

A survey of *Havaika* (Aranei: Salticidae), an endemic genus from Hawaii, including descriptions of new species

Обзор пауков *Havaika* (Aranei: Salticidae), эндемичного рода из Гавайских островов с описанием новых видов

Jerzy Prószyński
И. Прушинский

Museum and Institute of Zoology, Polish Academy of Sciences, ul. Wilcza 64, 00-679 Warszawa Poland. E-mail: jerzy.proszynski@wp.pl

KEY WORDS: island speciation, *Havaika*, Salticidae, new species, Hawaiian Islands, diagnostic characters, geographical distribution.

КЛЮЧЕВЫЕ СЛОВА: островное видообразование, *Havaika*, новый вид, Гавайи, диагностические признаки, распространение.

Paper dedicated to Dr J.A. Beatty, of Southern Illinois University at Carbondale, IL USA, one of the most knowledgeable spider experts I met, commanding imposing knowledge of the spiders of the Pacific area.

ABSTRACT. The genus *Havaika* has been revised. 23 species recognized from the Hawaiian Islands of which 14 are new to science: *Havaika arnedoi* sp.n., *H. beattyi* sp.n., *H. berlandi* sp.n., *H. berrorum* sp.n., *H. ciliata* sp.n., *H. gillespieae* sp.n., *H. gressitti* sp.n., *H. kahiliensis* sp.n., *H. kauaiense* sp.n., *H. kraussi* sp.n., *H. mananensis* sp.n., *H. mauiensis* sp.n., *H. oceanica* sp.n. and *H. tantalensis* sp.n. Pending description as new are further 5 unidentified *Havaika* species, photographed by Arnedo and Gillespie [2006]. Lectotypes are designated for: *Havaika albociliata* (Simon, 1900), *H. canosa* (Simon, 1900), *H. cruciata* (Simon, 1900), *H. navata* (Simon, 1900), *H. pubens* (Simon, 1900), *H. senicula* (Simon, 1900), *H. valida* (Simon, 1900) and *H. verecunda* (Simon, 1900).

РЕЗЮМЕ. Ревизован род *Havaika*, который включает 23 вида из Гавайских островов, из них 14 являются новыми для науки: *Havaika arnedoi* sp.n., *H. beattyi* sp.n., *H. berlandi* sp.n., *H. berrorum* sp.n., *H. ciliata* sp.n., *H. gillespieae* sp.n., *H. gressitti* sp.n., *H. kahiliensis* sp.n., *H. kauaiense* sp.n., *H. kraussi* sp.n., *H. mananensis* sp.n., *H. mauiensis* sp.n., *H. oceanica* sp.n. и *H. tantalensis* sp.n. Ещё 5 видов сфотографированных Arnedo & Gillespie [2006] ожидают описания. Выделены дектотипы у *Havaika albociliata* (Simon, 1900), *H. canosa* (Simon, 1900), *H. cruciata* (Simon, 1900), *H. navata* (Simon, 1900), *H. pubens* (Simon, 1900), *H. senicula* (Simon, 1900), *H. valida* (Simon, 1900) и *H. verecunda* (Simon, 1900).

Introduction

Havaika is a prolific genus of Salticidae, endemic to the Hawaiian Archipelago (Map 1), containing at least 23 described species, including 14 described here as new. It is very difficult taxonomically because of similarity of species, the paucity of specimens, and the poor condition of many of the specimens. The study of Hawaiian Salticidae, a part of studies on Salticidae of Pacific Islands [Berry, Beatty, Prószyński, 1996, 1997, 1998, as well as Berry, Prószyński, 2001] were carried out in 1998, in the Laboratory of Dr J.W. Berry in the Department of Zoology at Butler University, Indianapolis, IN, USA; using large collection of specimens borrowed from the Bishop Museum in Honolulu, HA; from the American Museum of Natural History in New York, NY; and from the personal collections of Dr J.W. and Mrs E.R. Berry, and Dr J.A. Beatty. The unidentified *Havaika* specimens were determined to the genus level (under synonymic name *Sandalodes*) by Dr J.A. Beatty (personal communication) and were to be studied by a team of authors: J.W. Berry, J.A. Beatty and J. Prószyński. The material was subsequently segregated by J. Prószyński, who also made quick sketches of genital organs and abdominal pattern of selected specimens. There was no possibility, however, to continue studies after that, and only partial results, including erecting genus *Havaika*, were subsequently published by Prószyński [2001]. Prószyński [2001] included redescriptions of the type specimens of Simon [1900] and Berland [1933], studied on earlier occa-



Map 1. Hawaiian Archipelago.
Карта 1. Гавайский архипелаг.

sions. The drawings not used in the 2001 paper, and working notes, have been made available in the Internet since 1998 [Prószyński, 2003, and personal correspondence with M. Arnedo, 2000–2002]. The collection was eventually lent by Dr J.W. Berry to M. Arnedo, who wanted to use it as taxonomic background to a pioneer study of DNA diversity in 29 fresh specimens of *Havaika* by Arnedo and Gillespie [2006]. Unfortunately that paper does not address taxonomy of the genus, and is misleading in that respect.

Materials and Methods

The research was done on type specimens as well as on unidentified materials from the following collections: AMNH — the American Museum of Natural History in New York; BMNH — Natural History Museum (British Museum), London; BPBM — the Bernice P. Bishop Museum in Honolulu; JWBC — personal collection of Dr J.W. Berry (destined for Florida State Collection of Arthropods, loaned to, and presently in the possession of Dr M. Arnedo); MNHN — Laboratoire de Zoologie (Arthropodes), Muséum National d'Histoire Naturelle, Paris.

The following abbreviations are used throughout the paper:

2.A–S — photographs of specimens unidentified and/or misidentified, faded during long preservation, in Arnedo and Gillespie [2006] (to be seen in their original publication). Identity of specimens photographed and their collecting localities were not given.

Abbreviations used for genitalic characters and diagrams of measurements are shown on Figs. 16, 19–20:

AS — anterior spermatheca, B — bulbus, C —

Cymbium, BE — base of embolus, E — embolus, CD — copulatory duct, FC — fertilization duct, NG — porous openings of nutritive glands, O — copulatory opening, P — median pocket, PS — posterior spermatheca, S — soft area, SC — translucent coils of spermatheca, SG — opening of scent gland, T — Tibia, TA — tibial apophysis, W — "window". Bars on Figs 16 and 19 indicate how measurements were taken.

Ratios: Cy/Ti — Cymbium length to tibia length, in %, Em/Ba — Embolus length to base length, in %, Bu/Em — Bulbus length to embolus length, in %, SA/P — length of soft area to length of median pocket, in %, W/SA — width of window to length of soft area, in %, W/P — width of window to length of median pocket, in %.

Specimens were studied under stereomicroscope, with magnification up to 100x (200x with additional 2x objective lens). Palpal organs were detached from body and for examination fixed in sand on the bottom of an ethanol filled Petri dish. After examination the palps were placed in micro vials and stored with specimen in the same collection vial. The epigynes were drawn on the specimens. For examination of internal structure, each epigyne was cut off with tip of a small scalpel, cleared for about 24 hours in 10–20% aqueous KOH solution, stained in Chlorazol Black E alcohol solution, mounted on a temporary slide in clove oil, and examined under a compound microscope, or dissecting microscope with additional lens. After examination, the epigyne was deposited in a microvial and stored together with the specimen. All drawings were made with a 10x10 mm grid micrometer (ocular graticule with squares) onto a paper with a grid (of dimension selected to fit requested drawing size). Complementary measurements of proportions of palps and epigynes were

made from drawings of these organ (as well as from small photographs published by Arnedo and Gillespie [2006]) and are presented as ratios — approximate, but useful as guides to characters shown on drawings. Additional remarks on taxonomic characters in Salticidae are given in further parts of the text.

Examined specimens were labeled with temporary labels, giving genus name (at periods variously *Sandalodes*, *Modunda*, *Havaiki* or *Havaika*) and numbers (like.g., "sp.13") quoted in descriptions in the present paper. The species names and designation of types are not written on the specimen labels, and collections' curators are hereby requested to add them, as designated in this paper.

Species are identified in this paper by pictures of their genital organs studied in single specimens. Comparison of differences is facilitated by ratios (see Table I), but intraspecific variation is not accounted for, as its study must be postponed until new material arrives. Matching of sexes in *Havaika* is at present highly tentative, because the only premise for that is preservation of both in the same vial, which suggests possible collecting in the same locality.

Taxonomic survey

Havaika Prószyński, 2001

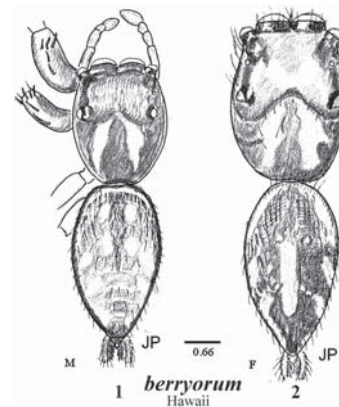
Type species: *Havaika jamiesoni* Prószyński, 2001
Prószyński, 2001: 226–241.
Prószyński, 2003: online.
Arnedo, Gillespie, 2006: 472–495.

DIAGNOSIS. Generalized jumping spiders differing from other genera by epigyne appearance: large anterior "window" covered with white membrane and bisected by sclerotized median pocket. Spermathecae in a form of bent, sclerotized channel, without C-shaped connecting duct as in *Bianor*, and not forming a compact sclerotized body as in *Habronattus*. Palpal organ simple, with embolus short, arising laterally from a base of different length. Body shape and color pattern shown on Figs 1–2, abdominal pattern variation on Figs 3–14.

DESCRIPTION. Cephalothorax dark with variable whitish setae ornamentation on face, as well as some white and yellow scales on frontal surface of chelicerae and on eyes rim. Some species with adpressed whitish setae, or scales, arranged into spots and lines. Anterior lateral eyes set on the face along upper half of median eyes, or slightly higher. Diameter of anterior median eyes twice as long as anterior lateral eyes. Remarkable photographs of facial appearance of five unidentified species of *Havaika* (not precised from where) were provided by Arnedo & Gillespie [2006: 2.A–J].

Abdomen oval, light brown with indistinct pattern of white and dark spots (Figs 1–14). As majority of specimens studied by me, or photographed by Arnedo and Gillespie [2006], are faded after many years of preservation in alcohol, their appearance should be documented again on fresh specimens. Legs yellow, with some segments dark, or with dark rings and spots. Legs I the longest (in males distinctly longer, in females only a little), IV=III, II shortest in both sexes.

Total length of the body varies in *Havaika* from 1.98 to 10 mm. For exemplary specimens — holotype and allotype of *Havaika jamiesoni*, type species of the genus, body mea-



Figs 1–2. *Havaika berryorum* sp. n. Male (1) and female (2).
Рис. 1–2. *Havaika berryorum* sp. n. Самец (1) и самка (2).

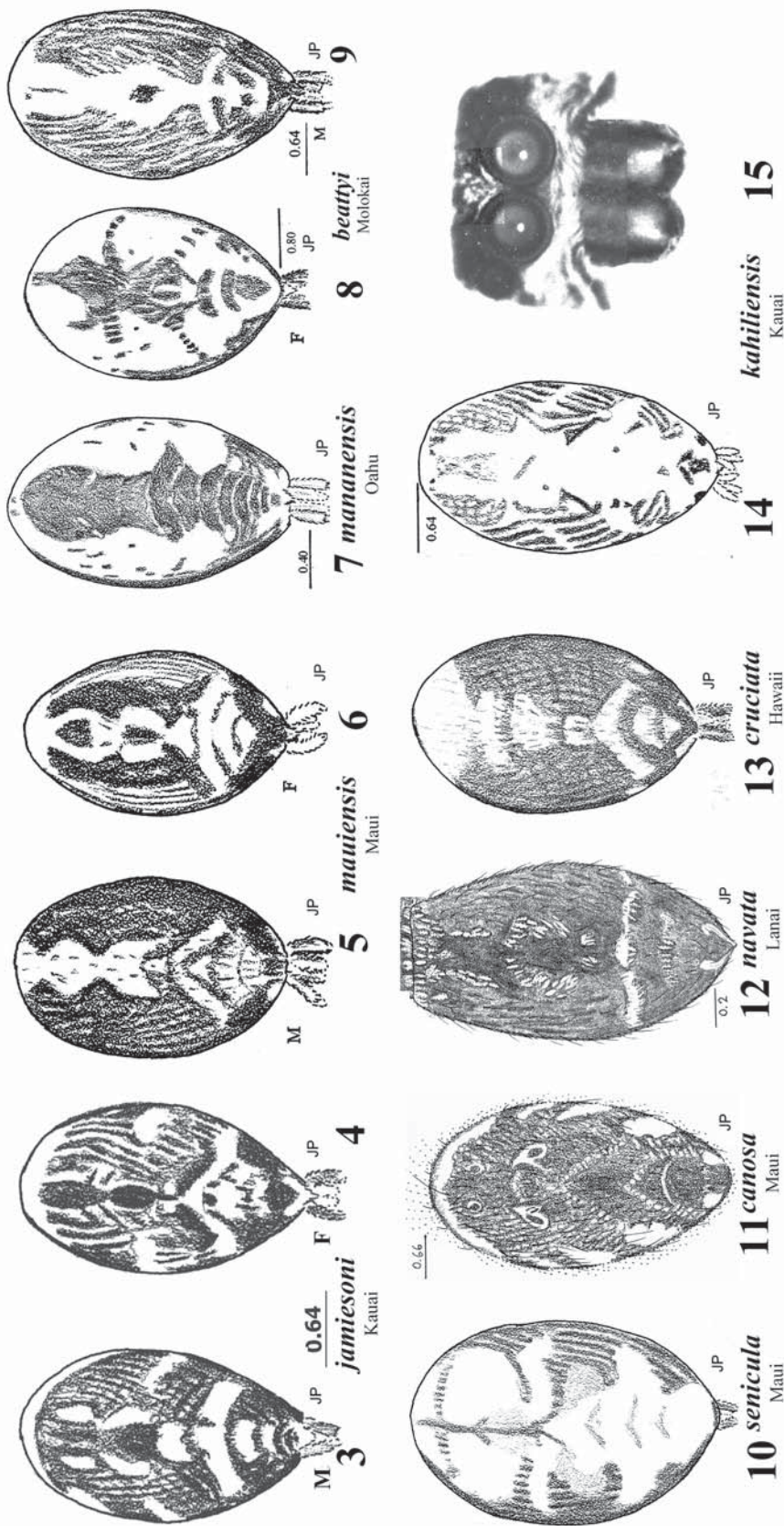
surements (in mm) and proportions (as % of length of cephalothorax, in brackets) are shown in the description below.

