Preliminary Report on Oribatid Mite (Acari: Oribatida) Diversity in the Hawaiian Islands[1]

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Introduction

Past and present studies of the terrestrial arthropods of the Hawaiian Islands focus almost entirely on endemic, large and attractive organisms, and these are often core taxa in assessing selected ecosystems (e. g., Odonata in aquatic systems; Polhemus, 1993). By contrast, mites—particularly those living in soil and related microhabitats—have been largely ignored, probably due to their small size, hidden existence, and generally poor level of taxonomic knowledge. This paper is intended to draw attention to the soil fauna by presenting many new distributional records and a preliminary catalogue of one such group, the oribatid mites (Acari: Oribatida).

Often called "beetle mites," because of their commonly rounded shape and dark, hard and shiny exoskeleton, oribatid mites are usually the most abundant and diverse arthropods in temperate forest soils, and the same seems true in subtropical environments. Densities of $10^5/m^2$, and within-habitat faunas surpassing 100,000 are commonly reported (see references in Norton, 1994; Travé *et al*., 1996).

As known for half a century, the importance of these organisms in ecosystem energy and nutrient dynamics is mostly indirect, and lies in their relationships with decomposer microorganisms (Wallwork, 1983; Seastedt, 1984). Direct consumption of fungal biomass and the comminution of dead structural material of higher plants are their most influential trophic activities, and resulting fecal pellets can contribute significantly to soil microstructure (Bal, 1982; Pawluk, 1985). While the presence of oribatid mites outside soil systems has long been known (they are sometimes called "moss mites" due to high densities in this substrate), their diversity in arboreal microhabitats, especially in warm climates, is only now becoming appreciated (Walter & O'Dowd, 1995).

Worldwide, oribatid mites are being increasingly examined as bioindicator taxa in a variety of contexts. Their high density and diversity, combined with various levels of environmental sensitivity, make them excellent candidates for assessing ecosystem perturbation and recovery (e.g., Dindal, 1975; Aoki, 1979; Norton & Sillman, 1985; Cancela da Fonseca, 1990; Kehl & Weigmann, 1992; Lebrun & van Straalen, 1995). They have become increasingly important in studies of paleobiology, especially as Pleistocene subfossils (Krivolutsky & Druk, 1986; Erickson, 1988), and have been successfully used as environmental indicators in archaeology (Schelvis, 1990).

Studies on the Hawaiian oribatid mite fauna began a century ago, but have progressed rather little in that time. The first mites recorded from the Hawaiian Islands were the nine species noted by Pearce (1910); the specimens were collected from 1892–1901 by Robert C.L. Perkins when the British Association for the Advancement of Science sent him to survey the fauna of the Hawaiian Islands (Manning, 1986). After having described four Hawaiian species in 2 papers (Jacot, 1928, 1929), the American acarologist Arthur Jacot (1934) produced the first substantive monograph on Hawaiian oribatid mites. In it, he reassessed some of Pearce's species records and proposed five new genera, 19 new species and 5 new subspecies. These were based on material from the 1923 *Tanager* Expe-

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dition and other specimens at the Bishop Museum, material he collected himself on O‘ahu in 1926, and other miscellaneous material. Jacot also speculated extensively on the origin of this fauna. His 1934 paper became a touchstone for the few additional studies of Hawaiian oribatid mites during the next 6 decades (e.g., Newell, 1956; Butler & Usinger, 1963; Aoki, 1964, 1966; Sengbusch & Sengbusch 1984; Niedbala, 1994; Swift & Norton, 1995). Published faunal lists that include oribatid mites are those by Garrett & Haramoto (1968; 18 families, 37 genera), Goff (1987: 22 families and 37 genera) and Nishida (1997; 30 families, 65 genera).

The present paper has two principal goals. First, we report new species and genus records that add substantially to the known oribatid mite fauna of the Hawaiian Islands. The value of the generic records is limited, but we hope that they attract the attention of specialists who can further study the material. Second, we summarize current knowledge of the distribution of genus- and species-group taxa among the various islands and discuss aspects of faunal origin.

Methods

Most of the new records derive from studying previously collected material preserved in the Bernice P. Bishop Museum. The bulk of these are collections from the main high islands of Hawai‘i, Maui, Moloka‘i, Kaho‘olawe, Lāna‘i, O‘ahu, and Kaua‘i. Smaller numbers of samples from Midway, French Frigate Shoal, Laysan, Pearl and Hermes and Nihoa of the Northwestern Hawaiian Islands were also examined. Most specimens had been collected using modified Tullgren-Berlese funnel extractors, but some came from a transect of pitfall traps on Mauna Loa, Hawai‘i, by the staff of Island Ecosystems Integrated Research Program/International Biological Program Hawai‘i Project (IRP/IBP) in 1970–1973. Collections in Kaua‘i were primarily conducted (by S. F. Swift) at Hono O Na Pali and Kuia Natural Area Reserves (NAR), both high elevation mesic habitats with old growths of *Metrosideros polymorpha* and *Acacia koa* and other native plants. All but a few specimens are housed in the Acarology Collection of the J. Linsley Gressitt Center for Research in Entomology, at the Bishop Museum. Several new records derive from samples of washed sand collected by R.A. Norton during field work supported by the Field Museum, Chicago.

Number of specimens refer only to those which were removed from the original samples and stored separately. No relationship to relative density should be assumed and, for most taxa, many specimens remain unsorted. The following are abbreviations for collector’s names: AEE = Andrew E. Engilis; AZ = Allan Ziegler; BR = Barbara Roth; CHS = Craig H. Sengbusch; DMA = D. M. Allred; FGH = Francis G. Howarth; FH = Frank Haramoto; FJR = Frank J. Radovsky; FXW = Francis X. Williams; GMN = Gordon M. Nishida; HSD = H. S. Dybas; IMN = I.M. Newell, JJ = Jim Jacobi; JMT = JoAnn M. Tenorio; JS = John Strazanac; KA = Keith Arakaki; LH = Larry Nakahara; MLG = M. Lee Goff; NLE = Neal L. Evenhuis; OHS = Otto H. Swezey; RAN = Roy A. Norton; RCR = Robin C. Rice; RCLP = Robert C.L. Perkins; RR = Robin Rathman; SFS = Sabina F. Swift; SLM = Steven L. Montgomery; TP = T. Parman; VR = Vincent Roth; WCG = Wayne C. Gagné; WDP = William D. Perreira; WMG = W. M. Giffard; WW = Warren Wagner.

For the convenience of users, the classification and order of entries for both new records and the island-specific distribution list mostly follows Balogh & Balogh (1992), which was also the source for generalizations on distribution of newly recorded genera; this is the most current comprehensive general source on the identification and distribution of oribatid mites. In some cases, taxonomic or distributional remarks are included with new records.

SUPERCOHORT PALAEOSOMATA

CTENACAROIDEA
CTENACARIDAE

Ctenacarus araneolus (Grandjean, 1932) **New island records**

Originally described from Morocco, this Holarctic species was first reported on Mt. Ka‘ala, O‘ahu at 500 m elevation (Swift & Norton, 1995). This delicate species seems to prefer the xeric habitats. The genus *Ctenacarus* is cosmopolitan in distribution (Balogh & Balogh, 1992).

Material examined: **KAHO‘OLAWE**: Smuggler’s Cove, 9.xi. 1979, ex *kiawe* duff & grasses (MLG), 1 specimen. **MIDWAY**: Sand I: litter under *Casuarina*, Berlese, 18.ii.1997 (GMN), 2 specimens. **NIHOA**: Top of E. Palm Valley, nr. Miller Peak, 28,vi.1990, ex *Eragrostis* litter, (JS), 1 specimen. **O‘AHU**: Mt. Ka‘ala, ca. 500 m, *Casuarina* litter, 10.x.1989 (SFS), 1 specimen. Mariner’s Ridge, 200 m, on *Eragrostis variabilis*, 3.vi.1990 (JS), 1 specimen.

APHELACARIDAE

Aphelacarus sp. **New island records**

The first Hawaiian report of this genus was from Kaho‘olawe (Sengbusch & Sengbusch, 1984), identified as a new species. According to Balogh & Balogh (1992), *Aphelacarus* has a Holarctic distribution.

Material examined: **KAHO‘OLAWE**: Smuggler’s Cove, 9.xi.1979, ex kiawe duff & grasses (MLG), 1 specimen. NE Hakioawa Pt., 3.iii.1981, *Atriplex semibaccata* grass and litter (CS), 1 specimen. Same data except *Chloris virgata* grass & litter, 3 specimens. **KAUA‘I:** Koke‘e State Park, Hono O Na Pali NAR, 1300 m, *Metrosideros* litter, 19.xi.1990 (SFS), 2 specimens. Same data except 1305 m, *Metrosideros* bark with moss, 1 specimen. **O‘AHU**: Kaena Point, 12.viii.1997, dry *Santalum* litter, on top of sand (SFS), 1 specimen.

SUPERCOHORT ENARTHRONOTA

HYPOCHTHONIOIDEA
HYPOCHTHONIIDAE.

Eohypochthonius sp. **New state record**

This is the first record of *Eohypochthonius* in the Hawaiian Islands. According to Balogh & Balogh (1992), *Eohypochthonius* has a cosmopolitan distribution.

Material examined: **KAUA‘I:** Koke‘e State Park, Pihea Trail, 1300 m, 27.v.1989, moss and litter (SFS), 1 specimen. Pu‘u O Kila Trail, 1270 m, 27.v.1989, fern litter (SFS), many specimens. Hono O Na Pali NAR, 1305 m, 18.ii.1991, *Metrosideros* litter with soil (SFS), 15 specimens. Same data except Pihea Trail, *Metrosideros* bark, 1 specimen. **MAUI:** Haycraft Park, Ma‘alea Bay, of Rt. 32, ca 3 mi NW Kihei, 3.xi.1992, ex sand in flat area above beach, among roots of grass and *Sesuvium portulacastrum* (RAN & SFS), 2 specimens. **O‘AHU:** Waimanalo Bay State Rec. Area, Rt. 22, 0.5 mi NW Waimanalo Beach, 24.x.1992, ex among roots and *Casuarina* litter in beach sand (RAN), 5 specimens.

Hypochthonius sp. **New state record**

This is the first record of *Hypochthonius* in the Hawaiian islands. According to Balogh & Balogh (1992), *Hypochthonius* has Holarctic, Australia/Pacific, and Oriental distribution.

Material examined: **HAWAI‘I:** Hawai‘i Volcanoes Nat. Park, east slope of Mauna Loa, 30 m E goat pen, 1981 m, 2.xi.1971, pitfall assoc. litter (JJ), 7 specimens. Same data except 1280–1341 m, 16.xi.1971, 8 specimens. Same data except 2.iv.1971, IBP, Berlese (FH & LH), many specimens. Same data except 28.ii.1971, many specimens. Volcano Village, wet *Metrosideros* litter, 1.vi.1997 (NLE), 2 specimens. **LĀNA‘I:** Lāna‘ihale Mt., ca 1000 m, 16.viii.1997, *Casuarina* litter (SFS), 6 specimens. **MAUI:** Olinda, Waihou Spring Trail, ca. 1200 m, 27.vi.1997 (SFS), 12 specimens.

PROTOPLOPHOROIDEA
PROTOPLOPHORIDAE

Cryptoplophora sp. **New state Record**

This is the first record of *Cryptoplophora* in the Hawaiian Islands and it seems to be limited to Moloka‘i. According to Balogh & Balogh (1992), this genus has Holarctic, Neotropical and Oriental distributions.

Material examined: **MOLOKA‘I**: Kaluakoi, 3–10 m, *kiawe* forest litter nr. beach, 24.v.1996, (WDP), 6 specimens.; Papio Stream, 180 m, 10.v.1996, soil/litter, Berlese (WDP), 3 specimens.

COSMOCHTHONIIDAE

Cosmochthonius sp. **New state record**

This is the first record of *Cosmochthonius* in the Hawaiian Islands. According to Balogh & Balogh (1992), *Cosmochthonius* has Holarctic, Neotropical, and Oriental distributions.

Material examined: **KURE**: soil under leaves, 6.5 m, 31.vii.1980 (CHS), 1 specimen. **O‘AHU**: Honolulu Police Dept., vacuum sample, flotation, 8.x.1980 (FJR & JMT), 2 specimens.

Phyllozetes sp. **New state record**

This is the first record of *Phyllozetes* in the Hawaiian Islands. *Phyllozetes* has a Holarctic distribution according to Balogh & Balogh (1992).

Material examined: **MIDWAY**: Sand I, NE of Frigate Pt, 28.viii–3.ix.1997, Berlese of *Casuarina* duff & soil under dead bird (GMN), 2 specimens.

HAPLOCHTHONIIDAE

Haplochthonius sp. **New state record**

This is the first record of *Haplochthonius* in the Hawaiian Islands. According to Balogh & Balogh (1992), *Haplochthonius* has Ethiopian, Holarctic, Neotropical, and Oriental distributions.

Material examined: **KAUA‘I:** Koke‘e State Park, Kuia NAR, Nualolo Trail, 890 m, 29.iv.1991, *Metrosideros* litter (SFS), 2 specimens. Hono O Na Pali NAR, off Pihea Trail, 1305 m, 19.xi.1990, *Metrosideros* leaves (SFS), 1 specimen. **O‘AHU:** Kaena Pt., dry *Santalum* leaf litter, 12.viii. 1997(SFS), 2 specimens.

PEDICULOCHELIDAE

Paralycus sp. **New state record**

This is the first record of *Paralycus* in the Hawaiian Islands. This genus has a cosmopolitan distribution (J.B. Kethley, pers. comm. 1997).

Material examined: **MAUI:** Haycraft Park, Ma‘alea Bay of Rt. 32, ca 3 mi NW Kihei, 3.xi.1992, ex sand in flat area above beach, among roots of grass and *Sesuvium portulacastrum* (RAN &SFS), 1 specimen.

