Asteiidae (Diptera) of the Galápagos Islands, Ecuador

[Asteiidae (Diptera) der Galapagosinseln, Ecuador]

by

Jessica FORREST and Terry A. WHEELER

Ste-Anne-de-Bellevue (Québec, Canada)

Abstract

The family Asteiidae is recorded for the first time from the Galápagos Islands, Ecuador. Four new species are described: Astiosoma sabulosum spec. nov.; Loewimyia fasciata spec. nov.; Loewimyia heleneae spec. nov.; Sigaloessa variata petua spec. nov. A key to the Galápagos species of Asteiidae is given. Three of the new species are known only from the littoral and arid zones; L. fasciata is most abundant in the Zassesia zone, but also present in the Micronia, arid and littoral zones. All four species are known from at least three islands within the archipelago and are probably widespread in the Galápagos.

Key words

Diptera, Asteiidae, Astiosoma, Loewimyia, Sigaloessa, new species, Neotropical, Galápagos Islands, systematics, zoogeography

Zusammenfassung


Stichwörter

Diptera, Asteiidae, Astiosoma, Loewimyia, Sigaloessa, neue Arten, Neotropis, Galapagosinseln, Systematik, Zoogeographie

Introduction

The family Asteiidae (Diptera) contains approximately 100 described species found in all major zoogeographic realms and on several oceanic islands. Because they are minute and delicate flies, which were rarely collected prior to the advent of methods such as Malaise traps and pan traps, many more species of Asteiidae undoubtedly await description. Several specimens of Asteiidae have been collected in the course of a comprehensive study of the arthropod fauna of the Galápagos Islands, Ecuador (see PECK 1996). Although 28 species of the family have been described from the Neotropical region (SABROSKY 1957) and 23 from oceanic islands in the Pacific (SABROSKY 1989), there are no previous asteiid records from the Galápagos Islands. The purpose of this paper is to record the family Asteiidae from the Galápagos Islands for the first time and to describe four new species in the genera Astiosoma DUDA, 1927; Loewimyia SABROSKY, 1943 and Sigaloessa LOWE, 1865.

Materials and methods

Type specimens of new species are deposited in the following institutions (acronyms used in the text are in parentheses): Canadian National Collection of Insects, Ottawa, Ontario (CNC); Lyman Entomological Museum, McGill University, Ste-Anne-de-Bellevue, Quebec (LEM). All specimens were preserved in 70 % ethanol and subsequently critical point dried using liquid CO₂. Preparations of genitalia were made by removing the abdomens of mounted speci-
mens and clearing them in 85 % lactic acid heated for approximately 30 seconds in a microwave oven. Cleared abdomens were then placed in glycerin for further dissection and examination. Dissected abdomens were stored in glycerin in plastic microvials pinned beneath the source specimen. Morphological terms follow McALPINE (1981) for non-genitalic structures and WHEELER (2000) for male and female genitalia.

Results

Key to the species of Astisidae of the Galápagos Islands

1 Antenna with arista minute and first flagellomere fringed with long dense setulae... 2
   - Antenna with arista long, first flagellomere pubescent ........................................ 4
2 Legs pale yellow, occasionally with a brown spot on hind femur; halter white ............
   - Legs more extensively marked with brown, always with some brown on mid femur; halter partly or entirely brown .................................................. 3
3 Halter distinctly banded; abdomen usually paler than thorax .................. Loewingia fasciata
   - Halter entirely dark brown; thorax and abdomen dark brown ...................... Loewingia spec.
4 Two pairs of orbital bristles present; inner and outer vertical bristles equal in length; arista appearing bare; scutellum yellow to brown, same colour as scutum ........
   - One pair of orbital bristles present; inner vertical bristle half as long as outer vertical; arista with a zigzag appearance and long hairs; scutellum white, contrasting with scutum ................................................................. Astisoma sabulosum

Astisoma sabulosum Forrestr and Wheeler spec. nov.
(Figs 1–5)