Palpal organs simple and very similar, however, when arranged together into a line (Figs 21–68), the differences in shapes, as well as in proportions of tibia, cymbium, bulbus and embolus become apparent and significant. Ratios in males and range of their variation: Cy/Ti (cymbium length to tibia length) — 90–190%, Em/Ba (embolus length to base length) — 70–240%, Bu/Em (bulbus length to embolus length) — 110–210%.

Genital plate of females (epigyne) with anterior membranous white "window" divided in the middle by sclerotized median pocket. It is remarkably similar in all *Havaika*, but differs among species in proportions (Figs 69–84). Ratios in females and range of their variation: SA/P (length of soft area to length of median pocket) — 110–200%, W/SA (width of window to length of soft area) — 100–170%, W/P (width of window to length of median pocket) — 160–300%. Internal structures consist of initial unsclerotized copulatory ducts, bent, connecting copulatory openings to sclerotized spermathecae, each consisting of several chambers arranged in lines, or making more compact body.

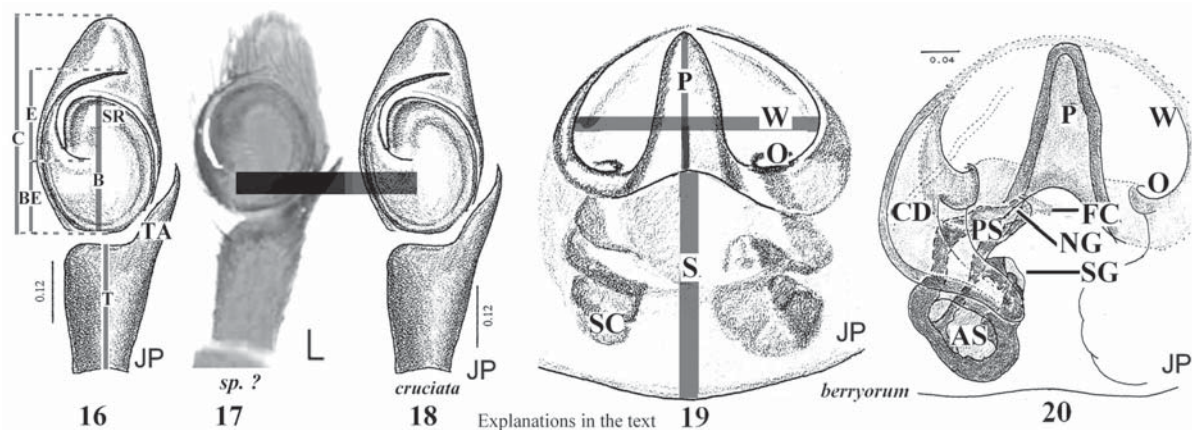
Composition. The genus consist at present of 23 described species (including 14 described here as new), with 5 more unidentified species, photographed by Arnedo and Gillespie [2006] and awaiting future description. Species are listed below, and shown on Table 1. I omit the species named *Havaika flavipes* (Berland, 1933) and *H. triangulifera* (Berland, 1933) from Marquesas Islands [Prószyński, 2001], as their classification is not confirmed by genitalic drawings. All species have very similar appearance, and there is no intrageneric groupings. Considerable morphological gaps in internal structures of epigyne in *Havaika* could indicate incomplete collecting, the extinction of many species, or both. The majority of species are known from specimens of one sex only, and there are no data for matching the males and females.

Relationships. The generalized jumping spiders characters of *Havaika* give few clues as to the relationship of *Havaika* with other genera. Members of the genus *Havaika* are lacking specialized body proportions and the shape of *Bianor* and related genera. The *Havaika* epigynes resemble those of the genera *Bianor*, *Modunda* and *Habronattus*, from which they differ by internal structures, especially spermathecae. Male palps of members of the genus *Havaika* seem to be more specialized. There are similarities in their



Figs 3–15. Color pattern in abdomen in *Hawaika* and face: *H. jamiesoni* male (3), *H. jamiesoni* female (4), *H. mauiensis* sp.n. male (5), *H. mauiensis* sp.n. female (6), *H. mananensis* sp.n. (7), *H. beatyi* sp.n. female (8), *H. beatyi* sp.n. male (9), *H. senicula* (10), *H. navata* (11), *H. navata* (12), *H. cruciata* (13), *H. kahiliensis* sp.n. (14), *H. kahiliensis* sp.n. face of female (15).

Рис. 3–15. Рисунок брюшка у *Hawaika* и "лицо": *H. jamiesoni* самца (3), *H. jamiesoni* самки (4), *H. mauiensis* sp.n. самца (5), *H. mauiensis* sp.n. самки (6), *H. mananensis* sp.n. (7), *H. beatyi* sp.n. самки (8), *H. beatyi* sp.n. самца (9), *H. senicula* (10), *H. navata* (11), *H. navata* (12), *H. cruciata* (13), *H. kahiliensis* sp.n. "лицо" самки (15).



Figs 16–20. Diagram and comparison of genitalic diagnostic characters in *Havaika*: Male palp of lectotype *Havaika cruciata* (16, 18) and palpus of specimen misinterpreted by Arnedo and Gillespie as that species (bar indicate difference in proportions of the base of embolus) (17), epigynum in *H. berryorum* sp. n. (19) and its internal structures (20). Abbreviations in male palpus (16): B — bulbus, C — Cymbium, BE — base of embolus, E — embolus, SR — sperm reservoir, T — Tibia, TA — tibial apophysis. Abbreviations in epigynum (19–20): AS — anterior spermatheca, CD — copulatory duct, FC — fertilization duct, NG — porous openings of nutritive glands, O — copulatory opening, P — median pocket, PS — posterior spermatheca, S — soft area, SC — translucent coils of spermatheca, SG — opening of scent gland, W — "window". Bars indicate how measurements were taken.

Рис. 16–20. Строение копулятивных органов у пауков рода *Havaika*: Пальпа самца *Havaika cruciata* (лектотип, 16, 18) и пальпа самца определённого Arnedo and Gillespie [2006] как *H. cruciata* (полоска показывает разницу в положении основания эмболюса) (17), эпигина *H. berryorum* sp. n. (19) и её внутреннее строение (20). Сокращения (пальпы самца, 16): В — бульбус, С — цимбиум, BE — основание эмболюса, Е — эмболюс, SR — семенной канал, Т — голень, ТА — отросток голени. Сокращения (эпигина, 19–20): AS — верхняя сперматека, CD — копуляционная трубка, FC — оплодотворительная трубка, NG — пора питательной железы, О — копуляционное отверстие, P — средний карман, PS — задняя сперматека, S — мягкий участок, SC — просвечивающиеся каналы сперматеки, SG — отверстие "scent" железы, W — "окошко". Тонкими линиями показано как делались измерения.

general plan to that of *Bianor*, and other related genera. There are no similarities in *Havaika* genital organs to the type species of the prolific continental genus *Pellenes*, perhaps only to a few poorly known North American species, presumably misclassified [Prószyński, 2003]. For these reasons, I abstain temporarily from formal subfamilial placement of the genus *Havaika*.

Havaika albociliata (Simon, 1900)

Figs 23, 39, 67, 77, 96.

Sandalodes albociliatus Simon, 1900: 514, pl. 18, f. 8.

Havaika albociliata: Prószyński, 2001: 231, f. 26–29 (and not f. 30–31).

Havaika albociliata: Prószyński, 2003 : online.

MATERIAL. ♂ lectotype (here designated) "*Sandalodes albociliatus* Simon, 1900. Mt. Koele, Lanai, 1894, Perkins", "1904. X. 24: 423–425" BMNH (there are 2 ♀♀ in the vial — not described in the original description by Simon [1900]. Conspecificity of female assumed, but not proven). 1 ♀, 1 ♂ "20862 *Sandalodes albociliatus* E.S. Lanai (Perkins)", "20862" MNHN. [♀ with epigyne in a separate vial, ♂ small, presumably not conspecific with lectotype, discolored, 1 palpus in a separate vial]. 6 ♀♀ *Havaika albociliatus* [Simon 1900]. "Hawaii: Lanai, Mts. Lanai, 17–II. 1965. N.L.H. Krauss". BPBM.

DIAGNOSIS. Male palpus similar to those of *H. pubens*, *H. arnedoi* and *H. tantalensis*, by having the cymbium about as long as palpal tibia, differs by proportions of bulbus and embolus. In comparison with type species *H. jamiesoni*, palpal tibia is proportionally longer and narrower than the cymbium, and the embolus base is shorter and bulbus narrower. Female: epigyne similar to those of *H. berlandi* and *H. pubens*, from which differs distinctly by the shape of the median pocket; it is also broader than that of the type species, *H. jamiesoni*.

DESCRIPTION. Male lectotype. Palpus (Figs 23, 39, 67), with cymbium indistinctly longer than tibia, embolus shorter than bulbus, the latter about 65% of the length of the cymbium and is relatively broad. Palpus proportions most similar to those of *H. tantalensis*, in which, however, the embolus base is shorter and bulbus narrower. Ratios (in %): Cy/Ti 100, Em/Ba 180, Bu/Em, 130. Anterior surface of chelicerae covered with sparse, small, almost invisible whitish setae. Eyes surrounded with dense, long white setae. Abdomen damaged and deeply altered, with remnants of brownish setae. Abdomen separated from cephalothorax. Large specimen in a very poor condition.

Female. Conspecificity with lectotype uncertain. Proportions of epigyne (Fig. 77) similar to that of *H. pubens*, the striking difference is the broad median pocket, indistinctly narrowing anteriorly. Ratios (in %): SA/P 120, W/SA 150, W/P 180. Spermathecae chambers make a long, relatively compact body, with copulatory ducts joining them in mid-length (Fig. 96). Chelicerae anteriorly with prominent white setae. Face with sparse, inconspicuous setae around anterior eyes, clypeus without white setae.

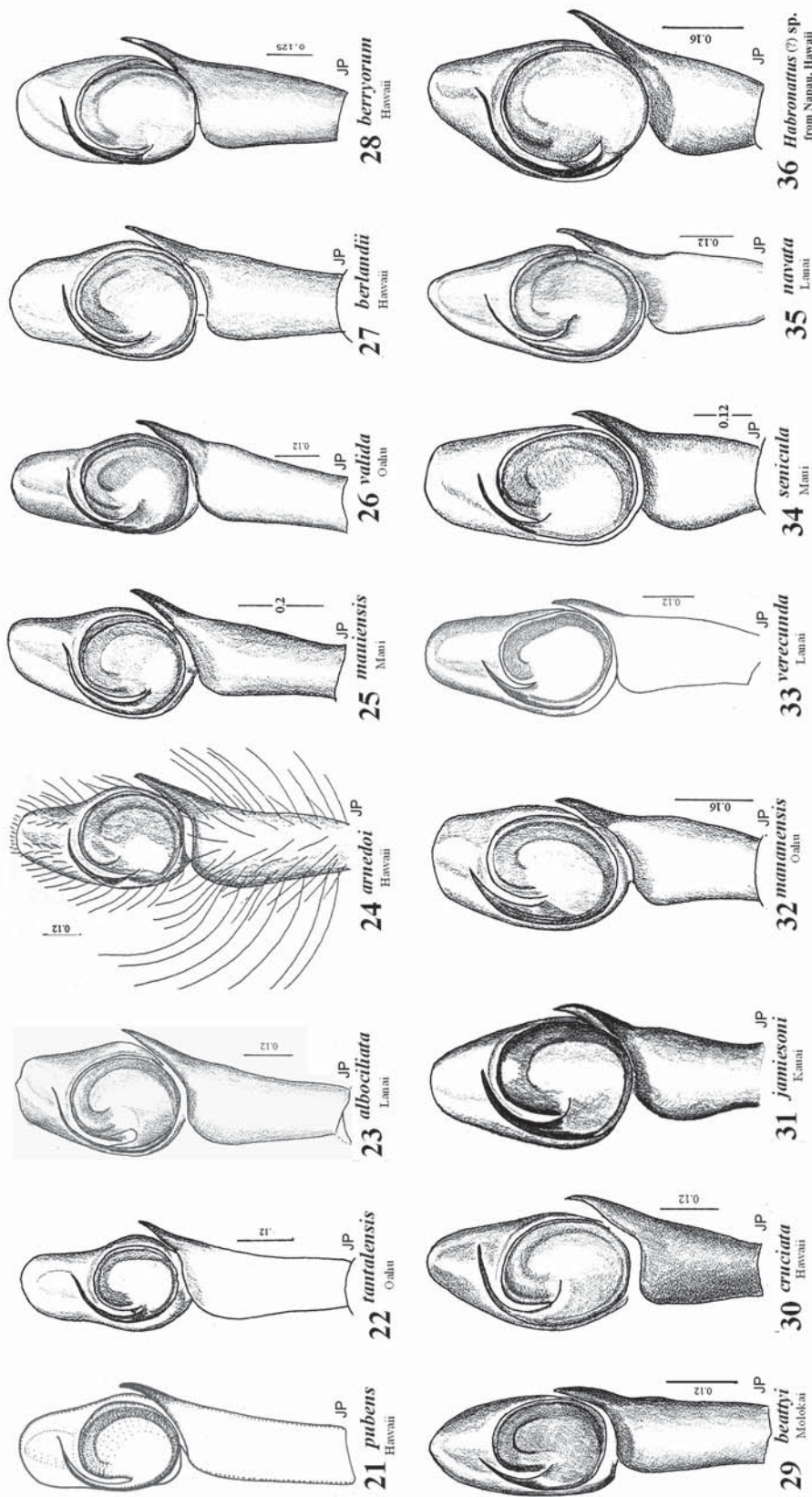
DISTRIBUTION. Documented from Lanai Island: Mt. Koele.