SPHAEROCHTHONIIDAE

Sphaerochthonius suzukii Aoki, 1977 **New island records**

Sengbusch and Sengbusch (1984) first reported this species from Hakioawa, NE Kaho‘olawe from litter under kiawe scrub. The genus *Sphaerochthonius* is of cosmopolitan distribution (Balogh & Balogh, 1992).

Material examined: **KAHO‘OLAWE:** Beck’s cove, 3 m, 12.ii.1980, ex *Mus musculus* (MLG), 1 specimen. **MAUI:** Kipahulu Valley nr. Sacred Pools, 50–70 m, 28.v.1997; wet *Pandanus* & mis-

cellaneous tree litter (SFS), 14 specimens. **MIDWAY**: Sand I: 18.ii.1997, litter under *Casuarina*, Berlese (GMN), 2 specimens. **MOLOKA'I:** Kaluakoi, 3–10 m, kiawe forest litter nr. beach, 24.v.1996 (WDP), 6 specimens. Papio Stream, 180 m, 10.v.1996, soil/litter, Berlese (WDP), 12 specimens. **O'AHU:** Lualualei, Halona Valley, Camp 1460 m, 8.iv.1996, sifted soil/litter (SFS), 2 specimens.

BRACHYCHTHONIOIDEA
BRACHYCHTHONIIDAE

Eobrachychthonius sp. **New state record**

This is the first record of *Eobrachychthonius* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Hawaii Volcanoes Natl. Park, Mauna Loa Trail, 2438 m, lava tube just off trail, 27.ix.1971 (FGH & JJ), many specimens.

Liochthonius sp. **New state record**

This is the first record of this genus in the Hawaiian Islands. According to Balogh & Balogh (1992), *Liochthonius* has a cosmopolitan distribution.

Material examined: **KAUA'I:** Koke'e State Park: Kuia NAR, Nualolo Trail, 890 m, 29.iv.1991, *Metrosideros* litter with soil (SFS), 2 specimens. Hono O Na Pali NAR, Kalalau Trail, Waiahuakua Stream, 240 m, 4.ix.1991, on moss (SFS), 1 specimen.

Sellnickochthonius sp. **New state record**

This species is similar to *S. zelawaiensis* (Sellnick, 1928), a Holarctic species originally described from Weiswasser, Germany. According to Balogh & Balogh (1992), the genus *Sellnickochthonius* is of cosmopolitan distribution. This is the first record of *Sellnickochthonius* in the Hawaiian islands.

Material examined: **KAUA'I:** Koke'e State Park: Kawaikoi Stream Trail, edge of Alakai Swamp, 1061 m, grass litter and soil, 27.v.1989 (SFS), 1 specimen. Kuia NAR, Nualolo Trail, 890 m, 27.xi.1990, soil under *Metrosideros* (SFS), 2 specimens.

ATOPOCHTHONIOIDEA
PTEROCHTHONIIDAE

Pterochthonius angelus Grandjean, 1950 **New state record**

This is the first record of this species in the Hawaiian Islands. According to Balogh & Balogh (1992), *P. angelus* has Holarctic and Neotropical distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, Mauna Loa Transect, 2438 m, 16–17.vii.1972, soil under *Metrosideros* (FH & LN), 1 specimen. **KAUA'I:** Koke'e State Park, Hono O Na Pali NAR; 1300 m, 19.xi.1990, *Metrosideros* litter (SFS), 6 specimens. Same data except Pu'u O Kila Trail, 1270 m, 27.v.1989, fern litter, 13 specimens. Same data except 1305 m, 13.vii.1991, *Metrosideros* litter with soil, 2 specimens. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, moss, 15.vii.1989, (SFS), 1 specimen.

SUPERCOHORT PARHYPOSOMATA

PARHYPOCHTHONIIDAE

Parhypochthonius aphidinus Berlese, 1904 **New state record**

This is the first record of this species in the Hawaiian Islands. According to Balogh & Balogh (1992), *P. aphidinus* has a Holarctic distribution.

Material examined: **O'AHU:** Windward Coast, Hukilau Park on Rt 83, ca 1 mi N Laie Point, 28.x.1992, open area between thin ground cover of *Ipomea pes-caprae brasiliensis* and prostrate

grass, soil wash (RAN), 1 specimen. **MAUI:** West Maui, D.T. Fleming Beach Co. Pk., Rt. 30 (Honoapi‘ilani Hwy.), ca 1 mi N Kapalua, 1.xi.1992, stable sand under *Casuarina* litter, along tidal wash, 1.5 m above tide line, soil wash (RAN), 1 specimen.

SUPERCOHORT MIXONOMATA

ORIBOTRITIIDAE

Mesotritia sp. **New state record**

This is the first record of *Mesotritia* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has Ethiopian, Holarctic and Australia/Pacific distributions.

Material examined: **KAUA‘I:** Koke‘e State Park, Pihea Trail, 1300 m, 27.v.1989, wet soil & litter (SFS), 5 specimens. Kawaikoi Stream Trail, 1060 m, 27.v. 1989, moss on *Metrosideros* stump (SFS), 2 specimens .

Oribotritia sp. **New island records**

Oribotritia hawaiiensis (Jacot, 1928) and *O. pulla* Niedbala, 1997 are the 2 reported species from O‘ahu and Kaua‘i (Table 1). According to Balogh & Balogh (1992), this genus has a cosmopolitan distribution.

Material examined: **KAUA‘I:** Koke‘e State Park: Pu‘u O Kila Trail, 1270 m, 27.v.1989, *Metrosideros* bark with moss (SFS), 1 specimen. Mts. Waimea, v. 1894, (RCLP), 1 specimen. Koloa, 1 m, limestone quarry cave, dark zone, 5.vi.1973 (FGH & RCR), 3 specimens. **MAUI:** Kipahulu Valley, nr. sacred pools, 5–75 m, 28.v.1997, wet *Pandanus* & miscellaneous tree litter (SFS), 4 specimens. Iao Valley, 11.iii.1989, guava litter and soil, (SFS), 7 specimens. **MOLOKA‘I:** Kainalu, 27.vii.1927, 549 m, ex *Gouldia* (OHS), 10 specimens. 28.vii.1927, 914 m, *Smilax* (OHS), 1 specimen. 29.vii.1927 (OHS), 1 specimen. **O‘AHU:** Tantalus, 457 m, 4.ii.106 (WMG), 2 specimens. Mt. Ka‘ala, 1225 m, 9.iv.1970, ex moss & lichen on *Broussaisia*, *Arguta* & *Pelea* sp. (FJR), 12 specimens. Kane‘ohe Bay along Kamehameha Hwy, T. Churma’s yard, soil/litter, 19.vii.1997 (SFS), 2 specimens.

LOHMANNIOIDEA

LOHMANNIIDAE

Annectacarus sp. **New state record**

This is the first record of *Annectacarus* in the Hawaiian Islands. According to Balogh & Balogh (1992), *Annectacarus* has Ethiopian, Neotropical, Australia/Pacific and Oriental distributions. This species seems to be well established on Midway.

Material examined: **MIDWAY**: Sand I., 18.ii.1997, litter under *Casuarina*, Berlese (GMN), many specimens.

Cryptacarus sp. **New state record**

This is the first record of *Cryptacarus* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has Holarctic, Ethiopian and Oriental distributions.

Material examined: **O‘AHU:** Leeward Coast, Kea‘au Beach Co. Park, 2 mi N Makaha, on Farrington Hwy (Rt 93), 25.x.1992, small low open area between mesquite and other legumes, at top of low dune separating beach from highway, soil wash (RAN & SFS), 2 specimens.

Vepracarus sp. **New island record**

First recorded in Kaho‘olawe, on kiawe scrub litter (Sengbusch & Sengbusch, 1984), *Vepracarus* is now recorded from O‘ahu as well. According to Balogh & Balogh (1992), this genus has Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **O‘AHU:** Bishop Museum Grounds, soil under *Acacia*, 27.ii.1995 (SFS), 1 specimen. Tripler Army Medical Ctr, gully above Patterson Rd, soil under introduced trees, wet, shady, 24.viii.1995 (SFS), 4 specimens.

PERLOHMANNIOIDEA
PERLOHMANNIIDAE
Perlohmannia dissimilis (Hewitt, 1908) **New state record**

First record of *Perlohmannia dissimilis*, a Palearctic species, in the Hawaiian Islands. According to Balogh & Balogh (1992), the genus *Perlohmannia* has a Holarctic distribution.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, 28.ii.1971, IBP, Berlese (FH & LN), 3 specimens. Hilo-Volcano Rd (RT 11), 684 spd. mi, 1040 m, 17.vi.1970, moss from fallen trees, (MLG & FJR), 6 specimens.

EPILOHMANNIOIDEA
EPILOHMANNIIDAE
Epilohmannia sp. **New island records**

Epilohmannia cylindrica (Berlese, 1904) and *E. pallida pacifica* (Aoki, 1965) are the 2 recorded species from O'ahu and Laysan Islands (see Table 1). The genus *Epilohmannia* is of Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions (Balogh & Balogh, 1992).

Material examined: **KAUA'I:** Koke'e State Park: Kuia NAR, Nualolo Trail, 900 m, 29.iv.1991, soil, Berlese, (SFS), 1 specimen. **MAUI**: Kipahulu Valley, nr. sacred pools, 50–75 m, 28.v.1997, wet *Pandanus* & miscellaneous tree litter, (SFS), 3 specimens. **MIDWAY**: Sand I: 18.ii.1997, under *Casuarina*, Berlese (GMN), 9 specimens. **MOLOKA'I**: Kamakou Preserve, Pu'u Kolekole, 1204 m, along stream banks 6 m E cabin, 16.vii.1989 (SFS), 5 specimens. **O'AHU:** Tripler Army Medical Ctr., gully above Patterson Rd, soil under introduced trees, wet, shady, 24.viii.1995 (SFS), 2 specimens. Same data except soil under *Ficus* canopy, 3 m off stream, 13.iv.1995 (SFS), 1 specimen.

NEHYPOCHTHONIOIDEA
NEHYPOCHTHONIIDAE
Nehypochthonius porosus **New state record**
Norton & Metz, 1980

Previously known only from the mainland Atlantic and Gulf Coastal Plains (North Carolina to Texas), *N. porosus* is found on Kaua'i, O'ahu, Moloka'i, Lāna'i, Maui, and Hawai'i. The species seems to prefer high elevation, moist, pristine areas in the Hawaiian Islands. It can be found in large numbers, in all all stages of development.

Material examined: **HAWAI'I:** East slope of Mauna Loa, 28.ii.1971, IBP, Berlese (FH & LN), 4 specimens. Same data except 2.iv.1971, 1 specimen. Thurston Lava Tube, 1204 m, 12.ix.1972 (JJ), 1 specimen. **KAUA'I:** Koke'e State Park, Hono O Na Pali NAR, 1305 m, 18.ii.1991, *Metrosideros* litter (SFS), 3 specimens. Kawaikoi Stream Trail, 1060 m, 27.vi.1989, moss on *Metrosideros* stump (SFS), 2 specimens. Pihea Trail, 27.v.1997, ex moss on decaying log on ground (SFS), many specimens. Pihea Trail, ex *Metrosideros* litter and soil, 27.v.1997 (SFS), 1 specimen. **LĀNA'I:** Lana'ihale Summit, 1027 m, 18.viii.1997, moss on bark of *Leptospermum scoparium* (SFS), 13 specimens. **MAUI:** Above Maluhia Boy Scout Camp, 780 m, 11.iii.1989, soil/litter (SFS), 1 specimen. **MOLOKA'I:** Papio Stream, 180 m, 10.v.1996, soil/litter, Berlese (WDP), 1 specimen; Kamakou Preserve, Pu'u Kolekole, 1204 m, moss, 15.vii.1989 (SFS), many specimens. **O'AHU:** Mt Ka'ala bog, 1225 m, 25.x.1996, *Metrosideros* litter & soil (NLE), 1 specimen; Lualualei, Halona Valley, Camp 1, 460 m, 8.iv.1996, sifted soil/litter (SFS), many specimens.

SUPERCOHORT DESMONOMATA

CROTONIOIDEA
CAMISIIDAE
Camisia sp. **New state record**

This is the first record of *Camisia* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, 2440 m, 5.vi.1972, pitfall assoc. litter (JJ), 1 specimen. Same data except 2.x.1972, 10 specimens. Same data except 2286–23l6 m, 5.vi.1972, 11 specimens. Same data except 10.iv.1972, 6 specimens. Same data except Mauna Loa Trail, 2280 m, 20.x.1970, (MLG), 12 specimens. Same data except Mauna Loa Trail-Transect #1, 2500 m, 22.vii.1970, duff (FJR), many specimens. Mauna Kea Park Sta., 2819 m, 21.vii.1970, *Sophora* duff in fine soil (FJR), many specimens. **MAUI:** Haleakala Mt, Kalahaku Overlook, 2740 m, 28.xi.1992, *Andropogon* litter & dirt (SFS), 5 specimens.

