagner *et al.* (1990), a rigorous assessment of them has never been done. In 1983 as part of the Hawaiian Flora Project at the Bishop Museum a Hawaiian nomenclatural database was

initiated. It included bibliographic and type information, and the current classification. The project was revitalized in 1994 (Wagner, Shannon and taxon collaborators, in prep.). A database intended for WWW publication, a book, along with several papers on specific problematic groups will be produced. In analyzing the nomenclature for the genus *Melicope* a number of problems were discovered, including names not validly published, errors in the original publications, problems with the typification, and incorrect placement of names in synonymy. We here present 3 names not validly published, 1 corrected synonymy, and a new island record; and provide 1 new combination for a common Ko'olau Mountain species for which there is currently no valid name in *Melicope*.

Names not validly published:

Publication of the following 3 names did not fulfill the requirement of ICBN Art. 36.1 and therefore were not validly published (no Latin diagnosis). In each of these cases the author was providing a name for an unnamed Hillebrand (1888) variety, the descriptions of which were in English.

Pelea elliptica (A. Gray) Hillebr. var. *mauiensis* H. St. John, *Lloydia* 7: 274. 1944. Published by St. John as a "nom. nov." based on *P. elliptica* (A. Gray) Hillebr. α var. Hillebr., *Fl. Hawaiian Isl.* 69. 1888.

Pelea wawraeana Rock var. *ternifolia* B.C. Stone, *Pacific Sci.* 16: 372. 1962, and the later combination *Pelea peduncularis* H. Lév. var. *ternifolia* (B.C. Stone) B.C. Stone, *Occas. Pap. Bernice P. Bishop Mus.* 23(10): 154. 1966. Published by Stone as a "var. nov." based on *P. sandwicensis* (Hook. & Arn.) A. Gray β var. Hillebr., *Fl. Hawaiian Isl.* 67. 1888.

Melicope honoluluensis (H. St. John) T.G. Hartley & B.C. Stone, *Taxon* 38: 121. 1989. *Pelea honoluluensis* H. St. John, *Lloydia* 7: 268. 1944. Neither the basionym nor the subsequent combination was validly published, because the requirement of a Latin diagnosis was not fulfilled (ICBN Art. 36.1, 1994). The next available name for this taxon is *Pelea hosakae* H. St. John, and we here make the combination in *Melicope*.

New combination:

Melicope hosakae (H. St. John) W. L. Wagner & R. K. Shannon, **comb. nov.**

Pelea hosakae H. St. John, *Lloydia* 7: 266. 1944. TYPE: O'ahu, Ko'olau Mts., Waipi'o, Kipapa Gulch, moist gully, 1700 ft, 6 May 1933, *E. Y. Hosaka 1006* (Holotype: BISH-579704!; Isotype(s): BISH!).

Corrected synonymy:

The following name was incorrectly synonymized under *Melicope kavaiensis* in Wagner *et al.* (1990).

Pelea kavaiensis H. Mann var. *glabra* Hillebr., *Fl. Hawaiian Isl.* 64. 1888. TYPE: Kaua'i, Waimea, 610-915 m, s.d., *V. Knudsen 200* (Holotype: B [PD, fragment BISH!, photo BISH!]). Present disposition: *Melicope anisata*.

New record:***Melicope ovata*** (H. St. John & Hume)**New island record**

T. Hartley & B. Stone

Formerly known only from northwestern Kaua'i, this species was collected at one locality in the Wai'anae Mountains of O'ahu in 1991.

Material examined: **O'AHU:** Wai'anae Mts., Honouliuli Preserve, Napepeiaulelo Gulch, 698 m, 12 Jan 1991, *J. Lau & J.L.Perry 3312* (BISH); Honouliuli Preserve, North Pālāwai Gulch, gulch bottom, mesic native forest & patch surrounded by alien *Schinus* forest, 690 m, 22 Jun 1991, *J. Lau & G. Uchida 3399* (BISH), *3400* (BISH).

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Fossil Cotton from the Salt Lake Crater area, O'ahu, Hawai'i

D.W. WOODCOCK, C.A. MANCHESTER (Department of Geography, University of Hawaii at Mānoa, Honolulu, Hawaii 96822, USA) & D.L. WEBB (Department of Botany, University of Hawaii at Mānoa, Honolulu, Hawaii 96822, USA)

This paper reports fossil leaves of Hawaiian cotton (*Gossypium tomentosum* Nutt. ex Seem) found east of Salt Lake Crater in volcanic sediments associated with the Salt Lake Crater/Aliamanu eruptions. There exist many mentions of fossil plant material in post-erosional volcanic sediments in the Hawaiian Islands (Hitchcock, 1906; Wentworth, 1926; Lyon, 1930; Sterns, 1939; Okamura & Forbes, 1961; Carlquist, 1980). Lyon (1930) described a fossil forest of "koa, 'ohi'a, and loulou" in Salt Lake Crater that was discovered when a drainage tunnel was excavated through a wall of the crater. Carlquist (1980) mentions later collections of *Pteralyxia* seeds and fronds of *Pritchardia* from the same area. Sterns (1966) treatment of the geology of the state includes mention of a volcanic mudflow in the Fort Shafter area containing fossil leaves and wood. A fossiliferous mudflow corresponding to Stern's description occurs in the road cut from which we obtained the cotton leaves. The fossil cotton leaves, however, are lower in the section, in the tuff at the base of the volcanic layer. The volcanic rocks are superposed on a paleosol and overlain by limestone, which if corresponding to the Waimanalo stand (Macdonald *et al.*, 1986), would place the age of the fossil material at upwards of 120,000–135,000 years old (Muhs & Szabo, 1994).

Fossil leaves are abundant in this part of the section. It appears that cotton was the dominant plant growing in the area at the time of deposition and that a dry coastal-flat environment is represented. The cordate, three-lobed leaves show evidence of raised protuberances corresponding to the mucilage cells typical of the genus (Fig. 1). The leaves range in width from 2–10 cm.

We believe that this is the first report of cotton in the fossil record (Fryxell, 1979).

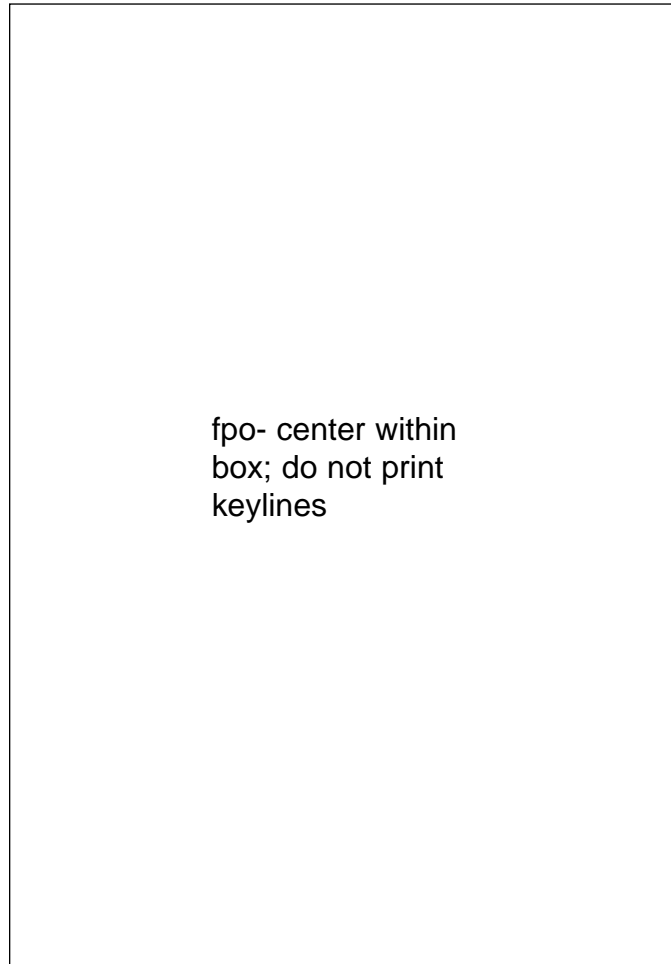


Fig. 1. Leaf of fossil cotton. Bar = 0.5 mm.

Hawaiian cotton is related to the allotetraploid cottons, which include the commercially important members of the genus. Although the genus has a distribution indicating a Cretaceous origin, estimations of the age of the tetraploid species have varied widely (Fryxell, 1979). Results of DNA hybridization between the diploid and tetraploid forms indicate that the tetraploids diverged 5–18 million years ago (Endrizzi *et al.*, 1989).

The fossil material reported on here is consistent with this idea and rules out a late Pleistocene or Holocene origin.

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Response of the Orangeblack Hawaiian Damselfly (*Megalagrion xanthomelas*), a Candidate Threatened Species, to Increases in Stream Flow

RON ENGLUND (Hawaii Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817, USA)

Introduction

Monitoring of a remnant population of the Orangeblack Hawaiian Damselfly (*Megalagrion xanthomelas*), a candidate Threatened species, started in May 1997 in an unnamed tributary of Moanalua Stream. Although formerly one of the most common damselflies in the Hawaiian Islands (Polhemus & Asquith, 1996), the O'ahu populations of this species have been reduced to little more than 95 m of stream habitat located within the Tripler Army Medical Center (TAMC). In fact, the Orangeblack Hawaiian Damselfly was con-

sidered to have been extirpated from O'ahu until the discovery of the TAMC population by N.L. Evenhuis in 1994 (Evenhuis & Cowie, 1994). Threats to the Orangeblack Hawaiian Damselfly include alien species, stream dewatering, and habitat alteration (Polhemus, 1996). Recent upstream construction by the Veterans Administration has also led to concerns that increased sediment input and decreased stream flow could adversely impact or eliminate this small remnant population.

Study Area

The TAMC study stream was located on Leeward O'ahu at an elevation of 79 m, and flows through a forest of introduced plants consisting of a *koa haole* (*Leucaena leucocephala*) overstory and an understory of Guinea grass (*Panicum maximum*). The upstream end of the TAMC stream was somewhat more open, allowing greater light penetration than downstream areas. The vegetation near Krukowski Road intersection (downstream end) of the TAMC stream was dense enough in places that crouching was required to walk down the stream.

Tall Guinea grass lined the stream channel in the upstream 30 m and provided perches for males and ample egg-laying substrate for the females. Orangeblack Hawaiian Damselflies are calm-water pool dwellers (Polhemus & Asquith, 1996), and the upstream 30 m of the TAMC stream had an abundance of deeper pools with little riffle habitat. A more in-depth description and map of the TAMC stream study area can be found in Evenhuis *et al.* (1995).

Methods

The entire length of wetted stream (including concrete channels at either end of the stream) was sampled starting 15 May 1997 at the upstream end of the man-made culvert where stream flow originates. Observers would walk slowly downstream and attempt to capture each observed adult damselfly. Damselfly sex and capture area were noted. Once captured, damselflies were recorded by marking each individual on the wing with a unique number using a permanent marker (Pangelinan, 1997). Individuals were not counted unless they were netted and the wings marked. Capture location was recorded for all previously marked damselflies. After completing the downstream walk, observers returned upstream and attempted to capture any previously unmarked damselflies.

Population estimates were not conducted for this study as in Pangelinan (1997). Instead, relative abundance or numbers of damselflies collected during each monitoring period were recorded.

The percent of wet, flowing streambed was also measured during each monitoring session. The percent of completely dewatered streambed was determined by measuring the dry streambed with a hipchain. Sections of the stream containing any water, even if shallow, were not considered dry streambed. Sampling occurred only in completely sunny weather.

Results

Streamflow

On 11 May 1997 the stream channel was 8% dry, and was 25% dry by 18 May. Stream level at the TAMC was very low in May 1997, with 40% of the channel completely dry on 22 May. Throughout May, virtually all areas of the TAMC stream were less than 17 cm deep, with most areas only 2.5–8 cm deep. Aquatic habitats consisted of inter-

mittent shallow pools connected by an approximately 0.5 cm layer of water prior to the flow increase. This contrasts with water depths up to 46 cm found by Evenhuis *et al.* (1995). Water depths equal to or greater than 46 cm were observed in the TAMC stream from October 1997–February 1998. Stream level prior to May 1997 is unknown, but appeared to have been low for an extended period of time due to a lack of algal growth on the substrate. The TAMC stream was at least partially flowing from July–December 1996 (Pangelinan, 1997). Except for November 1995 when the stream was completely dry (Pangelinan, 1997), the length of dry streambed was not recorded prior to this study. Starting in June 1997 stream flow was augmented from a 6.3 cm water pipe placed in a culvert draining into the TAMC stream by Veterans Affairs personnel. Flow remained stable through February 1998. Flow from the hose was estimated by Veterans Affairs personnel to range from 35–70 l/min.

Due to stable and adequate streamflow since June 1997, the quantity and quality of stream habitat in late 1997 through February 1998 was much improved from May 1997. In contrast to May 1997, water flowed the entire length (95 m) of the TAMC stream channel due to the flow augmentation begun in June 1997. The stream channel was full (from 0.5–1.5 m wide) but not overflowing, and flow did not appear to be causing erosion. After flow increased in June, a wide range of aquatic habitats such as pools, runs, and riffles became available. Aquatic vegetation, root wads, and algae were abundant but did not completely fill the stream channel.

Orangeblack Hawaiian Damselfly Numbers

Seventeen male and 2 female Orangeblack Hawaiian Damselflies were captured and marked on 15 May 1997. On 17 May 1997, a total of 15 males and 2 females were captured in the TAMC stream (Fig. 1). Fourteen of the 15 males captured on 17 May were recaptures from tagging initially conducted on 15 May 1997. This indicated successful tagging of most of the population. After May, attempts were not made to recapture damselflies several days after initial tagging. Most of the damselflies observed during May were in the upstream reaches of the TAMC stream, where a slight trickle of water still maintained some stream pools. A few remnant pools existed near the downstream end at the Krukowski road crossing, and these also attracted a few damselflies.

On 13 June 1997 a total of 28 male and 4 female Orangeblack Hawaiian Damselflies were marked and captured. A total of 35 male and 8 females were either marked or recaptured at the TAMC stream on 6 July 1997. Fifty-five males and 14 females were captured and marked at the TAMC stream on 11 September. All observed females were in tandem mating pairs. On 2 November 1997, a total of 109 damselflies were captured and released, with 81 newly captured males and 27 females. In November, a male Orangeblack Hawaiian Damselfly marked on 12 September was also observed and released. At 52 days, this was the longest-lived adult damselfly found during this study. Forty-one females and 95 males were captured and marked on 10 January 1998. No recaptures from the November 1997 monitoring were made during the January 1998 sampling. On 1 February 1998, a total of 162 damselflies (123 males, 39 females) were captured and marked at the TAMC stream. Three males and 3 females were recaptures from tagging conducted on 10 January 1998.

Discussion and Management Implications

Because of continued stable stream flow, damselfly numbers increased from May

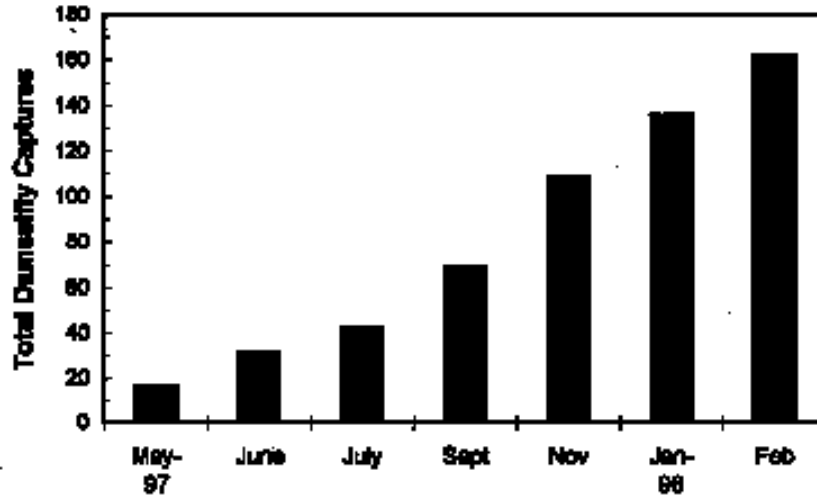


Fig. 1. Total number of Orangeblack Hawaiian damselflies (*Megalagrion xanthomelas*) captured in the 95 m TAMC stream from May 1997 to February 1998.

1997 to February 1998. During this period, aquatic habitat conditions also appear to have gradually become more favorable for Orangeblack Hawaiian Damselflies. For example, since May, two major pools in the TAMC stream have become deeper and wider. The pool immediately below the concrete culvert at the beginning of the stream increased in depth from 2.5–8 cm to 31 cm, and most of the fine silt was washed away. Numerous breeding pairs and ovipositing females were observed using this pool after flow augmentation. Another pool, slightly downstream of this first pool, has also become wider and deeper. During this study, the first 30 m (from the upstream culvert) of the TAMC stream contained the most breeding pairs and individual males.

Introduced fish are believed to be the main factor responsible for the decline of Orangeblack Hawaiian Damselflies (Polhemus & Asquith, 1996) throughout Hawai'i, and the behavior of Orangeblack Hawaiian Damselfly naiads may increase their vulnerability to introduced fish predators. For instance, in the TAMC stream, naiads were often observed free-swimming in pools and dwelling on top of the stream substrate. The common alien fish species found in all lowland stream and wetland areas of O'ahu, including green swordtails (*Xiphophorus helleri* Heckel, 1848), mollies (*Poecilia mexicana* Steindachner, 1863), and guppies (*Poecilia reticulata* Peters, 1859), are not able to access the TAMC stream. This is due to an impassable 7 m high culvert at the Krukowski Road and TAMC stream intersection. Surveys of adjacent streams, and downstream sections of the Moanalua Stream have found high densities of these introduced fish (Englund & Asquith, unpublished database), and no trace of *M. xanthomelas*.

Numbers of the Orangeblack Hawaiian Damselflies increased from 17 total adults inhabiting a few nearly stagnant pools in May 1997 to over 162 adults in February 1998. This suggests that the Orangeblack Hawaiian Damselfly will thrive if given adequate habitat and protection from introduced fish. Damselfly numbers at the TAMC stream

appeared to be higher in February 1998 than during monitoring conducted July–December 1996 (Pangelinan, 1997). Using mark-recapture techniques, Pangelinan (1997) estimated the Orangeblack Hawaiian Damselfly stream population at 50 (\pm 14 SD) adults. Although population estimates were not conducted for this study, the 162 adults captured in February 1998 were more than double the maximum observed during any one day of the Pangelinan study. However, the 162 damselflies captured in February 1998 was less than the maximum population size of nearly 300 calculated by Pangelinan (1997) for July 1996. It is also surprising that seasonal variation in damselfly numbers was not observed during this study.

Because of the lack of native or introduced fish predators, Orangeblack Hawaiian Damselfly densities at the TAMC stream currently appear to be higher than in undisturbed areas such as the Kalaupapa wetlands, Waikolu, and Pelekunu Streams on Moloka'i, or anchialine pool areas on Hawai'i Island (Englund, unpublished database; Polhemus, 1996). Other Odonata found at the TAMC stream such as the introduced damselfly (*Ischnura posita*) Hagen, or the dragonflies *Tramea abdominalis* (Rambur, 1842) and *Pantala flavescens* (Fabricius, 1798,) do not appear to be adversely impacting Orangeblack Hawaiian Damselflies. The Orangeblack Hawaiian Damselfly also frequently co-exists with other introduced dragonflies and damselflies on Lāna'i and Hawai'i Islands (Polhemus, 1996). On Lāna'i, Polhemus (1996) could not correlate the presence of introduced or native Odonata with the absence of Orangeblack Hawaiian Damselflies.