Havaika arnedoi sp.n.

Figs 24, 40, 62.

MATERIAL. ♂ holotype, 3 immature "*Havaika* sp. 1". "Hawaii, Hawaii Co., Waimea Watershed, on Waite Road along hiking trail. 29 January 1998. Coll. J.W. & E.R. Berry." JWBC.

DIAGNOSIS. Proportions of palpus similar to those of *H. albociliata*, from which they differ by diameter of bulbus some 10% smaller.



Figs 21–36. Comparison of male palpal organ in *Havaika*, ventral view. *H. pubens* (21), *H. tantalensis* sp. n. (22), *H. albociliata* (23), *H. arnedoi* sp. n. (24), *H. mauiensis* sp. n. (25), *H. valida* (26), *H. berlandii* sp. n. (27), *H. berryorum* sp. n. (28), *H. beatyi* sp. n. (29), *H. cruciata* (30), *H. jammersoni* (31), *H. mananensis* sp. n. (32), *H. verecunda* (33), *H. senicula* (34), *H. navata* (35), *Habronattus* sp. n. from Napau, Hawaii (36).

Рис. 21–36. Пальца самца *Havaika*, снизу. *H. pubens* (21), *H. tantalensis* sp. n. (22), *H. albociliata* (23), *H. arnedoi* sp. n. (24), *H. mauiensis* sp. n. (25), *H. valida* (26), *H. berlandii* sp. n. (27), *H. berryorum* sp. n. (28), *H. beatyi* sp. n. (29), *H. cruciata* (30), *H. jammersoni* (31), *H. mananensis* sp. n. (32), *H. verecunda* (33), *H. senicula* (34), *H. navata* (35), *Habronattus* sp. n. from Napau, Hawaii (36).

DESCRIPTION. Male holotype. Palpus proportions (Figs 24, 40, 62) resembling those of *H. albociliata*, with ratios: Cy/Ti 110%, Em/Ba 160%, Bu/Em 150%; seems to have particularly long and dense bristles on pedipalpal tibia. Cephalothorax dark brown with two lighter yellow brown streaks along major part of thorax (except posteriorly), separated by dark brown streak. Abdomen light grayish brown with lighter chains of minute dots, anterior margin with white scales, scattered also along the lateral margin. Dorsum of abdomen with sparse short upright dark bristles, giving general "hairy" appearance. Large specimen: length of cephalothorax 3.04 mm, length of abdomen 3.84 mm.

DISTRIBUTION. Documented from Hawaii Island.

ETYMOLOGY. Named for Dr M.A. Arnedo of University of Barcelona, a co-author of a pioneer paper on gene diversity in *Havaika*.

Havaika beattyi sp.n.

Figs 8, 9, 29, 45, 58, 71, 89.

Havaika sp. 6. : Prószyński, 2003: online.

MATERIAL. ♀ holotype, ♂ allotype (with palpus separated), 1 ♂ paratype. "sp. 6". "Molokai I., Molokai Forest Res., Kolekole Cabin, 1190 m in Cibotium stem. 14. I. 1974. F.G. Howarth, E.L. Bousfield". BPBM

DIAGNOSIS. Palpus proportions similar to those of *H. valida*, in both species ratio cymbium to tibia being 20% larger than in *H. albociliata*, and 60% larger than in *H. jamiesoni*; embolus relatively short. Shape of median pocket resembling that of *H. jamiesoni*, but soft area distinctly shorter, more similar to that of *H. albicincta*, which however has pocket broader.

DESCRIPTION. Male allotype. Ratios of palpus proportions are (in %): Cy/Ti 120, Em/Ba 130, Bu/Em 160 (Figs 29, 45, 58) with embolus arising slightly above mid-length of bulbus, embolus somewhat shorter than those of *H. cruciata* and *H. jamiesoni*, but these species differ in remaining ratios. Chelicerae with vertical lines of long white setae along chelicera, white setae on clypeus and around anterior eyes. Abdominal pattern (Fig. 9), darkish, with traces of light broad streak medially along 3/4 of abdomen, but its posterior triangle distinctly darker, remnants of light, short and thin chevrons posteriorly. It seems somewhat similar in appearance to *H. cruciata* and *H. jamiesoni*.

Female holotype. Median pocket appears very long (Fig. 71), particularly striking in comparison with soft area which is only slightly longer, and almost as long as white membranous window; it has rounded anterior tip and parallel sides. Ratios (in %): SA/P 110, W/SA 160, W/P 170. Copulatory ducts relatively short, joining anterior chamber of spermatheca; posterior part of spermatheca long, parallel to anterior one, chamber connecting both parts transverse (Fig. 89). Abdomen unusual white (possibly altered?), with streak of brown irregular spots medially (maximally to 1/3 of width of abdomen), irregular darker spots on lateral limits of dorsal surface (Fig. 8).

DISTRIBUTION. Documented from Molokai Island.

ETYMOLOGY. Named for Dr J.A. Beatty of Southern Illinois University, Carbondale, IL, an expert on Salticidae, who identified to the genus level all *Havaika* collections in the AMNH and in the BPBM.

Havaika berlandi sp.n.

Figs 27, 43, 64, 69, 85.

Havaika sp. 8. : Prószyński, 2003: online.

MATERIAL. ♀ holotype, ♂ allotype, "sp. 8". "Kilauea Park Boundary — Hilo side 3900 ft. 25. VI. 1966. T. Suman". BPBM.

DIAGNOSIS. Palpus most similar to that of *H. mauiensis*, from which differs by larger bulbus and longer embolus base, differs from that of *H. jamiesoni* which has the cymbium even longer and broader. Epigyne similar to that of *H. pubens*, but is narrower, soft area is shorter.

DESCRIPTION. Male allotype. Palpus (Figs. 27, 43, 64), nearest to specimen on photo 2.M — captioned "*verecunda* lineage", but embolus base distinctly shorter and bulbus somewhat longer. Bulbus relatively broad, tibial apophysis about as long as embolus. Ratios: Cy/Ti 140%, Em/Ba 200%, Bu/Em 130%. Chelicerae with long, sparse setae.

Female holotype. Epigyne appears broad, with "window" more than two times wider than length of median pocket (Fig. 69), median pocket conical, gently narrowing, shorter than membranous "window". Ratios (in %): SA/P 130, W/SA 170%, W/P 220%. Copulatory ducts long and broad, their posterior part with sclerotized walls, joining anterior spermathecal chamber along its whole length (Fig. 85), similar to that of *H. ciliata*. Posterior spermatheca occurs dorsal to the anterior spermatheca, and is only indistinctly longer. Setae on chelicerae more dense than in male. Abdominal pattern poorly preserved.

DISTRIBUTION. Documented from Hawaii Island.

ETYMOLOGY. Named for L. Berland, an arachnologist, author of 16 papers from 1913–1942, dealing with Salticidae of the Pacific Ocean basin.

Havaika berryorum sp.n.

Figs 1–2, 19–20, 28, 44, 61, 73, 87.

Havaika sp. Prószyński, 2001: 229, f. 10–15.

Havaika sp. 2. Prószyński, 2003: online.

MATERIAL. ♀ holotype, ♂ allotype (with palpus in separate vial), 1 ♂ paratype. "sp. 2" "Hawaii I., Kalopa St. Park, 2500' banana leaves, 13 Feb. 1995. J.W. & E.R. Berry". JWBC.

DIAGNOSIS. Male most similar to that of *H. mauiensis*, but with longer bulbus and embolus base. Proportions of epigyne similar to those of *H. jamiesoni* and *H. oceanica*, but differ distinctly by shape and size of median pocket

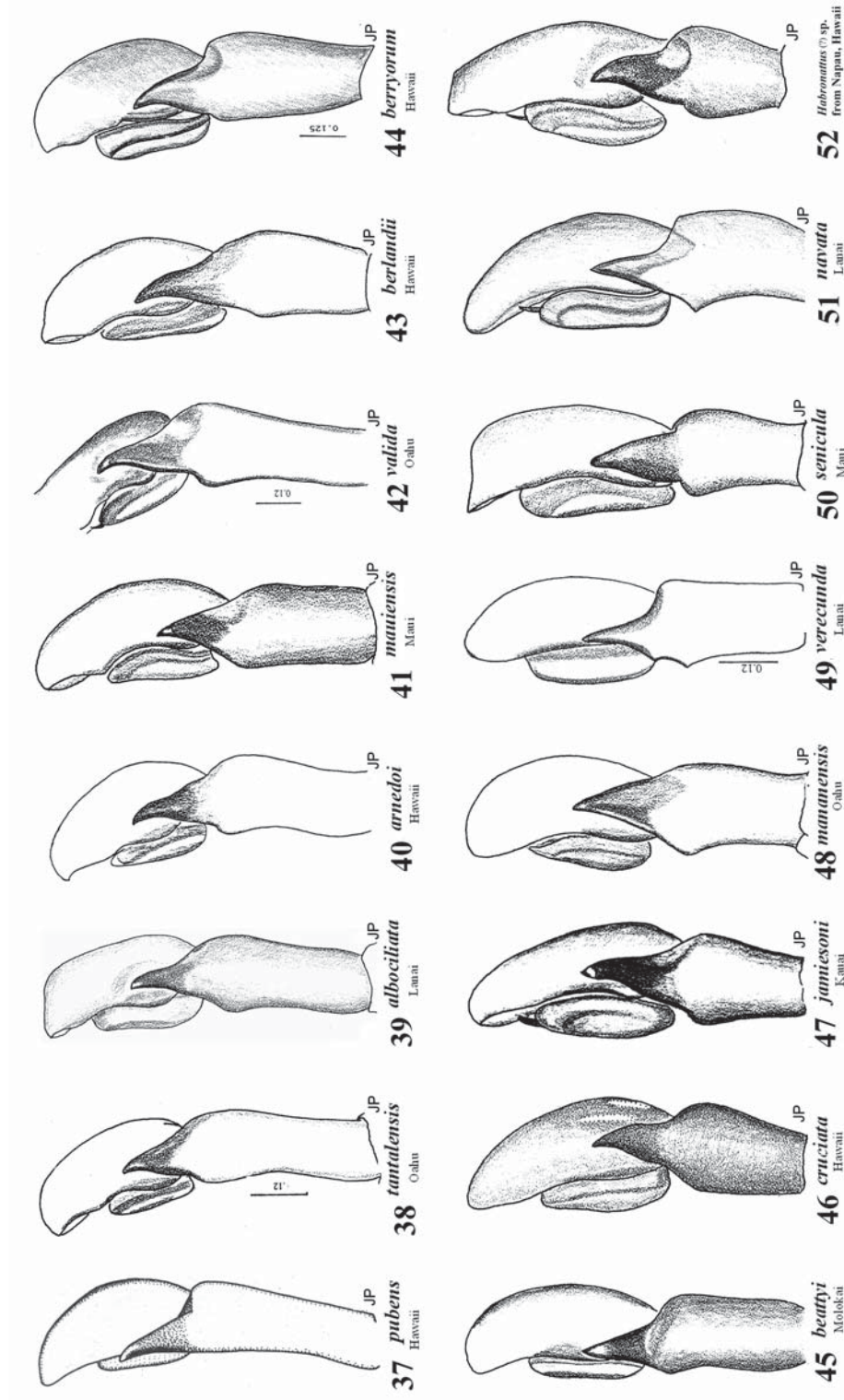
DESCRIPTION. Male allotype. Palpus (Figs, 28, 44, 61) ratios: Cy/Ti 120%, Em/Ba 210%, Bu/Em 130%. Dorsal pattern: thorax with a pair of prominent white streaks, abdomen with two indistinct pairs of light spots anteriorly, posteriorly with 4 indistinct dark median bars (Fig. 2).