Platynothrus sp. **New state record**

This is the first record of *Platynothrus* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, East slope of Mauna Loa, 1981 m, 13.xii.1972, pitfall assoc. litter (JJ), many specimens. Same data except 1890 m, 28.ii–1.iii.1972, pitfall, 1 specimen. Same data except 1280–1341 m, 16.xi.1972, pitfall assoc. litter, 12 specimens. Kīpuka Ki Weather Sta., 1220 m, 9.vii.1971, pitfall, 1 specimen. Same data except 14–16.ii.1972, pitfall, 5 specimens. Same data except 31.i–2.ii.1972, pitfall, 3 specimens. Same data except 7.iv.1972, pitfall assoc. litter, 14 specimens. Same data except 100 yds above marker for 38 Kīpuka Ki, pitfall, 31.i–2.ii.1972, 1 specimen. Mauna Loa Strip Rd. Weather Sta., 28.ii–1.iii.1972, pitfall, (FJR), 3 specimens. Same data except 1280–1341 m, 21–31.vii.1970, 1 specimen. Same data except 1890 m, 21–31.vii.1970, 1 specimen. Hakalau Forest Res., Transect 7, 2.vi.1996, soil under *Metrosideros* canopy, with roots (SFS), 12 specimens. **KAUA'I:** Koke'e State Park, Hono O Na Pali NAR, 1300 m, 9.xi.1990, *Metrosideros* litter (SFS), 1 specimen. Same data except Kuia NAR, Nualolo Trail, 990 m, 27.xi.1990, *Metrosideros* litter (SFS), 6 specimens. Same data except moss on *Metrosideros* bark 10 specimens. Same data except 900 m, 29.iv.1991, soil, Berlese, 12 specimens. **LĀNA'I:** Lāna'ihale Summit, Munro Trail, 1027 m, 16.viii.1997, moss & lichen on *Pittosporum confertiflorum* (SFS), 8 specimens. Lāna'ihale Mt, ca. 1000 m, 16.viii.1997, *Casuarina* litter (SFS), 4 specimens. Kaiholena Trail, ca. 800 m, 18.viii.1997, *Eucalyptus* leaf litter (SFS), 10 specimens. **MAUI:** E. Maui, Olinda, Waihou Spring Trail, 1200 m, 27.vi.1997, wet litter in pine forest (SFS), 5 specimens. W. Maui, above Maluhia Boy Scout Camp, 10.iii.1989, wet moss on *Metrosideros* (SFS), 1 specimen.

MALACONOTHRIDAE

Malaconothrus spp. (2) **New island records**

Hammer (1969) first recorded *Malaconothrus* in the Hawaiian Islands based on mainland interceptions of ground orchids that originated from Hawai'i (Hawaiian Islands). According to Balogh & Balogh (1992), *Malaconothrus* has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, Steaming Bluff Trail, vent #2, 29.vi.1971 (MLG), 7 specimens. Same data except 0.8 mi from Pk Hdqtrs, Crater Rim Rd, 1040 m, 21.x.1970, 1ft below surface of vent #8, 38˚C, 11 specimens. Same data except IBP test plot, trail along edge, 1400 m, 4 specimens. Same data except Park Hdqtrs, 25.iv.1971 (FJR), many specimens. **KAUA'I:** Koke'e State Park, Pihea Trail, 1300 m, 27.v.1989, moss & litter (SFS), 8 specimens. Hono O na Pali NAR, 1300 m, 19.xi.1990, *Metrosideros* bark with moss (SFS), 15 specimens. Same data except 1305 m, 18.ii.1991, *Metrosideros* litter, 2 specimens. Same data except Kuia NAR, Nualolo Trail, 890 m, *Metrosideros* leaves, Berlese, 29.iv.1991 (SFS), 1 specimen. Same data except 1000 m, *Metrosideros* bark, 1 specimen. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, moss along stream banks 6 m E cabin, 16.vii.1989 (SFS), 1 specimen. Kawela, Lualolo Cave, 1200 m, 6.i.1981, deep zone (FGH & WCG), 6 specimens. **O'AHU:** Mānoa Falls, 25.vii.1970, ex moss (MLG), many specimens, 2 species.

Trimalaconothrus sp. **New state record**

This is the first record of *Trimalaconothrus* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has a cosmopolitan distribution.

Material examined: **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, 15.vii.1989, moss in stream, 6 m E cabin (SFS), 3 specimens.

NOTHRIDAE

Nothrus sp. **New state record**

This is the first record of *Nothrus* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, 1890 m, 20.vii.1971 (FJR), 3 specimens. Same data except 1981 m, 13.xii.1972, pitfall assoc. litter, (JJ), 7 specimens. Same data except 1280–1341 m, 16.xi.1972, 9 specimens. Same data except Kīpuka Ki Weather Sta., 1220 m, 31.i. – 2.ii.1972, pitfall, 1 specimen. Same data except 7.iv.1972, pitfall assoc. litter, 3 specimens. Same data except 16.ii.1972, pitfall, 1 specimen. Same data except, Kīpuka Nene, 17.xii.1972, pitfall assoc. soil, 1 specimen. Same data except 28.ii.IBP, Berlese (FH & LN), 4 specimens. Same data except 28.ii.1971, many specimens. Hakalau Forest Res., Transect 7, 2.vi.1996, soil under *Metrosideros* canopy, with roots (SFS), 1 specimen. Same data except IBP test plot, trail along edge, 1400 m, 21.x.1970 (MLG), 10 specimens. **KAUA'I:** Koke'e State Park, Pihea Trail, 27.v.1997, ex *Metrosideros* litter & soil (SFS), 7 specimens. Same data except Kuia NAR, Nualolo Trail, 990 m, 27.xi.1990, moss on *Metrosideros* bark, Berlese, 6 specimens. Same data except *Metrosideros* litter, 2 specimens. **LANA'I:** Lana'i City, Kaiholena Trailhead, ca. 500 m, 17.viii.1997, *Araucaria* forest litter (SFS), 1 specimen. Lana'ihale Mt, ca. 1000 m, 16.viii.1997, *Casuarina* litter (SFS), 1 specimen. Lana'ihale Summit, 1027 m, 18.viii.1997, moss on bark of *Leptospermum scoparium* , (SFS), 3 specimens. **MAUI:** Olinda, Waihou Spring Trail, 2 1200 m, 27.vi.1997, wet pine forest litter (SFS), 3 specimens. **O'AHU:** Bishop Museum Grounds, soil under *Acacia*, 27.ii.1995 (SFS), 7 specimens. Kane'ohe Bay along Kamehameha Hwy, T. Churma's yard, soil/litter, 19.vii.1997 (SFS), 2 specimens. Halona Valley, Camp #1, 465 m, soil under shade, 8.v.1996 (SFS), 2 specimens.

TRHYPOCHTHONIIDAE

Afronothrus incisivus Wallwork, 1961 **New state record**

This is the first record of this species in the Hawaiian Islands. According to Balogh & Balogh (1992), the genus *Afronothrus* has Ethiopian, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, 0.8 mi from Pk Hdqtrs, Crater Rim Rd., 1040 m, 21.x.1970, ex mosses (MLG), 8 specimens. Same data except Steaming Bluff Trail, vent #2, 29.vi.1971 (MLG), 11 specimens. Same data except Park Hdqtrs, 25.iv.1971 (FJR), 4 specimens.

Allonothrus sp. **New state record**

This is the first record of *Allonothrus* in the Hawaiian islands. According to Balogh & Balogh (1992), this genus has Ethiopian, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, Steaming Bluff Trail, vent # 2, 12.vi.1971 (MLG), many specimens. Same data except 0.8 mi from Pk Hdqtrs, Crater Rim Rd., 1040 m, 21.x.1970, ex mosses (MLG), 4 specimens. Same data except 1' below surface of vent #8, 38˚C (MLG), many specimens.

Trhypochthoniellus sp. **Name change**, **new island record**

The genus *Trhypochthoniellus* was first reported in the Hawaiian Islands as *Hydronothrus* (Aoki, 1964). According to Balogh & Balogh (1992), *Trhypochthoniellus* has Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI'I:** Hilo-Volcano Rd. (Rt 11), 684.2 spd. mi., 1040 m, 17.vi. 1970, litter under *Metrosideros* & tree fern (MLG & FJR), many specimens. Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, 28.ii.1971, IBP, Berlese (FH & LN), 5 specimens. Same data except Thurston Lava Tube, 1204 m, 12.ix.1972 (JJ), 9 specimens. **KAUA'I:** Koke'e State Park, Pihea Trail, 27.v.1997, ex *Metrosideros* litter & soil (SFS), 3 specimens. Same data except 1300 m, 27.v.1989, moss & litter, 3 specimens. Hono O Na Pali NAR, 1305 m, 18.ii.1991, *Metrosideros* litter (SFS), 1 specimen.

Trhypochthonius sp. **New state record**

This is the first record of *Trhypochthonius* in the Hawaiian islands. According to Balogh & Balogh (1992), *Trhypochthonius* has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, 2440 m, 5.vi.1972, pitfall assoc. litter (JJ), many specimens. Same data except 2.x.1972, many specimens. Same data except Treemold Area, 1220 m, 31.i–2.ii. 1972, pitfall, 1 specimen. Same data except 2.iv.1971, IBP, Berlese (FH & LN), many specimens. Same data except 2280 m, 20.x.1970 (MLG), 4 specimens. **KAUA'I:** Koke'e State Park, Hono O Na Pali NAR, 1300 m, 19.xi.1990, *Metrosideros* litter (SFS), 5 specimens. Kuia NAR, Nualolo Trail, 890 m, 29.iv.1991, litter in *Metrosideros* tree hole (SFS), 2 specimens. Same data except *Metrosideros* bark, 1 specimen. Same data except *Metrosideros* litter, 2 specimens. Same data except 27.xi.1990, 7 specimens. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, 15.vii.1989, litter & moss (SFS), 5 specimens. Same data except 15,vii.1989, moss in stream, 6 m E cabin, 3 specimens.

NANHERMANNIOIDEA

NANHERMANNIIDAE

Cyrthermannia sp. **New state record**

This is the first record of *Cyrthermannia* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has Ethiopian, Holarctic, Neotropical, Australia/ Pacific and Oriental distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, 0.8 mi. from Pk Hdqtrs, Crater Rim Rd, 1040 m, 21.x.1970, ex mosses (MLG), 8 specimens.

Masthermannia sp. **New state record**

This is the first record of *Masthermannia* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **KAUA'I:** Koke'e State Park, Pihea Trail, 27.v.1997, ex *Metrosideros* litter & soil (SFS), 1 specimen. Hono O Na Pali NAR, 1305 m, 18.ii.1991, *Metrosideros* litter (SFS), 5 specimens. **MAUI:** W. Maui, Above Maluhia Boy Scout Camp, 780 m, 11.iii.1989, soil and litter (SFS), 1 specimen. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, ex moss, 15.vii.1989 (SFS), 9 specimens

Nanhermannia sp. **New state record**

This is the first record of *Nanhermannia* in the Hawaiian Islands. This genus has Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions (Balogh & Balogh, 1992).

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, IBP test plot, trail along edge, 1400 m, 21.x.1970 (MLG), many specimens. Same data except east slope of Mauna Loa, 28.ii.1971, IBP, Berlese (FH & LN), 4 specimens. Volcano Village, wet *Metrosideros* litter, 1.vi.1997 (NLE), 5 specimens. Hakalau Forest Reserve, Transect 7, 2.vi.1996, soil under *Metrosideros* canopy, with roots (SFS), 6 specimens. **KAUA'I:** Koke'e State Park, Pihea Trail, 27.v.1997, ex *Metrosideros* litter & soil (SFS), 3 specimens. Same data except 1300, moss & litter, 3 specimens. Same data except Hono O Na Pali NAR, 1300 m, 19.xi.1990, *Metrosideros* litter, 2 specimens. Same data except 1305 m, 13.vii.1991, 1 specimen. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, 1.i.1990, decaying tree fern stump (RR), immatures. Kawela Wheelchair Cave, 1265 m, 6.i.1981, rat dung (SLM & FGH), 1 specimen.

HERMANNIOIDEA

HERMANNIIDAE

Phyllhermannia sp. **New state record**

This is the first record of *Phyllhermannia* in the Hawaiian Islands. According to

Balogh & Balogh (1992), this genus has Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **O'AHU:** Mt. Ka'ala, 1225 m, 9.iv.1970, ex moss & lichen on *Broussaisia*, *Arguta* & *Pelea* sp. (FJR), 4 specimens.

SUPERCOHORT BRACHYPYLINA

HERMANNIELLOIDEA
HERMANNIELIDAE

Hermanniella sp. **New island records**

The first record of *Hermanniella* in the Hawaiian islands was from O'ahu (Swift & Norton, 1995). According to Balogh & Balogh (1992), *Hermanniella* has Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, Kilauea Forest Res., 1645 m, pitfall assoc. litter, 18.ix.1972 (JJ),1 specimen. Hakalau Forest Res., Transect 7. 2.vi.1997, soil under *Metrosideros* canopy, with many roots (SFS), 6 specimens. **KAUA'I:** Koke'e State Park, Pihea Trail, 27.v.1997, ex *Metrosideros* litter & soil (SFS), 3 specimens. **LANA'I:** Lana'ihale Summit, 1027 m, 18.viii.1997, moss on bark of *Leptospermum scoparium* (SFS), 7 specimens. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, moss along stream banks, 6 m E cabin, 16.vii.1989 (SFS), 13 specimens. **O'AHU:** Lualualei, N Kolekole Pass Rd., at waterfall, 2.ii.1996, (VR & BR), 1 specimen.

Issaniella sp. **New state record**

This is the first record of *Issaniella* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has an Ethiopian distribution.

Material examined: **KAUA'I:** Koloa Limestone Quarry Cave, on root in F Passage, 0–5 m, 14.iii.1974 (FGH), 1 specimen.

DAMAEOIDEA
DAMAEIDAE

Damaeus sp. **New island records**

First reported by Swift & Norton (1995) from the summit of Mt. Ka'ala, O'ahu, *Damaeus* is now also known in Hawai'i, Kaua'i, Lāna'i, Maui and Moloka'i. *Damaeus* has a Holarctic distribution (Balogh & Balogh, 1992).