The Orangeblack Hawaiian Damselfly population at the TAMC stream has responded favorably to the augmented stream flow, and it is important that the TAMC stream flow remain near the current level to ensure the continued survival of the species at this site on O'ahu. Even so, one major storm flow with large amounts of fine sediment or other pollutant input or an alien species introduction could seriously impact or eliminate the entire O'ahu population. The translocation of this population into other suitable areas is therefore of the utmost urgency. To ensure the survival of this native and formerly common O'ahu damselfly, suitable low-elevation stream or spring refugia without alien fish must be created, and breeding populations established.

Acknowledgments

Without the assistance and input from Arlene Pangelinan of the U.S. Fish & Wildlife Service this study could not have been completed. Randall Filbert, Neal Evenhuis, Gordon Nishida, and Dan Polhemus provided helpful reviews of this study.

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***Aeolus livens* (LeConte): A Correction for Hawaiian *Aeolus mellillus* (Say) (Coleoptera: Elateridae)**

PAUL J. JOHNSON & XINJIE LIN (Insect Research Collection, Box 2207A, South Dakota State University, Brookings, SD 57007, USA)

The click beetle *Aeolus livens* (LeConte) was first reported from Hawai'i as *Dra-sterius dorsalis* (Say) var. *comis* (LeConte) by Van Zwaluwenburg (1936a,b) from Nana-kuli Beach, O'ahu. Van Zwaluwenburg (1945) used the name *Aeolus mellilus* [sic] (Say) var. *comis* (LeConte) and reported a second specimen from a light trap at the Naval Air Station, and stated that "There is no evidence that the species is established here". Shortly thereafter, Pemberton (1948), using the name *A. mellilus comis*, reported specimens from a light trap at Iroquois Point. He also noted that "This beetle is apparently now firmly established on Oahu".

In a recent taxonomic revision of the Canadian and U.S. species of *Aeolus* Esch-scholtz (Lin, 1997), Hawaiian specimens attributed to all of the above species were exam-ined. The series available included those specimens originally reported by Pemberton as well as more contemporary collections. All of these specimens were identified as *A. livens* LeConte by comparison with homotypic material and treated as such by Lin (1997). Specimens reported by Van Zwaluwenburg (1936a,b, 1945) could not be located and con-firmed.

Aeolus livens is readily recognized in the Hawaiian fauna by the combination of its size (6.2–9.1 mm long) and an orange-yellow base coloration with piceous maculae on the pronotum and elytra. This is the only species of *Aeolus* reported from Hawai'i. To date, this species is only known from the more xeric leeward portions of O'ahu. *Aeolus mellil-lus* and *A. livens* are sister-species native to North America and separated most easily by natural distribution and aedeagal morphology. In general, *A. mellillus* is found in the Great Plains region and eastward, and *A. livens* in the Rocky Mountains and westward, with Oklahoma and Texas and extreme southcentral British Columbia as areas of geographic overlap. The aedeagus of *A. mellillus* has both the penis and parameres attenuate and sub-acute at apex, while the penis of *A. livens* is parallel and subapically constricted to a nar-rowly obtuse apex, and the parameres are broadly obtuse apically. Generally, the dorsal carinae of the pronotal hind angles of *A. mellillus* are subparallel and those of *A. livens* are anteriorly divergent.

Many species of *Aeolus*, including *A. mellillus* and *A. livens*, are attracted to lights and are commonly found on interstate and international land, sea, and air carriers, and among commercial products (P. Johnson, unpubl. determinations for USDA-SEL). It is unknown how or exactly when *A. livens* arrived on O'ahu. However, the earliest collect-ed specimens are dated 1935 and the earliest sites are near active naval and air military

installations, suggesting that this species was inadvertently introduced through military transportation.

Material examined: O'AHU: vi.59, E.J. Ford, Jr., light trap (1, BPBM), Aiea, iii.54, Ford (1, BPBM), Barber's Point, vi.49, Ford, (1, BPBM), Barber's Pt., vi.60, E.J. Ford, Jr., light trap (3, BPBM), Barber's Pt., iii.60, E.J. Ford, Jr., light trap (1, BPBM), Barber's Pt., ix.58, E.J. Ford, Jr., light trap (1, BPBM), Ewa, vii.51, light trap (2, BPBM), Ewa, 6.ix.54, light trap (1, BPBM), Hickam Field, vi.59, E.J. Ford, light trap (1, BPBM), Honolulu, 31.ii.66, G. Funasaki, in house (1, BPBM), Iroquois Point, 8.viii.47, J.S. Rosa, light trap (1, BPBM), Iroquois Point, 7.viii.47, J.S. Rosa, light trap (1, BPBM), Iroquois Point, 14.vii.47, J.S. Rosa, light trap (1, BPBM), Iroquois Point, 23.vii.47, J.S. Rosa light trap (1, BPBM), Iroquois Point, 4.ix.47, J.S. Rosa (1, CNC), Iroquois Point, 25.ix.47 (3, FSCA), Wai'anae, iv.51, Ford (1, BPBM), Wai'anae, ix.51, Ford (5, BPBM), Wai'anae, ix.51, Ford (1, BPBM), Waipio, ix.58, J.W. Beardsley, light trap (2, BPBM), Waipio, 12.vii.56, J.W. Beardsley, light trap (2, BPBM).

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New Records for Lice in Hawai'i (Insecta: Phthiraptera)

WILLIAM D. PERREIRA (P.O. Box 61547, Honolulu, Hawai'i 96839) & JOHN W. BEARDSLEY¹ (Research Associate, Hawaii Biological Survey, Bishop Museum, Honolulu, Hawai'i 96817, USA)

Presented here are 2 new state and 9 new island records for non-indigenous species of lice. With the exception of *Myrsidea conspicua*, all specimens were taken from road-kill vertebrates. Nishida (1994) was consulted as our principle source for earlier distribution records. These collections have been deposited in the Bishop Museum in Honolulu.

Hoplopleuridae

Hoplopleura pacificus Ewing

New island record

Tenorio & Goff (1980) discussed the range and host affinities of this species in the Hawaiian Islands.

Material examined: MOLOKA'I: Kalaniana'ole Colony, ca. 5 ft., 26.V.1995, W.D. Perreira. Host: Unidentifiable road-kill rodent. East of Kakahai'a National Wildlife Refuge nr. mile post 6, ca. 3 ft., W.D. Perreira. Host: Roof Rat, *Rattus rattus*.

Menoponidae

Ciconiphilus decimfasciatus

New state record

(Boisduval & Lacordaire)

The geographic distribution of *C. decimfasciatus* is worldwide throughout tropical and temperate regions and it has been found on more than 20 ardeid hosts (Price & Beer

1. Address for correspondence: 1026 Oak Dale Lane, Arcadia, California 91006, USA.

1965). The specimens listed below were collected from 3 immature clack-crowned night herons. We have also seen immatures of a *Ciconiphilus* sp. taken from the Cattle Egret, *Bulbulcus ibis*, at Kualoa, O'ahu. Additional collections of adult specimens from the egret will be required in order to determine whether or not these are *C. decimfasciatus*.

Material examined: MAUI: Mokolele Hwy. nr mile post 6, ca. 25 ft. 6.IX.1996, W.D. Perreira.
Host: Black-crowned Night Heron, *Nycticorax nycticorax*.

***Myrsidea conspicua* (Kellogg & Chapman) New island record**

This adventive species has been previously recorded from Maui on the House Finch.

Material examined: O'AHU: University of Hawai'i Mānoa Campus, ca. 80 ft., 7.VI.1995, D.M. Tsuda. Host: House Finch, *Carpodacus mexicanus*.

Phloptoridae

***Brueelia vulgata* (Kellogg) New island record**

This species has been previously recorded from Gardner Pinnacle and O'ahu.

Material examined: MOLOKA'I: Near One Ali'i Beach Park, ca. 3 ft., 14.IV.1995, W.D. Perreira. Host: English Sparrow, *Passer domesticus*.

***Coloceras chinese* (Kellogg & Chapman) New island record**

We suspect that Schwartz & Schwartz (1949) collected *Coloceras chinese* and *Columbicola columbae* on both *Geopelia* and *Streptopelia* doves during the course of their intensive study on Moloka'i and the other islands. However, when they reported their data, they noted the islands on which the hosts were collected and which lice were collected from which hosts, but they neglected to report the islands from which they collected the lice.

Material examined: MOLOKA'I: Kalaniana'ole Colony, 5 ft., 14.IV.1995, W.D. Perreira.
Host: Barred Dove, *Geopelia striata striata*.

***Columbicola columbae* (Linnaeus) New island record**

Columba, *Geopelia* and *Streptopelia* doves are hosts for this species in Hawai'i.

Material examined: MOLOKA'I: Pala'au State Park, 1500 ft., 30.IX.1994, W.D. Perreira.
Host: Chinese Lace Neck Dove, *Streptopelia chinensis chinensis* and Kalaniana'ole Colony, el 5 ft. 14.IV.1995, W.D. Perreira. Host: Barred Dove.

***Gonicotes gallinae* (De Geer) New island record**

Previously recorded from O'ahu and Hawai'i, the fluff louse is a cosmopolitan species.

Material examined: KAUA'I: Kekaha, 5–10 ft., 2.XII.1994, G.K. Uchida & W.D. Perreira.
Host: Domestic Chicken, *Gallus gallus*.

***Goniodes dissimilis* Denny New island record**

The brown chicken louse is distributed world wide. In Hawai'i it has been previously reported only from O'ahu.

Material examined: KAUA'I: Kekaha, 5–10 ft., 2.XII.1994, G.K. Uchida & W.D. Perreira.
Host: Domestic Chicken, *Gallus gallus*.

***Phlopterus picae* (Denny) New island records**

This species has been previously reported from Maui and Hawai'i Islands.

Material examined: **MOLOKA'I:** Near Kapa'akea Cemetery, 3 ft. 5.I.1996. **O'AHU:** Haleiwa Bypass near Opaepala Iki and Helemano Bridges, ca. 60–100 ft., G.K. Uchida & W.D. Perreira. Host: Northern Cardinal, *Cardinalis cardinalis*.

***Quadriceps charadrii orarius* (Kellogg) New island record**

Kellogg (1896) described this species from a single specimen taken from a Golden Plover at Lawrence, Kansas. The first Hawaiian record is from Kahului, Maui.

Material examined: **HAWAI'I:** Honoka'a, ca. 1200 ft., 17.XII.1996, G.K. Uchida & W.D. Perreira. Host: Lesser Golden Plover, *Pluvialis dominica fulva*.

***Strigiphilus aitkeni* Clay New state record**

Two species of *Strigiphilus* are known from the Barn Owl (Clay, 1965). *Strigiphilus aitkeni* is a wide ranging species from the Indian sub-continent east to the West Indies. The second species, *S. rostratus* (Burmeister), occurs throughout Africa, north to the Netherlands, west to the Cape Verde Islands, and east to Palestine.

Material examined: **HAWAI'I:** Lapahoehoe. 23.I.1962 Host: Barn Owl, *Tyto alba*. N. Wilson. B.P. Bishop Museum slide no. 1638. Undated determination by Teresa Clay. **MOLOKA'I:** Near Kamahuehue Fish Pond nr. mile post 9, 5 ft., 17.II.1995; Ho'olehua nr. airport, ca. 350 ft, both W.D. Perreira. Host: Barn Owl, *Tyto alba*.

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New Records of Hawaiian Coleoptera

G.A. SAMUELSON (Hawaii Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817, USA)

Various Coleoptera hitherto unreported for Hawai'i have shown up in the state and are treated here; also a number of species previously listed for the state (Nishida, 1997) turn out to be new records for Midway Atoll and are included. Many of these records arose from a 2-long survey at Lualualei Naval Magazine on O'ahu from late 1995 to late 1996 and Midway Atoll throughout 1997. These surveys were supported by funding from the Department of Defense's Legacy Program and the U.S. Fish & Wildlife Service (USFWS).

Any new record for Midway Atoll from anywhere within the atoll is regarded as a

“New island record.” Midway Atoll comprises 3 proximal islets: Sand Island (largest with airfield and village), Eastern I (smaller but large enough for aircraft runways that are now abandoned and deteriorated) and Spit I (a little more than an elongated sandbar with vegetation located between Sand and Eastern).

All entries are listed by family and are annotated with collection data. Families are arranged alphabetically and their names follow the scheme used in Nishida (1997), even though the modern system used by Lawrence & Newton (1995) is slightly compromised.

Four-letter codens identify institutions used in the text, often with those who assisted in identifications: ANIC = Australian National Collection, Canberra; BMNH = The Natural History Museum, London; BPBM = Bishop Museum, Honolulu; CMNC = Canadian Museum of Nature, Ottawa; FMNH = Field Museum of Natural History; and SDSU = South Dakota State University, Brookings. All species are represented by vouchered specimens in BPBM. Determinations are by Samuelson unless otherwise indicated.

Alleculidae

?*Lobopoda* sp.

New state record

This genus is not otherwise represented in Hawai‘i, and is placed with some question due to lack of comparative material in BPBM. This group is presently treated as a subfamily in Tenebrionidae (Newton & Lawrence 1995).

Material examined: MIDWAY: Sand I: Roosevelt Ave., ii.1997, ex *Malva*, *Leucaena*, *A. Asquith* (10 ex); Roosevelt at Halsey, 15.ii.1997, in axils of liliaceous plant, G.M. Nishida (1); same loc. but 12.v.1997, sweeping plants at night, Nishida (1); Henderson cart trail, 20.xii.1997, beating *Scaevola*, G.A. Samuelson (1).

Anthribidae

Araecerus fasciculatus (De Geer)

New island record

This adventive species is found on most islands of the Hawaiian chain but appears not to have been reported for Midway until now.

Material examined: MIDWAY: Sand I: Henderson cart trail, 20.xii.1997, beating *Scaevola*, G.A. Samuelson (4).

Bruchidae

Acanthoscelides macrophthalmus (Schaeffer) **New island record**

This species is a fairly recent arrival to the Hawaiian Islands, and has now reached Midway. This group is actually a subfamily of Chrysomelidae but is listed separately to coordinate with Nishida (1997).

Material examined: MIDWAY: Sand I: Roosevelt Ave. at Halsey Dr., 15.ii.1997, ex *Leucaena glauca*, G.M. Nishida (2 ex); same data but without plant host (1); Dump Lake, 18.ii.1997, sweeping *Pluchea*, Nishida (1).

Cerylonidae (Murmidiinae)

Murmidius sp.

New state record

This is the first record for the subfamily in Hawai‘i. The Murmidiinae is a small group of minute beetles of widespread distribution.

Material examined: MIDWAY: Sand I: Dump Lake, 18.ii.1997, sweeping *Pluchea*, G.M. Nishida (1 ex).

Chrysomelidae (Alticinae)

Altica torquata LeConte

New state record

This North American species was collected twice from higher elevations on Mauna

Kea, and it is presumably established there.

Material examined: **HAWAI'I:** Mauna Kea, road near summit, 11,800 ft, 23.viii.1996, N.L. Evenhuis & G.M. Nishida (1 ex); Mauna Kea, bottom of Hauoki Crater near Mauna Kea summit, 4100 m, 19-22.viii.1997, pitfall trap baited with shrimp, G. Brenner, F.G. Howarth, D.P. Preston, F. Stone (1).

Ciidae

Cis sp. *bilamellatus*-group

New state record

Individuals of this species group were with a large series of possibly *Cis pacificus* Sharp. This is the first species of the *bilamellatus*-group to be reported for Hawaii. Determined by J.F. Lawrence (ANIC).

Material examined: **O'AHU:** Lualualei, Halona Valley, 465 m, 22.xi.1995, Berlese of upper branches of fallen mature *Sapindus*, including moss and lichen from surface of branches, G.A. Samuelson (2 ex).

Coccinellidae

Cryptolaemus montrouzieri Mulsant

New island record

This species was purposely introduced to Hawai'i in 1893 from Australia via California to control mealybugs (Swezey, 1923). Like most of the coccinellids that were imported for biological control and now widespread throughout the main Hawaiian Islands, it probably reached Midway unintentionally at a much later date.

Material examined: **MIDWAY:** "Midway Island", 15.ix.1964, J.W. Beardsley (2 ex); Sand I: E peninsula, sweeping *Verbesina*, Nishida (2); Roosevelt Ave. at Halsey Dr., 19.xii.1997, on *Leucaena glauca*, Samuelson (1); Eastern I: 12.v.1973, on *Scaevola taccada*, W.C. Gagné (1); E side, 14.v.1997, sweeping *Verbesina*, Nishida (1); same data but without plant host (2); W part of island, 16.xii.1997, G.A. Samuelson (1); Spit I: S central, 17.ii.1997, Nishida (1).

Curinus coeruleus (Mulsant)

New island record

This is another purposely introduced species brought from Mexico and released in the Hawaiian Islands to combat *Pseudococcus* in 1922 (Swezey 1923). Its introduction to Midway was probably unintentional.

Material examined: **MIDWAY:** Sand I: Roosevelt Ave. at Halsey Dr., 17.ii.1997, sweeping *Poinsettia*, G.M. Nishida (1 ex); same data except sweeping *Verbesina* (1); same data except sweeping *Leucaena glauca* (1); Sand I, 17.v.1997, Nishida (1); Roosevelt Ave. at Henderson Dr., 16.v.1997, Nishida (1).

Diomus debilis (LeConte)

New island record

This species had already reached Hawai'i by 1885 when Sharp described it as another species now synonymized; it was also purposely reintroduced into Hawai'i in 1894 (Swezey, 1923). This is a rather small insect and is usually found on grasses. Owing to its small size, it may have reached remote islands more easily than the larger species; besides the main islands it has also been reported for Laysan and Nihoa. It may have been on Midway for many years even though our earliest specimens are dated 1997.

Material examined: **MIDWAY:** Sand I: 13.v.1997, sweeping mostly grass, G.M. Nishida (5 ex); 13.v.1997, golf course, sweeping *Portulaca*, Nishida (1); Roosevelt Ave. at Halsey Dr., 17.v.1997, Nishida (1); Dump Lake, 17, 19.xii.1997, sweeping Bermuda grass, Nishida, G.A. Samuelson (7); Eastern I: 15.v.1997, on Bermuda grass, Nishida (2).

Nephus bilucernarius* (Mulsant)*New island record**

This species was introduced to Hawai'i to control pineapple mealybugs sometime in advance of its first published Hawaiian record from near Ka'ena Point, O'ahu (Swezey, 1935). It was collected on Midway in 1997.

Material examined: **MIDWAY:** Sand I: Dump Lake, 18.ii.1997, sweeping sourgrass, G.M. Nishida (1 ex); Roosevelt Ave. at Halsey Dr., 15.ii.1997, sweeping *Verbesina*, Nishida (1); same loc. but 17.v.1997, Nishida (1); same loc., 20.xii.1997, on Malvaceae, G.A. Samuelson (6); inland of Henderson cart trail nr runway, 18.xii.1997, on *Poinsettia*, Samuelson (1).

Nephus* sp. possibly *bipunctatus* (Kugelann)*New island record**

This species closely resembles specimens identified by Timberlake as *N. bipunctatus* (Kugelann) in BPBM. It is slightly smaller on the average than *N. roepkei* (Fluiter), a species now established on O'ahu and Maui but possibly not on Nihoa (Nishida, 1997). *Nephus "bipunctatus"* was imported to Hawai'i from Japan, S China, and the Philippines in 1895, 1906, and 1914 (Swezey, 1923) but part or all may have been confused with *N. roepkei*. Specimens certainly of *N. bipunctatus* originating from the Philippines were released in Southern California in 1910 (Gordon, 1985) but that population apparently died out. Hawaiian specimens in BPBM include only a small series from Nihoa and the new collection from Midway. It may be that *N. "bipunctatus"* reached Nihoa and Midway early, and that those islands could be part of its natural distribution.