Female holotype. Epigyne with median pocket conical (Figs 9, 73), as long as membranous window, gently narrowing, posterior soft space distinctly longer than in that of *H. ciliata*. Ratios of epigyne: SA/P 160%, W/SA 110%, W/P 170%. Intermediate chamber connecting anterior and posterior parts of spermathecae arranged diagonally (Figs 20, 87). Dorsal pattern with two prominent white streaks along posterior part of cephalothorax, abdomen dark with striking white median streak along its central part, followed laterally by two pairs of diagonal white spots, there is anterior marginal white line (Fig. 1).

DISTRIBUTION. Documented from Hawaii Island.

Remark. Collected on banana leaves in the same locality as ♀ *H. ciliata*, 2 days earlier.

ETYMOLOGY. Named for Dr and Mrs J.W. Berry, formerly of Butler University, Indianapolis, IN, USA, collectors of Pacific Salticidae for 20 years, and very good friends who made possible my research in his laboratory.



Figs 37–52. Comparison of male palpal organ in *Havaika*, lateral view: *H. pubens* (37), *H. tantatensis* sp.n. (38), *H. albociliata* (39), *H. arnedoi* sp.n. (40), *H. mauiensis* sp.n. (41), *H. valida* (42), *H. berlandi* sp.n. (43), *H. berryorum* sp.n. (44), *H. beautyi* sp.n. (45), *H. cruciata* (46), *H. jamiesoni* (47), *H. mananensis* sp.n. (48), *H. verecunda* (49), *H. senicula* (50), *H. navata* (51), *Habronatus* sp. from Napau (52).

Рис. 37–52. Пальпа самца *Havaika*, сбоку: *H. pubens* (37), *H. tantatensis* sp.n. (38), *H. albociliata* (39), *H. arnedoi* sp.n. (40), *H. mauiensis* sp.n. (41), *H. valida* (42), *H. berlandi* sp.n. (43), *H. berryorum* sp.n. (44), *H. beautyi* sp.n. (45), *H. cruciata* (46), *H. jamiesoni* (47), *H. mananensis* sp.n. (48), *H. verecunda* (49), *H. senicula* (50), *H. navata* (51), *Habronatus* sp. из Напау (52).

Havaika canosa (Simon, 1900)
Figs 11, 81.

Sandalodes canosus Simon, 1900: 515, Pl. 18, f. 13.

Havaika canosa: Prószyński, 2001: 229–230, f. 32–33.

Havaika canosa: Prószyński, 2003: online.

MATERIAL. ♀ lectotype (here designated) "*Sandalodes canosus* E.S." "Haleakala" "1904, X. 24. 427". BMNH.

DIAGNOSIS. Proportions of epigyne very similar to those of *H. oceanica*, differ by shape of median pocket, broad and not narrowing apically.

DESCRIPTION. Female lectotype (see also Prószyński, 2001: 229–230, f. 32–33). Epigyne (shown on Fig 82) has proportions very similar to those of *H. jamiesoni* (Fig. 72) and *H. oceanica* (Fig. 75), but differ in details of shape, especially of median pocket. Ratios: SA/P 170%, W/SA 130%, W/P 210%. Abdominal pattern (Fig. 11) dark, with light dots arranged into 3 chevrons medially, as well as 2 pairs of white lines laterally, and a semilunar spot on anterior edge. I abstained from making slide of epigyne to preserve type specimen intact. Large specimen.

DISTRIBUTION. Documented from Maui Island.

Havaika ciliata sp.n.
Figs 70, 86.

Havaika sp. "not conspecific with *albociliata*" Prószyński, 2001: 232, f. 30–31.

MATERIAL. ♀ holotype (with epigyne cleared, in separate microvial), 2 ♀♀ paratypes, immature. "sp. 3". Hawaii I., Kalopa St. Park, banana leaves, 15 Feb. 1995. J.W. & E.R. Berry". JWBC.

DIAGNOSIS. Epigyne similar to those of *H. kahiliensis* and *H. berlandi*, differing by shape of median pocket which is broad, gently narrowing and rounded apically.

DESCRIPTION. Female holotype. Epigyne very similar to that of *H. kahiliensis*, with slightly longer soft area and median pocket (Fig. 70), which is gently rounded apically, its internal structures are shown on Fig. 86. Ratios: SA/P 140%, W/SA 150%, W/P 210%. Thorax with two distinct, lighter streaks, separated by the darker one. Abdomen — central part of dorsum dark with violet hue, anterior part with broad white margin, followed by two diagonal light lines of apparently interrupted anterior marginal band; ventral coloration — very distinct dark streak bordered with white. Clypeus black, narrow, thin line of short, inconspicuous orange hairs around dorsal rims of anterior eyes. Lines of white scales on chelicerae broad, expanded into three broad spots separated by a very narrow dark gaps. Large specimen.

DISTRIBUTION. Documented from Hawaii Island.

REMARK. Collected on banana leaves in the same locality as *H. berryorum*, 2 days later.

Havaika cruciata (Simon, 1900)
Figs 13, 16–18, 30, 46, 55.

Sandalodes cruciatus Simon, 1900: 516, pl. 18, f. 11.

Havaika cruciata: Prószyński, 2001: 230, f. 34–36.

Havaika cruciata: Prószyński, 2003, on line.

MATERIAL. ♂ lectotype (here designated, specimen with palpus separated), 3 ♂♂ (in worse condition), "*Sandalodes cruciatus* Simon, 1900. Hawaii, Kana, VI. 1893. Perkins "1904. X. 24: 440–442". BMNH. 1 ♂, 1 ♀ "21077 *Sandl. cruciatus* E.S. Hawaii (Perkins". MNHN.

Comparative material. Photographs f. 2.B, G, L, R of specimens captioned *Havaika "cruciata"* (misidentified), from the Hawaii Archipelago of unknown collection locality.

DIAGNOSIS. Palpus proportions similar to those of *H. jamiesoni*, differing by longer embolus base and shorter bulbous.

DESCRIPTION. Male lectotype. Palpus (Figs 30, 46, 55) similar to that of *H. jamiesoni*, in which embolus base is shorter and embolus longer. Ratios of type specimen (in %): Cy/Ti 170, Em/Ba 120, Bu/Em 160. Misidentified specimen shown in photograph 2.L, captioned as *H. "cruciata"*, has distinctly shorter embolus base and also embolus longer (Figs 16–17), its ratios (in %) are: Cy/Ti 150, Em/Ba 240, Bu/Em 130. Abdomen brown with median white streak consisting of fused, modified chevrons, anteriorly damaged (Fig. 13). Specimen small.

Female specimen is disregarded here because of uncertain conspecific status, also the collecting locality of the only known specimen, preserved in Paris collection, is not written on the label.

DISTRIBUTION. Documented from Hawaii Island (?) (there is also a Kana on Maui Island).

REMARKS. Color photographs 2. B, G and R of face ornamentation of male and female, as well as dorsal pattern of female, captioned *Havaika "cruciata"* cannot be used here because it is not known which species they purport to illustrate, and of which specimens they were taken (collecting labels quotation is not given). The characters shown seem to appear in several *Havaika* species.

Havaika gillespieae sp.n.
Fig. 83, 90.

Havaika sp. 11. Prószyński, 2003: online.

MATERIAL. ♀ holotype (with epigyne separated in microvial), 5 ♀♀ paratypes "sp 11". "Oahu, Mt. Koala, 4000' in swamp, 2. VIII. 1964 T. Suman". BPBM.

DIAGNOSIS. Epigyne proportions similar to those of *H. gressitti* and *H. navata*, from which they differ distinctly by shape of median pocket.

DESCRIPTION. Female holotype. Epigyne (Fig. 83) with median pocket conical, narrow and long, soft area relatively long, resembling by shape that of *H. oceanica*, but by proportions that of *H. gressitti* and *H. navata*. Ratios (in %): SA/P 180, W/SA 120, W/P 230. Copulatory ducts narrow, anterior chamber of spermathecae set diagonally, posterior part of spermathecae narrow and long (Fig. 90). Abdominal pattern resembling that of *H. cruciata*, but seems lighter.

DISTRIBUTION. Documented from Oahu Island.

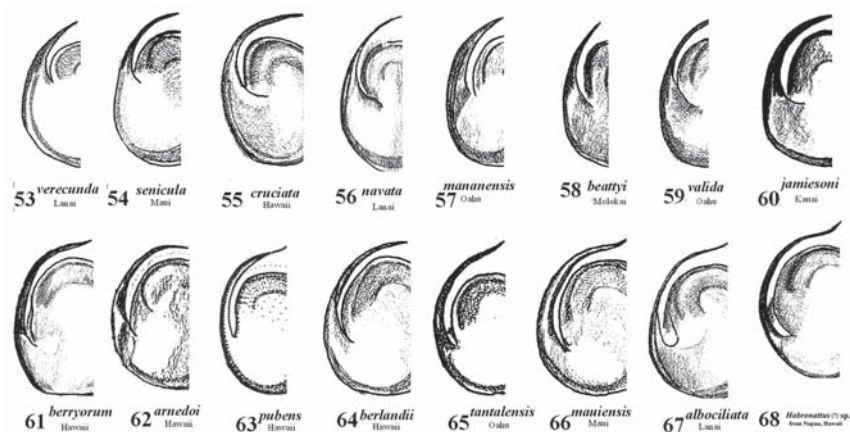
ETYMOLOGY. Named for Dr R.G. Gillespie of University of California at Berkeley, CA, a coauthor of a pioneer paper on DNA diversity in *Havaika*.

Havaika gressitti sp.n.
Figs 79, 91.

MATERIAL. ♀ holotype (with epigyne separated into small vial), 1 ♀ paratype — "cf. *albociliatus*", "Oahu, S end of Waianae Mts., 2000 ft. 25. VI. 1965. T. Suman". BPBM.

DIAGNOSIS. Epigyne proportions similar to those of *H. gillespieae*, from which they differ distinctly by the shape of the median pocket.

DESCRIPTION. Female holotype. Epigyne (Fig. 79) broad and short, similar to that of *H. gillespieae*, from which it differs by much broader and shorter median pocket, anteriorly truncated (bending of its edge seems not to be diagnostic), and to *H. kauaiense*. Ratios (in %): SA/P 190, W/SA 130, W/P 250. Copulatory ducts broad and short, anterior



Figs 53–68. Comparison of embolus and its origin point in *Havaika*: *H. verecunda* (53), *H. senicula* (54), *H. cruciata* (55), *H. navata* (56), *H. mananensis* sp.n. (57), *H. beattyi* sp.n. (58), *H. valida* (59), *H. jamiesoni* (60), *H. berryorum* sp.n. (61), *H. arnedoi* sp.n. (62), *H. pubens* (63), *H. berlandii* sp.n. (64), *H. tantalensis* sp.n. (65), *H. maiuensis* sp.n. (66), *H. albociliata* (67), *Habronattus* from Napau (68).

Рис. 53–68. Сравнительные рисунки эмболюса и его основания у пауков рода *Havaika*: *H. verecunda* (53), *H. senicula* (54), *H. cruciata* (55), *H. navata* (56), *H. mananensis* sp.n. (57), *H. beattyi* sp.n. (58), *H. valida* (59), *H. jamiesoni* (60), *H. berryorum* sp.n. (61), *H. arnedoi* sp.n. (62), *H. pubens* (63), *H. berlandii* sp.n. (64), *H. tantalensis* sp.n. (65), *H. maiuensis* sp.n. (66), *H. albociliata* (67) и *Habronattus* из Napau (68).

parts of spermatheca shorter than in other species (Fig. 91). Specimen externally resembling *H. albociliata*.

DISTRIBUTION. Documented from Oahu Island.

ETYMOLOGY. Named for Dr J.L. Gressitt, an entomologist who studied chrysomelid and cerambycid beetles, and an important writer on biogeography of Pacific basin, collector of some *Havaika* kept in Bishop Museum. He was the senior entomologist at the Bernice P. Bishop Museum at the time of his death in 1982 in an airplane accident in China.

Havaika jamiesoni Prószyński, 2001

Figs 3–4, 31, 47, 60, 72, 88.

Havaika jamiesoni Prószyński, 2001: 227, f. 4–9.

Havaika jamiesoni: Prószyński, 2003: online.

MATERIAL. ♂ holotype (with palpal organ separate in microvial), 2 ♂♂ paratypes, 1 ♀ allotype, 9 imm. — "*Havaika A*". Hawaii, Kauai Co., Koke's State Park, Nu'Alolo Trail. Elev. 3600 ft. 23 January 1998. Coll. J.W. & E.R. Berry. JWBC.

DIAGNOSIS. Palpus most similar to those of *H. berlandii* and *H. cruciata*, but it differs in details of proportions and shape. Epigyne with median pocket comparable to *H. beattyi*, but with different proportions.