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, 1280–1341 m, 28.ii.–1.iii.1972, pitfall (JJ), 2 specimens. Same data except 16.xi.1972, pitfall assoc. litter, 9 specimens. Same data except 1981 m, 13.xii.1972, pitfall assoc. litter, 2 specimens. Same data except 1890 m, 28.ii.–1.iii.1972, 1 specimen. Same data except Mauna Loa Strip Rd.,Weather Sta., 28.ii.–1.iii.1972, 2 specimens. Same data except 1890 m, 21–31.vii.1971, pitfall (FJR), 1 specimen. Same data except Kīpuka Ki Weather Sta., 1220 m, 20–31.vii.1972, pitfall (FJR), 1 specimen. **KAUA'I:** Koke'e State Park, Kawaikoi Stream Trail, 1060 m, 27.vi.1989, moss on *Metrosideros* stump (SFS), 2 specimens. Same data except Hono O Na Pali NAR, 18.ii.1991, *Metrosideros* litter, many specimens. Same data except Kuia NAR, Nualolo Trail, 990 m, 27.xi.1990, *Metrosideros* litter, 2 specimens. Same data except 900 m, 29.iv.1991, soil, Berlese, 7 specimens. Pihea Trail, 27.v.1997, ex *Metrosideros* litter & soil, 5 specimens. Same data except 1300 m, *Metrosideros* litter, 19.xi.1990, many specimens. Same data except *Metrosideros* bark with moss, Berlese, 2 specimens. Wahiawa Stream, bog margin, 700 m, 21.xi.1989, ex uluhe, moss, *Antidesma* (WW), 10 specimens. **LĀNA'I:** Lana'ihale Summit: Munro Trail, 1027 m, 16.viii.1997, moss & lichen on *Pittosporum confertiflorum* (SFS), 5 specimens. **MAUI:** E. Maui, Olinda, Waihou Spring Trail, ca. 1200 m, 27.vi.1997, wet litter in pine forest (SFS), 1 specimen. **MOLOKA'I:** Kamakou Preserve: Pu'u Kolekole, 1204 m, moss along stream banks 6 m E cabin, 16.vii.1989 (SFS), 3 specimens. **O'AHU:** Mt. Ka'ala Bog, 1225 m, 25.x.1996, *Metrosideros* litter & soil (NLE), 3 specimens.

New genus nr. ***Damaeobelba*** **New state record**

Material examined: **KAUA'I:** Koke'e State Park, Kawaikoi Stream Trail, 1060 m, 27.vi.1989, moss on *Metrosideros* stump (SFS), 8 specimens. **MAUI:** W. Maui, above Maluhia Boy Scout Camp, 782 m, 10.iii.1989, wet moss on *Metrosideros* (SFS), 5 specimens. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, 16.vii.1989, moss along stream banks 6 m E cabin (SFS), 5 specimens.

CEPHEOIDEA
CEPHEIDAE

"***Cepheus*** " ***pustulatus*** (Pearce, 1910) (n. genus) **New state record**

Cepheus pustulatus, described from 2 specimens from Moloka'i (Pearce, 1910), appears to belong to a new genus different from *Cepheus* C.L. Koch, 1835.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, IBP test plot, trail along edge, 1400 m, 21.x.1970 (MLG), 1 specimen. **KAUA'I:** Koke'e State Park, Kuia NAR, Nualolo Trail, 990 m, 27.xi.1990, *Metrosideros* litter (SFS), 1 specimen. Same data except 1145 m, 29.iv.199, soil under *Metrosideros*, 1 specimen. Wahiawa Stream, bog margin, 700 m, 21.xi.1989, ex moss *Antidesma* (WW), 10 specimens. **O'AHU:** Mt. Ka'ala bog, 1225 m, 25.x.1996, *Metrosideros* litter & soil (NLE), 1 specimen. Mt. Ka'ala Summit, 1225 m, 10.x.1989, ground moss with soil (SFS), 2 specimens.

POLYPTEROZETOIDEA
EREMAEOZETIDAE

Eremaeozetes n. sp. **New state record**

This is the first record of this genus in the Hawaiian Islands. According to Balogh & Balogh (1992), *Eremaeozetes* has Ethiopian, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **MOLOKA'I:** Kaluakoi, 3–10 m, Kiawe forest litter nr. beach, 24.v.1996 (WDP), 1 specimen.

MICROZETOIDEA
MICROZETIDAE

Berlesezetes sp. **New island records**

Aoki (1964) established the first record of this family in the Hawaiian Islands when he reported *Berlesezetes auxilliaris* (Grandjean, 1936) from Laysan (as *Microzetes auxilliaris*). According to Balogh & Balogh (1992), *Berlesezetes* has Ethiopian, Holarctic, and Oriental distributions.

Material examined: **LĀNA'I:** Unmarked trail SW Kaiholena ridge, ca. 700 m, 16.viii.1997, moss & guava leaf litter (SFS), 2 specimens. **MOLOKA'I:** Kaluakoi, 3–10 m, Kiawe forest litter, nr. beach, 24.v.1996 (WDP), 1 specimen. **O'AHU:** Honolulu: Liliha, wet *Cordyline* litter, 13.x.1997 (SFS), 3 specimens.

AMEROBELBOIDEA
BASILOBELBIDAE

Basilobelba sp. **New state record**

This is the first record of *Basilobelba* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has Ethiopian, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **O'AHU:** Tripler Army Medical Ctr., gully above Patterson Rd, soil under introduced trees, wet, shady, 24.viii.1995 (SFS), 6 specimens.

DAMAEOLIDAE

Fosseremus sp. **New state record**

This is the first record of *Fosseremus* in the Hawaiian Islands. According to Balogh

& Balogh (1992), this genus has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, 2.iv. 1971, IBP, Berlese (FH & LN), 1 specimen. **MOLOKA'I:** Papio stream, 180 m, 10.v.1996, soil/litter, Berlese (WDP), 1 specimen.

EREMOBELBIDAE

Eremobelba sp. **New state record**

This is the first record of this genus in the Hawaiian Islands. *Eremobelba* has a cosmopolitan distribution (Balogh & Balogh, 1992).

Material examined: **KAUA'I:** Koke'e State Park, Hono O Na Pali NAR, 1300 m, 19.xi.1990, *Metrosideros* litter (SFS), 1 specimen. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, 15.vii.1989, *Metrosideros* bark (SFS), 2 specimens. Same data except moss on *Metrosideros* bark, 1 specimen.

EREMULIDAE

Eremulus sp. **New state record**

This is the first record of this genus in the Hawaiian Islands. According to Balogh & Balogh (1992), *Eremulus* has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Cane fields above Hilo, 728 spd. mi, 140 m, 18.vi. 1970, guava thicket (MLG & FJR), 1 specimen. **KAUA'I:** Kalalau Trail, *Metrosideros* litter with soil 20.xi.1990 (SFS), 1 specimen.

GUSTAVIOIDEA

ASTEGISTIDAE

Cultroribula sp. **New state record**

This is the first record of *Cultroribula* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI'I:** Hawaii Volcanoes Natl. Park, Thurston Lava Tube, 1204 m, 18.x.1972, pitfall assoc. litter (JJ), 7 specimens, Volcano Village, wet *Metrosideros* litter, 1.vi.1997 (NLE), 4 specimens. Hakalau For. Res.: Transect 2, 2.vi.1996, soil under *Metrosideros* canopy, with roots (SFS), 12 specimens. **MAUI:** E. Maui, Olinda, Waihou Spring Trail, ca. 1200 m, 27.vi.1997, wet litter in pine forest (SFS), 1 specimen. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, 1.i.1990, ex decaying tree fern stump (RR), 21 specimens. **O'AHU:** Tripler Army Medical Ctr., gully above Patterson Rd, soil under introduced trees, wet, shady, 24.viii.1995 (SFS), many specimens. Same data except soil under *Ficus* canopy, 3 m off stream, 6.iv.1995, many specimens. Kane'ohe Bay, along Kamehameha Hwy, T. Churma's yard, soil/litter, 19.vii.1997, 3 specimens.

CARABODOIDEA

CARABODIDAE

Austrocarabodes sp. **New island records**

Austrocarabodes was first recorded by Aoki (1966) from bird nests on Midway. According to Balogh & Balogh (1992), *Austrocarabodes* has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, 1280–1341 m, 16.xi.1972, pitfall assoc. litter (JJ), 10 specimens. Same data except 14.viii.1972, 4 specimens. **MAUI:** E. Maui, Kipahulu Valley, nr. Sacred Pools, 50–75 m, 28.vi.1997, wet *Pandanus* & miscellaneous tree litter (SFS), 1 specimen. **MIDWAY:** Sand I., 13.v.1973, *Coccoloba* leaf litter, Berlese (WCG), 15 specimens. **O'AHU:** Mt. Ka'ala bog, 1225 m, 25.x.1996, *Metrosideros* litter with soil (NLE), 10 specimens. Lualualei, Halona Valley, Camp 1, 460 m, 8.iv.1996, sifted soil/litter, Berlese (SFS), 13 specimens. Same data except N of Kolekole Pass Rd., at waterfall, 2.ii.1996 (VR & BR), 3 specimens. **PEARL & HERMES**: Southeast I., 27.v.1969, ex Laysan Albatross nest, (MA), many specimens.

OTOCEPHEIDAE

Dolicheremaeus sp. **New island records**

This genus was first reported in the Hawaiian Islands as *Tetracondyla* (Newell, 1956). According to Balogh & Balogh (1992), *Dolicheremaeus* has a cosmopolitan distribution.

Material examined: **LĀNA‘I:** Lana‘ihale Summit, 1027 m, 18.viii.1997, moss on bark of *Leptospermum scoparium* (SFS), 3 specimens. Kaiholena Trail, ca 800 m, *Eucalyptus* leaf litter, 6 specimens. Lāna‘i City, Kaiholena Trailhead, ca.500 m, 17.viii.1997, *Araucaria* forest litter, 10 specimens. Same data except unmarked trail SW of Kaiholena Ridge ca. 700 m, 16.viii.1997, moss & guava leaf litter, 5 specimens. **MOLOKA‘I:** Papio Stream, 180 m, 10.v.1996, soil/litter, Berlese (WDP), 2 specimens. **O‘AHU:** Lualualei, Halona Valley, Camp 1, 8.iv.1996, sifted soil/litter, Berlese (SFS), 2 specimens. Bishop Museum Grounds, soil under *Acacia*, 27.ii.1995 (SFS), 1 specimen. Mt. Ka‘ala bog, 1225 m, 25.x.1996, *Metrosideros* litter & soil (NLE), 5 specimens. Honolulu: Honolulu Police Sta., 8.iii.1980, collapsed ceiling area with scats (FJR & JMT), 1 specimen.

TECTOCEPHEOIDEA

TECTOCEPHEIDAE

Tectocepheus sp. **New island records**

Tectocepheus was first reported in the Hawaiian Islands from Laysan (Aoki, 1964). According to Balogh & Balogh (1992), this genus has Antarctic, Ethiopian, Holarctic, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI‘I:** Hawai‘i Volcanoes Natl. Park, east slope of Mauna Loa, 28.ii.1971, IBP, Berlese (FH & LN), 12 specimens. Same data except 2.iv.1971, many specimens. **KAUA‘I:** Koke‘e State Park, Hono O Na Pali NAR, 1300 m, 19.xi.1990, *Metrosideros* litter (SFS), 6 specimens. Same data except 1305 m, 13.vii.1991, *Metrosideros* bark with moss, 14 specimens. Same data except Kuia NAR, Nualolo Trail, 1990 m, 27.xi.1990, moss on *Metrosideros* bark, Berlese, 1 specimen. Same data except Kawaikoi Stream Trail, 1060 m, 27.vi.1989, moss on *Metrosideros* stump, 2 specimens. Pihea Trail, 27.v.1997, ex *Metrosideros* litter and soil, 4 specimens. Pu‘u O Kila Trail, 1270 m, 27.v.1989, moss on *Metrosideros*, 10 specimens. **LANA‘I:** Lana‘i City, Kaiholena Trailhead, ca. 500 m, 17.viii.1997, *Araucaria* forest litter (SFS), 2 specimens. Unmarked trail SW Kaiholena ridge ca 700 m, 16.viii.1997, moss and guava leaf litter (SFS), 6 specimens. **MAUI:** W. Maui, Above Maluhia Boy Scout Camp, 782 m, 10.iii.1989, wet moss on *Metrosideros* (SFS), 11 specimens. **MOLOKA‘I:** Kamakou Preserve, Pu‘u Kolekole, 1204 m, moss along stream banks 6 m E cabin, 16.vii.1989 (SFS), 7 specimens.

OPPIOIDEA

OPPIIDAE

Machuella sp. **New state record**

This is the first record of *Machuella* in the Hawaiian islands. According to Balogh & Balogh (1992), *Machuella* has Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI‘I:** Mountain view, 400 m, Kazumura Cave, dark zone, on slime on wall, 11.iii.1973 (FGH), 10 specimens. **KAUA‘I:** Koke‘e State Park: Hono O Na Pali NAR, 1305 m, 13.vii.1991, *Metrosideros* litter with soil (SFS), 1 specimen. Kuia NAR, Nualolo Trail, 1000 m, 27.xi.1990, moss on dead *Metrosideros* tree, 1 specimen.

Microppia sp. **New island records**

Microppia minus (Paoli, 1908) from Mt Ka‘ala, O‘ahu (Swift & Norton, 1995) was the first species of *Microppia* reported in the Hawaiian Islands. According to Balogh & Balogh (1992), *Microppia* has a cosmopolitan distribution.

Material examined: **KAUA‘I:** Koke‘e State Park, Kuia NAR, Nualolo Trail, 1000 m, 29.iv.1991, *Metrosideros* litter (SFS), 4 specimens. **HAWAI‘I:** Hawai‘i Volcanoes Natl. Park, east

slope of Mauna Loa, 2.iv.1971, IBP, Berlese (FH & LH), 1 specimen.

Multioppia sp. **New island record**

Multioppia was first recorded in the Hawaiian Islands from Laysan and Kaho'olawe (Aoki, 1965). This genus has a cosmopolitan distribution (Balogh & Balogh, 1992).

Material examined: **KAUA'I:** Koke'e State Park: Kuia NAR Nualolo Trail, 1000 m, 29.iv. 1991, soil under *Metrosideros* (SFS), 2 specimens. Same data except 890 m, *Metrosideros* soil and litter, 3 specimens.