Type material: Holotype ♂; ECUADOR: Galápagos Islands: Santa Fe, sweeping sea lion beach, 4.iv.1989, B. J. Sinclair (CNC). Paratypes: ECUADOR: Galápagos Islands: Rábida, sticky traps, 13.i.1982, Y. Lühr (2 ♂; 1 ♀, CNC); Santa Cruz, CDRS, arid zone, mv-lights, 16.i.1989, B. J. Sinclair (2 ♀; 1 ♂, CNC), Santa Cruz, Academy Bay, ECD, 30 m, arid zone, thornscrub malaise-FIT trap, 10.v–14.vii.1985, S. & J. Peck (2 ♀; CNC); Santa Fe, littoral beach, 4–6.iv.1989, Peck & Sinclair (1 ♀, CNC); San Cristóbal, Pto. Baquerizo, southbeach, marine iguana nesting sites, littoral, 21.iii.1989, B. J. Sinclair (1 ♀, CNC; 1 ♂, LEM); Seymour, arid zone, flowers of PaloSanto, 23.iii.1989, B. J. Sinclair (1 ♂; 1 ♀, CNC).

Description

Male and female. Body length 1.2–1.9 mm. Head: Frons yellow to pale brown with dense procline interfrontal setulae, width slightly greater than eye width, length:width ratio 1.0–1.3; orbits slightly paler than frons, ocellar tubercle black, occiput grey; two reclinate and laterocline orbital bristles, ocellar bristles procline and divergent, postocellar short and procline, inner and outer bristles strong and equal in length. Face yellow to pale brown, occasionally with some black. Antenna yellow to pale brown, first flagellomere often darker dorsally; arista bare, black. Eye densely pubescent, with long axis nearly horizontal. Genae white, with two irregular rows of pale, procline hairs, gena height 0.16–0.35 times eye height. Palp white.

Thorax: Scutum yellow to pale brown and densely pollinose, with darker stripes along median, dorsal and central and, less distinctly, intra-alar lines; notopleuron, scutellum and thoracic pleurites yellow to pale brown. Thoracic chaetotaxy: two postaural drosocentral bristles; acrostichal, drosocentral, and intra-alar setulae each in two irregular rows extending as far back as anterior drosocentral bristle; one anterior and one posterior notopleural bristle; one postalar bristle; some presutural and postsutural intra-alar and supraalar hairs, one posterior

**Female postabdomen** (Figs 8–10). Tergites broad, weakly sclerotized, sternites membranous; tergite 8 rectangular, tergite 10 pale, cercus short, with long setae; sternite 8 reduced to lateral patches of bristles, sternite 10 pale, with 2 posterior bristles. Spermathecae simple, elongate, sclerotized; ventral receptacle unsclerotized.

**Etymology.** The species name is from the Latin fasciatus (banded, striped), referring to the banded halter and legs.

**Remarks.** Coloration is regionally variable. Specimens from Isla Santa Cruz have the fore femur lightly pigmented to entirely brown, mid femur with a median band or brown on proximal two-thirds, and hind femur with a median band; a narrow band may be present on the proximal half of the mid and/or hind tibia. Specimens from Isla San Cristóbal have darker markings, with the fore coxa and mid femur entirely black. The black facial markings are more pronounced and the halter is darker. The specimen from Isla Española is in poor condition but resembles specimens from Santa Cruz in having the legs only narrowly banded with black.

This species can be distinguished from the Neotropical species *Loewmia bifurcata* SABROSKY, 1943 by the rounded first flagellomere (strongly emarginate anteriorly in *L. bifurcata*), and by the conspicuously banded halter. *Loewmia orbiculata* HARDY, 1980 of Hawaii differs from *L. fasciata* in having two dorsoventral bristles, a rufous frons, and the halter only tinged with brown. Both previously described species have a dark brown abdomen and white or yellow gena. *Loewmia fasciata* can be distinguished from *L. helenae* spec. nov. by the banded halter and legs.

**Loewmia helenae** FORREST & WHEELER, spec. nov. (Figs 12–13)

**Type material.** Holotype ♀: ECUADOR: Galápagos Islands: Santa Cruz, Puntudo, 600 m, Scalesia forest, 10–30.III.1989, S. PECK & SINCLAIR (♀, CNC); C. Academy Bay, ECD, 100 m, Miconia, 15–23.III.1989, S. PECK & SINCLAIR (♀, CNC); San Cristóbal, Junco rurum, 700 m, pampa, 16.III.1989, B. J. SINCLAIR (♀, CNC).