DESCRIPTION. Male holotype. Palpus proportions (in %): Cy/Ti 160, Em/Ba 140, Bu/Em 150 (Figs 31, 47, 60) similar to that of *H. berlandii*, with embolus base longer, but embolus equal in length; it is also close to photograph 2.L misidentified as *H. "cruciata"*, from which it differs by longer embolus base and shorter embolus. Abdominal pattern (Fig. 3) consists of white spots, lines and bars on dark background. Measurements and proportions of male holotype: total body length 4.44, length of cephalothorax 2.04 (100 %), length of eyefield 0.96 (47%), height of cephalothorax .98 (48%), width of cephalothorax at eyes 1 — 1.32 (65%), width cephalothorax at eyes 3—1.38 (68%), width of cephalothorax at mid-length 1.50 (74%), length of abdomen 2.40 (118%), width of abdomen at mid-length 1.32 (65%). Length of segments of legs (tarsus + metatarsus + tibia + patella + femur): I 0.66 + 0.84 + 1.14 + 0.84 + 1.32, II 0.48 + 0.54 + 0.60 + 0.60 + 0.96, III 0.48 + 0.72 + 0.66 + 0.60 +

1.20, IV 0.48 + 0.78 + 0.66 + 0.60 + 1.04. Legs formula (length of 5 segments in % of leg I) I (100 %), III (76%) = IV (76%), II (66%).

Female allotype. Epigyne (Fig. 72) has proportions (in %): SA/P 160, W/SA 130, W/P 210 similar to those of *H. canosa* and *H. oceanica*, from which it differs in details of shape (Figs. 72, 81), especially in width and apical end of median pocket. Also shape of spermathecae is different (Fig. 88). Abdominal pattern (Fig. 4) consists of white spots, lines and bars on dark background. Medium-sized specimen (total length 4.32 mm). Measurements and proportions of female allotype. Total body length 4.32, length of cephalothorax — 2.04 (100 %), length of eye field 96 (45%), height of cephalothorax — .90 (44%), width of cephalothorax at eyes 1 — 1.20 (59%), width of cephalothorax at eyes 3 — 1.32 (65%), width of cephalothorax at mid-length 1.38 (68%), length of abdomen — 2.28 (112%), width of abdomen at mid-length — 1.38 (68%). Length of segments of legs: I 0.48 + 0.48 + 0.72 + 0.72 + 1.08; II 0.42 + 0.48 + 0.48 + 0.54 + 0.84, III 0.48 + 0.60 + 0.60 + 0.60 + 1.04, IV 0.48 + 0.66 + 0.60 + 0.60 + 1.08. Legs formula (length of 5 segments in % of leg I): I (100 %), III (98%) = IV (98%), II (79%).

DISTRIBUTION. Documented from Kauai Island.

REMARK. Type species of the genus, detailed description of this species is given by Prószyński [2001: 227, Figs 4–9], dimensions are quoted above.

ETYMOLOGY. Named for Mr Dean Jamieson, a retired entomologist and a collector on the island of Kauai.

Havaika kahiliensis sp.n.

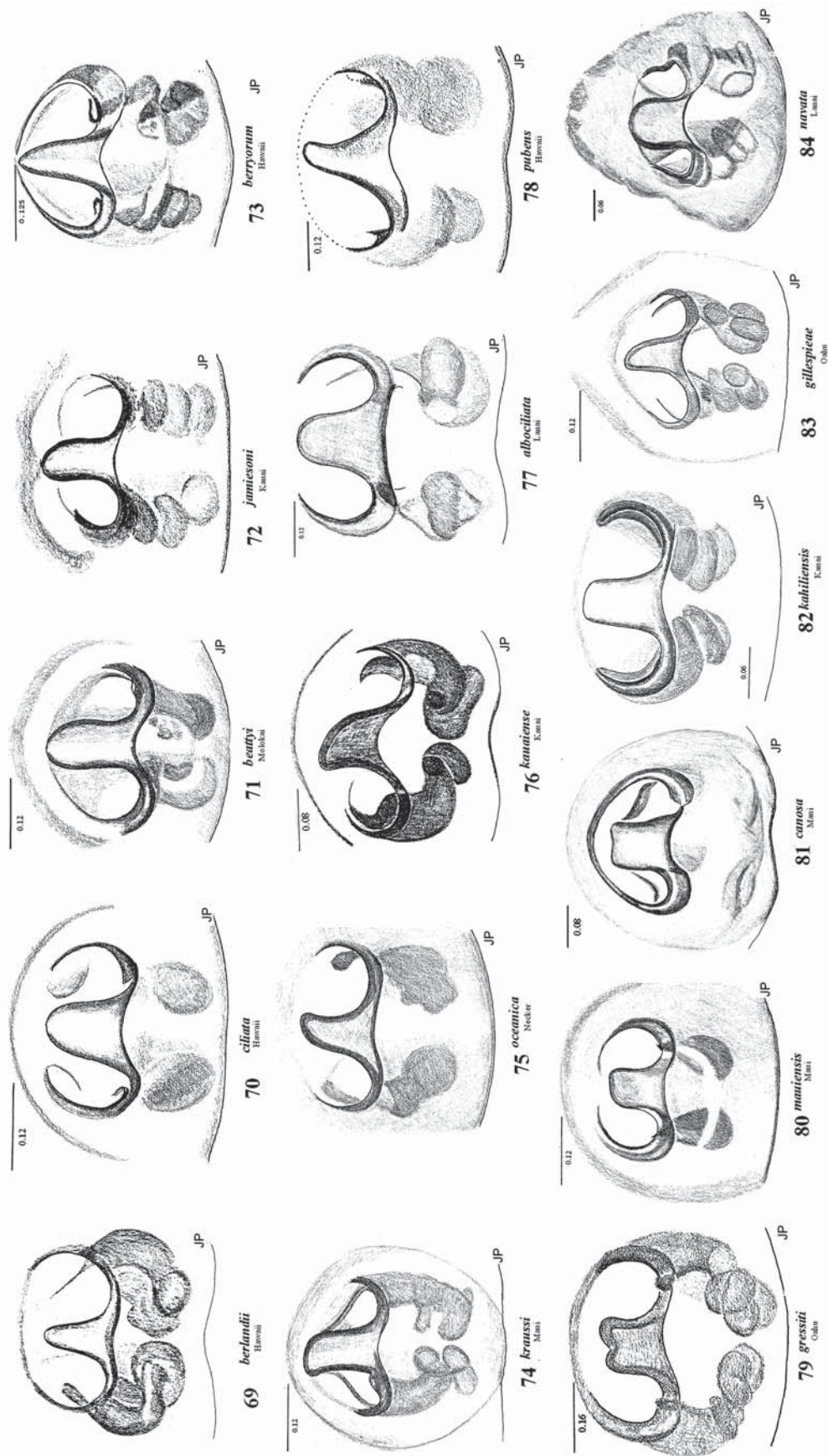
Figs 14–15, 82, 97.

Havaika sp.12. Prószyński, 2003: online.

MATERIAL. ♀ holotype" sp 12". "Kauai I., Mt. Kahili, on *Cheirodendron kauaiense* var. *Forbesi*, 17. XI. 1968. W.C. Cagne". BPBM.

DIAGNOSIS. Epigyne broad and short, most similar to that of *H. ciliata*.

DESCRIPTION. Female holotype. Epigyne appears short and broad, most similar to that of *H. ciliata*, broader than in



Figs 69–84. Comparison of epigynum in *Havaika*: *H. berlandii* sp.n. (69), *H. ciliata* sp.n. (70), *H. beatyi* sp.n. (71), *H. jamiesoni* (72), *H. berrorum* sp.n. (73), *H. kraussi* sp.n. (74), *H. oceanica* sp.n. (75), *H. kauaiense* sp.n. (76), *H. albociliata* (77), *H. pubens* (78), *H. gressitti* sp.n. (79), *H. mauiensis* sp.n. (80), *H. canosa* (81), *H. kahiliensis* sp.n. (82), *H. gillespieae* sp.n. (83), *H. navata* (84).
 Рис. 69–84. Сравнительные рисунки эпигиния *Havaika*: *H. berlandii* sp.n. (69), *H. ciliata* sp.n. (70), *H. beatyi* sp.n. (71), *H. jamiesoni* (72), *H. berrorum* sp.n. (73), *H. kraussi* sp.n. (74), *H. oceanica* sp.n. (75), *H. kauaiense* sp.n. (76), *H. albociliata* (77), *H. pubens* (78), *H. gressitti* sp.n. (79), *H. mauiensis* sp.n. (80), *H. canosa* (81), *H. kahiliensis* sp.n. (82), *H. gillespieae* sp.n. (83) и *H. navata* (84).

the other similar species, *H. jamiesoni*; median pocket apically truncated (Fig. 82). Ratios (in %): SA/P 150%, W/SA 150, W/P 220. Anterior part of spermatheca compact and short, posterior spermatheca narrow (Fig. 97), long and bent. Face (Fig. 15, resembling photograph 2.C), with broad band of intensely white scales hanging from clypeus edge, extended by bent thick line beneath anterior lateral eyes and continuing along lateral sides of cephalothorax, separated by a narrow dark stripe from a lower line of white setae. There is a broad triangle of white setae above the junction of anterior median eyes, being part of white setae dorsally on eye field. Sternum and coxae yellow, abdomen ventrally whitish yellow. Dorsal abdominal pattern light with irregular, broad light median area and darker, mottled sides (Fig. 14), presumably faded after 40 years of preservation in alcohol.

DISTRIBUTION. Documented from Kauai Island.

ETYMOLOGY. Name derived from collecting locality — Mt. Kahili.

Havaika kauaiense sp.n.

Figs 76, 93.

Havaika sp. 13. Prószyński, 2003: online.

MATERIAL. ♀ holotype. "sp 13". "Hawaiian Is. Kauai, T.H. Ko Kee, 4000 ft. July 1952, D.E. Hardy". AMNH.

DIAGNOSIS. Epigyne very similar to that of *H. gressitti*, from which it differs in the shape of the median pocket.

DESCRIPTION. Female holotype. Proportions of epigyne (in %: SA/P 190, W/SA 160, W/P 300) similar to that of *H. gressitti*, but with a broader "window", median pocket conical with posterior edge deeply bent (Fig. 76). Copulatory ducts and spermathecae seem somewhat misplaced on preparation by being pushed forward (Fig. 93). Frontal aspect: chelicerae with remnants of whitish setae, clypeus low, fawn colored, with a striking white fringe of setae overhanging cheliceral bases. Setae surrounding eyes I inconspicuous and colorless. Abdomen. Median streak dark, with broad whitish areas on both sides of streak. Length of cephalothorax 2.16 mm, length of abdomen 2.88 mm.

DISTRIBUTION. Documented from Kauai Island.

ETYMOLOGY. Name derived from collecting locality — Kauai.

Havaika kraussi sp.n.

Figs 74, 94.

Havaika sp. 10. Prószyński, 2003: online.

MATERIAL. ♀ holotype. "sp 10". "Maui, Haleakala crater, Haleauu trail, 8000 ft. 24. VII. 1965. T Suman". BPBM.

DIAGNOSIS. Epigyne proportions similar to those of *H. berryorum*, but it differs by shape of median pocket.

DESCRIPTION. Female holotype. Proportions of epigyne similar to those of *H. berryorum*, some 10% narrower, differ distinctly by longer median pocket with parallel sides and apically truncated, soft area slightly longer (Fig. 74). Ratios: SA/P 160%, W/SA 100%, W/P 160%. Anterior spermatheca somewhat smaller than those in *H. berryorum*, connecting chamber set transversally (Fig. 94).

Clypeus brown with very long, colorless setae stretching forward, and long white setae overhanging cheliceral bases. Small white adpressed setae on sides, behind the line of anterior lateral eyes. Abdomen (now) almost uniformly grayish brown, remnants of whitish spots covered with remnants of whitish adpressed setae on anterior margin, 2 pairs of small lateral spots and faint places of a row of median spots.

No trace of transverse white line. Length of cephalothorax — 2.64 mm, l. of abdomen 3.84 mm.

DISTRIBUTION. Documented from Maui Island.

ETYMOLOGY. Named for N.L.H. Krauss, collector of some *Havaika* kept in Bishop Museum.

Havaika mananensis sp.n.

Figs 7, 32, 48, 57.

Havaika sp. 13 — Koolau. Prószyński, 2003: on line

MATERIAL. ♂ holotype. "sp 13". "Hawaiian Is. Koolau Mts, Ewa For. Res., Manana Trail. 530 m, 15. XII. 1974. W.C. Gagne". BPBM.

DIAGNOSIS. Palpus very similar to *H. jamiesoni*, but with longer embolus base, equal to embolus itself.

DESCRIPTION. Male holotype. Palpus proportions very similar to those of *H. jamiesoni* (Cy/Ti 150%, Em/Ba 100%, Bu/Em 170%), somewhat less to those of *H. cruciata* and *H. navata*; bulbus is narrower, embolus is distinctly thicker and shorter, as long as its base (Figs 32, 48, 57). Abdominal pattern differs from the majority of *Havaika* species by white coloration, divided by rudiments of dark transverse bars arranged into median streak, there are posterior lateral dark areas and small dark dots scattered over white area (Fig. 7). There is some resemblance to abdominal pattern in female (but not male) of *H. beattyi* (Fig. 8), but both pattern seem to be changed, and their coloration should be checked on fresh specimens. Specimen seems to have been dried previously. Large specimen with length of cephalothorax 4.00 mm, length of abdomen 3.84 mm.