QUADROPPIIDAE

Quadroppia sp. **New state record**

This is the first record of this genus in the Hawaiian Islands. *Quadroppia* has a cosmopolitan distribution (Balogh & Balogh, 1992).

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, Kīpuka Keana Bihopa, 793 m, 20.ii.1980 (FGH), 1 specimen. **KAUA'I:** Koke'e State Park, Kawaikoi Stream Trail, 1060 m, moss on *Metrosideros* stump, 27.VI.1989 (SFS), 2 specimens. Hono O Na Pali NAR, 1305 m, 13.vii.1991, *Metrosideros* litter with soil (SFS), 3 specimens. **MAUI:** W. Maui, Above Maluhia Boy Scout Camp, 782 m, wet moss on *Metrosideros*, 10.iii.1989 (SFS). **O'AHU:** Lualualei: Halona Valley, Camp 1, 460 m, sifted soil/litter, 8.iv.1996 (SFS), 21 specimens.

SUCTOBELBIDAE

Suctobelbella sp. **New island records**

The record of *Suctobelba* sp. from Mt. Ka'ala by Swift and Norton (1995) was a lapsus; the record should have been *Suctobelbella* sp. The genus *Suctobelbella* has Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions (Balogh & Balogh, 1992).

Material examined: **HAWAI'I:** Hakalau For. Res., Transect 7, soil under *Metrosideros* canopy, with roots, 2.vi.1996 (SFS), 1 specimen. Hawai'i Volcanoes Natl. Park: Mauna Loa Strip Rd., 1340 m, 16.vi.1970 (MLG & FJR), 1 specimen. Hawai'i Volcanoes Natl. Park: east slope of Mauna Loa, IBP, Berlese, 2 iv.1971 (FH & LN), 10 specimens. **KAUA'I:** Koke'e State Park, Pu'u O Kila Trail, 1270 m, moss on *Metrosideros*, 27.v.1989 (SFS), 1 specimen. Kawaikoi Stream Trail, 1061 m, 27.v.1989, moss on *Metrosideros*, (SFS), 2 specimens. Hono O Na Pali NAR, 1305 m, 13.vii.1991, *Metrosideros* bark with moss (SFS), 2 specimens. Same data except *Metrosideros* litter with soil (SFS), 3 specimens.Same data except *Metrosideros* litter with soil, 1 specimen. Same data except 18.ii.1991, *Metrosideros* litter, 3 specimens. Same data except *Metrosideros* litter with soil, 3 specimens. Same data except 19.xi.1990, *Metrosideros* litter, 3 specimens.

THYRISOMIDAE

Banksinoma sp. **New state record**

This is the first record of this genus in the Hawaiian islands. According to Balogh & Balogh (1992), *Banksinoma* is of Holarctic and Neotropical distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, Thurston Lava Tube, 1204 m, 18.x.1972 (JJ), many specimens. Same data except 12.ix.1972, 7 specimens.

HYDROZETOIDEA

HYDROZETIDAE

Hydrozetes sp. **New state record**

This is the first record of this genus in the Hawaiian islands. According to Balogh & Balogh (1992), *Hydrozetes* has a cosmopolitan distribution.

Material examined: **KAUA'I:** Koke'e State Park, Hono O Na Pali NAR, Kalalau Trail, Waiahuakua Stream, 240 m, on moss, 4.ix.1991 (SFS), 3 specimens. **MOLOKA'I:** Kamakou Preserve:

Pu‘u Kolekole, 1204 m, moss in stream, 6 m E cabin, 15.vii.1989 (SFS), 3 specimens. **O‘AHU:** Honolulu: Tripler Army Medical Ctr., on algal mat in freshwater stream, v.1995 (SFS & KA), 2 specimens; many specimens from lab culture.

CYMBAEREMOIDEA
CYMBAEREMAEIDAE

Scapheremaeus sp. **New island records**

This genus was first reported from Laysan (Aoki, 1964). According to Balogh & Balogh (1992), *Scapheremaeus* has Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI‘I:** Hawai‘i Volcanoes Natl. Park, Mauna Kea Station, 2819 m, *Sophora* duff in fine soil, 21.vii.1970 (FJR), 1 specimen. Same data except Mauna Loa Trail, Transect 1, 2500 m, duff & soil, 22.vii.1970, 2 specimens. Same data except, east slope of Mauna Loa, 30 m. E goat pen, 1981 m, pitfall assoc. litter, 29.i.1973 (JJ), 9 specimens. Same data except Treemold Area, 1220 m, pitfall, 12.vii.1972, 1 specimen. **KAUA‘I:** Kalalau Trail, *Metrosideros* bark, 20.xi.1990 (SFS), 2 specimens. **MOLOKA‘I:** Mapolehu, 3–12 m, soil & litter, 10.v.1996 (WDP), 2 specimens. Mapolehu nr. Ililiopae Heiau, 3 m, soil & litter, 29.ix.1995 (WDP), 2 specimens.

LICNEREMAEOIDEA
ADHAESOZETIDAE

Adhaesozetes sp. **New state record**

This is the first record of this genus in the Hawaiian Islands. According to Balogh & Balogh (1992), *Adhaesozetes* has an Australia/Pacific distribution.

Material examined: **KAUA‘I:** Koke‘e State Park, Hono O Na Pali NAR, 1305 m, 18.ii.1991, *Metrosideros* leaves (SFS), 3 specimens.

LICNEREMAEIDAE

Licneremaeus sp. **New state record**

This is the first record of *Licneremaeus* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has a cosmopolitan distribution.

Material examined: **MOLOKA‘I:** Kaluakoi, 3–10 m, kiawe forest litter nr. beach, 24.v.1996 (WDP), 1 specimen.

ORIPODOIDEA
CAMPBELLOBATIDAE

Campbellobates acanthus hawaiiensis **New island record**
Balogh, 1985

First recorded by Balogh (1985) in the Hawaiian islands, this species was misplaced in the family Oribatulidae in Hawaiian Acari lists (Goff, 1987; Nishida, 1994, 1997).

Material examined: **KAUA‘I:** Koke‘e State Park, Hono O Na Pali NAR, 1305 m, 19.xi.1990, *Metrosideros* bark with moss (SFS), 1 specimen.

Campbellobates sp. **New island record**

According to Balogh & Balogh (1992), *Campbellobates* has Australia/Pacific and Oriental distribution.

Material examined: **KAUA‘I:** Koke‘e State Park, Hono O Na Pali NAR, 1305 m, 18.ii.1991, *Metrosideros* leaves (SFS), 1 specimen.

HAPLOZETIDAE

Peloribates sp. **New island record**

This genus was first recorded as quarantine interception from the Hawaiian Islands (Hammer, 1969). Alicata (1969) also implicated this genus as a possible intermediate host of *Monieza expansa,* an anoplocephalan tapeworm of sheep and cattle in Hawaii. According to Balogh & Balogh (1992), *Peloribates* has a cosmopolitan distribution.

Material examined: **O'AHU:** Leeward Coast, Kea'au Beach Co. Park, 2 mi N Makaha, on Farrington Hwy (Rt 93), 25.x.1992, small low open area between mesquite and other legumes, at top of low dune separating beach from highway, soil wash (RAN & SFS), 2 specimens.

Rostrozetes sp. **New island records**

This genus was first reported from Mt. Ka'ala, O'ahu (Swift and Norton, 1995). According to Balogh & Balogh (1992), *Rostrozetes* has a cosmopolitan distribution.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, 0.8 mi from Pk Hdqtrs., Crater Rim Rd, ex mosses, 21.x.1970 (MLG). 1 specimen. Same data except Steaming Bluff Trail, Vent #2, 29.vi.1971(MLG), 9 specimens. **KAUA'I:** Koke'e State Park, Kuia NAR, Nualolo Trail, 1145 m, 29.iv.1991, *Metrosideros* litter (SFS), 1 specimen. Hono O Na Pali NAR, 1305 m, 18.ii.1991, *Metrosideros* litter with soil (SFS), 3 specimens.

LAMELLAREIDAE

Tenuelamellarea sp. **New island record**

Tenuelamellarea was first reported by Balogh (1985) from Maui. According to Balogh & Balogh (1992), this genus has Ethiopian, Holarctic and Australia/Pacific distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, Mauna Loa Trail, Transect #1, 2500 m, duff & soil, 22.vii.1970 (FJR), many specimens. Same data except Mauna Loa Trail, 2590, *Styphelia*, etc. litter, ii.1973 (JJ), many specimens. Same data except east slope of Mauna Loa, 2440 m, pitfall assoc. litter, 20.x.1972, 6 specimens. Same data except 2440 m, 12.ix.1972, 4 specimens.

ORIBATULIDAE

Lucoppia burrowsii (Michael, 1890) **New state record**

This is the first record of *L. burrowsii* in the Hawaiian Islands, a definite European introduction. According to Balogh & Balogh (1992), the genus *Lucoppia* has Holarctic, Ethiopian, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **MAUI:** Kahana Beach, immediately N of Kahului Airport, 29.x.1992, small stabilized dune, open area among foot-high grass and mesquite seedlings, sand wash (RAN), 4 specimens. **O'AHU:** Leeward Coast, Kea'au Beach Co. Park, 2 mi N Makaha, on Farrington Hwy (Rt 93), 25.x.1992, small low open area between mesquite and other legumes, at top of low dune separating beach from highway, soil wash (RAN & SFS), 2 specimens.

Oribatula sp. **New state record**

This is the first record of this genus in the Hawaiian Islands. According to Balogh & Balogh (1992), *Oribatula* has Ethiopian, Holarctic, Neotropical and Oriental distributions.

Material examined: **MIDWAY**: Sand I., under *Casuarina*, Berlese, 18.ii.1989 (GMN), 3 specimens. **O'AHU:** Lualualei, N of Kolekole Pass Rd, at waterfall, 2.ii.1996, (VR & BR), 3 specimens. **PEARL & HERMES**: Southeast I., burrow of Wedge-tail Shearwater, 28.v.1969, (DMA), 8 specimens.

Phauloppia sp. **New island record**

This genus was first reported from French Frigate Shoals (Jacot, 1934). According to Balogh & Balogh (1992), *Phauloppia* has a cosmopolitan distribution.

Material examined: **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, moss on *Metrosideros*, along trail,16.vii.1989 (SFS), many specimens.

Zygoribatula sp. **New state record**

This is the first record of *Zygoribatula* in the Hawaiian Islands. According to Balogh & Balogh (1992), this genus has a cosmopolitan distribution.

Material examined: **MOLOKA'I:** Kaluakoi, 3–10 m, Kiawe forest litter nr. beach, 24.iv.1996 (WDP), 1 specimen.

New genus

Material examined: **KAUA'I:** Koke'e State Park, Hono O Na Pali NARS, 1300 m, 19.xi.1990, *Metrosideros* flowers, Berlese (SFS), 1 specimen.

ORIPODIDAE

This family includes the only named oribatid mite genus that is restricted to the Hawaiian Islands: *Scriptoripoda* Balogh, 1984. *Scriptoripoda excellens* from Maui and *S. tenorioae* from Hawai'i constitute the genus in the Hawaiian Islands.

Oripoda sp. **New island record**

This genus was first recorded in the Hawaiian islands when *Oripoda prominens* was described by Balogh (1985) from Maui. According to Balogh & Balogh (1992), *Oripoda* has Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, Mauna Loa Trail, Transect #1, 2500 m, duff & soil, 22.vii.1970 (FJR), many specimens.

SCHELORIBATIDAE

Jacot's (1934) description of 10 species in the genus *Scheloribates* from O'ahu alone shows the diversity of the family in the islands (see Table 1). Like the family Oppiidae, the taxonomy of this family is problematic. The genus *Scheloribates* is of veterinary importance as it has been found to be an important intermediate host for tapeworms in sheep (Sengbusch, 1977). Since they are among the most numerous and speciose oribatids in the Hawaiian Islands, they are excellent organisms for biomonitoring.

Hemileius sp. **New island record**

The first record of this genus in the Hawaiian Islands was by Balogh (1983), when he described *Hemileius gressitti* from Maui. *Hemileius* has Antarctic, Ethiopian, Holarctic, Neotropical and Oriental distributions (Balogh & Balogh, 1992).

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, 2135 m, 2.iii.1972 (JJ), 5 specimens.

New genus nr. ***Dometorina*** **New island record**

This new genus was first reported in the Hawaiian Islands from Mt Ka'ala, O'ahu (Swift & Norton, 1995).

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, Mauna Loa Transect, *Metrosideros* bark, 2012 m, ix.1972 (FH & LN), 12 specimens. East slope of Mauna Loa, 1280–1341 m, pitfall, 21–31.vii.1970 (FJR), 1 specimen.

CERATOZETOIDEA
CERATOZETIDAE

Ceratozetes sp. **New island records**

First reported from Laysan (*Ceratozetes incurvus* Aoki, 1964), *Ceratozetes* is now known in Hawai'i, Maui, Lāna'i and Kaua'i as well. According to Balogh & Balogh (1992), this genus has Antarctic, Ethiopian, Holarctic, Neotropical, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, East slope of Mauna Loa, 1280–1341 m, pitfall assoc. litter, 16.xi.1972 (JJ), many specimens. Same data except Mauna Loa Strip Rd. Weather Sta., pitfall, 28.ii–1.iii.1972, 7 specimens. Same data except Kīpuka Ki Weather Sta., pitfall, 14–16.ii.1972, many specimens. Same data except Bird-Park-Kīpuka Pua'ulu, pitfall assoc. soil, 29.iii.1973 (JJ), 6 specimens. Same data except Thurston Lava Tube, 1204 m, pitfall assoc. soil, 16.xii.1972, 1 specimen. Same data except Above marker 38 Kīpuka Ki, 1220 m, pitfall, 30.vii.1971, 3 specimens. Same data except Kīpuka Ki Weather Sta., 1220 m, pitfall, 31.i–2.ii.1972, 1 specimen. Same data except Steam vent area of benchmark 3944, dead grass & soil, ex fumerole, 22.vii.1970 (FJR), many specimens. Same data except 1280–1341, pitfall, 21–31.vii.1970, 2 specimens. Same data except Kīpuka Ki Weather Sta., 1220 m, pitfall, 20–31.vii.1970, 1 specimen. Bird Park Cave # 3, general collection, 23.vii.1971 (FGH & WCG). 2 specimens. **KAUA'I:** Koke'e State Park, Kuia NAR, Nualolo Trail, 900 m, soil, Berlese, 29.iv.1991 (SFS), 3 specimens. Hono O Na Pali NAR, 1300 m, *Metrosideros* bark with moss, Berlese, 19.xi.1990 (SFS), 1 specimen. **LĀNA'I:** Lāna'ihale Summit, Munro Trail, moss & lichen on *Pittosporum confertiflorum*, 16.viii.1997 (SFS), 5 specimens. **MAUI:** E. Maui, Olinda, Waihou Spring Trail, ca. 1200 m, wet litter in pine forest, 27.vi.1997 (SFS), 15 specimens.