Material examined: **MIDWAY:** Spit I: 17.ii.1997, sweeping *Tournefortia*, G.M. Nishida (20 ex).

Curculionidae***Hypera postica* (Gyllenhal)****New state record**

This is the economically important alfalfa weevil, a Palearctic species that became established in North America around 1900. It was taken on the island of Hawaii.

Material examined: **HAWAI'I:** Parker Ranch, 21.viii.1996, in *Dodonaea* litter, R. Cowie & G.A. Samuelson (3 ex).

Elateridae**?*Cardiophorus* sp.****New state record**

This species appears not to be *C. stolatus* Erichson, an adventive Oriental species that is established on O'ahu. It was first collected on Midway in 1970 but apparently not reported until now.

Material examined: **MIDWAY:** Sand I: 16.xii.1970, J.L. Gressitt (1 ex); 14-19.vii.1983, W.C. Gagné (3); 15-18.vii.1983, at light, Gagné (4); 18.11.1997, at light, G.M. Nishida (4); Eastern peninsula, 14.ii.1997, in grass, S.E. Miller (1); Midway Memorial, at light, 17.xii.1997, G.A. Samuelson. (1).

Conoderus amplicolis* (Gyllenhal)*New island record**

This adventive species was previously reported from O'ahu. P.J. Johnson identified the earliest Midway specimen cited below.

Material examined: **MIDWAY:** Sand I: 15-18.vii.1983, at light, W.C. Gagné (1 ex); Sand I (E), 17.v.1997 under rocks, Nishida (1); Eastern I: 14.v.1997, under rocks, Nishida (1); 15.v.1997, mostly on *Verbesina*, Nishida (1).

Hydrophilidae***Helochaeres* sp.****New state record**

This is the first record of *Helochaeres* for Hawai'i. This species appears close or identical with undetermined specimens from SE Asia, and thus has probably come from that direction. It is not close to any species from California.

Material examined: O'AHU: Lualualei Valley, makai [seaward] side of 16th Street, 8.viii.1996, from artificial stream created by leaky hose running length of street, D.J. Preston (2 ex).

Lathridiidae

Corticaria longicollis Zetterstedt **New state record**

This cosmopolitan species turned up in one of our Berlese samples; its original range is probably through Eurasia.

Material examined: O'AHU: Halona Valley, 465 m, 22.xi.1995, Berlese of upper branches of fallen mature *Sapindus*, including moss and lichen from surface of branches, G.A. Samuelson (1 ex).

Limmichidae

Parathroscinus sp. **New state record**

This is the first limnichid to be reported for Hawai'i but it is not yet identified. It is certainly established in the Pearl Harbor area, and is rather common on mudflats and near streams associated with the harbor. The origin of this species is probably from SE Asia, as the genus occurs throughout that area according to D.P. Woolridge, who described the genus (1982) and kindly identified our specimens. The habits of *P. murphyi* Woolridge (1990) from Singapore are similar to our species, as both readily fly over mud in tidal flats.

Material examined: O'AHU: Pearl Harbor, Pouhala Marsh between Waikele Stream and Kapakahi Stream, 18.xii.1996, G.M. Nishida (2 ex); Pearl Harbor (Waimalu) at Blaisdell Park, 3 m, 11.iii.1997, mudflats, W.D. Perreira (6); Pearl Harbor, Honouliuli Stream-estuary area, 29.x.1997, sweeping over mud and saltbush, D.J. Preston (ca 5); same as preceding but 20.xi.1997, yellow pan trap, Preston (ca 15); Pearl Harbor, Waikele Stream, on banks of stream, 2.xii.1997, Preston (13).

Nitidulidae

Conotelus mexicanus Murray **New island record**

This adventive nitidulid is reported for most of the main Hawaiian Islands and has now reached Midway.

Material examined: MIDWAY: Sand I: Roosevelt Ave. at Halsey Dr., 17.v.1997, G.M. Nishida (1 ex).

Scarabaeidae (Aphodiinae)

Pleurophorus parvulus (Chevrolat) **New island record**

This species is known from O'ahu, Moloka'i, Lāna'i, and Laysan. It is now reported for Midway.

Material examined: MIDWAY: Eastern I: 15.v.1997, underneath low-growing ground cover, G.M. Nishida (1 ex).

Scarabaeidae (Cetoniinae)

Protoetia fusca (Herbst) **New island record**

This species is widespread throughout the Pacific but was apparently not reported for Midway until now.

Material examined: MIDWAY: Eastern I: 14.v.1997, attracted to flowers of spider lily, G.M. Nishida. (1).

Protoetia (Pyropotosia) pryeri (Janson) **New state record**

There has been a population of this adventive species on Midway for some years, with the earliest specimens in BPBM dated in 1978 (data below) but it had apparently escaped documentation for Midway until now. It originates from the Ryukyu Islands

vicinity (Japan). Determination assisted by Henry F. Howden (CMNC) and confirmed by R.T. Thompson (BMNH).

Material examined: **MIDWAY:** Sand I: vii.1978, L. Pinter. (9 ex); Sand I, 29.vi.1980, on *Messerschmidia argentea* inflorescence [now = *Tournefortia*], D. Herbst & W. Takeuchi (2); 14-19.vii.1983, W.C. Gagné (5); ditto by M.S. Collins & S. Conant (1); Frigate Point, 28.viii-3.ix.1997, Malaise trap, G.M. Nishida (many ex); alive on Henderson Drive cart trail, 19.xii.1997, G.A. Samuelson (1); Eastern I: ca 75 m SW of boat dock, in soil (upper 5 cm) under *Verbesina* and *Casuarina*, 16.xii.1997, Samuelson (larvae); S shore nr western end, in sandy soil (upper 5 cm) under *Scaevola*, 16.xii.1997, Samuelson (larvae).

Further notes. On Midway, this species is extremely common but seasonal, with adults appearing in great numbers in June through August. Stray specimens, however, are sometimes seen in the cooler months (see data above; also, at least 1 uncited specimen was noted in Malaise trap, making at least 2 specimens for December 1997). Also, in December 1997, G.M. Nishida and I found 5 larvae in a 1/2 meter² of soil under a mature *Casuarina* stand on Sand I. Similar densities of larvae were found at the 2 sites on Eastern I (see data above). Larvae were also seen in dead *Casuarina* branches on the ground on Sand I. USFWS personnel said that rats are now eradicated from Sand I and almost so from Eastern I. They also stated that the summer populations of this beetle have been extremely high over the past several years. It is a popular assumption that rats had included this beetle in their diet; and now without rats, the beetle populations have increased. The beetle is not only a nuisance but is of some economic importance, e.g. a slide from P. Whitebear (USFWS) shows beetles literally covering ripe tomatoes on which they were feeding.

Scirtidae

Genus and species undetermined

New state record

This species is the second one of this family to be collected in Hawai'i; its origin has not been established. It has the hind femur slender instead of swollen and is therefore not congeneric with the *Scirtes* reported for Hawai'i in recent years. The latter species is identical to undetermined specimens from the Oriental region. The example of the present species is in poor condition and was not compared with other specimens.

Material examined: **O'AHU:** Lualualei Valley, 500-1300 ft, 19.iv.1994, G.M. Nishida (1 ex).

Staphylinidae (Aleocharinae)

Atheta coriaria (Kraatz)

New island record

This adventive species occurs throughout the main Hawaiian Islands, extending to Nihoa and now Midway.

Material examined: **MIDWAY:** Eastern I: 15.v.1997, under dead albatross, G.M. Nishida (2 ex).

Staphylinidae (Oxytelinae)

Carpelimus fulvipes (Erichson)

New island record

This genus contains some endemic Hawaiian species besides the adventive *C. fulvipes*.

Material examined: **MIDWAY:** Sand I: Frigate Point, 13.ii.1997, sweeping *Casuarina*, G.M. Nishida (1).

Staphylinidae (Paederinae)

Scopaeus sp.

New state record

This genus appears not to be documented for Hawai'i though a few Hawaiian specimens were identified by A.F. Newton (FMNH). A recent specimen from Midway agrees with the earlier ones.

Material examined: O'AHU: Waikiki, viii.1902 (1 ex); Mānoa Val., 17.x.1936, at light, N.L.H. Krauss (1); Honolulu, ix.1937, ex rice, E.C. Zimmerman (1 thorax); Mānoa Val., I.1952, Zimmerman (1); Ewa, 10.ix.1958, light trap, [probably E.J. Ford] (1); Kunia, 16.vi.1982, D.P. Preston (6); MIDWAY: Sand I: Frigate Point, 13.ii.1997, sweeping *Casuarina*, G.M. Nishida (1).

Trogositidae

Neaspis sp.

New state record

I had earlier keyed this beetle to *Soronia* in Nitidulidae and found that it compared fairly well with specimens of the Australian *S. variegata* Macleay. J.F. Lawrence later indicated that the affinities of our Hawaiian specimens are with Lophocaterinae in Trogo-sitidae, and that it is possible that some of the Australian species of *Soronia* will have to be reassigned to *Neaspis*. This is the first record of *Neaspis* for Hawai'i.

Material examined: O'AHU: Lualualei, Halona Valley, 465 m, 22.xi.1995, berlese of upper branches of fallen mature *Sapindus*, including moss and lichen from surface of branches, G.A. Samuelson (1 ex); Lualualei Valley: below Pohakea near Halona Valley, 355 m, 27.iii.1996, on dead *Sapindus* branch, K. Kami & G.A. Samuelson (1); Halona Valley, "Sapindus" grove, 475 m, 18.iv.1996, F.G. Howarth (1).

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Polistes tepidus malayanus Cameron Erroneously Reported from the Hawaiian Islands (Hymenoptera: Vespidae)

ROY R. SNELLING² (Research Associate, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, California 90007, USA)

Carpenter (1997) reported that the social wasp, *Polistes tepidus malayanus* Cameron 1906, has been introduced into the Hawaiian Islands. This report is in error, the result of a number of factors, including misunderstanding, misidentification, and carelessness. The errors began approximately 150 years ago.

Two *Polistes* specimens were sent to the eminent Swiss hymenopterist, Henri de Saussure, probably around the middle of the last century. The specimens, a female and a male, were collected on "Sandwich I." Saussure gave the specimens a manuscript name, derived from the place name Hawai'i, based on the assumption that "Sandwich I." was

1. Research Associate, Department of Natural Sciences, Bishop Museum, Honolulu.

uniquely equivalent to the Hawaiian Islands. Fortunately, the name remained unpublished, but the “type” specimens are in The Natural History Museum (BMNH), London.

Richards (1978) evidently saw these specimens and, seeing the manuscript name, assumed that they originated from the Hawaiian Islands. He further assumed that these were a color form of *Polistes tepidus* (Fabricius, 1775), a common Australopapuan species, and that they were similar to *P. tepidus* subsp. “*religiosus* Cheesman”, a *nomen nudum*. The “types” of *religiosus* are also in the BMNH.

I have examined the Cheesman specimens and the Saussure manuscript specimens; the latter are part of the F. Smith collection in the BMNH. Neither set of specimens is, in my opinion, conspecific with *P. tepidus* and it is clear that Richards is responsible for that error. The “type” of *religiosus* bears 2 identification labels. The first of these, in Cheesman’s hand, indicates that she regarded this as a distinct species. The second, even though written on a “det. E. Cheesman” label, is in O.W. Richards’ hand, and identifies *religiosus* as a subspecies of *P. tepidus*. Following a list of the recognized subspecies of *P. tepidus*, Richards (1978) remarked that “[a] form rather like the last [*religiosus*] is found in Hawaii”.

Both *religiosus* and the Sandwich Island specimens are conspecific with *P. hebridensis* Giordani Soika, 1981, a species limited to Vanuatu (formerly New Hebrides). In fact, the type of *P. hebridensis*, also in the BMNH, bears a data label identical to that of the *religiosus* “type” and the 2 are obviously from the same series. The pair from Sandwich Island are from that Vanuatan island now named Efate (Motteler, 1986) and are essentially identical to the *religiosus* and *P. hebridensis* type material. There is, incidentally, one additional island that formerly bore the name Sandwich: it is now Dyaul and is situated off the northwest coast of New Ireland in Papua New Guinea (Motteler, 1986).

Carpenter (1997) apparently did not examine the relevant specimens and placed both *religiosus* and the unnamed “Hawaiian” form in the synonymy of *P. tepidus malayanus*, a common Papuan wasp, in effect synonymizing a New Hebridean wasp he had not seen with a species not known to occur in the New Hebrides. No explanation or justification was given. And, since he regarded these as forms of *malayanus*, he went on to report that *malayanus* has been introduced into the Hawaiian Islands. I recently curated the *Polistes* collection at the Bishop Museum, Honolulu; there are no Hawaiian specimens of *malayanus* in that collection, nor are there any Hawaiian specimens of *P. hebridensis*.

In my opinion, there is no reason to believe that either *P. tepidus malayanus*, or any form of that species, or *P. hebridensis* is now, or ever has been, present in the Hawaiian Islands, despite Carpenter’s contrary assertion.

Acknowledgments

I am profoundly grateful to Laraine Tarel (BMNH) for her cooperation in making available the specimens that enabled me to sort out this small misconception. To Scott Miller and Gordon Nishida at the Bishop Museum, my thanks for initiating my interest in the *Polistes* of Hawai‘i. For reviewing and commenting on the manuscript, I am indebted to Brian Brown, Scott Miller, Gordon Nishida, and Fred Truxal.

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New Genus of Parasitic Mite (Acari: Prostigmata) on *Scotorythra* (Lepidoptera: Geometridae) in Hawai'i

MANDY L. HEDDLE (Pacific Biomedical Research Center, Center for Conservation Research and Training, 3050 Maile Way, Honolulu, Hawai'i 96822, USA) & SABINA F. SWIFT (Hawaii Biological Survey, Bishop Museum, 1525 Bernice St., Honolulu, Hawai'i 96817, USA)

Recently we have discovered at least 1 species of mite from an undescribed genus of mites in the family Trombellidae (identified by Dr. W. Calvin Welbourn of Florida State Dept. Agric. & Consumer Services). This genus is parasitic on moths in the genus *Scotorythra*, and has not been observed on any other moths in Hawai'i. The family Trombellidae has not previously been recorded from the Hawaiian Islands.

Scotorythra is thought to be an endemic genus of moths that have speciated within Hawaii (Zimmerman, 1958). There are about 45 species in the genus, some of which are host specific on plants such as *Canthium* and *Ilex* (Heddle, unpubl.). When preparing to pupate the caterpillars move from the host plant into the leaf litter and moss below (Heddle, unpubl.). It is likely that the trombellid larvae attach themselves to the moth as it emerges and begin feeding on the host haemolymph. They are found attached to the underneath of the wings and around the head, sometimes in densities as high as twenty per moth.

Thus far, mites have been found on *Scotorythra* from native habitats on West Maui, O'ahu, Kaua'i and Moloka'i. Although *Scotorythra* species have been collected in habitats that are infested with alien invertebrates and weeds (e.g., Mt. Tantalus, O'ahu), no mites have been found on specimens from these locations. However, mites have been found on museum specimens collected at the turn of the century. These two observations lead us to hypothesize that this new trombellid genus is native to the Hawaiian Islands.

Material examined. **MAUI:** Nakalaloa Camp, Pu'u Kukui, 1340 m, Aug 1997. **MOLOKA'I:** Pu'u Kolekole, Kamakou Forest Reserve, 1515 m, Sep 1996. **KAUA'I:** Mt. Kahili, Wahiawa Mts., 942 m, Aug 1997. **O'AHU:** Mt. Ka'ala, Wai'anae Mts., 1227 m, May 1997.

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Occurrence of the Milliped *Glyphiulus granulatus* (Gervais) in the Hawaiian Islands (Spirostreptida: Cambalidea: Cambalopsidae)

ROWLAND M. SHELLEY (North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA)

Introduction

The order Spirostreptida is of primary importance to the diplopod fauna of the Hawaiian Islands because it contains the only indigenous forms in the archipelago, the representatives of the cambaloid genus *Nannolene* Bollman (suborder Cambalidea, family Cambalidae), which may be referable to *Hawaicambala* Mauriès, as explained by Shelley *et al.* (1998, footnote 1). The order is also represented by an exogenous cambaloid species, *Glyphiulus granulatus* (Gervais) (family Cambalopsidae), which has been widely introduced onto islands in the Pacific and Indian Oceans and is readily identified because it is the only cylindrical milliped in Hawai'i with dorsal crests. The type locality is the "Mascarene islands" (Reunion and Mauritius Islands) in the Indian Ocean, and the milliped has subsequently been recorded from the Seychelles and the Comoro islands, in the Indian Ocean; American Samoa (Tutuila, Pago Pago), New Caledonia and the Loyalty islands, and French Polynesia (Tahiti and Marquesas islands) in the Pacific; and Hong Kong (Attems, 1900, 1937; Carl, 1926; Silvestri, 1935; Mauriès, 1970, 1980, 1983; Crosland, 1994). In the Hawaiian Islands, Silvestri (1935) reported *G. granulatus* from Honolulu based on specimens he collected earlier in the century, and Attems (1938) listed Hawai'i in general; Nishida (1994) cited it from Kaua'i and O'ahu, misspelling the genus as "*Calyphiulus*." In sorting preserved Hawaiian diplopods at the Bishop Museum, I found samples of *G. granulatus* from the following specific sites in Kaua'i and O'ahu; I also record the milliped for the first time from Maui and Moloka'i.

Glyphiulus granulatus (Gervais, 1847)

New island records

Diagnosis. Moderately long and slender, narrowest anterior between segments 4–9, with broad, lighter dorsal stripe; dorsum with 6 distinct longitudinal crests between poriferous carinae (3 on each side of midline); collum much longer than succeeding segments; gonopods as shown by Attems (1900, pl. 16, figs. 20–21).

Published records. "Hawaii," referring to the islands in general (Attems, 1938). KAUA'I: Kaua'i in general (Nishida 1994). O'AHU: O'ahu in general (Nishida, 1994), Honolulu (Silvestri, 1935).

Material examined: (all from Bishop Museum except FSCA = Florida State Collection of Arthropods, Gainesville). **KAUA'I:** Kōloa, Knudsen Cv. #1, 150ft. in, twilight and dark zones, 23 June 1972, F.G. Howarth (FGH), W.C. Gagné (WCG); 45m, Knudsen Cv. #2, 23 June 1972, FGH, WCG; Kōloa Cv. #1, 24 June 1972, FGH, WCG; 37m, Kōloa Cv. #2, 100m from entrance, dark zone, 11 August 1971, FGH; 25 m, Kōloa Cv. #3, 24 June 1972, FGH, WCG. **MAUI:** Hana, Wainapanapa Cv., twilight zone, 13 December 1971, FGH. Haikū, 21 April 1963, and under stones, 20 March 1967, N.L.H. Krauss. Kipahulu Val., Pu'alu'u stream, 200 m, bamboo litter, 6 July 1980, WCG, S.L. Montgomery. **MOLOKA'I:** Papio stream, 600 ft., soil and litter, 10 May 1996, W.D. Perreira. **O'AHU:** Mānoa Val., Ball, 1922. Kuli'ou'ou Val., below 1,000 ft., 24 July 1966, T. Suman. Liliha, litter, 12 April 1984, S.F. Swift. Ulumawao Pk., 2 September 1965, T. Suman. Honolulu, location

unspecified, April 1941, Y. Kondo, and “ex. avocado,” 23 August 1921, J.W. Thompson; Kalihi, 120 m, in *Pheidole* nest in wood, 30 December 1979, FGH; Judd St. Cv., 30 m, on wood in twilight zone, 21 May 1972, FGH; and upper Moanalua Valley, in damp, rotten logs, vegetation, and on rocks in small stream, usually in great numbers and in assoc. with black and white striped spirobolellid milliped, 25 May 1973, D.L. Rambo (FSCA).