DISTRIBUTION. Documented from Oahu Island.

ETYMOLOGY. Name derived from collecting locality — Manana Trail.

Havaika mauiensis sp.n.

Figs 5–6, 25, 41, 66, 80, 92.

Havaika sp. 7. Prószyński, 2003: online.

MATERIAL. ♀ holotype, ♂ allotype "sp. 7". "Hawaiian Islands (E.) Maui I. Hanna For. Res. 4500'. 17. III. 1974. Sweeping ferns. W.C. Cane". BPBM.

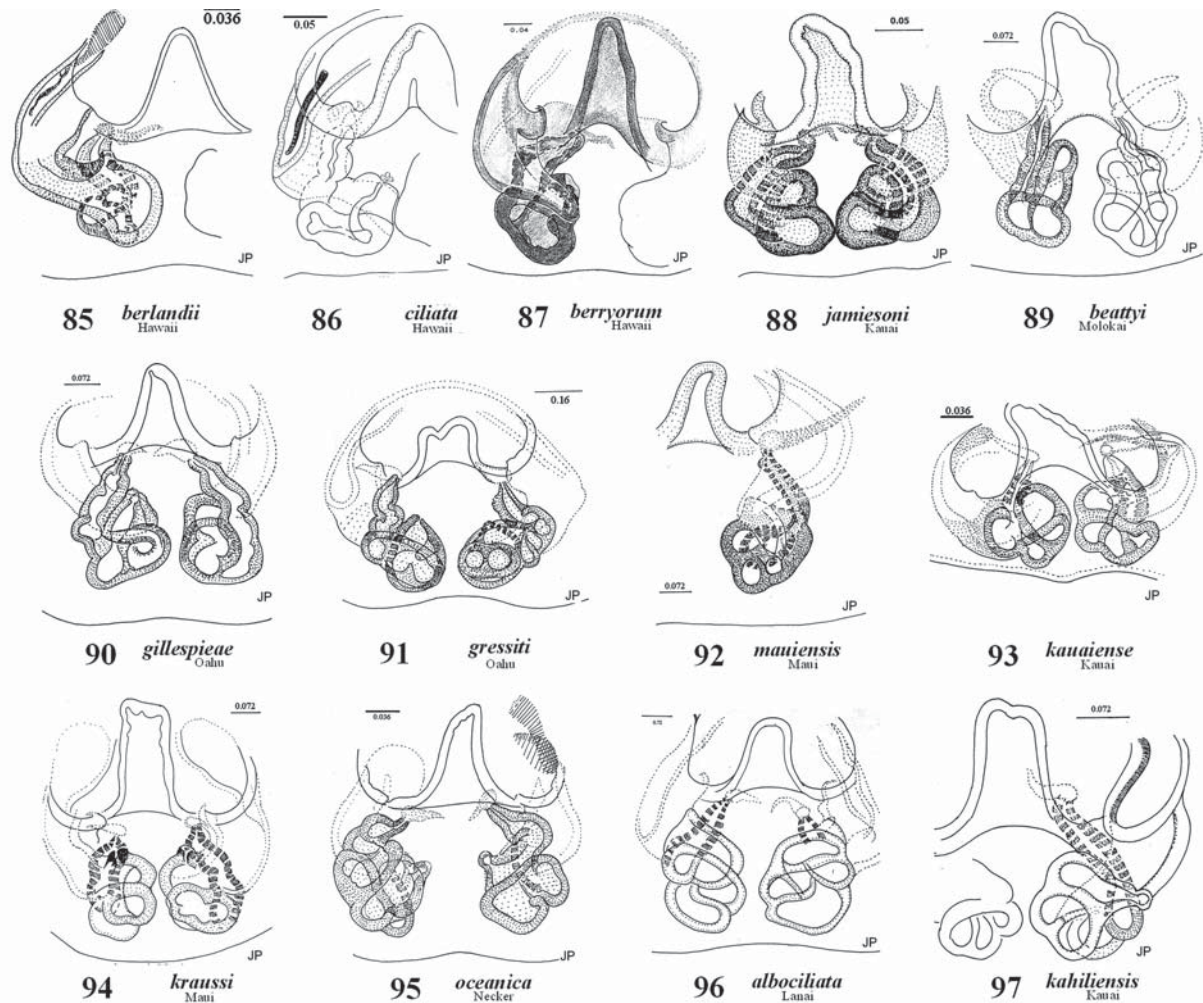
DIAGNOSIS. Palpus proportions very similar to *H. berryorum*, but embolus base is shorter, bulbus appears more round. Epigynum appears smaller than those in other species, more distant from epigastric fold, narrower, with almost square median pocket.

DESCRIPTION. Male allotype. Palpus proportions (in %: Cy/Ti 120, Em/Ba 220, Bu/Eme 120) similar to those of *H. berryorum*, but with embolus and its base somewhat shorter, and only indistinctly longer than bulbus (Figs 25, 41, 66). Cephalothorax with broad belt of adpressed whitish scale-like setae, sparse now. Dark species, with streak of diamond-shaped patches of white setae along abdomen (Fig. 5). Length of cephalothoraxes 2.64 mm, length of abdomen 3.12 mm.

Female allotype. Epigyne very small, with proportions (in %): SA/P 200, W/SA 100, W/P 210, with shorter median pocket, broad and apically truncated (Fig. 80). Copulatory ducts appear long, anterior spermatheca is compact, short and narrow, posterior spermatheca narrow (Fig. 92). Abdominal pattern damaged, but its remnants comparable with male, white diamonds with two dark internal spots and two thin dark chevron shaped lines (Fig. 6). Length of cephalothorax 2.64 mm, length of abdomen 2.88 mm.

DISTRIBUTION. Documented from Maui Island. Hana Forest Reserve.

ETYMOLOGY. Name derived from collecting locality — Maui Island.



Figs 85–97. Comparison of internal structures of epigynum in *Havaika*: *H. berlandii* sp.n. (85), *H. ciliata* sp.n. (86), *H. berryorum* sp.n. (87), *H. jamiesoni* (88), *H. beattyi* sp.n. (89), *H. gillespieae* sp.n. (90), *H. gressitti* sp.n. (91), *H. mauiensis* sp.n. (92), *H. kauaiense* sp.n. (93), *H. kraussi* sp.n. (94), *H. oceanica* sp.n. (95), *H. albociliata* (96), *H. kahiliensis* sp.n. (97).

Рис. 85–97. Сравнительные рисунки вульвы *Havaika*: *H. berlandii* sp.n. (85), *H. ciliata* sp.n. (86), *H. berryorum* sp.n. (87), *H. jamiesoni* (88), *H. beattyi* sp.n. (89), *H. gillespieae* sp.n. (90), *H. gressitti* sp.n. (91), *H. mauiensis* sp.n. (92), *H. kauaiense* sp.n. (93), *H. kraussi* sp.n. (94), *H. oceanica* sp.n. (95), *H. albociliata* (96) и *H. kahiliensis* sp.n. (97).

Havaika navata (Simon, 1900)

Figs 12, 35, 51, 56, 84.

Sandalodes navatus Simon, 1900: 515, pl. 18, f. 9.

Sandalodes navatus: Simon, 1903: 689, f. 819.

Havaika navata: Prószyński, 2001: 235, f. 37–40.

Havaika navata: Prószyński, 2003: online.

MATERIAL. ♂ lectotype (here designated), 1 imm "*Sandalodes navatus* E.S. Hawaii: Koele", "Koele", 1904. X. 24. 432–434" Coll. BMNH. 1 ♂ of different species in the same vial, separated by a cotton stopper, labeled "*Sandalodes navatus* E.S. Kanai", "Wanihea" [? illegible label] "1904/24 7d" Coll. BMNH. 1 ♂, 1 ♀ "14229 *Sandal. navatus* E.S. Hawaii (Perkins". MNHN.

DIAGNOSIS. Palpus resembles that of *H. cruciata* — type, with cymbium being slightly longer. Epigyne with broad median pocket, very similar to that of *H. canosa*.

DESCRIPTION. Male lectotype. Palpus proportions (in %: Cy/Ti 180, Em/Ba 110, Bu/Em 160) locate this species as an intermediary between *H. senicula* with shorter embolus, and *H. cruciata* — type with embolus longer. *H. jamiesoni*

ni has an even longer embolus (Figs 35, 51, 56). Abdomen dark mottled grey, with much darker median streak, delimited by thin lines of white scales and reaching transverse line of white scales in 2/3rd of length of abdomen. There is also a line of sparse white scales along anterior edge, and two white lines near posterior end (Fig. 12).

Female (specimen in MNHN collection, conspecificity uncertain). Epigyne with median pocket broad, short and rounded apically; soft area long (Fig. 84), its proportions (in %: SA/P 180, W/SA 110, W/P 200) intermediate between those of *H. canosa*, and *H. gillespieae*, the latter with conical, narrowing median pocket.

DISTRIBUTION. Documented from Lanai Island.

Havaika oceanica sp.n.

Figs 75, 95.

Havaika sp. 9. Prószyński, 2003: online.

"Necker-Nihoa population": Arnedo and Gillespie, 2006: f. 2, t. 9 (♀ only, ♂ uncertain).

MATERIAL. ♀ holotype. "sp. 9". "Necker Is. 26. IX. 1964. Beardsley". BPBM.

Photographs of ♂ and ♀ "Necker-Nihoa morphotype": Arnedo and Gillespie (2006: 2.E, J, O) (one of them, or both, possibly conspecific with *H. oceanica*).

DIAGNOSIS. Female holotype with conical median pocket, very similar to *H. jamiesoni*. Male of uncertain species from "Necker Nihoa population", shown on f. 2.O, is very similar to the type specimen of *H. verecunda*.

DESCRIPTION. Female holotype. Epigyne (Fig. 75) with proportions (in %: SA/P 160, W/SA 130, W/P 210) very similar to those of *H. jamiesoni* (Fig. 72) and *H. canosa* (Fig. 81), from which they differ by details of shape, particularly of median pocket — conical and apically narrowing by half. Posterior spermatheca shorter and broader (Fig. 95). Face with light brown-reddish clypeus and sides of face, horizontal lines of white adpressed setae, cephalothorax dorsally with irregular spot of sparse white, adpressed setae; abdominal pattern destroyed. Presumably this species is shown on photograph 2.E.

Male "from Necker Nihoa", illustrated on photographs 2. J, O by Arnedo and Gillespie [2006] could possibly be a match to the female holotype of *H. oceanica*, if it was collected on Necker Island, and not on distant Nihoa Island (lumped together by Arnedo and Gillespie [2006] without documentation), provided that only single species inhabits the small, inhospitable islet; chances of conspecificity of male from Nihoa are smaller. Palpus proportions (in %: Cy/Ti 120, Em/Ba 90, Bu/Em 190), as shown on above mentioned photograph 2.O, are very similar to those of the type of *H. verecunda*, (but not to photograph 2.M captioned "verecunda lineage") from which they differ insignificantly (while individual variation in these parameters remains unknown). Differences with *H. jamiesoni* are significant, which do not parallel resemblances of the above-mentioned female. Reddish face coloration with thin, transverse lines of white setae closely matches the description of *H. oceanica* and photograph 2.E.

REMARK. There are only 2 female specimens (in the Bishop Museum, collected in 1962 and 1964) and 2 males (in the AMNH, collected in 1923) known from Necker Island, and only 1 male from Nihoa (AMNH, collected in 1923) (personal information from Dr J.A. Beatty, who made list of unidentified Salticidae in these two Museums), lumped together as "Necker-Nihoa population" or "morphotype Necker and Nihoa", by Arnedo and Gillespie [2006]. The premises for lumping together these 3 males and 2 females are not substantial: whilst in descriptions of Salticidae sexes are often matched because of "cohabitation" in the same collection vial, this time "cohabitation" happens in two distant Museums (Honolulu and New York), with males 40 years older than females.

Necker Island is described as isolated mid-oceanic islet, some 690 km NW from Honolulu, windswept, dry, with rudimentary vegetation: because of an inhospitable environment, one may wonder whether its occurrence is a relict, as supposed by Arnedo and Gillespie [2006], or recent incidental arrivals. Nihoa Island is located 450 km NW from Honolulu, and is said to have somewhat richer vegetation.

DISTRIBUTION. Proven from Necker Island only.

ETYMOLOGY. Name related to occurrence on mid-oceanic islet, a fact of prime importance in geographical distribution of this species.

Havaika pubens (Simon, 1900)

Figs 21, 37, 63, 78.

Sandalodes pubens Simon, 1900: 513, tab. 18, f. 7.

Sandalodes pubescens: Prószyński, 1984: 66. [NB. Spelling from the original label].

Havaika pubens: Prószyński, 2001: 234, f. 41–43.

Havaika pubens: Prószyński, 2003: online.

MATERIAL. ♂ lectotype (here designated) "20947. *Sandalodes pubescens* ES. Hawaii: Kenu (Perkins)". MNHN. 1 ♀ paralectotype (here designated), 1 imm "*Sandalodes pubens* E. S. Hawaii, Kau, 1895. "1904. X. 24: 412–413" BMNH.

DIAGNOSIS. Very similar to *H. albociliata*, but palpus with tibia thinner and longer, cymbium narrower; epigynum with median pocket conical, apically narrower.