Fuscozetes sp. **New island records**

This genus was first reported in the Hawaiian Islands from Mt Ka'ala, O'ahu (Swift & Norton, 1995). *Fuscozetes* has a Holarctic distribution (Balogh & Balogh, 1992).

Material examined: **HAWAI'I:** Hakalau Forest Res., Transect 7, soil under *Metrosideros* canopy, with roots, 2.vi.1996 (SFS), 15 specimens. **KAUA'I:** Koke'e State Park, Pihea Trail, *Metrosideros* litter with soil, 27.v.1997 (SFS), 2 specimens. Same data except 1300 m, *Metrosideros* litter, 19.xi.1990, 1 specimen. Same data except moss & litter, 27.v.1989, 2 specimens. Same data except Pu'u O Kila Trail, 1270 m, moss on *Metrosideros*, 27.v.1989, 2 specimens. Kuia NAR, Nualolo Trail, 990 m, 27.xi.1990, *Metrosideros* litter (SFS), 1 specimen. Same data except 900 m, 29.iv.1991, soil, Berlese, 9 specimens. Hono O Na Pali NAR, 19.xi.1990, *Metrosideros* litter, 2 specimens. **LĀNA'I:** Lāna'ihale Summit, 1027 m, moss on bark of *Leptospermum scoparium*, 18.viii.1997 (SFS), 6 specimens. **O'AHU:** Mt. Ka'ala, 1225 m, on wet *Sphagnum* moss, 10.x.1989 (SFS), 2 specimens.

HUMEROBATIDAE

Humerobates sp. **New island records**

The genus *Humerobates* was first observed in the Hawaiian Islands by Pearce (1910). The specimens that he misidentified as *Oribata globula* were later named *Humerobates humeralis perkinsi* by Jacot (1934), and this combination was subsequently changed to *H. rostrolamellatus perkinsi* (see Norton, 1985). According to Balogh & Balogh (1992), the genus *Humerobates* has Ethiopian, Holarctic, Australia/Pacific and Oriental distributions.

Material examined: **HAWAI'I:** Volcano Village, wet *Metrosideros* litter, 1.vi.1997 (NLE), 6 specimens. Hakalau Forest Res., Transect 7, soil under *Metrosideros* canopy, with roots, 2.vi.1996 (SFS), 1 specimen. **KAUA'I:** Koke'e State Park, Pihea Trail, 1300 m, moss on *Metrosideros* trunk, 27.v.1989 (SFS), 1 specimen. **LĀNA'I:** Lana'ihale Summit, Munro Trail, 1027 m, moss & lichen on *Pittosporum confertiflorum*, 16.viii.1997 (SFS), 1 specimen. Lāna'i City, Kaiholena trailhead, ca. 500 m, *Araucaria* forest litter, 17.viii.1997 (SFS), 1 specimen. **MOLOKA'I:** Kamakou Preserve, Pu'u Kolekole, 1204 m, moss on *Metrosideros*, along trail, 16.vii.1989 (SFS), 6 specimens. **O'AHU:**

Mt. Ka‘ala Trail, 760–915 m, 11.iv.1948 (HSD), 3 specimens. Mt. Ka‘ala, 1225 m, ex moss & lichen on *Broussaisia*, *Arguta* & *Pelea* sp., 9.iv.1970 (FJR), 7 specimens. Wai‘anae, nest in *Metrosideros*, no date (WCG), 10 specimens.

MYCOBATIDAE

Mycobates sp. **New state record**

This is the first record of *Mycobates* in the Hawaiian Islands. According to Balogh & Balogh (1992), *Mycobates* has Holarctic and Neotropical distributions.

Material examined: **HAWAI‘I:** Mauna Kea slope, 100 yds. from benchmark 4141, 1310 m, 21.vii.1970 (FJR), 1 specimen. **KAUA‘I:** Koke‘e State Park, Kawaikoi Stream Trail, 1060 m, moss, 27.vi.1989 (SFS), 2 specimens. **MAUI:** W. Maui, Maluhia Boy Scout Camp, 782 m, wet moss on *Metrosideros*, 10.iii.1989 SFS), 1 specimen. **MOLOKA‘I:** Kamakou Preserve, Pu‘u Kolekole, 1204 m, moss on *Metrosideros*, along trail, 16.vii.1989 (SFS), 4 specimens. Same data except 15.vii.1989, moss on pine bark, many specimens.

PHENOPELOPOIDEA

PHENOPELOPIDAE

Eupelops sp. **New state record**

This is the first record of *Eupelops* in the Hawaiian Islands. According to Balogh & Balogh (1992), *Eupelops* has a cosmopolitan distribution.

Material examined: **HAWAI‘I**: Hawai‘i Volcanoes Natl. Park, Mauna Loa Transect, 1707 m, ex duff, 1707 m, ix.1972 (FH & LN), 8 specimens. Same data except East Slope of Mauna Loa, 30 m E goat pen, S horse corral, pitfall, 9.vii.1971 (JJ), 1 specimen. Same data except 1890 m, pitfall assoc. litter, 6.v.1972, 5 specimens. **O‘AHU**: Bishop Museum Ground, soil under *Acacia*, 27.ii.1995 (SFS), 7 specimens. **PEARL & HERMES**: Southeast I., ex Laysan Albatross nest, 27.v.1969 (DMA), 1 specimen.

ACHIPTERIOIDEA

ACHIPTERIIDAE

Achipteria sp. **New island records**

Achipteria was first recorded in the Hawaiian Islands from Mt. Ka‘ala, O‘ahu (Swift & Norton 1995). According to Balogh & Balogh (1992), *Achipteria* has Ethiopian, Holarctic and Oriental distributions.

Material examined: **HAWAI‘I**: Hawai‘i Volcanoes Natl. Park, east slope of Mauna Loa, Thurston Lava Tube, 1204 m, pitfall assoc. soil, 16.xii.1972 (JJ), 2 specimens. Same data except 14.viii.1972, 12 specimens. Same data except Treemold area, 1220 m, pitfall, 12.vii.1972, 1 specimen. Same data except IBP, Berlese, 28.ii.1971 (FH &LN), 8 specimens. Mauna Kea slope, 100 yds. from benchmark 4141, 1310 m, 21.vii.1970 (FJR), many specimens. **LĀNA‘I:** Lāna‘ihale Summit, Munro Trail, 1027 m, moss & lichen on *Pittosporum confertiflorum*, 16.viii.1997 (SFS), 15 specimens. Lana‘i City, Kaiholena trailhead, ca. 500 m, *Araucaria* forest litter, 17.viii.1997 (SFS), 1 specimen. **MOLOKA‘I**: Kamakou Preserve, Pu‘u Kolekole, 1204 m, *Cheirodendron* bark with moss, 15.vii.1989 (SFS), 7 specimens. Same data except moss on *Metrosideros* bark, 16.vii.1989 (SFS), 1 specimen.Same data except moss along stream banks 6 m E cabin, 16.vii.1989 (SFS), 15 specimens. Same data except moss on pine, 15.vii.1989 (SFS), 14 specimens. **O‘AHU**: Mt. Ka‘ala summit, 1225 m, ground moss with soil, 10.x.1989 (SFS), 3 specimens.

New genus

Material examined: **KAUA‘I:** Wahiawa Stream, bog margin, 700 m, ex moss, *Antidesma*, 21.xi.1989 (WW), 21 specimens.

AUSTRACHIPTERIIDAE

Paralamellobates sp. **New state record**

This is the first record of this genus in the Hawaiian islands. According to Balogh & Balogh (1992), *Paralamellobates* has Ethiopian, Holarctic, Australian/Pacific and Oriental distributions.

Material examined: **KAUA'I:** Kalalau Trail, *Pandanus* leaves, 20.xi.1990 (SFS), 1 specimen.

TEGORIBATIDAE

Tegoribates sp. **New state record**

This is the first record of the genus *Tegoribates* in the Hawaiian Islands. According to Balogh & Balogh (1992), *Tegoribates* has Ethiopian, Holarctic and Neotropical distributions.

Material examined: **HAWAI'I:** Hawai'i Volcanoes Natl. Park, east slope of Mauna Loa, Power Line area, 1493 m, pitfall assoc. litter, 30.vi.1973 (TP), 11 specimens. Same data except Treemold area, 1220 m, 28.vi.1973 (TP), 9 specimens. **KAUA'I:** Koke'e State Park, Hono O Na Pali NAR, 1300 m, *Metrosideros* litter, 19.xi.1990 (SFS), 3 specimens. Same data except *Metrosideros* bark, 3 specimens.

Discussion

The list of oribatid mites now known from the Hawaiian Islands (Table 1) includes 61 families and 111 genera. Most of the new generic records, amounting to a 85% increase in the previously known fauna, were generated during a 2-week period of intensive work by one of us (RAN) in existing collections at the Bishop Museum. Considering this level of effort, and the fact that certain whole islands (e.g. Ni'ihau, Necker, Lisianski), general habitats (grasslands, lowland forests, agricultural areas) and microhabitats (arboreal and other non-soil microhabitats; e.g., Aoki, 1967) have been mostly ignored by collectors, many more genera certainly remain to be discovered.

Despite our rather superficial knowledge, the 111 genera represent a considerable fauna for such a small (10, 380 km^2), isolated land area. The number of species cannot reasonably be estimated yet, but material examined by us or discussed by other authors probably represents 175–200 species. To put these numbers in perspective, Table 2 summarizes oribatid mite diversity for various genus- and family-level richness for various island and mainland faunas; not included are data for the many species-poor subantarctic islands, well summarized by Pugh (1993). The known generic richness of oribatid mites in the Hawaiian Islands is similar to that of the Galapagos Islands and the British Isles, and is about one-half that of the Japanese Islands. It is considerably higher than that of Macaronesia, and is about 70% of that in an average European country (158).

Comparisons of diversity among islands have to be considered very preliminary (Table 1, 3), but O'ahu has the highest number of known species (70) followed by Hawai'i (68) and Kaua'i (55). To some degree, these numbers probably are artifacts of collection intensity. For example, O'ahu has been more intensively sampled because of greater access to scientists and students. The high number of genera on Hawai'i reflects the large amount of material accumulated during transect sampling on Mauna Loa during the International Biological Programme (Mueller-Dombois *et al.,* 1981), and that on Kaua'i derived mostly from a year-long sampling at Hono O Na Pali and Kuia Natural Area Reserves by one of us (SFS). Until collection intensity is more equal, we have little ability to judge how well the oribatid mite fauna of the Hawaiian Islands fits predictions of various biodiversity models (e.g., MacArthur & Wilson, 1967). However, on other islands

(Bernini, 1990; Schatz, in press) habitat diversity, which is strongly affected by altitude, appears to have more effect on oribatid mite diversity than does, for example, surface area.

Currently, there are a number of genera known only from a single island. The Holarctic genus *Phyllozetes* has been reported only in Midway. *Eremaeozetes*, *Licneremaeus*, *Phauloppia*, and *Zygoribatula* have so far been reported only from soil and litter on Moloka‘i. A new genus of Achipteriidae was collected only in 1 area on Kaua‘i, from riparian moss (*Antidesma*). *Haplochthonius* and *Adhaesozetes* are known only from Kaua‘i, where they were found on *Metrosideros* leaves.

Faunal origins

The origin of the Hawaiian Island biota is a subject of considerable interest. In general, a taxon exists at such a remote location for 1 of 3 reasons: it evolved there, it dispersed there by natural (non-human) means, or it was introduced by humans. The great isolation and considerable age of this island system resulted in very high degrees of endemism at generic and specific levels, as is well known for arthropods in general and insects in particular (Gressitt, 1971; Simon *et al.*, 1984). At the same time, the diverse origins and history of human habitation and exploitation in the Hawaiian Islands have resulted in a high diversity of introduced arthropods (Brockie *et al.,* 1988). Small soil arthropods, such as oribatid mites, are particularly easy to introduce with potted plants or ship ballast and, due to their size, are unlikely to be noticed until they are well established.

Bernini (1990) calculated that species-level endemism of oribatid mites is generally high in island faunas, ranging from 24% on Tenerife to 80% in New Zealand. The Hawaiian Islands were not included in his calculations, probably because even a rough estimate is not currently possible at the species level. Radiations of species that rival those of the fly genus *Drosophila* (Hardy, 1964; Simon, 1987) or the snail genus *Partulina* (Carlquist 1980) seem unlikely to have occurred in oribatid mites. If significant radiations exist, they might be sought in the cosmopolitan genera *Phthiracarus* (5 endemic species; Niedbala, 1994) and *Scheloribates* (sensu lato) (8 endemic species; Jacot, 1934). Endemism is clearly not high at the generic level. A single described genus of oribatid mite, *Scriptoripoda*, appears restricted to the Hawaiian Islands [four others—*Calvoppia*, *Imparatoppia*, *Cardioribates* and *Styloribates*—are usually considered synonyms of widely distributed taxa (e.g., Balogh & Balogh, 1992); we discuss them below in an Appendix]. If we include the 6 undescribed genera (Table 1) and the genus *Scriptoripoda*, only 6% of the genera are endemic. In comparison, Bernini (1990) estimated that, worldwide, 22% of nominal oribatid mite genera are endemic to islands or archipelagos.