Remarks. In Hong Kong, *G. granulatus* was found in refuse areas of nests of the ant, *Harpegnathos venator* F. Smith (Crosland, 1994).

Confusion exists as to the original combination of this species as the generic and specific names were both authored by Gervais (1847). He originally assigned *granulatus* to *Julus* L., and in remarks at the conclusion of the species account, proposed the subgenus *Glyphiulus* to accommodate the species. However, the original combination was with *Julus*, so combining *granulatus* with *Glyphiulus* requires parentheses around the author's name.

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The Milliped Order Julida in the Hawaiian Islands

ROWLAND M. SHELLEY (North Carolina State Museum of Natural Sciences, P. O. Box 29555, Raleigh, NC 27626-0555, USA) & SABINA F. SWIFT (Hawaii Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817-0916, USA)

Introduction

The order Julida is a major component of the Holarctic diplopod fauna. The cylindrical arthropods, round in cross section, occur in most native biotopes, even ranging northward into subarctic regions, and numerous Palearctic representatives of the families Blaniulidae and Julidae have been introduced into North America. They have become established in American and Canadian cities and are now important components of the Nearctic fauna (Chamberlin & Hoffman, 1958; Shelley, 1978, 1988, 1990). The Blaniulidae, never before recorded from the Hawaiian islands, are thread-like organisms that are either blind or have the ocelli in 1 or 2 rows, the latter condition sometimes being characterized as a "narrow triangle"; the Julidae are larger and more robust, are characterized by prominent metazonal striae, and almost always have numerous ocelli in an ovoid or subequilateral triangular arrangement. Previous Hawaiian julid records, all from the island of Hawai'i, include "*Diploiulus luscus* Meinert" from Kona (Silvestri, 1904), cited from this site as *Julus luscus* Meinert by Chamberlin (1920), and, from unspecified sites, *Cylindroiulus frisius* Verhoeff and "*?C. luscus*" (Attems, 1938, 1941) and *Allajulus latestriatus* (Curtis) (Nishida, 1994). According to Blower (1985), *Cylindroiulus frisius* is a synonym of *C. latestriatus* (Curtis), which was returned to this genus from *Allajulus* Koch by Read (1990), but *C. luscus* is an enigmatic name that frustrated diplopodologists for many years. The situation is compounded by the fact that the first gonopod illustrations by Latzel (1884) are of a different species from that described by Meinert (1868), the latter of which was originally assigned to *Julus* Linnaeus. Korsós & Enghoff (1990) discussed this situation and formally disposed of *luscus* by designating a lectotype, which is a male of *C. latestriatus*. Consequently, the previous Hawaiian records of the Julidae are all of one species, *C. latestriatus*.

Nishida (1994) also included *Julus anguinus* Karsch (1880) in the Julidae and cited it from Maui and Hawai'i. The type locality is Olinda, Maui, and as *Iulus anguinus*, Silvestri (1904) and Attems (1938, 1941) recorded it from the Hawaiian islands in general. This species is not a julid and its identity is under investigation by R.L. Hoffman; it may be a cambaloid and temporarily referable to *Nannolene* Bollman (see Shelley *et al.* 1998, footnote 1).

In the ensuing species accounts, localities corresponding to numbered Berlese and pitfall samples of *C. latestriatus* and unidentifiable samples of *Cylindroiulus* at the Bishop Museum (BPBM), all from the island of Hawai'i, are presented in the appendix. Female julid samples from Kaua'i appear to be *C. truncorum* (Silvestri) because of the greater number of marginal setae (more than 5 pairs) on the paraprocts. The Blaniulidae, represented by *Proteroiulus fuscus* (Am Stein) and *Choneiulus palmatus* (Nemec), has been taken on Hawai'i and Maui. The acronyms FSCA, NCSM, and NMNH denote the Florida State Collection of Arthropods, Gainesville, the North Carolina State Museum, Raleigh, and the National Museum of Natural History, Washington, D.C., respectively.

Blaniulidae***Choneiulus palmatus*** (Nümeç, 1895)**New state record**

Diagnosis. Ocelli in single row; segments with more than 10 long, fringing setae. Drawings of the gonopods and the anterior end showing the fringing setae are available in Blower (1985, figs. 34A-D); SEM photos of the gonopods are available in Enghoff (1984, figs. 2–3).

Occurrence in Hawaii. Known only from a single sample from the island of Hawai‘i.

Published Records. None.

Material examined: **HAWAI‘I:** Volcano, 1150m, on fallen, rotting *Passiflora* sp. fruit, 29 October 1975, W.C. Gagné (BPBM). **MAUI:** Haleakalā Natl. Park, Pu‘u Nianiau, 3 December 1976, D. & M. Davis (NMNH).

Remarks. *Nopoiulus kochii* (Gervais), another commonly introduced blaniulid, may someday be found in Hawai‘i and is distinguished by the presence of no more than 10 fringing setae per segment, which tend to be shorter than those of *C. palmatus*.

Proteroiulus fuscus (Am Stein, 1857)**New state record**

Diagnosis. Ocelli in 2 lines (a “narrow triangle”); segmental setae much shorter than those of *C. palmatus*. Illustrations of the head, ocelli, and gonopods are available in Blower (1985, figs. 33A-I).

Occurrence in Hawaii. Known only from the islands of Maui and Hawai‘i.

Published Records. None.

Material examined: **HAWAI‘I:** Ola‘a Forest Res., 3800 ft., on tree fern and in leaf litter, 25 January 1973, E.L. Bousfield, F.G. Howarth (BPBM). Volcano, on fallen, rotting *Passiflora* sp. fruit, 29 October 1975, W.C. Gagné (BPBM). **MAUI:** Ko‘olau Forest Res., 4250 ft, moss and leaf litter under tree fern, 23 January 1973, F.G. Howarth, E.L. Bousfield (BPBM). Waikamoi Forest Res., 1219 m, in litter, 3 January 1986, W.D. Perreira (BPBM). Upper Waikamoi Gulch, 7600 ft., in *Astelia* axils, 7 April 1980, W.C. Gagné (BPBM). Makawao Forest Res., 1780 m., under *Acacia koa* bark, 28 June 1975, W.C. Gagné (BPBM). Haleakalā Natl. Pk., 2310 m., under rocks, 30 June 1975, W.C. Gagné (BPBM).

Julidae***Cylindroiulus latestriatus*** (Curtis, 1845)**New island records**

Diagnosis. Epiproct short and blunt, not protruding beyond margins of paraprocts; latter with 3 marginal setae apiece; gonopods and paraproct setation as shown by Blower (1985, figs. 40f, 48a-b).

Occurrence in Hawaii. Known definitely from the islands of Hawai‘i, Maui, and Moloka‘i; a sample from O‘ahu that lacks males probably represents *C. latestriatus*.

Published Records. Hawaiian islands in general (Attems, 1938); the island of Hawai‘i (Nishida, 1994); Kona, Hawai‘i (Silvestri, 1904; Chamberlin, 1920).

Material examined: **HAWAI‘I:** Kohala Mts., Upper Hamakua Trail, 3000 ft., in leaf, moss, and fern litter, 26 January 1973, F.G. Howarth, E.L. Bousfield (BPBM). Saddle Rd., Pu‘u Huluhulu, under stones, 28 August 1979, F.G. Howarth (BPBM). Mauna Kea, Ahumoa, 7000 ft., myoporum slime flux on ground, 9 June 1980, W.C. Gagné (BPBM). Ola‘a, 3800 ft., tree fern and leaf litter, 25 January 1973, E.L. Bousfield, F.G. Howarth (BPBM). Hawai‘i Volcanoes Natl. Park, Kilauea, November 1905, F.W. Terry (BPBM); Volcano, May-June 1905, F.W. Terry (BPBM); halfway between Volcano House and Crater House, 8 August 1922, M.C. Neal (BPBM). Kipuka Puauulu‘u, 16 January 1964, Clayton (FSCA). Also, the following numbered samples at the BPBM (see appendix): 00282, 00488, 00510, 00720, 00722, 00726, 00819, 01178, P-0003, P-0015, P-0016, P-0017, P-0025, P-0027, P-0030, P-0037, P-0040, P-0044, P-0046, P-0064, P-0079, P-0224, P-0225, P-0226, P-0228, P-0240, P-0244, P-0257, P-0268, P-0269, P-0291, P-0294, P-0300, P-0307, P-0313. **MAUI:** East Maui, Auwahi, August 1916, G.P. Wilder (BPBM). Mt. Haleakalā, 8000 ft., 4 March 1962, J.W.

Beardsley (BPBM). **MOLOKA'I**: Kaulolo, under moist leaves along roadside, 8 July 1968, D.M. Allred (BPBM).

The following samples lack adult males and are tentatively assigned to *C. latestriatus*; some could represent the anatomically similar species, *C. britannicus* (Verhoeff), which is distinguished by details of the gonopods (compare Blower 1985, figs. 48B and 49B).

HAWAII: Kohala Mts., 1067 m, 24 July 1966, Beardsley, Suman, Ashlock, Yoshimoto (BPBM). Kīpuka Ki, 1500 m., *koa* duff, 17 April 1971, J.L. Gressitt (BPBM). Pu'u Wa'awa'a Ranch, Waihou-Henahena Gate, 31 December 1937 (BPBM). Kealakekua Ranch, Shelter Cv., 1310 m, 10 October 1972, F.G. Howarth, W.C. Gagné, J. Jacobi (BPBM). Keauhou, 5000–6000 ft., 20 March 1922, A.F. Judd (BPBM). Hawai'i Volcanoes Natl. Pk., Kilauea, Vierra's yard (e. of Gifford's property), in moss, July 1922, M.C. Neal (BPBM). Also, the following numbered samples at the BPBM (see appendix): 0103, 0329, 00381, 00405, 00482, 00494, 00528, 00580, 00584, 00714, 00727, 00760, 00810, 01142, P-0002, P-0008, P-0019, P-0087, P-0091, P-0094, P-0217, P-0271, P-0281, P-0284, P-0286, P-0322, P-0323, P-0332. **MAUI**: Huelo (BPBM). Olinda, 10 March 1932, O. Bryant (BPBM). Kula, 26 May 1924, C.M. Cooke (BPBM). Waihoi Valley, 847 m, Berlese of soil and litter, 29 June 1972, P. Ching (BPBM). Haleakalā Natl. Pk., 7000 ft., 22 February [no further data] (BPBM); nr. Pu'ulua, 5500 ft., 27 April 1945, E.C. Zimmerman (BPBM); Auwahi, March 1920, Forbes (BPBM). **O'AHU**: Waimea, about 1891, A.B. Lyons (BPBM).

Remarks. Males in this Hawaiian material comprise 2 variants, one in which the tip of the posterior gonopod lies flat, as in Blower's illustration (1985, fig. 48b), and one in which it curves slightly ventrad. The latter resembles the condition in *C. britannicus* (Verhoeff) (see Blower, 1985, fig. 49b), but other details of the gonopods show that the species is *C. latestriatus*.

Cylindroiulus truncorum (Silvestri, 1896) **New state record**

Diagnosis. Epiproct short and blunt, not protruding beyond margins of paraprocts; latter with more than 5 marginal setae. Gonopod illustrations are available in Blower (1985, figs. 51a,b); though not of this species, figs. 40i and 50a in Blower show the paraproct setation. SEM photos of the gonopods are available in Korsòs & Enghoff (1990: pl. P figs. 1, 5-8); fig. 31 shows the paraproct setation.

Occurrence in Hawaii. Known only from Kaua'i.

Published Records. None.

Material examined: **KAUAI**: [location unknown], 14 May 1969, Allred (BPBM). Koke'e St. Pk., Kalalau Lookout, 25 May 1992, R.W. Baumann, H. Spafford (NCSM); 0.9 mi [1.4 km] E. Koke'e Peak, 17 January 1973, F.G. Howarth, E.L. Bousfield, W.C. Gagné (BPBM).

Remarks. These samples lack males but conform to *C. truncorum* in having more than five setae on the paraprocts, as opposed to only 3 setae in *C. latestriatus* (compare Blower, 1985, figs. 40f,i). Both *C. parisiorum* (Brölemann & Verhoeff) and *C. truncorum* exhibit this feature, the 2 being distinguished by details of the gonopods in males and cyphopods in females (compare figs. 21 and 22 in Korsòs & Enghoff, 1990). Cyphopod dissections in female julids are extremely difficult and were not attempted here. We believe these specimens are probably *C. truncorum* because this species has been introduced into several areas of North and South America (Chamberlin & Hoffman, 1958; Shelley, 1978, 1988), whereas to our knowledge, *C. parisiorum* has never been authentically encountered outside of Europe.

Acknowledgements

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Appendix. List of numbered localities referred to in this paper

BBM-Berlese numbers:

- 00103 HAWAI'I: East slope of Mauna Loa, 2.1 mi. E., 9.8 mi. W. N. Kulani, 1360 m, litter, Berlese, 22.ii.1971, F.J. Radovsky
- 00282 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall assoc. humus, 21.vii.1971, F.J. Radovsky
- 00329 HAWAI'I: East slope of Mauna Loa, 2440 m, pitfall assoc. litter, Berlese, 30.viii.1971, J. Jacobi
- 00381 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall assoc. soil, Berlese, 6.x.1971, J. Jacobi
- 00405 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall assoc. litter, Berlese, 8.xi.1971, J. Jacobi
- 00482 HAWAI'I: Hawai'i Volcanoes National Park (HVNP), Kīpuka Pua'ulu, 1220m, soil and *Charpentiera* litter, Berlese, 31.viii.1971, G.A. Samuelson
- 00488 HAWAI'I: HVNP, Kīpuka Pua'ulu, litter at base of mature *Metrosideros*, 31.vii.1971, Berlese, G.A. Samuelson.
- 00494 HAWAI'I: East slope of Mauna Loa, end of Strip Road, soil and *Vaccinium* litter, Berlese, 31.viii.1971,

- G.A. Samuelson
- 00510 HAWAI'I: HVNP, end of Strip Road, Koa, *mamane* and *Styphelia* litter, 31.viii.1971, Berlese, G.A. Samuelson
- 00528 HAWAI'I: East slope of Mauna Loa, Kipuka Ki Weather Station, 1220 m, 19.i.1972, pitfall assoc. litter, J. Jacobi
- 00580 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall assoc. litter, Berlese, 2.iii.1972, J. Jacobi
- 00584 HAWAI'I: East slope of Mauna Loa, Kipuka Ki Weather Station, 1220 m, 6.iii.1972, pitfall assoc. litter, J. Jacobi
- 00621 MAUI: Waihoi Valley, 847 m, 29.vi.1972, litter, Berlese, 29.vi.1972, P. Ching
- 00623 MAUI: Waihoi Valley, 847 m, 29.vi.1972, soil, Berlese, P. Ching
- 00714 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall assoc. litter, Berlese, 10.iv.1972, J. Jacobi
- 00720 HAWAI'I: East slope of Mauna Loa, 1280–1341 m, pitfall assoc. litter, 7.iv.1972, J. Jacobi
- 00722 HAWAI'I: East slope of Mauna Loa, Kipuka Ki Weather Station, 1220 m, pitfall assoc. litter, 7.iv.1972, J. Jacobi
- 00726 HAWAI'I: East slope of Mauna Loa, 100 yards above marker for 38 Kipuka Ki, 1220 m, pitfall assoc. litter, 7.iv.1972, J. Jacobi
- 00727 HAWAI'I: East slope of Mauna Loa, 100 yards above marker for 38 Kipuka Ki, 1220 m, pitfall assoc. soil, 7.iv.1972, J. Jacobi
- 00760 HAWAI'I: East slope of Mauna Loa, 1280–1341 m, pitfall assoc. litter, 2.v.1972, J. Jacobi
- 00810 HAWAI'I: East slope of Mauna Loa, 1280–1341 m, pitfall assoc. litter, 2.v.1972, J. Jacobi
- 01142 HAWAI'I: East slope of Mauna Loa, Power Line Area, 1493 m, pitfall assoc. litter, Berlese, 13.xii.1972, J. Jacobi
- 01178 HAWAI'I: East slope of Mauna Loa, Bird Park-Kipuka Puauulu, 1220 m, pitfall assoc. litter, Berlese, 16.i.1973, J. Jacobi

Pitfall numbers:

- P-0002 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 21–23.vii.1971, F.J. Radovsky
- P-0003 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 21–23.vii.1971, F.J. Radovsky
- P-0008 HAWAI'I: East slope of Mauna Loa, 1280–1341 m, pitfall trap, 20–31.vii.1971, F.J. Radovsky
- P-0015 HAWAI'I: East slope of Mauna Loa, Kipuka Ki Weather Station, 1220 m, pitfall trap, 9.vii.1971, J. Jacobi
- P-0016 HAWAI'I: East slope of Mauna Loa, 1890 m, 9.vii.1971, J. Jacobi
- P-0017 HAWAI'I: East slope of Mauna Loa, Kilauea Forest Reserve, 1646 m, pitfall trap, 9.vii.1971, J. Jacobi
- P-0019 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 30.vii.1971, J. Jacobi
- P-0025 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 9.viii.1971, J. Jacobi
- P-0027 HAWAI'I: East slope of Mauna Loa, Bird Park-Kipuka Pua'ulu, 1220 m, pitfall trap, 9.vii.1971, J. Jacobi
- P-0030 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 30.vii.1971, J. Jacobi
- P-0037 HAWAI'I: East slope of Mauna Loa, Kilauea Forest Reserve, 1646 m, pitfall trap, 23.viii.1971, J. Jacobi
- P-0040 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 23.viii.1971, J. Jacobi
- P-0044 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 16.viii.1971, J. Jacobi
- P-0046 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 23.viii.1971, J. Jacobi
- P-0064 HAWAI'I: East slope of Mauna Loa, Kipuka Ki Weather Station, 1220 m, pitfall trap, 29.ix.1971, J. Jacobi
- P-0079 HAWAI'I: East slope of Mauna Loa, 1280–1341 m, pitfall trap, 10–13.x.1971, J. Jacobi
- P-0087 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 27.x.1971, J. Jacobi
- P-0091 HAWAI'I: East slope of Mauna Loa, Kipuka Ki Weather Station, pitfall trap, 1220 m, 27.x.1971, J. Jacobi
- P-0094 HAWAI'I: East slope of Mauna Loa, Treemold area, 1220 m, pitfall trap, 27.x.1971, J. Jacobi
- P-0217 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 13–15.iii.1972, J. Jacobi
- P-0224 HAWAI'I: East slope of Mauna Loa, Kilauea Forest Reserve, 1646 m, pitfall trap, 13–15.iii.1972, J. Jacobi
- P-0225 HAWAI'I: East slope of Mauna Loa, 1981 m, pitfall trap, 27–29.iii.1972, J. Jacobi
- P-0226 HAWAI'I: East slope of Mauna Loa, 1980 m, pitfall trap, 27–29.iii.1972, J. Jacobi
- P-0228 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 27–29.iii.1972, J. Jacobi
- P-0240 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 10–12.iv.1972, J. Jacobi