**Description.** Male and female. Body length 1.2–1.3 mm. Head: Frons yellowish brown, pale anteriorly, width twice eye width, length:width ratio 0.5–0.6; ocellar tubercle dark brown to black; occiput concave, brown; four reclinate fronto-orbital setae; ocellar bristles minute, proclinate; postocellar bristles minute, divergent; inner and outer vertical bristles strong. Face white, often with a faint black V-shaped mark. Antenna pale brown; first flagellomere large, with variable small indentation on anterior margin, fringed with long dense brown setae, longest anteriorly; arista minute, much shorter than surrounding setae (Fig. 11). Eye pubescent. Vibrissal angle white; vibrissa long but weak; gena brown posteriorly, with four to five subvibrissal setae; gena height 0.05 mm eye height. Palp white.

**Thorax.** Scutum sparsely pollinose; thoracic sclerites brown, notopleuron and postpronotum usually paler. Thoracic chaetotaxy: one strong posttural dorsoentral bristle; two rows of acrostichal setae and one row of dorsocentral setae, sparser posteriorly; one anterior and one posterior notopleural bristle; one postalar bristle; scutellum with one pair of long and strong widely spaced apical bristles and one pair of short subapicals; katepisternum with two bristles, posterior stronger. Legs white to pale yellow with variable brown markings (see Remarks). Wing length 1.2–1.4 mm; venation typical of genus. Halter white with brown stripe.

**Abdomen.** Subshining; tergites and sternites white to brown, usually paler than thorax; tergites darker than sternites. Spiracles apparently in membrane close to lateral margins of tergites. 

**Male postabdomen** (Figs 6–7). Surstylus fused to epandrium, straight, with several short bristles at ventral apex. Hypandrium simple, U-shaped. Postgonite slender, as long as surstylus.
one anterior and one posterior notopleural bristle; one postalar bristle; scutellum with one pair of long and strong widely spaced apical bristles and one pair of short subapicals; katepisternum with two bristles, posterior stronger. Legs white to pale yellow; hind femur occasionally with a small brown spot. Wing length 1.0–1.1 mm; venation typical of genus. Halter white.

**Abdomen** subshining; tergites and sternites white. Spiracles apparently in membrane very close to lateral margins of tergites.

**Male postabdomen** (Figs 12–13). Surstylus fused to epandrium, slightly curved posteriorly, with several short bristles at ventral apex. Hypandrium simple, U-shaped. Postgonite slender, shorter than surstylus. Phallopodeme straight. Phallus short, membranous. Ejaculatory apodeme large. Cercus with few long hairs.

**Female postabdomen**. Similar to *L. fasciata* (as in Figs 8–10).

**Etymology.** The species name is a patronym in honour of Helen Grossman, who was supportive of this work but passed away before its completion.

**Remarks.** This species differs from all other described species of *Loewimyia* in having entirely yellow legs and white abdomen and halter.

**Loewimyia spec.**

Three additional specimens of *Loewimyia*, assignable to neither of the above species, were examined. Two of these, from Isla Isabel, resemble *L. bifurcata* in having banded legs and a black halter but they are in poor condition and their identity cannot be confirmed. The first flagellomere of one specimen appears bifurcate, as in *L. bifurcata*, but that of the other is more rounded. The third specimen is a female from Isla Floreana, possibly belonging to the same species, but with all femora entirely black.

**Material examined**: ECUADOR: Galápagos Islands: Isabela, agriculture zone, 380 m, sweeping; 9.iii.1989, B. J. Sinclair (1♂, 1♀, CJC); Floreana, 8 km E Black Beach, 360 m, Scalesia, FIT, 22–28.i.1989, Pick & Sinclair (1♀, CJC).