Possible means by which oribatid mites can be naturally dispersed to remote oceanic islands have been discussed by Jacot (1934), Hammer (1982), Bernini (1990) and Schatz (1991, in press). Regarding the Hawaiian Islands, aerial dispersal of these mostly soil-dwelling arthropods, which are generally very susceptible to desiccation, seems rather unlikely under normal circumstances. The latter includes eastern trade winds that travel across vast distances and jet streams that originate from various points around the Pacific Rim and decelerate over the islands, thereby dropping suspended materials (Carlquist, 1980). There is little empirical information on such potential dispersal, but oribatid mites were not among the arthropods collected from aerial plankton samples above open oceans (Gressitt *et al.*, 1961; Yoshimoto *et al.,* 1962). If aerial dispersal occurs, it seems more likely to happen during typhoons and hurricanes coming from the west (Zimmerman, 1948). These storms move materials quickly in moist air, such that oribatid

mites would be less likely to desiccate, and the 2 recent direct hits (hurricanes Ewa in 1982 and Iniki in 1992) show that they frequently affect the Hawaiian Islands. Rafting on floating plant materials has been considered a more significant mode of dispersal in Pacific Island chains (Hammer, 1982), and Schatz (1991, in press) noted that rafting materials from South America are a likely source of oribatid mite propagules deposited in the Galapagos Islands. However, Jacot (1934) believed that the great distances and time involved in reaching Hawai‘i were too great for such dispersal to occur (see also Dalenius & Wilson, 1958).

There is no question that humans have played a major role in the transport of plants and animals to the Hawaiian Islands (Zimmerman, 1948). From the standpoint of oribatid mites, this certainly began with the early Polynesians who introduced plants that carried mites on their foliage or in attached soil. Such introductions continue today, but now they are potentially worldwide in origin. For example, recent plant quarantine interceptions include mites of the genera *Trichoribates* (Ceratozetidae) and *Humerobates* (Humerobatidae) (Neil Reimer, pers. comm.) from commercial herbs and ornamental cuttings from California and Oregon. The tremendous potential for such introductions was first discussed by Hammer (1969), who distinguished more than 160 species of oribatid mites among 10 years' worth of interceptions at quarantine stations.

With some exceptions, we do not yet know the Hawaiian oribatid mites well enough to identify the introduced species (which probably are many), let alone discuss their origins. Further, it will be virtually impossible to distinguish between natural and human-aided dispersal with regard to those species that are widespread in the Pacific region. Generally poor knowledge of oribatid mite distribution worldwide adds to the overall problem. However, the origin of a few mites seems clear. Species that probably were introduced from Europe, where they are common, include *Perlohmannia dissimilis, Epilohmannia cylindrica* (= *E. verrucosa* Jacot) and *Lucoppia burrowsii*. Such introductions are easy to imagine: the former species was originally described from specimens taken from tulip bulbs, although it is more commonly found in natural habitats (Schuster, 1960); the second is extremely common in garden soil, and the latter species generally inhabits plants. Both of these were included in the plant quarantine material examined by Hammer (1969). Specimens of the second and third species have been identified from several different lots of intercepts at mainland quarantine stations, taken from plant material of European origin (RAN, unpublished).

Other locations have also contributed to the Hawaiian fauna in this manner. *Nehypochthonius porosus* almost certainly was introduced from southeastern North America. Except for the Hawaiian populations, it is known only from leaf litter and moss in rather low elevation pine forests in the Atlantic and Gulf coastal plains (Marshall *et al.* 1987 and unpublished observations). It has been collected from all 6 main Hawaiian islands (Kaua‘i, O‘ahu, Moloka‘i, Lana‘i, Maui and Hawai‘i), but at rather high elevations in wet, humid forests. Niedbala (1994) reported several Oriental species of Euptyctima from Hawai‘i that are not known to be present on other Pacific Islands; this suggests that they have been introduced to Hawai‘i from the west. Jacot (1934) was confident that *Galumna australis* was introduced from South America.

Table 1. List of oribatid mites recorded in the Hawaiian Islands.

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Supercohort **PALAEOSOMATA**																
Superfamily CTENACAROIDEA																
Family Ctenacaridae																
Ctenacarus araneolus (Grandjean, 1932)		Mi						Na			Oa			Kh		
Family Aphelacaridae																
Supercohort **ENARTHRONOTA**																
Superfamily HYPOCHTHONOIDEA																
Family Hypochthoniidae																
Eohypochthonius sp.										Ka						
Hypochthonius sp.													Ln		Ma	Ha
Superfamily PROTOPLOPHOROIDEA																
Family Protoplophoridae																
Cryptoplophora sp.												Mo				
Family Cosmochthoniidae																
Cosmochthonius sp.	Ku	Mi									Oa					
Phyllozetes sp.		Mi														
Family Haplochthoniidae																
Haplochthonius sp.										Ka						
Family Pediculochelidae																
Paralycus sp.															Ma	
Family Sphaerochthoniidae																
Sphaerochthonius suzukii Aoki, 1977										Ka						
Sphaerochthonius sp.		Mi								Ka	Oa	Mo		Kh	Ma	

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Superfamily BRACHYCHTHONIOIDEA																
Family Brachychthoniidae																
Eobrachychthonius sp.																Ha
Liochthonius sp.										Ka						
Sellnickochthonius sp.										Ka						
ATOPOCHTHONIOIDEA																
Family Pterochthoniidae																
Pterochthonius angelus (Berlese, 1910)										Ka		Mo				Ha
Supercohort **PARHYPOSOMATA**																
Superfamily PARHYPOCHTHONOIDEA																
Family Parhypochthoniidae																
Parhypochthonius aphidinus (Berlese, 1904)											Oa				Ma	
Supercohort **MIXONOMATA**																
Superfamily PHTHIRACAROIDEA																
Family Phthiracaridae																
Atropacarus (*Atropacarus*) *striculus* (Koch, 1835)										Ka	Oa	Mo			Ma	Ha
Atropacarus (*Hoplophorella*) *scapellatus* (Aoki, 1965)																Ha
Atropacarus (H.) singularis (Sellnick, 1959)														Kh		
Austrophthiracarus latior (Niedbala, 1982)										Ka	Oa					

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Plonaphacarus kugohi (Aoki, 1959)										Ka						Ha
Phthiracarus anonymus Grandjean, 1933										Ka					Ma	Ha
Phthiracarus crispus Hammer, 1972																Ha
Phthiracarus curiosus Niedbala, in press										Ka	Oa	Mo				Ha
Phthiracarus perlucidus Niedbala, 1994										Ka						
Phthiracarus plenus Niedbala, in press										Ka					Ma	Ha
Phthiracarus pygmaeus (Balogh, 1958)																Ha
Phthiracarus reductus Niedbala, in press											Oa	Mo				Ha
Phthiracarus swiftae Niedbala, in press												Mo			Ma	Ha
Superfamily EUPTHIRACAROIDEA																
Family Euphthiracaridae																
Euphthiracarus (?) *nasutus* Niedbala, in press															Ma	Ha
Microtritia hawaiiensis Niedbala, 1994										Ka	Oa				Ma	Ha
Microtritia cf. minima (Berlese, 1904)											Oa					
Rhysotritia ardua (C.L. Koch, 1841)															Ma	

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Rhysotritia lucida (C.L. Koch,1841)										Ka					Ma	Ha
Rhysotritia sp.										Ka						
Family Oribotritiidae																
Mesotritia sp.										Ka						
Oribotritia hawaiiensis (Jacot, 1928) (= *Hoploderma dasypus* sensu Pearce, 1910)										Ka	Oa		Ln			Ha
Oribotritia pulla Niedbala, in press										Ka	Oa					
Oribotritia sp.										Ka	Oa	Mo			Ma	
Sabacarus corneri Ramsay & Sheals, 1969										Ka		Mo				
Superfamily LOHMANNIOIDEA																
Family Lohmanniidae																
Annectacarus sp.		Mi														
Cryptacarus sp.											Oa					
Vepracarus sp.											Oa	Kh				
Superfamily PERLOHMANNIOIDEA																
Family Perlohmanniidae																
Perlohmannia dissimilis (Hewitt, 1908)																Ha
Superfamily EPILOHMANNIOIDEA																
Family Epilohmanniidae																
Epilohmannia cylindrica (Berlese, 1904)					Ly					Oa						

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Epilohmannia pallida pacifica Aoki, 1965					Ly											
Epilohmannia sp.		Mi							Ka	Oa	Mo			Ma		
Superfamily NEHYPOCHTHONIOIDEA																
Family Nehypochthoniidae																
Nehypochthonius porosus Norton & Metz, 1980										Ka	Oa	Mo	Ln		Ma	Ha
Supercohort **DESMONOMATA**																
Superfamily CROTONIOIDEA																
Family Camisiidae																
Camisia sp.															Ma	Ha
Platynothrus sp.										Ka			Ln		Ma	Ha
Family Malaconothridae																
Malaconothrus spp. (2)										Ka	Oa	Mo				Ha
Trimalaconothrus sp.												Mo				
Family Nothridae																
Nothrus sp.										Ka	Oa		Ln		Ma	Ha
Family Trhypochthoniidae																
Afronothrus incisivus Wallwork, 1961																Ha
Allonothrus sp.																Ha
Trhypochthoniellus crispus (Aoki, 1964)										Ka						
Trhypochthoniellus sp.										Ka						Ha
Tryhypochthonius sp.										Ka		Mo				Ha

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Superfamily NANHERMANNIOIDEA																
Family Nanhermanniidae																
Cyrthermannia sp.																Ha
Masthermannia sp.										Ka		Mo			Ma	
Nanhermannia sp.										Ka		Mo				Ha
Superfamily HERMANNIOIDEA																
Family Hermanniidae																
Phyllhermannia sp.											Oa					
Supercohort **BRACHYPYLINA**																
Superfamily HERMANNIELLOIDEA																
Family Hermanniellidae																
Hermanniella sp.										Ka	Oa	Mo	Ln			Ha
Issaniella sp.										Ka						
Superfamily LIODOIDEA																
Family Liodidae																
Liodes hawaiiensis (Jacot, 1929)											Oa	Mo	Ln		Ma	
Liodes swezeyi (Jacot, 1929)											Oa					
Liodes theleproctus (Hermann, 1804)										Ka		Mo	Ln			Ha
Liodes wakensis (Jacot, 1929)								Na								
Superfamily DAMAEOIDEA																
Family Damaeidae																
Damaeus sp.											Oa					
New genus nr. *Damaeobelba*										Ka		Mo			Ma	

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Superfamily CEPHEOIDEA																
Family Cepheidae																
"*Cepheus " pustulatus*																
(Pearce, 1910), (new genus)										Ka	Oa	Mo				Ha
Superfamily POLYPTEROZETOIDEA																
Family Eremaeozetidae																
Eremaeozetes n. sp.												Mo				
Superfamily MICROZETOIDEA																
Family Microzetidae																
Berlesezetes sp.											Oa	Mo	Ln			
Berlesezetes auxiliaris																
(Grandjean, 1936)					Ly											
Superfamily AMEROBELBOIDEA																
Family Basilobelbidae																
Basilobelba sp.											Oa					
Family Damaeolidae																
Fosseremus sp.												Mo				Ha
Family Eremobelbidae																
Eremobelba sp.										Ka		Mo				
Family Eremulidae																
Eremulus sp.										Ka						Ha
Superfamily GUSTAVIOIDEA																
Family Astegistidae																
Cultroribula sp.											Oa	Mo			Ma	Ha

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Superfamily CARABODOIDEA																
Family Carabodidae																
Austrocarabodes imperfectus (Sellnick, 1959)		Mi														
Austrocarabodes sp.		Mi	Pe												Ma	Ha
Carabodes sp.	Ku										Oa					
Odontocepheus immarginatus Jacot, 1934											Oa					
Family Otocepheidae																
Dolicheremaeus damaeiodes (Berlese, 1913)											Oa					
Dolicheremaeus pallida (Newell, 1956)											Oa					
Dolicheremaeus sp.											Oa	Mo	Ln			
Superfamily TECTOCEPHEOIDEA																
Family Tectocepheidae																
Tectocepheus sarekensis Tragardh, 1910					Ly									Kh		
Tectocepheus velatus (Michael, 1880)		Mi														
Tectocepheus sp.										Ka		Mo	Ln		Ma	Ha
Superfamily OPPIOIDEA																
Family Oppiidae																
Exanthoppia ornatissima Balogh & Balogh, 1983															Ma	
Machuella sp.										Ka						Ha
Microppia minus (Paoli, 1908)											Oa					

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Microppia sp.																Ha
Multioppia wilsoni Aoki, 1964					Ly									Kh		
Multioppia sp.										Ka						
Oppia alces (Jacot, 1934)																Ha
Oppia cronus (Jacot, 1934)											Oa					
Oppia ultraciliata (Jacot, 1934)											Oa					
Oppiella doryphoros Balogh & Balogh, 1983										Ka						
Oppiella nova (Oudemans, 1902)											Oa					
Paroppia flagellata Balogh & Balogh, 1983																Ha
Paroppia hawaiiensis Balogh & Balogh, 1983																Ha
Family Quadroppiidae																
Quadroppia sp.										Ka	Oa				Ma	Ha
Family Suctobelbidae																
Suctobelbella sp.										Ka	Oa					Ha
New genus										Ka						
Family Thyrisomidae																
Banksinoma sp.																Ha
Superfamily HYDROZETOIDEA																
Family Hydrozetidae																
Hydrozetes sp.										Ka	Oa	Mo				