- P-0244 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 10–12.iv.1972, J. Jacobi
- P-0257 HAWAI'I: East slope of Mauna Loa, 1280–1341 m, pitfall trap, 8–10.v.1972, J. Jacobi
- P-0268 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 5–7.vi.1972, J. Jacobi
- P-0269 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 5–7.vi.1972, J. Jacobi
- P-0271 HAWAI'I: East slope of Mauna Loa, 1280–1341 m, pitfall trap, 5–7.vi.1972, J. Jacobi
- P-0281 HAWAI'I: East slope of Mauna Loa, 1981 m, pitfall trap, 10–12.vii.1972, J. Jacobi
- P-0284 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 10–12.vii.1972, J. Jacobi
- P-0286 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 10–12.vii.1971, J. Jacobi
- P-0291 HAWAI'I: East slope of Mauna Loa, Kīlauea Forest Reserve, 1646 m, pitfall trap, 10–12.vii.1972 J. Jacobi
- P-0294 HAWAI'I: East slope of Mauna Loa, 1981 m, pitfall trap, 14–16.viii.1972, J. Jacobi
- P-0300 HAWAI'I: East slope of Mauna Loa, Kīlauea Forest Reserve, 1646 m, pitfall trap, J. Jacobi
- P-0307 HAWAI'I: East slope of Mauna Loa, 1981 m, pitfall trap, 17–19.ix.1972, J. Jacobi
- P-0313 HAWAI'I: East slope of Mauna Loa, Kīlauea Forest Reserve, 1646 m, pitfall trap, 17–19.x.1972, J. Jacobi
- P-0322 HAWAI'I: East slope of Mauna Loa, Mauna Loa Strip Road Weather Station, 1585 m, pitfall trap, 15–17.i.1973, J. Jacobi
- P-0323 HAWAI'I: East slope of Mauna Loa, 1280–1341m, pitfall trap, J. Jacobi
- P-0332 HAWAI'I: East slope of Mauna Loa, Power Line Area, 1490 m, pitfall trap, 15–17.i.1973, J. Jacobi

The Milliped Family Paradoxosomatidae in the Hawaiian Islands (Diplopoda: Polydesmida)

ROWLAND M. SHELLEY, SELENA B. BAUER (North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA) & SABINA F. SWIFT (Hawai'i Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817-0916, USA)

Introduction

Because of their status as the commercial center of the Pacific, the Hawaiian islands have been flooded with exogenous species. Some have been deliberately imported, but most enter the state accidentally with plants and cargo from other parts of the world, particularly the Pacific Rim. These organisms thrive in warm, moist environments and quickly become established on the islands. The arthropod class Diplopoda exemplifies this phenomenon, and excepting the endemic forms of *Nannolene* Bollman (order Spirostreptida: family Cambalidae)¹, the Hawaiian fauna is comprised entirely of introduced species, primarily in the orders Spirobolida, Julida, and Polydesmida. The Hawaiian julidans are detailed by Shelley & Swift (1998); in the Spirobolida, *Trigoniulus corallinus* (Gervais) (Pachybolidae: Trigoniulinae) has been reported from the island of Hawai'i (Chamberlin,

1. The endemic Hawaiian cambaloids, traditionally assigned to *Nannolene*, probably are not congeneric with the type species, *Julus burkei* Bollman, in northern California. They were originally assigned to *Dimerogonus* Attems but probably are not congeneric with its type species either, *D. orophilus* Attems, in Australia. Verhoeff (1944) erected *Hawaicambala*, spelled as "*Hawaicambala*" by Hoffman (1980), for these cambaloids, but this genus was invalidly proposed because no type species was designated nor were any species specifically included. Verhoeff's proposal was accompanied by the general statement, "Ein Dutzend Arten beschrieb Silvestri von Hawai, eine Art Attems von Japan," but genus-group names proposed after 1931 must include at least one component species to be valid. Consequently, *Hawaicambala* Verhoeff, 1944, has no standing in nomenclature (Jeekel, 1971, Hoffman, 1980). To rectify this situation, Mauriès (1983) designated *Dimerogonus aveburyi* Silvestri (1904) as the type species of *Hawaicambala* and thereby also became the author of the genus. Consequently, if a separate genus is required for the Hawaiian cambaloids, the taxon will be *Hawaicambala* Mauriès, 1983, not *Hawaicambala* Verhoeff, 1944; otherwise, *Hawaicambala* Mauriès is a synonym of *Nannolene*.

1922; Nishida, 1994) and is established on O'ahu and Kaua'i (Shelley, 1998), and 2 or 3 species in the family Spirobolellidae have been encountered on several islands. The principal Hawaiian representative of the Polydesmida is the family Paradoxosomatidae with 3 species—*Oxidus gracilis* (C.L. Koch), *Asiomorpha coarctata* (Saussure), and *Akamptogonus novarae* (Humbert and Saussure) — which have been introduced throughout the world and hold no systematic importance. We present identifying features of these three millipeds and records from Hawai'i, with the islands listed in alphabetical order and localities arranged in general north to south sequences. Localities corresponding to numbered pitfall and/or berlese samples of *O. gracilis* and *A. novarae* at the Bishop Museum, all from the island of Hawai'i, are provided in the appendix. Repository acronyms are as follows: BPBM - Bishop Museum, Honolulu, Hawai'i; BYU - Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah; CAS - California Academy of Sciences, San Francisco; NMNH - National Museum of Natural History, Smithsonian Institution, Washington, D. C.; PMNH - Peabody Museum of Natural History, Yale University, New Haven, Connecticut.

For the purposes of this contribution, the Paradoxosomatidae is distinguished by the relatively narrow, parallel-sided body; the smooth, glabrous dorsum; the smooth, entire paranotal margination; and the strong, transverse metatergal grooves. *Oxidus gracilis* is virtually pan-global, occurring on all the inhabited continents and many islands, and occupying urban areas throughout North America; it is extremely adaptable and may be the world's most common non-parasitic, metazoan animal. *Asiomorpha coarctata* is pan-tropical and, in North America, is established in Florida, south Georgia, and along the Gulf Coast; *Akamptogonus novarae*, however, is a newcomer to the continental United States and is known only from California: Mendocino, Sonoma, and Napa counties, San Francisco (Golden Gate Park), Santa Barbara, and Torrey Pines State Park near San Diego (Hoffman, 1979; unreported specimens examined by the first author). In addition to the distinctive configuration of the male gonopods, *Akamptogonus novarae* is reliably identified by the different body form and color pattern that persists in alcohol for several years, so females are readily recognized in the absence of males. The most reliable determinant between *O. gracilis* and *Asiomorpha coarctata* is the gonopodal configuration. Their somatic features are similar, but the caudolateral paranotal corners of all segments of the latter are prolonged and acuminate, whereas those of anterior and midbody segments of the former are not extended and blunt; female and juvenile samples are distinguished by this feature. Blower (1985, fig. 72a) provides a whole body drawing in lateral perspective of a male of *O. gracilis*.

Several other paradoxosomatid species have been introduced into distant parts of the world, particularly on islands. While none have been encountered in Hawaiian environments, all may eventually become established on one or more of the islands. Three such species have been intercepted in quarantine at Honolulu, in soil with plants from Ceylon, Java, China, and the Philippines (Chamberlin, 1923, 1941); they confirm that human commercial activities like the importation of plants and associated soil from foreign countries is the principal mechanism through which exotic milliped introductions occur. As there is no evidence that these species now occur in the Hawaiian islands, we delete them at the conclusion of the paper. Another commonly introduced paradoxosomatid, never encountered in Hawai'i, is *Chondromorpha xanthotricha* (Attems), which is native to India/Sri Lanka, is now widespread in the northern Neotropics, and is established on the Philippine

Islands (Luzon), New Caledonia, the Fiji Islands, Bali, and Samoa (Chamberlin 1920; Jeekel, 1963, 1972, 1982). Because the paranotal corners are angular and extended, *C. xanthotricha* has the general body form of *A. coarctata*, but the metatergites are densely pubescent with low tubercles, in contrast to the smooth, glossy dorsum of the latter, which has scattered segmental setae. Reasonably accurate illustrations showing the tergites and gonopods *in situ* of *C. xanthotricha* are found in Loomis (1948, figs. 4–6) under the synonym, *Xaymacia granulata* Loomis.

***Oxidus gracilis* (C. L. Koch, 1847)**

New island records

*Diagnosis.*² Dorsum relatively flat, deep chestnut brown to black in adults, juveniles pallid; paranota extending directly laterad, corners blunt and not extended on anterior and midbody segments, prolonged and acuminate caudad; gonopods relatively short and broad, extending anteriorly to between caudal legs of preceding (6th) segment, divided at midlength into 4 clearly separated terminal branches. Reasonably accurate illustrations that show the general form of the gonopod so as to enable reliable determinations are available in Attems (1909, figs. 26–27; 1937, fig. 101), Schubart (1934, fig. 283; 1945, fig. 38), Causey (1943, fig. 1), Shelley (1978, fig. 45), and Golovatch & Enghoff (1993, figs. 115–16). Blower (1985, fig. 72) showed a medial view of a gonopod plus one of the structures *in situ*; Golovatch & Enghoff (1993, figs. 12–14) provide SEM photos of the gonopod in 3 perspectives.

Occurrence in Hawai'i. Known from all the major islands except Kaho'olawe and Ni'ihau.

Published records: "Hawaii," referring to the islands in general [Schubart (1934) and Silvestri (1935) [as *Orthomorpha gracilis*]; Attems, 1937, 1938a, 1940]. HAWAI'I: Hilo (Pocock, 1893³ [as *Strongylosoma gracile*], Silvestri, 1904; Chamberlin, 1920 [as *Orthomorpha gracilis*]). Kilauea (Attems, 1903 [as *Orthomorpha gracilis*], Silvestri, 1904). MAUI: Olinda (Karsch, 1880 [as *Polydesmus (Paradesmus) gracilis*]). MOLOKA'I: Kalae (Attems, 1903 [as *Orthomorpha gracilis*], Silvestri, 1904). O'AHU: Honolulu (Pocock, 1903 [as *Strongylosoma gracile*]; Silvestri, 1904; Chamberlin, 1920 [as *Orthomorpha gracilis*], 1922).

Material examined: **HAWAI'I:** Niuli'i Beach Pk. (BPBM). Kohala Mts. (BPBM). Pu'u Waa Waa Ranch, Waihou-Henahena Gate, 31 December 1937 (BPBM). Kaumana Cv., 290 m, on rock 100 m inside dark zone, 21 July 1971, F.G. Howarth (BPBM). Pu'u Wa'awa'a Lava Tube, 30 September 1971, F.G. Howarth (BPBM). Honoka'a, 610 m, Hamakua For. Res. Cv., upper section, 2000 ft., 24 April 1971, F.G. Howarth (BPBM). Kalopa St. Pk., 19 September 1972, O. S. & C. M. Flint (NMNH) and 730 m, 7 June 1983, V.F. Lee (CAS). Kazumura Cv., dark zone, 700 ft. in, 22 July 1971, F.G. Howarth (BPBM), and Station 8, 8 December 1972, F.G. Howarth, W.C. Gagné (BPBM). S. Kona (BPBM). 15 mi SW Hilo (BPBM). Kīpuka Puauulu, 16 January 1964, Clayton (FSCA) and Bird Park Cv. #1, dark zone, 3 July 1971, F.G. Howarth (BPBM). Hawai'i Volcanoes Nat. Pk., between Volcano House and Crater Hotel (BPBM); Fern-'Ohi'a For., 1160 m, 6 June 1983, V.F. Lee (CAS); and Thurston Lava Tube, dark zone, 23 July 1971, F.G. Howarth, W.C. Gagné (BPBM). Volcano, Hongo Store Cv., 28 September 1971, F.G. Howarth, J. Jacobi (BPBM). Ola'a Forest (BPBM). Also the following numbered samples at the BM (see appendix): BM-Berlese 00249, 00250, 00251, 00488, 00491, 00502, 00582, 00727, 00938, 01166, 01178. Pitfall P-0001, P-0002, P-0003, P-0004, P-0008, P-0009, P-0016, P-0020, P-0022, P-0023, P-0024, P-0025, P-0028, P-0031, P-0032, P-0036, P-0039, P-0040, P-0041, P-0042, P-0043, P-0050, P-0051, P-0052, P-0055, P-0056, P-0058, P-0066, P-0077, P-0078, P-0080, P-0081, P-0084, P-0089, P-0180, P-0181, P-0192, P-0194, P-0202, P-0219, P-0220, P-0242, P-0244, P-0245, P-0246, P-0258, P-0259, P-0270, P-0274, P-0296, P-0297, P-0302, P-0309,

2. The diagnostic features cited in this contribution only contrast these 3 species and only apply to islands with exclusively introduced paradoxosomatids. They will not contrast congeneric species and will not work in areas of Asia and the Pacific Rim with complex, indigenous paradoxosomatid faunas.

3. According to Silvestri (1904), the diplopod records of Pocock (1893) are the first from Hawai'i, then called the Sandwich Islands. However, this distinction really belongs to Karsch (1880), who described *Iulus anguinus*, from Olinda, Maui, and reported *O. gracilis* from this locality.

P-0315, P-0318, P-0321, P-0322, P-0329, P-0331. **KAUAI**: Na Pali-Kona For. Res., Mohihi-Waiālae Tr., 1040–1070 m, 12 May 1991, D.H. Kavanaugh (CAS). Koke'e St. Pk. (BPBM). Koke'e, 4–6 August 1961, T. Maa, Miyatake, C. Yoshimoto (BPBM) and 9 March 1963, N.L.H. Krauss (BPBM). Alakai Swamp, 15 August 1971, F.G. Howarth (BPBM), and 27 May 1992, R.W. Baumann, H. Spafford (BYU). (BPBM). Haena Caves, 7 August 1961, T. Maa (BPBM). 4 mi W Lihue, along hwy. 50, Hoinakaunalehua Stream, 20 May 1992, R.W. Baumann, M.L. Nelson (BYU). 2 mi SE Lawa'i, along Hwy. 530, 22 May 1992, R.W. Baumann, M.L. Nelson (BYU). Koloa, Limestone Quarry Cv., debris in deep twilight zone, 5 m, 21 June 1972, F.G. Howarth (BPBM); Koloa Cv. #2, rotting wood, 46 m, inside dark zone, 11 August 1971, F.G. Howarth (BPBM); and Knudsen Cv. #1, 45 m, twilight and dark zones, 23 June 1972, F.G. Howarth (BPBM). Hanapepe, 20 May 1992, R.W. Baumann, M.L. Nelson (BYU). Poipu Beach, 24 May 1992, R.W. Baumann (BYU). Pacific Botanical Garden, 26 May 1992, R.W. Baumann, H. Spafford (BYU). Koke'e St. Pk., Pu'u Kila Look-out, 25 May 1992, R.W. Baumann, H. Spafford (BYU). Polihale St. Pk., NE Barking Sands Military Res., 21 May 1992, R.W. Baumann, H. Spafford (BYU). Along Kanaie River, 1067 m, 3 September 1961, S.D. Ripley (PMNH). Waimea Dist., Mt. Kahili, 919 m (BPBM). Waimea Dist., Mohihi Valley (BPBM). **LĀNA'I**: Garden of the Gods, 27 April 1994, R.W. Baumann, C.E. Campora (BYU). Kaumalapau, 27 April 1994, R.W. Baumann, C.E. Campora (BYU). Top of Lāna'ihale Mt., 12 July 1968, D. M. Allred (BPBM). **MAUI**: Pu'u Kukui Trail (BPBM). Puu Mahoe Cv. #1, 2,300 ft., twilight zone, 11 December 1971, S. Montgomery, F.G. Howarth (BPBM). Lahaina, Lahainaluna High School, 4 August 1993, R.W. Baumann, R. Ochoa (BYU). Iao Valley St. Pk., along Iao Stream, 4 August 1993, R.W. Baumann (BYU). Waihoi Valley, 847 m, Berlese of litter and soil, 29–30 June 1972, P. Ching (BPBM). Ko'olau For. Res., 1584 m, on rotting log, 8 August 1973, W.C. Gagné (BPBM). Wailuku Hts., 11 August 1993, R.W. Baumann, R. Ochoa (BYU). Waipoli Rd., 3 mi above jct. Hwy. 377, 10 August 1993, R.W. Baumann, R. Ochoa (BYU). Olinda (BPBM). Hana, 5 mi (8 km) W jct. hwy., 360 W Airport Rd., sifting leaf litter & rotting logs, 24 January 1973, F.G. Howarth, E. L. Bousfield (BPBM). Mt. Haleakalā, NW slope E Olinda, Waikamoi Flume, 1310 m, 9 May 1991, D. H. Kavanaugh (CAS). Hana, Waikoi Valley, Trench Cv., 19 August 1972, F.G. Howarth, W.C. Gagné (BPBM). **MOLOKA'I**: Moloka'i Forest Res., Pu'u Kolekole (BPBM), and Pu'u Kolekole Tr. (BPBM). E. Kaunakakai (BPBM). Kamiloloa Gulch (BPBM). Pukuo'o (BPBM). Hanailolilo, 914–1,067 m, 3 August 1965, T. Suman (BPBM). Kaulolo, under mist leaves at roadside, 8 July 1968, D. M. Allred (BPBM). **O'AHU**: Kaena Point St. Pk., 22 April 1994, R.W. Baumann, C. E. Campora (BYU). N. slope of Pu'u Pueo (BPBM). Pupukeya (BPBM). N. end of Ko'olau Mts. (BPBM). Laie, Koloa Gulch, 21 April 1994, R.W. Baumann, C. E. Campora (BYU). Sacred Falls St. Pk., 21 April 1994, R.W. Baumann, C. E. Campora (BYU). Kualoa Pk., along Hwy. 83, 21 April 1994, R.W. Baumann, C. E. Campora (BYU). Kahalu'u Beach Pk. (BPBM). Ko'olau Mts., Opaelua Valley, E. Wahiawa, 6 July 1964, T. Suman (BPBM); windward side, 11 June 1964, R. F., T. S. (BPBM); and Poamoho Trail, sifting leaf litter nr. summit, 2 June 1977, F.G. Howarth (BPBM). Wai'anae Mts., Mt. Ka'ala, 1220 m, in swamp, 2 August 1964, T. Suman (BPBM), 1,190–1,220 m, 18 May 1991, D.H. Kavanaugh (CAS), and summit, 1,220 m, crawling on dead branch at night, 4 November 1996, S.F. Swift (BPBM); S. end Wai'anae Mts. (BPBM). Mānoa (BPBM). Waterfall at head of Mānoa Valley, 1925, T.D.A. Cockerell (NMNH). Kuliouou Val. (BPBM). Aiea Heights, 11 December 1962, C. Yoshimoto (BPBM). Pearl City, 28 March 1968, B. Chambers (BPBM). Honolulu, Salt Lake, 26 July 1977, G.M. Nishida (BPBM); Makiki Heights Rd., 27 September 1964, T. Suman (BPBM); Judd St. Cv., 30 m, on wood in twilight zone, 21 May 1972, F.G. Howarth (BPBM); Diamond Head, 30 May 1991, W.E. Steiner (NMNH); Mt. Tantalus (BPBM). Konahuanui Val. (BPBM). Mt. Ka'ala Tr. and summit, Mt. Ka'ala (BPBM). Waimano Tr. (BPBM). Ulumawao Pk. (BPBM). Halawa (BPBM). Waikane Tr. (BPBM). Kailua, Pu'u O Ehu (BPBM).

Remarks. Entomologists and arthropodologists from numerous universities and museums in the continental United States have visited Hawai'i and collected *O. gracilis* on various islands. The first author has seen many more Hawaiian samples but has not recorded them, and *O. gracilis* is expected on all major islands in the archipelago. As the holdings at all North American institutions have been sorted and organized, persons inter-

ested in Hawaiian records can retrieve the samples from jars containing this species. *Oxidus gracilis* is a major urban pest in the continental United States and regularly invades houses and buildings; it undergoes sporadic population explosions that can overwhelm homeowners (see O'Neill & Reichle, 1970). Commonly known as the “hothouse” or “greenhouse” milliped because of its prevalence in these structures, *O. gracilis* is one of the few millipeds whose life history is understood. Readers interested in its ecology and general biology are referred to Causey (1943) and Bennett & Kerr (1973).