**Sigaloessa variatincta** Forrest & Wheeler, spec. nov.

(Figs 14–18)

**Type material**: Holotype ♀: ECUADOR: Galápagos Islands: Isabela, Pto. Villamil, littoral, ex. sweeping beach morning glories, 6.iii.1989, B. J. Sinclair (CJC). Paratypes: ECUADOR: Galápagos Islands: Fernandina, Cabo Hammond, 0 m, 5.v.1991, J. Heraty (1♂, 1♀, CJC); Floreana, Beach, 10 m, littoral–air malaise, 21–28.iii.1989, Pick & Sinclair (1♂, 1♀, CJC); Isabela, Pto. Villamil, littoral, ex. sweeping beach morning glories, 6.iii.1989, B. J. Sinclair (2♂♂, 6♀♀, CJC; 1♂, 1♀, LEM); Isabela, coastal wet meadow, arid zone, 6.iii.1989, B. J. Sinclair (1♀, CJC); Isabela, Pto. Villamil, littoral, mv-lights, 3.iii.1989, B. J. Sinclair (2♂♂, 3♀♀, CJC); Isabela, Pto. Villamil, littoral mangrove lagoon, 3–15.iii.1989, B. J. Sinclair (4♂♂, 6♀♀, CJC); Santa Cruz, Tortuga Bay, 0 m, littoral/airid, 15.5.1991, J. Heraty (2♀♀, CJC).

**Description**

**Male and female.** Body length 1.25–1.5 mm. **Head**: Frons in male yellow on anterior 50 to 80%, darker brown posteriorly except for pale, well-defined interfrontal stripes extending from the occipital margin forward to or just beyond level of orbital bristles; frons in female entirely yellow, interfrontal stripes lacking; frons narrowing slightly posteriorly, length:width ratio 1.0–2.0; frons with sparse procline interfrontal setulae and one pair of short, procline, cruciate interfrontal bristles projecting over lunule; ocellar tubercle black; occiput concave, dark brown, frequently pale brown to yellow behind ocellar tubercle; one lateroconal and reclinate orbital bristle and a row of reclinate orbital setulae present; ocellar bristles procline, divergent; postocellar bristles weak, divergent; outer vertical bristle strong; inner vertical bristle half as long as outer. Face silvery-white, epistoma brown to
except for brown patch in ventral half of katepisternum, narrower brown stripes along ventral margins of anepisternum, anepimeron, proepisternum and proepimeron, brown spot on meron. Thoracic chaetotaxy: two strong postsutural dorsocentral bristles; one row of acrostichal setulae extending posteriorly to level of anterior dorsocentral bristle, and single dorsocentral and intra-alar rows of setulae; one anterior and one posterior notopleural bristle; one postalar bristle; scutellum with one pair of long and strong apical bristles, and a pair of weak, hairlike subapicals; katepisternum with two bristles, posterior stronger. Legs entirely yellow; fore femur with row of pale, posterodorsal bristles, slightly longer than diameter of femur, and shorter posteroventral row. Wing length 1.6–1.7 mm. Halter yellow with two brown stripes on knob.

Abdomen with tergites brown and pollinosity, relatively small; sternites small, yellow. Spiraclip in membrane near lateral margins of tergites.


Female postabdomen (Figs 16–18). Tergites broad, sclerotized, sternites membranous; tergite 8 rectangular, with posterior margin broadly excavated, tergite 10 a narrow transverse strip; cerci broadly separated at base, with long setae; sternites 8 and 10 reduced to patches of bristles. Spermathecae mushroom-shaped, well-sclerotized; ventral receptacle unsclerotized.

Etymology. The species name is from the Latin varius (different) and tinctus (dye, paint), referring to the colour patterns on the halter, scutum and thoracic pleurites.

Remarks. The banded halter distinguishes this species from all previously described Sigaloessa, although this character is shared with two undescribed species from Canada and Jamaica. Sigaloessa insularis Malloch, 1930 from Tahiti has a pattern on the scutum similar to that of S. variatincta but the latter species differs in having a strongly developed outer vertical bristle and orbits indistinguishable from the frons. Sigaloessa variatincta can be incorporated in SABROSKY’s (1957) key to New World species of Sigaloessa by replacing couplet 12 with the following:

12 Halter banded; mesonotum with yellow prescutellar patch and median, intra-alar and, often, dorsocentral stripes

– Halter entirely black; mesonotum without pattern as above

12a (SABROSKY’s couplet 12)

Discussion

Astrosoma sabulosum, Loewimia helenae and Sigaloessa variatincta are known only from the littoral and arid zones. Loewimia fasciata was collected most frequently in the Scalesia zone, but was also found in the Miconia zone with very few specimens collected in the arid and littoral zones.