DESCRIPTION. Male lectotype. Palpus (Figs 21, 37, 63) with proportions (in %: male Cy/T 100, Em/Ba 160, Bu/Em 130) most similar to those of *H. albociliata*, differing somewhat in proportions from the photograph 2.K captioned "*pubens* lineage".

Female paralectotype. Proportions of epigyne (in %: SA/P 130, W/SA 150, W/P 200) very similar to those of *H. albociliata*, but with membranous "window" broad and soft area long, differs strikingly by shape of median pocket, which is conical and narrowing distinctly in apical half (Fig. 78). Preparation of internal structures were not made (to save paralectotype specimen). Chelicerae covered in basal half by dense white scales. Abdomen medially dark with colorless, light reflecting scales, the anterior margin is white, extended by two pairs of marginal diagonal spots. Specimen large.

DISTRIBUTION. Documented in locality written differently on labels as Kanu, Kenu or Kau, presumably on Hawaii Island.

REMARK. Arnedo and Gillespie [2006] did not write on the species "*Havaika pubens*," as assumed by Platnick [2008], but on specimens representing "*pubens* lineage", from the islands Kauai, Oahu, West Maui, Maui and Hawaii. They did not state clearly which species came from which island. As there are several species displaying characters assigned to the "*pubens* lineage", there is no possibility to identify the species they have photographed. Range of length of cephalothorax of longer specimens is given as almost double that of shorter ones, which is not very probable, although it could happen. As this difference is repeated on every island they list specimens from, there is a strong possibility that specimens belonging to different species were lumped together.

Havaika senicula (Simon, 1900)

Figs 10, 34, 50, 54.

Sandalods seniculus Simon, 1900: 517, pl. 18, f. 12.

Havaika senicula: Prószyński, 2001: 235, f. 44–46.

Havaika senicula: Prószyński, 2003: online.

MATERIAL. ♂ lectotype (here designated) "*Sandalodes seniculus* Simon, [Hawaii] Haleakala "1904. X. 24: 443". BMNH.

DIAGNOSIS. Palpus with short embolus, shorter than that of *H. navata*, tibia short.

DESCRIPTION. Male lectotype. Palpus proportions (in %: Cy/Ti 190, Em/Ba 80, Bu/Em 190) intermediate between those of *H. verecunda* and *H. navata*, but differing from both by shorter tibia, as long as cymbium, but with a shorter embolus (Figs 34, 50, 54). Abdomen apparently discolored (Figs 10), with traces of white longitudinal, median area with weak remnants of thin, grey chevrons, and a median

line (being perhaps rudiments of dark delimitation of white spots), lateral surface mottled grey.

DISTRIBUTION. Documented from Maui Island.

Havaika tantalensis sp.n.

Figs 22, 38, 65.

MATERIAL. ♂ holotype (here designated, specimen with palpal organ separated), 1 ♂ paratype (here designated) — "albociliatus" "Oahu, Honolulu, Tantalus, Manoa Cliff Trail, 1800 ft. elev. Sept. 6, 1936 Chris. E. Olsen". AMNH.

DIAGNOSIS. Male with long tibia, but relatively short bulbus, very similar to that of *H. pubens*.

DESCRIPTION. Male holotype. Length of cymbium equal to that of tibia (Figs 22, 38), which resembles those of *H. albociliata* and *H. pubens*. However, the bulbus is short, equal to about half the length of cymbium, which is unique in *Havaika*. Embolus is relatively long, twice as long as its base. Ratios of palpus (in %): Cy/Ti 100, Em/Ba 220, Bu/Em 140. Almost whole anterior surface of chelicerae covered with dense whitish short setae. Clypeus very low, bald, eyes anterior median surrounded by inconspicuous yellowish setae. Well-preserved abdominal pattern. Dimensions (2 specimens): length of cephalothorax in larger specimen is 3.84, in smaller one 2.88 mm, length of abdomen 4.80, 2.88 mm respectively; difference in size may suggest that sample contains 2 species.

DISTRIBUTION. Documented from Oahu Island.

ETYMOLOGY. Name derived from collecting locality — Tantalus.

Havaika valida (Simon, 1900)

Figs 26, 42, 59.

Sandalodes validus Simon, 1900a: 514, pl. 18, f. 6.

Havaika valida: Prószyński, 2001: 235, f. 47–48.

Havaika valida: Prószyński, 2003: online.

MATERIAL. ♂ lectotype (here designated, specimen with palpus separated), 1 ♂ (half the size of the lectotype) "22201 *Sandalodes validus* E.S. Oahu [?] (Perkins)". MNHN. 1 ♂ "*Sandalodes validus* Simon, 1900. Olau", "1904 X. 24.: 422" (Conspecificity uncertain). BMNH.

DIAGNOSIS. Most similar to *H. arnedoi*, but with shorter tibia.

DESCRIPTION. Male lectotype. Proportions of palpus (in %: male Cy/Ti 120, Em/Ba 160, Bu/Em 150) intermediate between those of *H. arnedoi* and *H. beattyi*, with cymbium 1/5th longer than tibia, embolus 50% shorter than bulbus and 60% longer than its base (Figs 26, 42, 59). Anterior surface of chelicerae covered with white setae. Dense white longer setae around anterior eyes, with addition of some yellowish ones (probably remnants of reddish setae, mentioned in the original description, red frequently fades to yellow during long preservation in alcohol).

DISTRIBUTION. Presumably Oahu Island.

Havaika verecunda (Simon, 1900)

Fig. 33, 49, 53.

Sandalodes verecundus Simon, 1900a: 516, Pl. 18, f. 10.

Havaika verecunda: Prószyński, 2001: 235, f. 49–50.

Havaika verecunda: Prószyński, 2003: online.

MATERIAL. ♂ lectotype (here designated), 2 imm "*Sandalodes verecundus* E.S. Oahu." "Kavaiiloa River, Oahu. April 1893" "1904 4. X. 24. 437–439". BMNH. 2 imm "18538 *Sandl. verecundus* E.S. Lanai (Perkins)", "18. 538" — immature, discolored, unusable. MNHN.

DIAGNOSIS. Palpus with shortest embolus (in relation to base) within the genus *Havaika*.

DESCRIPTION. Male lectotype. Palpus of male lectotype (proportions in %: Cy/Ti 130, Em/Ba 70, Bu/Em 210) distinct from those of other species by having the shortest embolus (70% of length of its base), twice half the length of the bulbus, shorter than in specimen on photograph 2.O, captioned "morphotype Necker Nihoa"; it is distinctly different from the specimen on photo 2.M, captioned "*verecunda* lineage", which has a much longer embolus (proportions in %: Cy/Ti 140, Em/Ba 120, Bu/Em 150).

DISTRIBUTION. Documented from Oahu Island.

Remark. Arnedo and Gillespie [2006: 479] did not write on the species *Havaika verecunda*, as assumed by Platnick [2008], but on specimens representing "*verecunda* lineage", (from the islands Kauai, Oahu, Molokai, Lanai and Maui), including probably more than one species. The geographical origin of specimens shown in figs. 2.C, H, M is not given.

Species classified provisionally as *Habronattus* (?)

Figs 36, 52, 68.

Havaika sp 14. Prószyński, 2003: online.

MATERIAL. 1 ♂ "sp. 14" "Hawaii: Napau Crater, Kilaulea, July 1953. D.E. Hardy". AMNH.

DESCRIPTION. Male. Generic classification uncertain. Proportions of palpal organ (ratios in %: Cy/Ti 256, Em/Ba 246, Bu/Em 119), and shape (Figs 36, 52, 68) are very similar to those of a specimen on photograph 2.Q — misidentified *Habronattus "rufescens"* from Marquesas Archipelago: Nuku Hiva. Cymbium is two and a half times longer than palpal tibia, broad, bulbus round, embolus long, arising from the posterior part of bulbus, apophysis robust. Cheliceral tooth conical, prominent. Clypeus very low, bare, setae surrounding eyes anterior whitish, more intensely white setae below eyes anterior lateral, adpressed. Abdominal pattern much changed, originally was apparently dark, with transverse whitish spots in 2/3rd of length of abdomen. Small species, length of cephalothorax 1.80 mm, length of abdomen 1.92 mm.

DISTRIBUTION. Documented from Hawaii Island.

REMARKS. I abstain from formal description of this species because of doubts about its generic classification, arising from comparison with *Habronattus tarsalis* in Prószyński [2001: 237, f. 54–63], in particular I cannot see a prominent conductor, parallel to the embolus, also the tibial apophysis is not split apically. *H. tarsalis* is presumably an immigrant from North America.

Provisional key to species of *Havaika* (ratios calculated from measurements of drawings, or photographs, of single specimens (types))

MALES

1. Cymbium about equal to tibia
 - a) embolus 20% shorter than its base — specimen on photograph 2.K — quoted as "*pubens* lineage"
 - b) embolus 10% longer than its base (Figs 21, 37, 63) — *pubens*
 - c) embolus 60% longer than its base (Figs 24, 40, 62) — *arnedo* sp.n.
 - d) embolus 80% longer than its base, bulbus appears broader, apophysis longer (Figs 23, 39, 67) — *albociliata*

e) embolus twice as long as its base, bulbus appears narrower, apophysis shorter (Figs 22, 38, 65) — *tantalensis* sp.n.

2. Cymbium 20–30% longer than tibia

a) embolus short, 10–30% shorter than its base

I — bulbus 90% longer than embolus — specimen on photograph 2.O — quoted as "Necker Nihoa population"

II — bulbus 110% longer than embolus, the latter is the shortest among studied species (Fig. 33, 49, 53) — *verecunda*

b) embolus medium length, 30–50% longer than its base

I — bulbus 50% longer than embolus, the latter bent in front of bulbus (Figs 26, 42, 59) — *valida*

II — bulbus 60% longer than embolus, the latter shorter and straight (Figs 29, 45, 58) — *beattyi* sp.n.

c) embolus long, twice as long as its base

I — bulbus 20% longer than embolus, bulbus approximately round (Fig. 25, 41, 66) — *mauiensis* sp.n.

II — bulbus 30% longer than embolus, bulbus broad oval (Figs 28, 44, 61) — *berrorum* sp.n.

3. Cymbium 40% longer than tibia

a) embolus 20% longer than its base, bulbus narrower — specimen on photograph 2.M — quoted as "*verecunda*" lineage

b) embolus twice as long as its base, bulbus broader (Figs 27, 43, 64) — *berlandii* sp.n.

4. Cymbium distinctly longer than palpal tibia, by 50–90%

a) bulbus 90% longer than embolus, embolus shorter than its base — *senicula*

b) bulbus 50–70% longer than embolus, embolus 10–40% longer than its base, or equal to

I — length of embolus equal to length of its base (Figs 32, 48, 57) — *mananensis* sp.n.

II — embolus 10% longer than its base, embolus thin (Figs 35, 51, 56) — *navata*

III — embolus 20% longer than its base (Figs 30, 46, 55) — *cruciata* (type)

IV — embolus 40% longer than its base (Figs 31, 47, 60) — *jamiesoni*

c) bulbus 30% longer than embolus, embolus twice as long as its base

I — embolus 110% longer than its base — specimen on photograph 2.N — quoted as "morphotype D".

II — embolus 140% of length of its base — specimen on photograph 2.L — quoted as "*cruciata*".

FEMALES

1. Epigyne with prominent white membranous "window", distant from epigastric fold and divided partially by sclerotized median pocket — genera *Havaika*, *Habronattus* and a few other related genera (not known from Hawaii)

a) spermathecae in a form of twisted sclerotized channels — *Havaika*-3

b) spermathecae in a form of compact sclerotized body with internal convoluted chambers — *Habronattus*

2. Membranous "window" different, or epigyne without "window" — other genera of Salticidae.

3. "Window" separated from epigastric fold by a distance about 10–20% longer than the length of its median pocket

a) width of "window" 70% broader than length of pocket, pocket appears long, with deeply bent posterior edge (Fig. 71) — *beattyi* sp.n.

b) width of "window" 80% broader than length of pocket, pocket appears shorter and broad, posterior edge less bent (Fig. 77) — *albociliata*

4. "Window" separated from epigastric fold by distance about 30–50% longer than length of its median pocket

a) width of "windows" 70% broader than length of soft area, pocket narrow, shorter than "window" (Fig. 69) — *berlandii* sp.n.

b) width of "windows" about 50% broader than length of soft area, pocket long — reaching anterior limit of "window"

I — anterior part of pocket strikingly narrowing conically (Fig. 78) — *pubens*

II — pocket broad, not strikingly narrowing, its tip rounded (Fig. 70) — *ciliata* sp.n.

III — pocket slightly narrower, its tip truncated (Fig. 82) — *kahiliensis* sp.n.

5. "Window" separated from epigastric fold by distance about 60–70% longer than length of its median pocket

a) width of "window" 60% bigger than length of the pocket, pocket appears long

I — sides of pocket parallel, apical end truncated (Fig. 74) — *kraussi* sp.n.

II — pocket conical (Fig. 73) — *berrorum* sp.n.

b) width of "window" 110% larger than length of the pocket, the latter appears shorter

I — posterior spermatheca short (Fig. 75, 95) — *oceanica* sp.n.