***Asiomorpha coarctata* (Saussure, 1860)**

Diagnosis. Dorsum relatively flat, deep chestnut brown to black in adults, juveniles pallid; paranota extending directly laterad, corners angular, acuminate, and strongly extended on all segments; gonopods relatively long and slender, extending anteriorly to between caudal legs of 5th segment, appearing undivided but actually divided around midlength into 3 closely appressed, indistinct branches. Reasonably accurate illustrations that show the general form of the gonopod are available in Attems (1898, fig. 85; 1937, fig. 75) and Schubart (1945, fig. 40).

Occurrence in Hawai'i. Known only from Kaua'i and O'ahu.

Published records (all as “*Orthomorpha coarctata*”). “Hawaii,” referring to the islands in general (Silvestri, 1935; Attems, 1938a). KAUA'I: Lihue (Attems, 1903; Silvestri, 1904). O'AHU: Honolulu (Chamberlin, 1920).

Material examined: KAUA'I: Koke'e St. Pk., Kalalau Lookout, 4000 ft. [1220 m], 9 March 1963, N.L.H. Krauss (BPBM). O'AHU: In cane field, exact location and collector unknown, 28 March 1930 (NMNH). Honolulu, Kalihi Valley, 30 m, 25 February 1982, F.G. Howarth (BPBM). Pearl City, 28 March 1968, B. Chambers (BPBM). Kailua, Pu'u O Ehu (BPBM).

Remarks. In Hawai'i, *Asiomorpha coarctata* is rare in comparison to *O. gracilis*, whereas it is more abundant than the latter on Caribbean Islands. Additional Hawaiian samples are available in American and Canadian repositories, which can be retrieved from jars labeled as this species. Where it occurs, *A. coarctata* can become locally abundant, but unlike *O. gracilis*, it is not infamous for invading houses. Bennett & Kemp (1973) studied the biology and behavior of populations in Florida.

***Akamptogonus novarae* (Humbert & Saussure, 1869) New island records**

Diagnosis. Dorsum gently arched or vaulted, brownish orange in color, protergites and anterior halves of metatergites (anterior to transverse grooves) distinctly lighter, forming subcontinuous middorsal stripe; paranota interrupting slope of dorsum and extending directly laterad; gonopods relatively short and broad, extending anteriorly to between caudal legs of preceding (6th) segment, divided at midlength into three clearly separated terminal branches. Illustrations that show the general form of the gonopod are available in Attems (1937, fig. 315) and Hoffman (1979, fig. 1).

Occurrence in Hawai'i. Known from the islands of Hawai'i and O'ahu.

Published records. “Hawaii,” probably meaning the islands in general (Jeekel, 1981; Shear, 1992).

Material examined: HAWAII'I: Kohala Mts. (BPBM). Waipio Valley (BPBM). Kalopa St. Pk., 19 September 1972, O.S. & C.M. Flint (NMNH). Kipuka Pua'ulu, Bird Park Cv. #1, dark zone, 3 July 1971, F.G. Howarth (BPBM). Honoka'a, Hamakua For. Res. Cvs., 600 m, lower section, twilight zone, 24 April 1972, F.G. Howarth (BPBM) and 610 m in upper section, 24 April 1972, F.G. Howarth (BPBM). Hawai'i Volcanoes Nat. Pk., 1 August 1976, C.F.E. Roper (NMNH); Mauna Loa, entrance to Bird Park Cv. #2, twilight zone, 1250 m, 9 December 1976, D. & M. Davis (NMNH); and Kilauea Iki floor (BPBM). Also the following numbered samples at the BM (see appendix): 00249, 00250, 00938, 01030, 01094, 01142, 01178, P-0004, P-0008, P-0009, P-0013, P-0015, P-0018, P-

0023, P-0025, P-0027, P-0031, P-0040, P-0041, P-0043, P-0051, P-0055, P-0061, P-0068, P-0080, P-0081, P-0082, P-0090, P-0091, P-0180, P-0181, P-0193, P-0195, P-0196, P-0205, P-0218, P-0220, P-0222, P-0230, P-0244, P-0245, P-0246, P-0258, P-0259, P-0271, P-0272, P-0273, P-0274, P-0275, P-0286, P-0289, P-0296, P-0297, P-0304, P-0309, P-0310, P-0312, P-0315, P-0316, P-0329, P-0332.

O‘AHU: Honolulu, Mānoa, under stone, 13 February 1944, N.L.H. Krauss (NMNH).

Remarks. The initial report of *A. novarae* from “Hawaii” is an obscure reference to unpublished samples by Jeekel (1981: 21), which is itself an unofficial mimeographed report of an expedition to Australia, not a scientific publication. The actual statement is, “It appears to spread gradually through human agency, and has been recorded recently from California, U.S.A., and became known from Hawaii (unpublished).” Shear’s citation (1992) is based on this unsupported statement. We have no idea which island the source material came from or where it is housed, but as Dr. Jeekel is an authority on the Paradoxosomatidae, the citation must be considered valid. Obviously, *A. novarae* had been discovered in the state prior to 1981, possibly in the 1970s.

Deletions

Chamberlin (1923, 1941) inadvisedly proposed 2 new genera, 1 new subgenus, and 4 new species for 4 paradoxosomatid samples taken in quarantine at Honolulu in 1921–1922 and 1938; they actually comprise only 3 species, all previously described. One of his genera, *Desmoxytes*, is the senior name for an assemblage of Oriental paradoxosomatids with sculptured, ornamented dorsums and elaborate paranota. It now encompasses the spectacularly ornamented “Chinese Dragon Milliped,” *D. draco* (Cook & Loomis), as Golovatch & Enghoff (1994) placed its original genus, *Hylomus* Cook and Loomis, in synonymy under *Desmoxytes*. However, the other 2 genus-group names, *Chinosoma* and *Ceylonismus*, the latter proposed as a subgenus of *Euphyodesmus* Attems, have been synonymized under older names, as have all 4 specific names. We officially delete all 3 species from the Hawaiian fauna.

Desmoxytes planata (Pocock, 1895) (= *D. coniger* Chamberlin, 1923; *Euphyodesmus* (*Ceylonismus*) *vector* Chamberlin, 1941). Originally discovered on the Andaman Islands, in the Bay of Bengal, this species is readily transported by commerce and is known from Thailand, the Seychelles, Java, Ceylon, and Fiji (Jeekel, 1980a,b; Golovatch & Enghoff, 1994); Jeekel (1980a) speculated that its native area was probably Myanmar or Malaya. Chamberlin (1923) proposed *Desmoxytes* and *D. coniger* for 3 males, 1 female, and numerous juveniles that were intercepted in soil with plants coming from Bogor (formerly Buitenzorg), Java. Attems (1938a) recorded the species from Hawai‘i, meaning the islands collectively, with a question mark, misspelling the specific name as “*corniger*”; later that year, he (Attems, 1938b) spelled the name correctly and listed Honolulu as its locality. Chamberlin (1941) proposed *Euphyodesmus* (*Ceylonismus*) *vector* for nine specimens of unknown sex taken “in soil about plants from Ceylon.” Jeekel (1980a, figs. 1–3) provided drawings of a body segment and a gonopod, which enable reliable determinations of *D. planata* if it is ever discovered in a Hawaiian environment.

Helicorthomorpha holstii (Pocock, 1895) (= *Chinosoma hodites* Chamberlin, 1923). This species is known from the Ryukyus, China, and Vietnam; Chamberlin (1923) proposed *Chinosoma* and *C. hodites* for 1 male and 3 juveniles that were intercepted in soil with a cactus plant from an unspecified locality in China. Attems (1938a) cited *C. hodites* and listed Honolulu as its locality. Jeekel (1980a) placed *Chinosoma* in synonymy under *Helicorthomorpha* Attems and *C. hodites* under *H. holstii*; he also provided drawings of

a somite and a gonopod that enable reliable determinations of *H. holstii* if it is ever discovered in the Hawaiian islands.

Helicorthomorpha orthogona (Silvestri, 1898) (= *Orthomorpha hodites* Chamberlin, 1941). This species is known from Taiwan, the Philippines, and New Guinea; Chamberlin (1941) proposed *O. hodites* for a male found on a root of *Phalaenopsis stuartiana* shipped from the Philippines. Jeekel (1967) referred *O. hodites* to *Helicorthomorpha*; thirteen years later, he (Jeekel, 1980a) placed *O. hodites* in synonymy under *H. orthogona*. No recent gonopod drawings of *H. orthogona* exist, so the best available is that with the original description (Silvestri, 1898, fig. 2).

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Appendix. List of numbered localities referred to in this paper

BM-Berlese numbers:

- 00249 HAWAI'I: Mauna Loa Strip Road, plot no. 19, 28.vi - 5.vii.1971, pitfall trap, M.L. Goff
- 00250 HAWAI'I: Mauna Loa Strip road, plot no. 19, 12-20.vii. 1971, pitfall trap, M.L. Goff
- 00251 HAWAI'I: Hawaii'i Volcanoes National Park (HVNP), Bird Park, plot no. 19, 5-12.vii.1971, pitfall trap, M.L. Goff
- 00488 HAWAI'I: HVNP, Kīpuka Pua'ulu, litter at base of mature *Metrosideros*, 31.vii.1971, Berlese, G.A. Samuelson
- 00491 HAWAI'I: HVNP, Kīpuka Pua'ulu, nr. pitfall no. 10, 26.viii.1971, grass & *Metrosideros* leaves, Berlese, G.A. Samuelson
- 00502 HAWAI'I: HVNP, Kīpuka Pua'ulu, 31.viii.1971, *Pipturus* leaf litter and soil, Berlese, G.A. Samuelson
- 00582 HAWAI'I: East slope of Mauna Loa, 2286-2316 m, 21-31.vii.1971, pitfall trap, F.J. Radovsky
- 00727 HAWAI'I: East slope of Mauna Loa, 100 yards above marker 38 Kīpuka Ki, 1220 m, 7.iv.1972, pitfall assoc. litter, Berlese, J. Jacobi
- 00938 HAWAI'I: East slope of Mauna Loa, Thurston Lava Tube, 1204 m, 14.viii.1972, pitfall assoc. litter, Berlese, J. Jacobi
- 01030 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall assoc. litter, Berlese, 16.x.1972, J. Jacobi
- 01094 HAWAI'I: East slope of Mauna Loa, Power Line area, 1493 m, pitfall assoc. litter, 18.xi.1972, J. Jacobi
- 01142 HAWAI'I: East slope of Mauna Loa, Power Line area, 1493 m, pitfall assoc. litter, Berlese, 13.xii.1972, J. Jacobi
- 01166 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, leaf litter, Berlese, 23.i.1973, J. Jacobi
- 01178 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall assoc. litter, Berlese, J. Jacobi

Pitfall numbers:

- P-0001 HAWAI'I: East slope of Mauna Loa, 2440 m, pitfall trap, 21-31.vii.1971, F.J. Radovsky
- P-0002 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 21-23.vii.1971, F.J. Radovsky
- P-0003 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 21-31.vii.1971, F.J. Radovsky
- P-0004 HAWAI'I: East slope of Mauna Loa, 100 yards above marker for 38 Kīpuka Ki, 1220 m, pitfall trap, 21-31.vii.1971, F.J. Radovsky
- P-0008 HAWAI'I: East slope of Mauna Loa, 1280-1341 m, pitfall trap, 20-31.vii.1971, F.J. Radovsky
- P-0009 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 20-31.vii.1971, F.J. Radovsky
- P-0013 HAWAI'I: East slope of Mauna Loa, 1200 m, pitfall trap, 30.vii.1971, J. Jacobi
- P-0015 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 9.vii.1971, J. Jacobi
- P-0016 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 9.vii.1971, J. Jacobi
- P-0018 HAWAI'I: East slope of Mauna Loa, 1280-1341 m, pitfall trap, 30.vii.1971, J. Jacobi
- P-0020 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 30.vii.1971, J. Jacobi
- P-0022 HAWAI'I: East slope of Mauna Loa, Kilauea Forest Reserve, 1646 m, pitfall trap, 30.vii. 1971, J. Jacobi
- P-0023 HAWAI'I: East slope of Mauna Loa, 1280-1341 m, pitfall trap, 23.viii.1971, J. Jacobi
- P-0024 HAWAI'I: East slope of Mauna Loa, Kilauea Forest Reserve, 1645 m, 30.vii.1971, J. Jacobi
- P-0025 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 9.viii.1971, J. Jacobi

- P-0027 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 9.vii.1971, J. Jacobi
- P-0028 HAWAI'I: East slope of Mauna Loa, Treemold area, 1220 m, pitfall trap, 9.vii.1971, J. Jacobi
- P-0031 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, viii.1971, J. Jacobi
- P-0032 HAWAI'I: East slope of Mauna Loa, Mauna Loa Strip Rd Weather Station, 1585 m, 30.vii.1971, J. Jacobi
- P-0036 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 11.viii.1971, J. Jacobi
- P-0039 HAWAI'I: East slope of Mauna Loa, Mauna Loa Strip Rd Weather Station, 1585 m, pitfall trap, (no date), J. Jacobi
- P-0040 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 23.viii.1971, J. Jacobi
- P-0041 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 23.viii.1971, J. Jacobi
- P-0042 HAWAI'I: East slope of Mauna Loa, Kilauea Forest Reserve, 1645 m, pitfall trap, 16.viii.1971, J. Jacobi
- P-0043 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 16.viii.1971, J. Jacobi
- P-0050 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 1.ix.1971, J. Jacobi
- P-0051 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, pitfall trap, 1220 m, 1.ix.1971, J. Jacobi
- P-0052 HAWAI'I: East slope of Mauna Loa, 1890 m, pitfall trap, 1.ix.1971, J. Jacobi
- P-0055 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 1.ix.1971, J. Jacobi
- P-0056 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 1.ix.1971, J. Jacobi
- P-0058 HAWAI'I: East slope of Mauna Loa, Mauna Loa Strip Rd Weather Station, 1585 m, pitfall trap, 1.ix.1971, J. Jacobi
- P-0061 HAWAI'I: East slope of Mauna Loa, treemold area, 1220 m, pitfall area, 29.ix.1971, J. Jacobi
- P-0066 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 29.ix.1971, J. Jacobi
- P-0068 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, 29.ix.1971, J. Jacobi
- P-0077 HAWAI'I: East slope of Mauna Loa, Mauna Loa Strip Rd Weather Station, 1585 m, pitfall trap, 10-13.x.1971, J. Jacobi
- P-0078 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 10-13.x.1971, J. Jacobi
- P-0080 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 10-13.x.1971, J. Jacobi
- P-0081 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 10-13.x.1971, J. Jacobi
- P-0082 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 10-13.x.1971, J. Jacobi
- P-0084 HAWAI'I: East slope of Mauna Loa, Kilauea Forest Reserve, 1645 m, pitfall trap, 10-13.x.1971, J. Jacobi
- P-0089 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 27.x.1971, J. Jacobi
- P-0090 HAWAI'I: East slope of Mauna Loa, 1280-1341 m, pitfall trap, 27.x.1971, J. Jacobi
- P-0091 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, 27.ix.1971, J. Jacobi
- P-0180 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 31.i-2.ii.1972, J. Jacobi
- P-0181 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 31.i-2.ii.1972, J. Jacobi
- P-0192 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 14-16.ii.1972, J. Jacobi
- P-0193 HAWAI'I: East slope of Mauna Loa, 1280-1341 m, pitfall trap, 14-16.ii.1972, J. Jacobi
- P-0194 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 14-16.ii.1972, J. Jacobi
- P-0195 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, 14-16.ii.1972, J. Jacobi
- P-0196 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 14-16.ii.1972, J. Jacobi
- P-0202 HAWAI'I: East slope of Mauna Loa, Mauna Loa Strip Rd Weather Station, 1585 m, pitfall trap, 28.ii-1.iii.1972, J. Jacobi
- P-0205 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 28.ii-1.iii.1972, J. Jacobi
- P-0218 HAWAI'I: East slope of Mauna Loa, 1280-1341 m, 13-15.iii.1972, pitfall trap, J. Jacobi
- P-0219 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 13-15.iii.1972, J. Jacobi
- P-0220 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 13-15.iii.1972, J. Jacobi
- P-0222 HAWAI'I: East slope of Mauna Loa, Treemold area, 1220 m, 13-15.iii.1972, pitfall trap, J. Jacobi
- P-0230 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 27-29.iii.1972

- P-0242 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 10-12.iv.1972, J. Jacobi
P-0244 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 10-12.iv.1972, J. Jacobi
P-0245 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 10-12.iv.1972, J. Jacobi
P-0246 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 10-12.iv.1972, J. Jacobi
P-0258 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 8-10.v.1972, J. Jacobi
P-0259 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 8-10.v.1972, J. Jacobi
P-0270 HAWAI'I: East slope of Mauna Loa, 1585 m, pitfall trap, 5-7.vi.1972, J. Jacobi
P-0271 HAWAI'I: East slope of Mauna Loa, 1280 -1341 m, pitfall trap, 5-7.vi.1972, J. Jacobi
P-0272 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 5-7.vi.1972, J. Jacobi
P-0273 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 5-7.vi.1972, J. Jacobi
P-0274 HAWAI'I: East slope of Mauna Loa, 1220 m, pitfall trap, 5-7.vi.1972, J. Jacobi
P-0275 HAWAI'I: East slope of Mauna Loa, Treemold area, 1220 m, pitfall trap, 5-7.vi.1972, J. Jacobi
P-0286 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 10-12.vii.1972, J. Jacobi
P-0289 HAWAI'I: East slope of Mauna Loa, Treemold area, 1220 m, pitfall trap, 10-12.vii.1972, J. Jacobi
P-0296 HAWAI'I: East slope of Mauna Loa, 1280-1341 m, pitfall trap, 14-16.viii.1972, J. Jacobi
P-0297 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 14-16.viii.1972, J. Jacobi
P-0302 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 14-16.viii.1972, J. Jacobi
P-0304 HAWAI'I: East slope of Mauna Loa, Thurston Lava Tube, 1204 m, pitfall trap, 14-16.viii.1972, J. Jacobi
P-0309 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 17-19.x.1972, J. Jacobi
P-0310 HAWAI'I: East slope of Mauna Loa, Kīpuka Ki Weather Station, 1220 m, pitfall trap, 17-19.x.1972, J. Jacobi
P-0312 HAWAI'I: East slope of Mauna Loa, Treemold area, 1220 m, pitfall trap, 17-19.x.1972, J. Jacobi
P-0315 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 17-19.x.1972, J. Jacobi
P-0316 HAWAI'I: East slope of Mauna Loa, Kīpuka Nene, pitfall trap, 17-19.x.1972, J. Jacobi
P-0318 HAWAI'I: East slope of Mauna Loa, Power Line area, 1493 m, 17-19.x.1972, pitfall trap, J. Jacobi
P-0321 HAWAI'I: East slope of Mauna Loa, 1981 m, pitfall trap, 15-17.i.1973, J. Jacobi
P-0322 HAWAI'I: East slope of Mauna Loa, Mauna Loa Strip Road Weather Station, 1585 m, pitfall trap, 15-17.i.1973, J. Jacobi
P-0329 HAWAI'I: East slope of Mauna Loa, Bird Park-Kīpuka Pua'ulu, 1220 m, pitfall trap, 24-26.i.1973, J. Jacobi
P-0331 HAWAI'I: East slope of Mauna Loa, Thurston lava tube, 1204 m, pitfall trap, 23-25.i.1973, J. Jacobi
P-0332 HAWAI'I: East slope of Mauna Loa, Power Line area, 1490 m, pitfall trap, 15-17.i.1973, J. Jacobi

Interception of the Milliped *Rhinotus purpureus* (Pocock) at Quarantine, and Potential Introduction of the Order and Family Into the Hawaiian Islands (Polyzoniida: Siphonotidae)

ROWLAND M. SHELLEY (North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA)

While recently perusing unsorted millipeds at the National Museum of Natural History, Smithsonian Institution, Washington, D.C., I discovered a specimen of *Rhinotus purpureus* (Pocock, 1894) with the following label, "From Panama at Hawaii, Sept. 1932." While this milliped is not known from a Hawaiian environment, the record bears mention because the order and family, if not this genus and species, could readily survive in the islands if accidentally introduced.