Asteid larvae are apparently saprophagous and have been reared from a variety of substrates including decaying plant material and fungi (FERRAR 1987). Adults have been collected in similar habitats, as well as at tree wounds and from wood chips or sawdust (FERRAR 1987, SABROSKY 1987). Galápagos species collected in the littoral and arid zones were usually...
associated with sea lion or marine iguana colonies, or with vegetation such as beach morning glories or PaloSanto flowers. *Loewinia fasciata* was collected in a wide range of habitats, including agricultural fields, from the littoral zone to elevations over 600 m in the *Scaletia* zone. All species except *L. fasciata* were also collected at lights. All species of Galápagos Asteidae are known from at least three islands, usually widespread throughout the archipelago. Additional collecting may show these species to be present on more islands. The minute size of these flies and their apparently generalist habits would allow them to be easily dispersed from island to island, either by wind, water or human-mediated transport.

The family is quite diverse in the Pacific and Neotropical regions, although 20 of the 23 described species known from Pacific islands are in the genus *Asteia* MEIGEN, 1830. The three genera recorded from the Galápagos are most diverse in the New World. There are four described species of *Astiosoma* in the southern Nearctic realm (SABBROSKY 1957); one or two species are also known from each of the Palearctic, Oriental and Australasian realms. Species of *Loewinia* have been described only from Central and South America and Hawaii (SABBROSKY 1957, HARDY & DELFINADO 1980), although there are additional undescribed species in the southern Nearctic and Neotropical realms. *Sigaloessa* is known from the southern Nearctic and Neotropical realms (4 and 11 species, respectively) (SABBROSKY 1957), and is represented by a single species in Tahiti (MALLOW 1930). *Sigaloessa* has recently been recorded in Hawaii (BEARDSLEY et al. 1999) and we have examined undescribed species from both the Nearctic and Neotropical realms.

Given the pattern of distribution of these three genera, it seems most likely that the ancestors of the Galápagos species originated in the southwestern Nearctic or western Neotropical regions. However, in the absence of a hypothesis on phylogenetic relationships within the Asteidae, it is difficult to determine the sister group of any of the Galápagos species and, therefore, the point of origin of the ancestral populations. In addition to resolving questions of zoogeography, a phylogenetic analysis of the Asteidae is needed in order to establish the status limits and the currently recognized genera. As more species are described from the tropics, the generic limits may become more confused. For example, an undescribed species of *Astiosoma* from Venezuela in the LEM collection has characters of both *Astiosoma* (2 orbital bristles, long inner vertical bristle, face not narrow between vibrissae) and *Sigaloessa* (R1 and R2+3 ending together in C, overall colour and collinosity), but differs from both in having only 1 dorsalcentral bristle. The male genitalia are also variable within aetid genera: *Astiosoma sabulsum* has a small, membranous distiphallus (Fig. 2), whereas *A. aridum* and the undescribed Venezuelan species have a larger distiphallus with areas of dark sclerotization, as in *Sigaloessa* (Fig. 15). There are similar problems with other genera.

Acknowledgements

We thank Dr. B. J. SINCLAIR (Bonn, Germany) for his invitation to participate in the study of the Galápagos acalyprate Diptera. M. COMMINS (CNC) arranged loans of specimens. The late C. W. SABBROSKY (Washington DC) provided advice on the status of these specimens in the early stages of the study. Fieldwork in the Galápagos by S. B. PECK and B. J. SINCLAIR was facilitated by the Galápagos National Park Service, Department of Forestry, Ministry of Agriculture, Ecuador and the Charles Darwin Research Station, Isla Santa Cruz. Funding was provided by a NSERC Undergraduate Student Research Award to J. FORREST and a NSERC research grant to T. A. WHEELER.

Literature


Authors’ address

Jessica FORREST and Dr. Terry A. WHEELER

Department of Natural Resource Sciences

McGill University, Macdonald Campus

Ste-Anne-de-Bellevue

QC, H9X 3V9

Canada

E-mail: wheeler@nrs.mcgill.ca

The paper was accepted on 10 January 2002.