II — posterior part of spermatheca long (Fig. 72, 88) — *jamiesoni*

6. "Window" separated from epigastric fold by distance about 70% longer than length of its median pocket, pocket broad, apically truncated and shorter than "window" (Fig. 81) — *canosa*

7. "Window" separated from epigastric fold by distance about 80–100% longer than length of its median pocket

a) Epigyne appears narrow, width of "windows" 110–130% of length of the pocket

I — pocket conical (Fig. 83) — *gillespie* sp.n.

II — pocket almost rectangular, apically truncated (Fig. 80) — *mauiensis* sp.n.

III — pocket broad, apically broadly rounded, as long as "window" — *navata* (Fig. 84).

b) Epigyne appears broad, about the width of "windows" 250–300% of length of the pocket

I — pocket conical (Fig. 76) — *kauaiense* sp.n.

II — pocket almost rectangular, apically truncated (Fig. 79) — *gressitti* sp.n.

Table 1. Diversity of ratios calculated from measurements of drawings and photographs of single specimens (types) of the genus *Havaika*, rounded to nearest 10.

Таблица 1. Разнообразие индексов, рассчитанных по рисункам и фотографиям у разных видов *Havaika*. Индексы измерены только у одного экземпляра (типа), значения округлены до 10.

Species of <i>Havaika</i>	Males			Species	Females		
	Ratio Cy/Ti %:	Ratio Em/Ba%:	Ratio Bu/Em %:		Ratio SA/P%	Ratio W/SA%	Ratio W/P%
specimen on photo 2.K — “ <i>pubens</i> lineage”	90	90	180	<i>beattyi</i>	110	160	170
<i>pubens</i>	100	110	170	<i>albociliata</i>	120	150	180
<i>albociliata</i>	100	180	130	<i>pubens</i>	130	150	200
<i>tantalensis</i>	100	210	110	<i>berlandii</i>	130	170	220
<i>arnedoi</i>	110	160	150	<i>ciliata</i>	140	150	210
<i>beattyi</i>	120	130	160	<i>kahiliensis</i>	150	150	220
<i>valida</i>	120	160	150	<i>kraussi</i>	160	100	160
<i>berrorum</i>	120	210	130	<i>berrorum</i>	160	110	170
<i>mauiensis</i>	120	220	120	<i>oceanica</i>	160	130	210
specimen on photo 2.O — “morphotype Necker and Nihoa”	120	90	190	<i>jamiesoni</i>	160	130	210
“ <i>verecunda</i> lineage” f. 2.M	140	120	150	<i>canosa</i>	170	130	210
<i>berlandii</i>	140	210	130	<i>navata</i>	180	110	200
<i>verecunda</i>	130	70	210	<i>gillespieae</i>	180	120	230
<i>mananensis</i>	150	100	170	<i>gressiti</i>	190	130	250
specimen on photo 2.L — “ <i>cruciata</i> ”	150	240	130	<i>kauaiense</i>	190	160	300
specimen on photo 2.N — “morphotype D”	160	210	130	<i>mauiensis</i>	200	100	210
<i>jamiesoni</i>	160	140	150				
<i>cruciata</i> – type	170	120	160				
<i>navata</i>	180	110	160				
<i>senicula</i>	190	80	190				
<i>Habronattus</i> (?) “ <i>rufescens</i> ” — 2.Q from Nuku Hiva	200	260	110				
<i>Habronattus</i> (?) sp. from Napau Crater	260	250	120				
Values of mean ratio Cy/Ti calculated for multispecies assemblages by Arnedo and Gillespie (2006: 18, tab. 9)							
“ <i>pubens</i> lineage” (n=39)	0.994–1.071						
“ <i>verecunda</i> lineage”(n=44)	1.180–1.535						

Table 2. Collecting areas of single specimens (types) representing species of *Havaika* in the Hawaiian Islands.

Таблица 2. Распространение видов (собственно типовых серий) рода *Havaika* на Гавайских островах.

Necker	Nihoa	Kauai	Oahu	Molokai	Lanai	Maui	Hawaii
<i>oceanica</i>	?	<i>jamiesoni</i>	<i>gillespieae</i>	<i>beattyi</i>	<i>albociliata</i>	<i>canosa</i>	<i>arnedoi</i>
		<i>kahiliensis</i>	<i>gressiti</i>		<i>navata</i>	<i>kraussi</i>	<i>berlandii</i>
		<i>kauaiense</i>	<i>mananensis</i>			<i>mauiensis</i>	<i>berrorum</i>
			<i>tantalensis</i>			<i>senicula</i>	<i>ciliata</i>
			<i>valida</i>				<i>cruciata</i> ?
			<i>verecunda</i>				<i>pubens</i>
							<i>Habronattus</i> (?) from Napau

Discussion

The salticid fauna of the Hawaii Islands is poorly known, with only 30 species (identified, or defined by diagnostic drawings) reported until now. Of these only *Havaika* seems to display a pattern typical of endemic

island proliferation (with 23 species known at present, including 14 new, 5 more are photographed, but not identified) and constitutes approximately 77% of Salticidae. As far as we know at present, 10% of species of Salticidae are presumably of Asiatic origin, 13% are N American.

Distribution. Richness of fauna of *Havaika* may be illustrated by the case of two distinctly different species, *H. berryorum* sp.n. and *H. ciliata* sp. nov., collected within two days in the same locality and environment: Kalopa St. Park on banana leaves. Although the collections contain numerous similar species, we have documented identification (by genital organs) of *Havaika* only for single specimens/sex for each species. Delimitation of species ranges should therefore be delayed until more data are available.

Correlation of species numbers with the size of islands, environment, or isolation is not yet possible to hypothesize because the intensity and frequency of collecting on particular islands cannot be compared.

Pending further studies I abstain from considering species reported from Marquesas Islands: *Havaika flavipes* (Berland, 1933) and *H. triangulifera* (Berland, 1933) [Prószyński, 2001] within this genus, because there is no genitalic drawings documentation.

Comments on Arnedo and Gillespie [2006] views on taxonomy and biogeography of *Havaika*

Original contribution of Arnedo and Gillespie [2006] was DNA sequencing in 29 fresh specimens of *Havaika*. They commented also on taxonomy of 250 long preserved specimens, the same as I had the opportunity to scan quickly in 1998 [Prószyński, 2001, 2003 and in the present paper], which entitles me to search for mutual conclusions. To understand the taxonomy of that genus, Arnedo and Gillespie made some measurements and provided exemplary photographs of a few specimens, but failed to survey genital-organ diversity in the rich material in their hands. They disregarded original preparations of epigynes and separated palps that were stored in the collections together with specimens, as well as of drawings available to them [Prószyński, 2003, and personal letters to M. Arnedo, 2000–2002]. The automontage digital photographs constitute correct modern documentation of taxonomic features, provided they document in the same way the whole of the material of all the species. Arnedo and Gillespie [2006] photographs remains useless, even as samples of selected species, because of the simple omission of data from specimen labels, and the defining the specimens illustrated. Tentative identification of photographs decorating their paper is as follows:

1. Male palpi shown on figs: 2.K–O:

a) palpus 2.K of "*pubens* lineage" is very similar, but not identical, with that of type specimen of *H. pubens* (Fig. 21);

b) palpus 2.L labeled as "*H. cruciata*" is misidentified, and belongs to a species close to *H. jamiesoni* (Fig. 31), black bar on comparative drawings (Figs 17–18) indicates misevaluated proportions of length of embolus base;

c) palpus 2.M "*verrecunda* lineage" is hardly comparable to the type of *H. verrecunda* (Fig. 33), which

has a remarkably short embolus, and could be very similar to that of *H. mananensis* (Fig. 32);

d) palpus 2.N of "morphotype D" seems to be very similar to that of *H. berlandi* (Fig. 27);

e) palpus 2.O "morphotype Necker and Nihoa" is very similar to that of *H. verrecunda* (Fig. 33), but has longer embolus. There is no documentation for conspecificity of *Havaika* specimens from Necker and Nihoa Islands.

Conclusions: none of the 5 photographs of male palpal organ could be identified with drawings of palpal organs of 16 type specimens presented in this paper. Actually, the number of species of *Havaika* living in the Hawaii Archipelago could be much higher than 16.

2. Photographs of facial marks in 5 females and 5 males are very important clues for identification, and constitute a significant technical progress to be followed in the subsequent publications. There is observed high sexual dimorphism in this character, which is not accounted sufficiently by Arnedo and Gillespie [2006]. The "*verrecunda* lineage" face (f. 2.C) seems to be very similar to that of *H. kahiliensis* (Fig. 15).

3. Abdominal pattern shown on f. 2.R–S, is so deeply changed by long preservation that it cannot indicate species. Perhaps these are remnants of a pattern resembling *H. jamiesoni*.

4. The omission of the study of genital organs structure of males and females in so poorly a known genus of Salticidae cannot be justified, especially considering that the authors inherited preparations of epigynes and male palps from my preliminary studies. These had been preserved with specimens in the vials in the collection.

5. Utility of measurements in taxonomy of Salticidae could be discussed, but the limitation of them just to the length of carapace make them meaningless.

Range of mean ratios shown for "*pubens* lineage": (means, n=39) 0.994–1.071 corresponds with diversity reported in this paper for four species, the same range for "*verrecunda* lineage": (means, n=44) 1.180–1.535 for six species. Species with lower and higher ranges, available in the collection, are not included [Arnedo, Gillespie, 2006: 18, tab. 9].

6. The biogeography of "lineages" by Arnedo and Gillespie [2006] is meaningless: one cannot substitute undefined multi-species assemblages for species. The information that "*verrecunda* lineage" occurs on Kauai, Oahu, Molokai, Lanai and Maui is valueless when we do not know which species are concerned.

ACKNOWLEDGEMENTS. I am very much indebted to Dr and Mrs James W. Berry, of Indianapolis, IN, USA, for providing specimens and laboratory facilities for this paper, and for assistance in the study. The actual work was done in Dr J.B. Berry's Laboratory in the Biology Department, Butler University, Indianapolis, IN, USA, in 1998, with housing assistance from that University. Unidentified old specimens for study were selected preliminarily by Dr J.A.

Beatty in the collections of the Bishop Museum in Honolulu (90 vials) and the American Museum of Natural History in New York (43 vials). Of particular value were relatively fresh specimens from personal collection of Dr J.W. Berry. Comparative material, especially type specimens, described originally as *Sandalodes* by Simon [1900] and Berland [1933], were borrowed from Natural History Museum in London, and Museum National d'Histoire Naturelle in Paris. Drawings of type specimens and excerpts of descriptions were originally published in *Athropoda Selecta*, [Prószyński, 2001:f. 1–81], and I wish to express thanks to the Editors, KMK Ltd, for permission to quote them in this work. Palpus used in the diagram of Fig. 17 is copied from Arnedo and Gillespie [2006: f. 2.L.] belonging to Elsevier Inc.

The author wishes to express best thanks to the above mentioned institutions and persons.

References

- Arnedo M.A., Gillespie R.G. 2006. Species diversification patterns in the Polynesian jumping spider genus *Havaika* Prószyński, 2001 (Araneae, Salticidae) // *Molecular phylogenetics and Evolution*. Vol.41. No.2. P.472–495.
- Berland L. 1933. Araignée des îles Marquises // *Bernice P. Bishop Museum Bulletin*, Honolulu. Vol.114. P.39–70.
- Berry J.W., Beatty J.A., Prószyński J. 1996. Salticidae of the Pacific Islands. I. Distribution of twelve genera, with description of eighteen new species // *Journal of Arachnology*. Vol.24. No.3. P.214–253.
- Berry J.W., Beatty J.A., Prószyński J. 1997. Salticidae of the Pacific Islands. II. Distribution of nine genera, with description of eleven new species // *Journal of Arachnology*. Vol.25. No.2. P.109–136.
- Berry J.W., Beatty J.A., Prószyński J. 1998. *Salticidae* of the Pacific Islands. III. Distribution of seven genera, with description of nineteen new species and two new genera // *Journal of Arachnology*. Vol.26. No.2. P.149–189.
- Berry J.W., Prószyński J. 2001. Description of *Hakka* — a new genus of *Salticidae* (Araneae) from Hawaii and East Asia // *Journal of Arachnology*. Vol.29. N.2. P.201–204.
- Platnick N.I. 2008. The World Spider Catalog, Version 9.0. American Museum of Natural History, online at <http://research.amnh.org/entomology/spiders/catalog/SALTICIDAE.html>
- Prószyński J. 1984. Atlas rysunków diagnostycznych mniej znanych *Salticidae*. *Zeszyty Naukowe WSRP*, Siedlce. 177 pp.
- Prószyński J. 2001. Remarks on Salticidae (Aranei) from Hawaii, with description of *Havaika* — gen. nov. // *Arthropoda Selecta*. Vol.10. No.3. P.225–241.
- Prószyński J. 2003. Salticidae (Araneae) of the World. Online at <http://www.miiz.waw.pl/salticid/main.htm> (available in the Internet since 1998)
- Simon E. 1900. *Arachnida // Fauna Hawaiiensis or the Zoology of the Sandwich Isles: being Results of the Explorations instituted by the Joint Committee appointed by the Royal Society of London promoting Natural Knowledge, and the British Association for the Advancement of Science*. London. Vol.2. P.443–519.