Rhinotus purpureus is a common synanthropic milliped in the northern Neotropics, being known from Belize, Costa Rica, Panama, Dominica, Guadeloupe and Marie Galante, Haiti, Martinique, Puerto Rico, St. Vincent, Tobago, Trinidad, and Surinam (Loomis, 1934, 1936; Hoffman, 1960; Causey, 1965; Velez, 1967; Mauriès, 1980); the native area is uncertain. In the United States, the species has been introduced into Louisiana (Calcasieu and East Baton Rouge parishes) and Florida (Dade, Monroe, Pinellas, Volusia counties) (Causey, 1953, 1965, plus unreported samples examined by the author), and it was described from Miami as *Siphonotus miamiensis* by Causey (1953). In the Indian Ocean, *Rhinotus purpureus* has been recorded from Madagascar; Mauritius Island; and Amirantes, Farquhar, Mahé, Poivre, and Silhouette islands of the Seychelles (Golovatch & Korsòs, 1992); perhaps referring to this species, Hoffman (1977, 1980) recorded the genus from the Bonin Islands and "Micronesia." The most obvious diagnostic feature is the subacuminate, triangular-shaped head with one large ocellus (Pocock, 1894, pl. 37, fig. 5; Mauriès (1971, figs. 3, 18, 30, and 36) and Hoffman (1977, fig. 2) illustrate the heads of species of *Siphonotus* Brandt, which resemble that of *R. purpureus* except that they have 2 ocelli. The gonopods are minute and must be examined under a compound microscope; the best illustrations are by Golovatch & Korsòs (1992, figs. 1–4).

Aside from species of *Rhinotus*, the Siphonotidae is represented in Australasia by slender, elongate species of unknown genus, which are recognizable by the triangular head. I have seen very large samples with scores of individuals in museum collections, which suggest introductions because exogenous diplopods tend to form larger local populations than indigenous forms. These too could survive on the Hawaiian islands if introduced.

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Occurrence of the Milliped *Trigoniulus corallinus* (Gervais) on O'ahu and Kaua'i (Spirobolida: Pachybolidae: Trigoniulinae)

ROWLAND M. SHELLEY (North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA)

Introduction

The trigoniuline milliped, *Trigoniulus corallinus* (Gervais)¹ (Spirobolida: Pachybolidae), has been introduced onto islands throughout the world and is common on those in the Pacific Ocean. Cited as *T. lumbricinus* (Gerstaecker), it was first encountered in the Hawaiian Islands in a quarantine interception at Honolulu, among soil with plants from the Botanical Gardens in Bogor (formerly Buitenzorg), Java (Chamberlin, 1922), which was probably the source of Attems' record (1938) from the islands in general. Williams (1931) was the first to record *T. corallinus* from a Hawaiian environment when he cited it from the Experiment Station, Hawaiian Sugar Planters' Association, Aiea, O'ahu; he noted that it is Hawai'i's largest milliped and provided a sketch of a female coiled in the resting position. Nishida (1994) added Kailua, O'ahu, and North Kona and Kailua Kona, on the island of Hawai'i, all based on unpublished specimens (G.M. Nishida, pers. comm.). In sorting preserved Hawaiian diplopods at the Bishop Museum, the Florida State Collection of Arthropods, Gainesville (FSCA), the National Museum of Natural History, Washington, D.C. (NMNH), the North Carolina State Museum of Natural Sciences (NCSM), and the Virginia Museum of Natural History (VMNH), I found 19 samples of *T. corallinus* from O'ahu and 2 from Kaua'i that I document here as part of the series of papers on the state's milliped fauna (see Shelley *et al.*, 1998; Shelley & Swift, 1998).

1. Unpublished research by R.L. Hoffman in the 1970s established that *corallinus* Gervais, originally assigned to *Iulus* (recte *Julus*) L., is the oldest name for this species and therefore holds priority over the 2 commonly used names, *lumbricinus* Gerstaecker and *goësi* Porath. To the best of my knowledge, the only published usage of *T. corallinus* is by Nishida (1994) in the listing of Hawaiian arthropods, which therefore constituted a new combination.

Trigoniulus corallinus (Gervais, 1842)**New island record**

Diagnosis. Distinguished by the relatively large size (mature individuals ca. 48–54 mm in length and 4.0–4.5 mm in width), the cylindrical body form (round in cross section), and the generally reddish coloration, which is devoid of stripes. Gonopod illustrations are available in Golovatch & Korsòs (1990, figs. 14–22).

Occurrence in Hawai‘i. Known from Hawai‘i, Kaua‘i, O‘ahu.

Published Records. “Hawaii,” referring to the islands in general (Attems, 1938 [as *T. lumbricinus*]); Aiea, O‘ahu (Williams, 1931); O‘ahu and Hawai‘i (Nishida, 1994).

Material examined: (all in BPBM except those from the FSCA, NCSM, NMNH, and VMNH). **KAUA‘I:** 2 mi SE Lawa‘i, 22 May 1992, R.W. Baumann (NCSM); Hanapepe Val., 14 January 1994, N.L.H. Krauss (NMNH). **O‘AHU:** Sacred Falls St. Pk., 21 April 1994, R.W. Baumann (NCSM); and Sacred Falls Nature Trail, 4F, 8 December 1993, K. Buhlman (VMNH). Mānoa Valley, 10 April, 2 July 1922, S.C. Ball, Kalihi Valley, Kamehameha School Campus, 1928, E.H. Bryan. Along stream behind East-West Center, 4 July 1964, “T.S.” Tripler Army Medical Center, 12 September 1995, S.F. Swift. Honolulu, 13 April 1934, E.H. Bryan; May 1941, Y. Kondo. The following specific sites in Honolulu: home of W.R. Castle, 1916, A.P. Cooke; University of Hawai‘i Farm, 1927; University of Hawai‘i Campus, 18 February 1950, W. Schafer; Bishop Museum grounds, September 1972, A. Lester; Kalihi Valley, 16 November 1980, W.C. Gagné, 26 April 1973, F.G. Howarth, 1 July 1982, F.G. Howarth; Maunawili, 1015 Auloa Rd, horse manure pile, 15 September 1996, D. Peterson; Damon Estate, Moanalua Valley, under large, dry objects (rocks, wood, sheet metal, etc.), 25 May, 4 August 1973, D.L. Rambo (FSCA).

Remarks. With the abundance of exogenous species in the Hawaiian Islands and the intensity of sampling on the 5 major islands, it is surprising that *T. corallinus* is known only from 3 islands, and from only 2 samples each from Kaua‘i and Hawai‘i. Another trigoniuline that is common on Pacific islands, *Leptogoniulus naresi* (Pocock), surprisingly has not been encountered in a Hawaiian environment but should be expected on the largest islands, as 19 females were intercepted in quarantine at Honolulu on 19 April 1947 (specimens at NMNH) from the Philippines. A study on the global occurrences of both trigoniulines is in progress.

Acknowledgment

I thank Sabina F. Swift and Richard L. Hoffman, for loaning the Bishop Museum and VMNH specimens, respectively; Gordon Nishida, for advice on unpublished records; and Richard W. Baumann, Brigham Young University, for collecting the sample from Kaua‘i and donating it and one from O‘ahu to the NCSM.

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Addendum

As this paper was going to press, I discovered 3 samples of *Leptogoniulus naresi* at the National Museum of Natural History, Washington, D.C., that were intercepted at quarantine in the Hawaiian Islands. They suggest that this spiroboloid will soon inhabit the islands, if it does not already occur and has not yet been detected.

Material examined: O'AHU: Pearl Harbor, from Samar Island, Philippines, 20 March 1947. [ISLAND NOT SPECIFIED]: from Tafuna, Tutuila, American Samoa, 18 July 1948; from Manila, Luzon Island, Philippines, 19 April 1947.

Deletion of the Milliped *Vanhoeffenia tristriatus* (Attems) from the Hawaiian Fauna (Polydesmida: Dalodesmidae)

ROWLAND M. SHELLEY (North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, North Carolina 27626-0555, USA)

The milliped family Dalodesmidae exhibits a Gondwanan distribution pattern, occurring south of the equator in Chile, Argentina, southeastern Brazil, extreme southern Africa, Madagascar, Java, New Guinea, Australia, New Caledonia, and New Zealand (Hoffman, 1974, 1979, 1980). However, *Vanhoeffenia tristriatus* (Attems), a dalodesmid occurring in Natal province, South Africa, has twice been reported from the Hawaiian Islands (Attems, 1938, 1940).

This error results from Attems' studies (1928, 1934) on South African myriapods. According to Lawrence (1962), Attems had been sent the entire collection of the Natal Museum and had returned it prior to publishing the latter work, which appeared in October 1934. In December 1934, W.G. Rump, Caretaker of the Natal Museum, collected at Impolweni, a small railroad siding approximately 13 mi [20.8 km] northwest of Pietermaritzburg, and sent the material to Attems, who unknowingly mixed it with samples from Hawai'i and other Pacific Islands. Consequently, Attems (1938) described *tristriatus* in his study of Hawaiian myriapods; he also erected the genus *Pelmatotylus* to accommodate it and misspelled the locality as "Impolvani." Two years later, Attems (1940) transferred the species to *Gnomeskelus* Attems and cited "Hawai'i: Impolvani" as its locality. Recognizing that the milliped belonged to a South African group of dalodesmids, R.L. Hoffman in 1960 informed the specialist in that country, the late R.F. Lawrence, who resolved the confusion (Lawrence, 1962), although misspelling the specific name "*tristriatus*." Hoffman (1974) effectively transferred *triseriatus* to *Vanhoeffenia* Attems by placing *Gnomeskelus* in synonymy under this genus.

To my knowledge, *V. tristriatus* has not been cited from the Hawaiian Islands since 1940. The milliped is not included in Nishida (1994), which correctly implies that it does not occur there. However, it needs to be officially deleted to eliminate any possibility of confusion among future arthropod researchers. I therefore delete both *V. tristriatus* and the family Dalodesmidae from the Hawaiian fauna.

Acknowledgement

I thank R.L. Hoffman for advice on the relevant literature.

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Recent Records of the Landsnails *Amastra micans* (Pfeiffer) and *Laminella sanguinea* (Newcomb) (Pulmonata: Amastridae)

DANIEL CHUNG (Kapiolani Community College, Math/Science Department, 4303 Diamond Head Road, Honolulu, Hawai‘i 96816, USA) & VINCENT J. COSTELLO (Directorate of Public Works, Environmental Division, US Army Garrison Hawai‘i, Schofield Barracks, Hawai‘i 96857, USA)

The amastrid landsnails, a family of pulmonate gastropods endemic to the Hawaiian Islands, have been little investigated in recent years, and their biology is poorly known. Amastrids have been largely ignored by most biologists, and this along with their increasing rarity in the last few decades, has been responsible for their absence in the biological and conservation literature (with the exception of a few instances, e.g., Chung, 1986, 1996; Cowie *et al.*, 1995). As sightings of amastrids are rarely reported in the literature, we document here a recent occurrence of living *Amastra micans* (Pfeiffer, 1859) and *Laminella sanguinea* (Newcomb, 1854) in the Schofield Barracks area, O‘ahu, in 1996.

Amastra micans* (Pfeiffer)*Notable recent record**

Two adults were seen on 6 June 1996 (by DC) in the Wai‘anae Mountains west of Schofield Barracks. One adult was seen by the authors on 14 June 1996 in the same spot. This is the first reported occurrence of living *A. micans* since 1966 (The Nature Conservancy (TNC) of Hawai‘i Heritage database record).

Material examined: O‘AHU: Schofield Barracks Forest Reserve, to the south-east of Kolekole Pass, Wai‘anae Mountains, 14 June 1996 (D. Chung & V.J. Costello), 15 recently dead shells (the living snails were not collected) (BPBM Malacology 253681).

Laminella sanguinea* (Newcomb)*Notable recent record**

Six adults were seen (but not collected) on 6 June 1996 (by DC) in the same patch of

plants with the *Amastra micans*. Nine *L. sanguinea* were seen on 14 June 1996 (by DC and VJC) in the same spot. This is the first reported occurrence of living *L. sanguinea* since 1993 (TNC Hawai'i Heritage database record). The 1993 record was from an area about 4 km S of the sighting reported here.

Material examined: O'AHU: Schofield Barracks Forest Reserve, to the south-east of Kolekole Pass, Wai'anae Mountains, 14 June 1996 (D. Chung & V.J. Costello), 6 shells, some recently dead (the living snails were not collected) (BPBM Malacology 253682).

Both species of snails were living arboreally on *Freycinetia arborea* ('ie'ie), along with the native arboreal landsnails *Achatinella mustelina*, *Auriculella ambusta*, and *Philonesia* sp. Vegetation in the area included *Urera glabra* (*opuhe*) *Diospyros* spp. (*lama*), *Pisonia* sp. (*papala kepau*), *Nestegis sandwicensis* (*olapua*), and *Pouteria sandwicensis* ('*ala'a*'). Since these 2 extremely rare species of snails were found only in this very small area, for reasons of conservation, more detailed locality data are not given here, but are archived with the material (dead collected specimens only) at Bishop Museum.

More than 20 freshly dead *A. micans* (one rat eaten) and more than 10 freshly dead *L. sanguinea* (none rat eaten) were found dead at the site. More than 17 living and 25 freshly dead *Achatinella mustelina* were also found; 20 of the freshly dead were rat eaten.

Once common in Hawai'i, the amastrids (like most of the native Hawaiian landsnails) have become very rare today due to problems known to be or possibly affecting landsnails in general in Hawai'i, such as: rat predation; predation by the introduced carnivorous snail, *Euglandina rosea*; loss of habitat by spread of introduced weeds and other human-caused disturbances; and, perhaps, meteorological disturbances, like drought and elevated temperatures, possibly related to global warming. Rat predation is the only one of these possible causes of decline that has so far been demonstrated as a mortality factor for the amastrids (see e.g., Stokes, 1917). As rat predation leaves a distinct signature in the shell of eaten snails, this cause of mortality is easy to determine. Demonstration of the significance of any other causes of mortality requires further study.

Acknowledgments

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New Records of Nonindigenous Land Snails and Slugs in the Hawaiian Islands

ROBERT H. COWIE (Hawaii Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817-0916, USA)

Polygyridae

Polygyra cereolus (Mühlfeld, 1818)

New island records

This species was first recorded in the Hawaiian Islands in 1995, on O'ahu (Cowie 1996). It is native to Florida. It has now been recorded from the islands of Kaua'i and Hawai'i. The record from Hawai'i is from bedding plants in a horticultural retail outlet. The earlier record from O'ahu and the present record from Kaua'i are from domestic gardens. These records all suggest that it may have been imported with domestic plants from the US mainland and that it is being spread from island to island by the horticultural trade.

Material examined: **KAUAI:** Anini, seashore *Paspalum* lawn, 8 April 1997, 10 May 1997, L. Ishii (BPBM Malacology 252749, 253268); **HAWAI:** Kailua-Kona, Walmart Garden Store, on bedding plants, 30 July 1997, L. Hadway (BPBM Malacology 253300).

Ariophantidae

Parmarion martensi Simroth, 1893

Range extension

This semi-slug (carries a small shell, mostly covered by the mantle, and into which the body cannot be withdrawn) was first recorded in the Hawaiian Islands in 1996 from Kahalu'u on the windward side of the Ko'olau Range of O'ahu (Cowie, 1997). The present records suggest that it is established in the Kahalu'u area and extends its known distribution to the leeward side of the Ko'olau Mountains. The identification (B. Scott, pers. comm., 15 November 1996) remains provisional. The species was originally described from Cambodia, but, assuming correct identification, it has since been recorded from Taiwan, Singapore and American Samoa, probably distributed by human activities (Cowie, 1997).

Material examined: **O'AHU:** Kahalu'u, Pulama Road, Fong's Plantation, 16 March 1997, I. Santos-Bear (BPBM 252738); Mānoa Valley, Lyon Arboretum, 21 October 1997, J. Tuitele (BPBM Malacology 253434).

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First Record of the Reef Coral *Montipora turgescens* Bernard, 1897 in Hawai'i (Cnidaria: Anthozoa: Scleractinia)

S.L. COLES (Hawai'i Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817, USA)

During sampling conducted at Midway Atoll, Northwestern Hawaiian Islands in September 1997, it was noted that the dominant coral in shallow areas of the eastern

lagoon was a species not previously seen by the author in Hawai'i. This coral superficially resembled *Montipora flabellata* Studer, 1901, a species relatively common in the main Hawaiian Islands, but ranged from lavender to brown, rather than the distinctive cobalt blue coloration of *M. flabellata*, the color of the Midway *Montipora*. In addition, the growth form of its colonies was characteristically nodular rather than flat and encrusting. This coral comprised most of the sparse coral coverage in this area of the Midway lagoon, (coverage for all coral species was less than 20% of the available substratum). Other coral species in the area were *Pocillopora damicornis* Linnaeus, 1758, *Pocillopora meandrina* Dana, 1846, *Montipora capitata* (Dana, 1946) [= *M. verrucosa* (Lamarck, 1816)], *Porites lobata* Dana, 1846, *Pavona duerdeni* Vaughan, 1907, *Cyphastrea ocellina* Dana, 1846, and *Leptastrea purpurea* Dana, 1846. These species were all in low abundance at Midway, but are well represented in the main Hawaiian islands.

***Montipora turgescens* Bernard, 1897**

New state record

Samples of the coral identified by Dr. J.E. Veron as *Montipora turgescens* Bernard, 1897. This species was not previously reported in coral listings for the Hawaiian Islands (Vaughan, 1907; Maragos, 1977, 1995; Grigg, 1983; Wells, 1982). The species was originally described by Bernard from specimens obtained on the Great Barrier Reef, and published records include reports from the Red Sea, northeast Indian Ocean, eastern Australia, south China Sea, and southern Japan (Sheer & Pillai, 1974; Eguchi & Miyawaki, 1975; Zou, 1975; Veron & Wallace, 1984, Shirai & Sano, 1985, Tribble & Randall, 1986; Nishihara, 1988; Antonius *et al.*, 1990; Chou & Yamazato, 1990; Veron, 1992; Woesik, 1995) and south and west to the Kermadec islands north of New Zealand (Vaughan, 1917). Veron (1993) listed numerous locations for this species throughout the central Indo-Pacific to the southern islands of Japan and eastward in the South Pacific to the islands of Samoa and French Polynesia. More recent observations extend its northeastern distribution to the Caroline and Phoenix Islands (Veron, pers. comm.). The closest reports of this species to Midway are thus over 3500 km to the west and southwest.

Midway Atoll (28°N) is one of the most remote and northern locations in the Pacific that supports coral growth, which raises the question of the origin of the source of this species for the atoll. The most likely origin by natural colonization is Japan, with planulae having been transported eastward on the North Pacific current. *Montipora turgescens* occurs in Japanese waters as far north as 34°N (Tribble & Randall, 1986) and has been observed to spawn at 32°N (van Woesik, 1995), suggesting a ready source of colonizing larvae from this area. As an alternative to natural transport by currents, *M. turgescens* may have been transported to Midway in the last century as hull fouling or in ballast water of ships utilizing the Midway harbor. The introduction of a hardy coral species by ship transport from the temperate coast of South America to the waters of the western Mediterranean (Zibrowius, 1992) and its extension into the eastern Mediterranean has recently been documented (Bitar & Zibrowius, 1997).