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Superfamily CYMBAEREMAEOIDEA																
Family Cymbaeremaidae																
Scapheremaeus fisheri Aoki, 1966		Mi														
Scapheremaeus sinuosus Aoki, 1964					Ly									Kh		
Scapheremaeus sp.										Ka		Mo				Ha
Superfamily LICNEREMAEOIDEA																
Family Licneremaeidae																
Licneremaeus sp.												Mo				
Family Adhaesozetidae																
Adhaesozetes sp.										Ka						
Superfamily ORIPODOIDEA																
Family Campbellobatidae																
Campbellobates acanthus hawaiiensis P. Balogh, 1985	(HI)															
Campbellobates sp.										Ka						
Family Haplozetidae																
Peloribates sp.											Oa					
Protoribates cf. *capucinus* Berlese, 1908											Oa					
Protoribates pembertoni (Jacot, 1934)											Oa					
Rostrozetes sp.											Oa					Ha
Family Lamellareidae																
Tenuelamellarea hawaiiensis Balogh, 1985															Ma	
Tenuelamellarea sp.																Ha

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Family Oribatulidae																
Cardioribates oriformis (Pearce, 1910)															Ma	Ha
Lucoppia burrowsii (Michael, 1890)															Ma	
Exoribatula pacifica (Aoki, 1964)					Ly											
Oribatula sp.		Mi	Pe								Oa					
Phauloppia bryani Jacot, 1934						Fr										
Phauloppia (Calvoppia) perkinsi (Jacot, 1934) **n. comb**.															Ma	Ha
Phauloppia (Imparatoppia) imparata (Jacot, 1934) **n. comb**.																Ha
Phauloppia sp.												Mo				
Zygoribatula sp.												Mo				
New genus										Ka						
Family Oripodidae																
Oripoda prominens P. Balogh, 1985															Ma	
Oripoda sp.																Ha
Scriptoripoda excellens P. Balogh, 1985															Ma	
Scriptoripoda tenorioae P. Balogh, 1985																Ha
Family Scheloribatidae																
Euscheloribates pembertoni (Jacot, 1934)											Oa					Ha
Hemileius gressitti Balogh & Balogh, 1983															Ma	

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Scheloribates calcaratus (Jacot, 1934)					Ly						Oa					
Scheloribates castlei Jacot, 1934)											Oa					
Scheloribates elegans Hammer, 1958														Kh		
Scheloribates indicus (Oudemans, 1917)											Oa					
Scheloribates insularis (Oudemans, 1917)											Oa					Ha
Scheloribates insularis sandwichensis (Jacot, 1934)											Oa					Ha
Scheloribates manoai Jacot, 1934											Oa					
Scheloribates muiri Jacot, 1934		Mi									Oa					
Scheloribates oahuensis Jacot, 1934											Oa					
Scheloribates vanzwaluwenburgi (Jacot, 1934)											Oa					
Styloribates pectinatus Jacot, 1934											Oa					
Tuberemaeus pappilifer (Newell, 1957)											Oa					
Tuberemaeus singularis Sellnick, 1930																Ha
New genus nr. *Dometorina*											Oa					Ha

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Superfamily CERATOZETOIDEA																
Family Ceratozetidae																
Ceratozetes incurvus Aoki, 1964					Ly											
Ceratozetes sp.										Ka			Ln		Ma	Ha
Fuscozetes sp.										Ka	Oa		Ln			Ha
Family Humerobatidae																
Humerobates rostrolamellatus Grandjean, 1936											Oa					
Humerobates rostrolamellatus perkinsi Jacot, 1934											Oa		Ln			Ha
Humerobates sp.											Oa	Mo	Ln			Ha
Family Mycobatidae																
Mycobates sp.										Ka	Oa				Ma	Ha
Superfamily PHENOPELOPOIDEA																
Family Phenopelopidae																
Eupelops sp.			Pe								Oa					Ha
Superfamily ACHIPTERIOIDEA																
Family Tegoribatidae																
Tegoribates sp.										Ka						Ha
Family Achipteriidae																
Achipteria sp.											Oa	Mo	Ln			
New genus										Ka						
Family Austrachipteriidae																
Hypozetes laysanensis Aoki, 1964					Ly									Kh		
Paralamellobates sp.										Ka						

Table 1. List of oribatid mites recorded in the Hawaiian Islands (continued).

Taxon	Ku	Mi	Pe	Li	Ly	Fr	Ne	Na	Nu	Ka	Oa	Mo	Ln	Kh	Ma	Ha
Superfamily GALUMNATOIDEA																
Family Galumnatidae																
Galumna alata (Hermann, 1804)										Ka			Ln			Ha
Galumna australis pembertoni (Jacot, 1934)		Mi									Oa		Ln			Ha
Galumna elimata (C.L Koch, 1841)		Mi														
Galumna flabellifera Hammer, 1958					Ly									Kh		
Galumna fordi (Jacot, 1934)											Oa					
Galumna swezeyi (Jacot, 1928)											Oa		Ln			
Pergalumna hawaiiensis (Jacot, 1934)											Oa					
Family Ceratokalummatidae																
Ceratokalumma kazsabi Balogh & Balogh, 1988																Ha

Island Distribution: Fr = French Frigate Shoals, Ha = Hawaii, HI = Hawaiian Islands, Ka = Kaua, Kh = Kahoolawe, Ku = Kure, Li = Lisianski, Ln = Lanai, Ly = Laysan, Ma = Maui, Mi = Midway, Mo = Moloka‘i, Ne = Necker, Na = Nihoa, Oa = Oahu, Pe = Pearl & Hermes.

Table 2. Number of oribatid mite taxa reported from selected islands, island systems and continental regions. (Records since the cited source are not included; no attempt was made to adjust numbers for differences in taxonomic concepts).

Region	Families	Genera	Species	Source
Hawaiian Islands (total)	61	111	157	This paper
Japan (all islands)	106	247	564	Fujikawa *et al.,* 1993
Iceland	39	77	159	Gjelstrup & Solhøy, 1994
British Isles	58	135	303	Luxton, 1996
Macaronesian Islands	?	90	142	Pérez-Iñigo, 1974
St. Helena	22	27	48	Wallwork, 1977
Galapagos Islands (total)	63	121	193	Schatz (in press)
Falkland Islands	15	26	32	Stary & Block, 1996
Australia	50	120	220	Hunt, 1994
USA and Canada	108	329	1177*	Marshall *et al.,* 1987
(former) Soviet Union	91	281	956	Ghilarov & Krivolutsky, 1975
Italy	93	249	721	Bernini *et al.,* 1995
Korean Peninsula	73	153	281	Choi, 1988
Austria	78	170	559	Schatz, 1983
(former) Yugoslavia	74	159	451	Tarman, 1983
(former) Czechoslovakia	80	168	404	Kunst, 1971
Romania	78	183	536	Vasiliu *et al.,* 1993
Spain	49	113	237	Pérez-Iñigo, 1974
Denmark	54	114	232	Gjelstrup, 1978
Poland	79	173	505	Olszanowski *et al.,* 1996
Finland	63	139	309	Niemi *et al.,* 1997
Sweden	54	116	263	Lundqvist, 1987

* includes subspecies

Table 3. Number of oribatid mite species known on each of the Hawaiian Islands.

Island	Number of species
Kure	2
Midway	11
Pearl & Hermes	3
Lisianski	0
Laysan	11
French Frigate Shoals	1
Necker	0
Nihoa	2
Ni‘ihau	0
Kaua‘i	55
O‘ahu	70
Moloka‘i	35
Lana‘i	17
Kaho‘olawe	12
Maui	34
Hawai‘i	68

It is interesting that Jacot (1934) and Hammer (1982) had diametrically opposite views on the history of the Hawaiian oribatid mite faunas, but neither author had access to very much data. Jacot (1934) thought that Hawai‘i is too isolated for dispersal by any means except by human transportation; i.e., virtually the whole Hawaiian oribatid mite fauna accrued this way. He believed in very rapid evolutionary change, and suggested that we can distinguish older introductions from recent ones by their degree of divergence. Only the most recent introductions would be indistinguishable from their source populations. Prehistoric introductions would be recognizable as distinct subspecies, and he even claimed to see differences that evolved in only 150 years. Many of his claims seem unlikely today, but Niedbala (1994) recently considered at least 1 endemic species (*Microtritia hawaiiensis*) to derive from speciation after a North American introduction. By contrast, Hammer (1982) believed that European introductions seem insignificant in South Pacific islands such as Tahiti, and even in Java, where there has been considerable European influence. However, the general ecology and socioeconomic history of the Hawaiian Islands is quite different from other islands, and there have been many more opportunities for introductions.

At this point, when most of our knowledge is still at the generic level, we can say relatively little about the origins of the Hawaiian oribatid mite fauna. Hammer (1982; Hammer & Wallwork, 1979) noted that it seems not to be a simple extension of the Polynesian fauna, yet Niedbala (1994) saw Pacific relationships in the Hawaiian species of *Phthiracarus*. Even at this early stage of study it is apparent that the oribatid mite fauna of the Hawaiian Islands derives from many sources. Its eclectic makeup is perhaps best indicated by the presence, in these tropical islands, of an endemic subspecies of *Campbellobates acanthus* , a species elsewhere known only from the subantarctic Campbell Island. Clearly, there are many mysteries waiting to be solved, and many others waiting to be noticed, with regard to the Hawaiian oribatid mite fauna. Solutions will come both from traditional studies of systematics and faunistics, and from the use of DNA markers to identify source populations.

Native Hawaiian oribatid mites are perhaps less likely to be forced into extinction than are the larger, charismatic fauna, and it might be suggested that their study can be safely delayed. However, these small arthropods are also more prone to continual, cryptic introductions by humans which, as time goes by, can only increase the problem of distinguishing the native fauna.

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APPENDIX: Taxonomic Notes

1. The monobasic genus *Cardioribates* was proposed by Jacot (1934), with *Oribata oriformis* Pearce, 1910 as type species. Jacot believed it was related to *Scheloribates*, and Balogh (1961, 1965) included *Cardioribates* with *Scheloribates* among the Oribatulidae (the latter genus is now included in Scheloribatidae by most authors). This was followed by Coetzer (1968). In his later synopses of oribatid mite genera, Balogh (1972, Balogh & Balogh 1992) listed *Cardioribates* (wrongly attributed to Pearce 1910) as a junior synonym of *Lucoppia*, and this was accepted by Fujikawa (1991). Marshall *et al.* (1987) noted a problem with this synonymy, but made no correction.

We list the genus in Table 1 because we feel the past synonymies are incorrect, and that even the family placement is wrong. Based on Jacot's (1934) redescription and figures, we think *Oribata oriformis* is a species in the family Mochlozetidae. The posteriorly tapered shape and large pteromorphs are common in these mites which, like *C. oriformis*, commonly reach 1 mm or more in size. The shape of the lamella-translamella complex and the dorsophragmatic apophyses are consistent with this idea, as are the subterminal notches in the pretarsal claws. The only inconsistency is that the notogaster of Mochlozetidae is fused to the prodorsum anteromedially, while Jacot's fig. 29 shows a complete separation; we think this will prove to be an observation error. Type material in the British Museum (London) needs to be restudied to confirm our idea. Because we feel the genus is indeed a synonym, it is not considered above as endemic to the Hawaiian Islands.

2. Three other endemic, monobasic genera proposed by Jacot (1934) have been considered junior synonyms. Balogh (1972, Balogh & Balogh, 1992) listed *Calvoppia* and *Imparatoppia* as junior synonyms of *Lucoppia*, although they had been recognized as distinct in his earlier synopses (Balogh, 1961, 1963) and in Coetzer's (1968) key to genera of Oribatulidae (*sensu lato*). However, *Lucoppia* has a characteristic prodorsal translamella, which is not present in Jacot's 2 genera. Jacot specifically compared his new taxa to *Phauloppia*, not to *Lucoppia*, and if there is a synonymy it is with the former genus. In lieu of a detailed study of the relationships in this group of oribatulid genera, we address this problem in Table 1 by maintaining Jacot's taxa, *Calvoppia* and *Imparatoppia*, but as subgenera of *Phauloppia* (see n. comb. in Table 1 under Oribatulidae).

The third genus, *Styloribates*, was synonymized with *Scheloribates* (Balogh, 1961) but Coetzer (1968) transferred the type species, *S. pectinatus* Jacot, to his newly proposed genus *Muliercula*, which is known from Africa and the Oriental region (Balogh & Balogh, 1992). Coetzer ignored the fact that *S. pectinatus* was the type species of *Styloribates*. The latter has precedence, and we therefore consider *Muliercula* Coetzer, 1968 as a junior subjective synonym of *Styloribates* Jacot, 1934.

3. The Hawaiian record of *Humerobates rostrolamellatus* is from the publication of Hammer (1969). Mites she determined as the palearctic species *H. fungorum* were intercepted at mainland quarantine stations on plants purportedly coming from Hawaii, with no specific island provenance mentioned. Hammer used *H. fungorum* as a senior synonym of *H. rostrolamellatus*, but referred to by Jacot (1934) as *H. humeralis* (see references in Norton, 1985); he proposed *H. perkinsi* as a Hawaiian subspecies of this mite and we have used the corrected combination.

4. Two literature records are difficult to interpret and we consider them species inquirendae with regard to the Hawaiian fauna. Pearce (1910) reported *Oribata lapidaria* (Lucas, 1846) from the Hawaiian Islands, but this record probably referred to *Humerobates rostrolamellatus* as Jacot (1934) first suspected. Pearce's source was probably Michael (1884) who, as is commonly known, incorrectly used Lucas' name for the mite now known as *H. rostrolamellatus* (see Marshall *et al.,* 1987 and included references). *Oribates dasypus* Dugés, 1834, is a European species that Balogh & Mahunka (1983) and Niedbala (1992) considered to be unrecognizable.