Material examined: MIDWAY: 3 small colonies, "Reef Hotel" eastern Midway Atoll lagoon, 1 m depth, 9 September 1997, S.L. Coles (BPBM SC3970).

Acknowledgments

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New Records of Crabs in Hawai'i (Crustacea: Decapoda: Brachyura)

PETER J.F. DAVIE (Queensland Museum, P.O. Box 3300, South Brisbane 4101, Queensland, AUSTRALIA)

Collections of crabs made over the past several years by underwater photographers and naturalists John Hoover, Ron Holcom and Darrell Takaoka, were sent to me for identification. While the Hawaiian fauna has been thought to be relatively well known through the works of Rathbun (1906) and Edmondson, it is apparent that careful collecting will still be rewarded. Besides the new records of crabs reported here at least 2 new species have been discovered that will be the subject of a separate report. Voucher specimens are deposited in the collections of the Queensland Museum, Brisbane (QM) and the Bishop Museum (BPBM).

Brachyura: Dromiidae***Cryptodromiopsis plumosa* (Lewinsohn, 1984) New state record**

This species was moved into *Cryptodromiopsis* from *Dromidia* by McLay (1993). It is a female specimen (10.5 mm carapace breadth). The female was previously unknown and its morphology confirms its generic placement. It was identified by Dr C. McLay, University of Canterbury and will be described further as part of revisionary studies he is undertaking.

There are only 2 previous records from widely separated localities: the Seychelles (type locality), and the Chesterfield Reefs, west of New Caledonia. The present specimen extends its range considerably.

Material examined: O'AHU: Palea Pt, 11 July 1996, J. Hoover (QM-W21890).

Brachyura: Portunidae***Charybdis (Gonioinfradens) paucidentata* New state record**

(A. Milne Edwards, 1861)

It is the only species to have only 4 primary anterolateral teeth with usually 2 very small subsidiary teeth. Poupin (1994) has provided a color photograph of specimens of this species from French Polynesia. Previously recorded in the Indian Ocean from Mauritius (type locality) to the Persian Gulf, and in the Pacific Ocean from Japan and the Marquesas, French Polynesia. This apparent disjunct distribution is probably an artefact of collecting as it also occurs at Lady Elliot Island at the southern end of the Great Barrier Reef (QM collection).

Material examined: MAUI: 27 October 1997, G. Paulay (BPBM S11363).

Brachyura: Grapsidae***Pachygrapsus fakaravensis* (Rathbun) New state record**

Pachygrapsus fakaravensis is immediately recognizable by the deep transverse striations lined with close-set setae, the presence of setae along the longitudinal striations on

the outer face of the chela, and the subparallel lateral borders of the carapace. Being a relatively large intertidal species it is certainly interesting that this species has not been previously recorded and is grounds for speculation that it may have only recently become established. Previously recorded from French Polynesia (type locality is Paumotu [= Tuamotu]), and Japan (Poupin, 1994).

Material examined: O'AHU: Barber's Point Harbor, on rocks in splash zone, 21 December 1996, D. Takaoka (QM-W21943).

Brachyura: Grapsidae

***Nanosesarma minutum* (de Man, 1887) New state record**

Two females (4.0, 4.6 mm carapace breadth) of this small species were recently found in Pearl Harbor. They represent the first record for this genus not only for Hawai'i, but for the central Pacific region. *Nanosesarma* is most easily recognized from other Sesarminae by the presence of a serrated infero-distal margin on the meri of the walking legs. *Nanosesarma gordonii* (Shen), known from Hong Kong and Japan in the north Pacific, is indistinguishable from *N. minutum* and I consider it to be a junior synonym. The case for this will be argued more fully in revisionary work currently being conducted.

This species lives in fouling and amongst oysters, etc. in the intertidal and shallow subtidal zones of sheltered shores. It is common around major shipping ports such as Hong Kong and Singapore. Its new discovery in Hawai'i, so far outside its known distribution, suggests that it may have been introduced to these waters via larvae in ballast water, or as adults in fouling on ship's bottoms.

Material examined: O'AHU: Pearl Harbor, Stn. 7, Middle Loch Channel, February 1996, S.L. Coles & R. DeFelice (BPBM Unreg.).

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Hawaiian Porcelain Crabs (Crustacea: Decapoda: Porcellanidae)

ALAN W. HARVEY (Department of Invertebrates, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024, USA)

Porcelain crabs are characteristic members of rocky intertidal and coral reef communities worldwide. They are abundant but often inconspicuous, hiding under rocks and in crevices; many species are commensal with other organisms, especially corals, echinoderms, burrowing polychaetes, and hermit crabs. With more than 200 species described from the Indo-West Pacific and eastern Pacific regions, it seems surprising that only 3 species have been recorded from Hawai'i: *Petrolisthes coccineus* (Owen, 1839), *Pachycheles pisoides* (Heller, 1865), and *Pachycheles attaragos* Harvey & De Santo, 1997. Whereas the first 2 species are widely distributed throughout the Indo-West Pacific, *P. attaragos* is so far endemic to the Hawaiian Islands. Because so little is known about the occurrence of *P. attaragos* within the Hawaiian Islands, and because the Hawaiian porcelain crab fauna is very likely to include more than the 3 species currently reported, I here provide brief diagnoses and color notes (so far as known) for these species. The primary purpose of these diagnoses is not to separate these species from each other (they are readily distinguishable) but rather to alert investigators to potential new additions to the Hawaiian porcelain crab fauna. That is, any specimen that does not closely match any of these diagnoses probably represents a new species for Hawai'i. Specimens examined for this report came from Bishop Museum, Honolulu, Hawai'i (BPBM), American Museum of Natural History, New York, New York (AMNH), and Museum of Comparative Zoology, Cambridge, Massachusetts (MCZ).

Petrolisthes coccineus (Owen, 1839)

Hawaiian material examined: O'AHU: 2 males, 1 female, Hanauma Bay (AMNH 17623); 2 males, 1 female, Kailua (AMNH 17624).

Diagnosis: Carapace approximately as long as broad, with lateral margins convex; anteriorly with distinct transverse rugae, interrupted medially, rugae fringed anteriorly with minute setae; front of carapace between eyes narrowly triangular, lacking tuft of setae; carapace with both supraorbital and epibranchial spine; lateral wall of carapace consists of one large piece. Chelipeds subequal in size; carpus approximately twice as long as broad; anterior margin with 3–4 strong, acute teeth, terminating in strong, forward-pointing spine; manus with posterior margin armed with open row strong, forward-pointing spines (reduced in very large specimens), dorsal surface with slightly elevated longitudinal ridge denticulate granules to base of dactyl, surface posterior to ridge with scattered, rounded spines (reduced in large specimens) obscured by short plumose setae, surface anterior to ridge with very low granules, each with fringe minute non-plumose setae. Carpus of first walking leg with anterodistal spine; merus of first and second walking legs with 8–10 strong spines on anterior margin, 2 spines at posterodistal angle. Abdomen setose. Telson divided into 7 plates.

Coloration: Miyake (1978) described *P. coccineus* from Japan as having a reddish brown carapace with greenish blue lateral walls. However, Kropp & Haig (1994) reported that *P. coccineus* from Guam has a pale blue-green carapace with yellow-orange markings on the gastric region and a blue-green cheliped manus with a distinctive orange longitudinal crest and yellow-orange outer margin. Edmondson (1946) noted that *P. coccineus* from Hawai'i is red.

Distribution in Hawai'i: Recorded from Maui and O'ahu; typically shallow water.

Remarks: The name *Petrolisthes coccineus*, as currently understood, quite possibly refers

to more than one species across its extensive range. The description and illustration of *P. coccineus* from Japan by Miyake (1978) differ considerably from those of Kensley (1970) for Mozambique specimens, as does the coloration reported by Miyake (1978) and Kropp & Haig (1994). Hawaiian specimens of *P. coccineus* differ from previous descriptions in two key respects: the lateral margins of the carapace are convex rather than strongly diverging posteriorly, and the carpus of the chelipeds is only about twice as long as broad. In addition, the setation and armature of the cheliped manus of Hawaiian specimens does not match prior descriptions or illustrations very well. Whether Hawaiian specimens are in fact conspecific with the nominate *P. coccineus* remains uncertain pending a comprehensive comparison of specimens across the putative range of the species.

***Pachycheles pisoides* (Heller, 1865)**

Hawaiian material examined: Over 400 specimens in 17 cataloged and 21 uncataloged lots from the BPBM collections, mostly from O'ahu and Maui. Largest cataloged lots: O'AHU: 40 specimens, Kahala (S3195); 33 specimens, Kawela Bay (S4314); 25 specimens, Kawela Bay (S3815); 24 specimens, Maili Point (S6054).

Diagnosis: Carapace broader than long, with lateral margins convex, with scattered short setae, most noticeable on anterior half; front of carapace between eyes truncate in dorsal view, lacks tuft of setae; carapace lacks both supraorbital and epibranchial spine; lateral wall of carapace consists of one large anterior piece and one moderately large posterior piece. Chelipeds noticeably unequal in size, covered with stiff bristles of varying length; carpus of chelae about as long as broad; anterior margin with 3–4 strong teeth, with convex, serrate margins. Merus of walking legs unarmed on anterior margin and at posterodistal angle. Abdomen glabrous to sparsely setose. Telson divided into 5 plates.

Coloration: Nakasone & Miyake (1968) reported that *P. pisoides* from Japan has a gray to yellow-orange carapace, sometimes with a median longitudinal white stripe. No information is available on the coloration of *P. pisoides* from Hawai'i.

Distribution in Hawai'i: Recorded from O'ahu, Maui, French Frigate Shoals, and Midway; typically associated with coral reefs in shallow water.

Remarks: Specimens of *P. pisoides* from the Indian Ocean differ from Hawaiian specimens in that the carapace is more uniformly covered with scattered long and short stiff bristles, whereas the chelipeds are less densely covered with such bristles; the carpus teeth are relatively shorter and broader, and the antennae is more heavily sculptured. Because *P. pisoides* has such an extensive geographic range, more detailed study is required to determine whether specimens from Hawai'i are specifically distinct from the Indian Ocean specimens.

***Pachycheles attaragos* Harvey & de Santo, 1997**

Hawaiian material examined: 2 males, no specific locality (MCZ 11851a [= holotype], MCZ 11851b [= paratype]).

Diagnosis: Carapace slightly longer than broad, with lateral margins parallel, dorsal surface punctate, almost smooth; front of carapace between eyes broadly triangular in dorsal view, with tuft of setae; carapace lacks both supraorbital and epibranchial spine; lateral wall of carapace consists of one large anterior piece and one very small posterior fragment. Chelipeds subequal in length, with major noticeably deeper than minor; carpus of chelae about as long as broad, with a single broad, angular lobe on proximal half of anterior margin. Merus of walking legs unarmed on anterior margin and at posterodistal angle. Abdomen sparsely setose. Telson divided into 5 plates.

Coloration: No information available.

Distribution: No information available.

Remarks: Despite its recent description, this is one of the least known members of the Porcellanidae; only 2 small males have been recorded, and these were collected over 130 years ago, with minimal locality data and no depth or habitat data. Thus, any new records would be particularly valuable.

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New Records of Namanereidinae (Polychaeta: Nereididae) from Hawai'i

CHRISTOPHER J. GLASBY (National Institute for Water & Atmospheric Research, PO Box 14-901, Kilbirnie, Wellington, New Zealand), M. ERIC BENBOW, ALBERT J. BURKY (Department of Biology, University of Dayton, 300 College Park, Dayton, Ohio 45469-2320, USA) & CARL M. WAY (Barry A. Vittor and Associates, 8060 Cottage Hill Rd., Mobile, Alabama 36695, USA)

Namanereidinae are one of the most successful marine invertebrate groups to have radiated into freshwater and semiterrestrial environments, but for most places the namanereid fauna remains poorly documented. Hawai'i is no exception with the description of *Lycastis hawaiiensis* (now *Namalycastis*) by Johnson (1903) representing the only record of an Hawaiian namanereid in the taxonomic literature. More common are reports of namanereid species in faunal synopses, checklists (e.g., van Zwaluwenburg, 1948; Brock & Brock, 1974; Maciolek & Brock, 1974; Bailey-Brock, 1987). All but one of these literature records can be assigned to *Namalycastis hawaiiensis*; the record of *Namalycastis* sp. by Maciolek & Brock (1974: 63) represents both *N. hawaiiensis* and

Namanereis littoralis. Collecting trips to several islands in the Hawaiian group in January and February, 1987 (CJG) and in May–July 1995 (MEB, AJB, CMW) yielded an additional species of each genus, *Namalycastis abiuma* and *Namanereis amboinensis*, and new island records for the 2 previously known species.

Comprehensive descriptions, full synonymies and justification for the generic placements of species reported herein can be found in Glasby (in press). Details of collecting localities at Kiholo Bay and Anaehoomalu (Hawai‘i) are available in Maciolek & Brock (1974). Abbreviations used in this note are as follows: AM, Australian Museum, Sydney; BPBM, Bishop Museum, Honolulu; HZM, Zoologisches Institut und Museum, Universität Hamburg, Hamburg; UH, University of Hawai‘i at Mānoa, Honolulu (collection of J. Bailey-Brock); BV, Barry A. Vittor Environmental Consulting, Mobile, AL.

Polychaeta: Nereididae: Namanereidinae

Namalycastis abiuma (Grube, 1872)

New state record

Namalycastis abiuma (Grube, 1872): *Lycastis* [syn. *Lycastis meraukensis* Horst, 1918; *Lycastis nipae* Pflugfelder, 1933; *Lycastis vivax* Pflugfelder, 1933; *Namalycastis meraukensis zeylanica* Silva, 1961; *Namalycastis rigida* Pillai, 1965]

A common namanereid of the supralittoral zone of mud flats in the tropics and subtropics around the world, often associated with mangroves and decaying vegetation such as *Nipa* palms, coconut husks and *Enteromorpha* overlying mud flats. On Moloka‘i the species was found in mixed gravel and detritus along the stream edge at 8–9 m elevation. This is the first record of the species in Hawai‘i. The species referred to by Brock & Brock (1974) and Bailey-Brock (1987: 297-298) as *Namalycastis abiuma* is probably *N. hawaiiensis*.

Material examined: **MOLOKA‘I**: Pelekunu Str., near mouth, 7/19/95 2(BV). *Namalycastis hawaiiensis* (Johnson, 1903: *Lycastis*) [syn. *Lycastis ranauensis* Feuerborn, 1931]

The most abundant freshwater namanereid species in Hawai‘i. Johnson’s syntypes of *Lycastis hawaiiensis* are thought to be lost, and a neotype has been designated (Glasby, in press). The following collection represents new island records for Kaua‘i, Moloka‘i and Maui. The species was previously known from 2 localities on O‘ahu, a spring near Honolulu (Johnson, 1903) and the Ewa Plantation (van Zwaluwenburg, 1948) and on the Kona coast of Hawai‘i (Brock & Brock, 1974; Maciolek & Brock, 1974). In Hawai‘i the species occurs in mud to muddy-sand sediments of streams, swamps, aquaculture ponds and on the Kona coast in closed coastal anchialine ponds; preferred salinities range from fresh to very slightly brackish. *Namalycastis hawaiiensis* is often associated with leaf litter, under stones, coconut husks and under the bark of floating wood in areas of heavy nutrient load together with talitrid amphipods, the oligochaete *Branchiura sowerbyi* Beddard and other unidentified oligochaetes (BV). The species also occurs in east Asia (Hong Kong, Ryukyu Is.), South-east Asia (Sumatra and Java) and the western Pacific (New Guinea; Palau Islands, Guam).

Material examined: **O‘AHU**: Mānoa Str. at Dole Street bridge, mud and detritus, 2/2/87 (neotype, AM); Mānoa Str., 2/2/87, 22(AM), 6(AM), 1(AM), 1(UH); He‘eia Str., 1/31/87 10(AM), 2(AM); Kahana Str., 1/24/87, 14(AM); Ewa 1(HZM P14369); Ewa Plantation, 3/28/47 1(BPBM R334), 4/2/47, 7(BPBM R333); Kamehameha Farm [Hawai‘i Kai], June 1931, 1(BPBM unreg.); Kaluanui Str., 103 m, upstream of several cascades, 7/26/95, 3 (BV). **KAUAI**: stream near Niūmalu Park 18 (AM); Wailua River, 67 m above Wailua Falls, 7/25/95, 2 (BV). **HAWAII**: Kiholo Bay ponds, 2/7/87, E14, 9(AM), E17, 6(AM), F1, 5(UH), F3,F5, 3(UH); Lower Kiholo Bay ponds,

2/7/87, 13(AM), Hakalau, c. 75 m upstream of mouth, 3–4 m, 7/22/95, 2 (BV). **MOLOKA'I**: Waikolu Str., near mouth (upstream of a small dam), 9 m, 7/19/95, 2(BV), upstream of several cascades, 240 m, 6/14/94, 4(BV); Wailau Str., near mouth, 5 m, 7/19/95, 2(BV); **MAUI**: Palauhulu Str., above several waterfalls, 45 m, 7/10/95, 1(BV); Honokohau Str., near mouth, 3 m 6/24/95, 9(BV), Makamaka'ole Str., upstream of several waterfalls, 226 m, 5/29/95, 4(BV); Waihe'e Str., near mouth, 6/26/95, 2(BV).

***Namanereis amboinensis* (Pflugfelder, 1933) New state record**

Namanereis amboinensis (Pflugfelder, 1933): *Lycastopsis* [syn. *Lycastopsis tecolutlensis* Rioja, 1946]

This species is found in the upper littoral zone of mangroves (together with *Namanereis littoralis*) and under the bark of logs floating in fresh-brackish water (together with talitrid amphipods and *Namalycastis hawaiiensis*). It is widely distributed in the upper littoral zone throughout the tropics and subtropics.

Material examined: **O'AHU**: He'eia Str., 1/31/87 13(AM), 4(AM), 12(AM), 2(AM).

***Namanereis littoralis* (Grube, 1872) New island record**

Namanereis littoralis (Grube, 1872): *Lycastis* [syn. *Lycastopsis beumeri* Augener, 1922; *Lycastopsis augeneri* Okuda, 1937]

A cosmopolitan species previously reported from open ponds on the Kona Coast, Hawai'i (as *Namalycastis* sp.) by Maciolek & Brock (1974: 63). The present material extends its Hawaiian distribution to O'ahu where it occurs behind the mangrove (*Rhizophora*) zone in muddy sand with surface detritus together with the more numerous species *Namanereis amboinensis* (Pflugfelder). On the Kona coast of Hawai'i the species occurs in anchialine ponds under stones at the waters edge.

Material examined: **HAWAII**: near Anaeho'omalu Bay 1+1 specimen gold coated for SEM (AM); Anaeho'omalu Str., 2/6/87, pond D5, 10(UH). **O'AHU**: He'eia Str., 1/31/87, 2(AM).

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Correction

An overlooked naturalized aroid for the Hawaiian flora. 1997. G.W. Staples & K.R. Woolliams, *Bishop Mus. Occas. Pap.* 49: 13-16.

After publication of this article, in which we stated that *X. roseum* appeared not to have been vouchered prior to 1990, one of us (GS) discovered that several Hawaiian *Xanthosoma* specimens from BISH were on loan to the Royal Botanic Gardens, Kew. Therefore, it is possible that specimens of *X. roseum* collected prior to 1990 exist, but it will only be possible to ascertain this when the loan is returned.

—G.W. Staples
Hawaii Biological Survey
Bishop Museum