

Wood midges (Diptera: Cecidomyiidae: Lestremiinae) from the Galápagos Islands, Ecuador

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Abstract. This is the first report on wood midges (Cecidomyiidae, Lestremiinae) occurring in the Galápagos Islands. Of the three species identified, two are new to science: *Peromyia galapagensis* sp. n. and *Insulestremia sinclairi* spec. nov., the latter assigned to a new genus, *Insulestremia* gen. nov. The third island lestremiine, *Anarete buscki* (Felt), is a widespread New World species. The new taxa are described, illustrated and their systematic relationships are discussed.

Kurzfassung. Holzmücken (Diptera: Cecidomyiidae, Lestremiinae) von den Galápagos-Inseln, Ecuador. Es wird erstmalig über Holzmücken (Cecidomyiidae, Lestremiinae) von den Galápagos-Inseln berichtet. Von den drei identifizierten Arten sind zwei neu für die Wissenschaft: *Peromyia galapagensis* sp. n. und *Insulestremia sinclairi* sp. n. Letztere Art wird der neuen Gattung *Insulestremia* gen. n. zugeordnet. Die dritte Insel-Lestremiine ist *Anarete buscki* (FELT), eine in der Neuen Welt weit verbreitete Art. Die neuen Taxa werden beschrieben, illustriert und ihre systematische Stellung wird diskutiert.

Key words. Diptera, Cecidomyiidae, Lestremiinae, new taxa, Galápagos Islands, Ecuador, biogeography.

Introduction

Any study of the Galápagos fauna and flora at some point addresses the question of the biota's origin, i.e. phylogenetic and biogeographic relationships of the taxa occurring on these isolated eastern Pacific islands. When Bradley J. Sinclair asked me to contribute to his study of the Diptera fauna of the Galápagos Islands, I agreed to treat the wood midges (Cecidomyiidae, Lestremiinae), knowing that such a task would mean the description of findings rather than analyzing and discussing their possible origins. Knowledge of the Lestremiinae from Mexico, Central and South America — which are generally considered the primary source regions of Galápagos colonists (PECK & KUKALOVÁ-PECK 1990, PECK 1996) — is simply too sparse for an analysis like that. GAGNÉ, in his "Green Book" (1994), summarized the published knowledge of the Neotropical Lestremiinae. His list of taxa includes eight named species and ten genera, a body of taxa in need of revision and almost negligible considering that the subfamily Lestremiinae, cosmopolitan in distribution, currently consists of some 550 species classified into almost 50 genera. Recent studies of Costa Rican Lestremiinae show that a diverse wood midge fauna is present also in the Neotropics (JASCHHOF unpubl.), even though not comparable to the taxic diversity met, for instance, among lestremiines from the Oriental tropics (JASCHHOF 1998a).

There are no previous records of lestremiines in Galápagos. From the study material at hand I identified three species, each belonging to a different genus. Two species and one genus are new to science (and necessarily considered endemic to Galápagos for the time being); a third species is presumably widespread throughout the New World both mainland and insular. All these taxa will be treated in detail in the following. Considering that fruitful collecting of tiny and largely obscure lestremiine adults requires a range of methods, including some group-

specific ones (JASCHHOF 1998b), one may assume that more than these three species occur in the Galápagos Islands, most likely in the upland humid forests.

Cecidomyiids including lestreimiines are usually considered to be morphologically adapted for aerial transport (MAMAEV 1975), which should pre-adapt them for long distance dispersal. The aerial and sea-surface transport of insects between the islands of the Galápagos Archipelago was documented by PECK (1994a, b). As regards aerial plankton (PECK 1994a), 20 cecidomyiids were identified among a total of 16,858 individuals belonging to 13 families of the order Diptera, which of 16,523 individuals (= 98%) belonged to just one family, Sciaridae. Excluding Sciaridae, Cecidomyiidae was the second largest Diptera family holding a share of six percent of the Diptera individuals found. These numbers support rather than contradict the view of cecidomyiids being good drifters; however it has not been studied whether there were lestreimiines among them. The pleuston (PECK 1994b) was found to contain only one cecidomyiid among a total of 2,864 Diptera (2,778 Sciaridae = 97%), a result that is not surprising considering that these minute, fragile midges should disintegrate rapidly on the ocean surface. Intensive search for lestreimiines in another oceanic archipelago, Bonin Islands (to Japan) in the western Pacific, resulted in findings of less than ten species, which reflects an extremely depauperate island fauna compared with that of the nearest mainland, the Asian east coast including Japan (JASCHHOF, unpubl. report).

Material and Methods

Specimens examined here come from the Canadian National Collection of Insects, Agriculture Canada, Ottawa (CNC) where all the material, including types, are deposited. Various collection methods were used by Stewart B. and Jarmila Kukalová-Peck and Bradley J. Sinclair in 1985 and 1989, respectively (for more details, see BICKEL & SINCLAIR 1997). Previously stored in 70% ethanol, all specimens were mounted in Canada balsam for compound microscope study (JASCHHOF 1998b). For the preparation of drawings I used an OLYMPUS BX50 microscope in combination with the U-DA drawing unit. Classification of the Lestremiinae follows that proposed by JASCHHOF (1998b). Morphological terminology follows that applied by JASCHHOF & JASCHHOF (2003).

Taxonomy

Tribe Lestremiini

Genus *Anarete* HALIDAY, 1833

The genus *Anarete* has 28 described species in the Holarctic, Neotropical, Oriental and Oceanian regions. The only known Neotropical species, that is present also in the Nearctic, was found to occur on two of the Galápagos Islands.

Anarete buscki (Felt, 1915)

Anarete buscki was described from Cuba and subsequently found in Puerto Rico and the United States (Arizona, Minnesota) (PRITCHARD 1951, KIM 1967). Given such a wide range of distribution, its presence on the Galápagos Islands is not surprising and may be expected also in Central and South America. Within the Galápagos, *A. buscki* is found on the islands of San Cristóbal and Santa Cruz. Individuals were encountered swarming over sandy ground

which perfectly fits into what is known of the biology of *Anarete*. Species of this genus differ from most other wood midges in that they clearly prefer open habitats rather than forests. Sand dunes as an *Anarete* habitat are specifically mentioned by PRITCHARD (1951). Another peculiarity, *Anarete* adults form mating swarms, a behaviour intensively studied by CHIANG (1961, 1962, 1963) and CHIANG AND STENROOS (1963).

Material. ECUADOR: Galápagos Islands: San Cristóbal: 20 males, Porto Baquerizo, swarming on path, 14 Feb. 1989, by sweeping, B.J. Sinclair; 3 females, 4 km E Baquerizo, 150 m, 12–23 Feb. 1989, flight interception trap, S.B. Peck and B.J. Sinclair. Santa Cruz: 4 males, Tortuga Bay, on sandy path to beach, 30 Jan. 1989, by sweeping, B.J. Sinclair.

Genus *Insulestremia* gen. n.

Type species: *Insulestremia sinclairi* sp. n., described below.

Description

Male. Head: Postcranium with irregularly arranged long setae. Two ocelli present. Antenna with scape somewhat larger than pedicel, both setose ventrally. Antennal flagellum with 14 flagellomeres; each but terminal flagellomere with distinct neck; node completely covered with microtrichae, and further with crenulate whorls of long sensory hairs and 1 flattened sensillum distally. Face non-setose. Clypeus mainly fused with face, small, with long setae. Maxillary palpus 5-segmented (including small, smooth and non-setose presegment); segment 2 thickest, with numerous sensory hairs; segments 3–5 cylindrical, increasing in length; segments 2–5 with numerous setae.

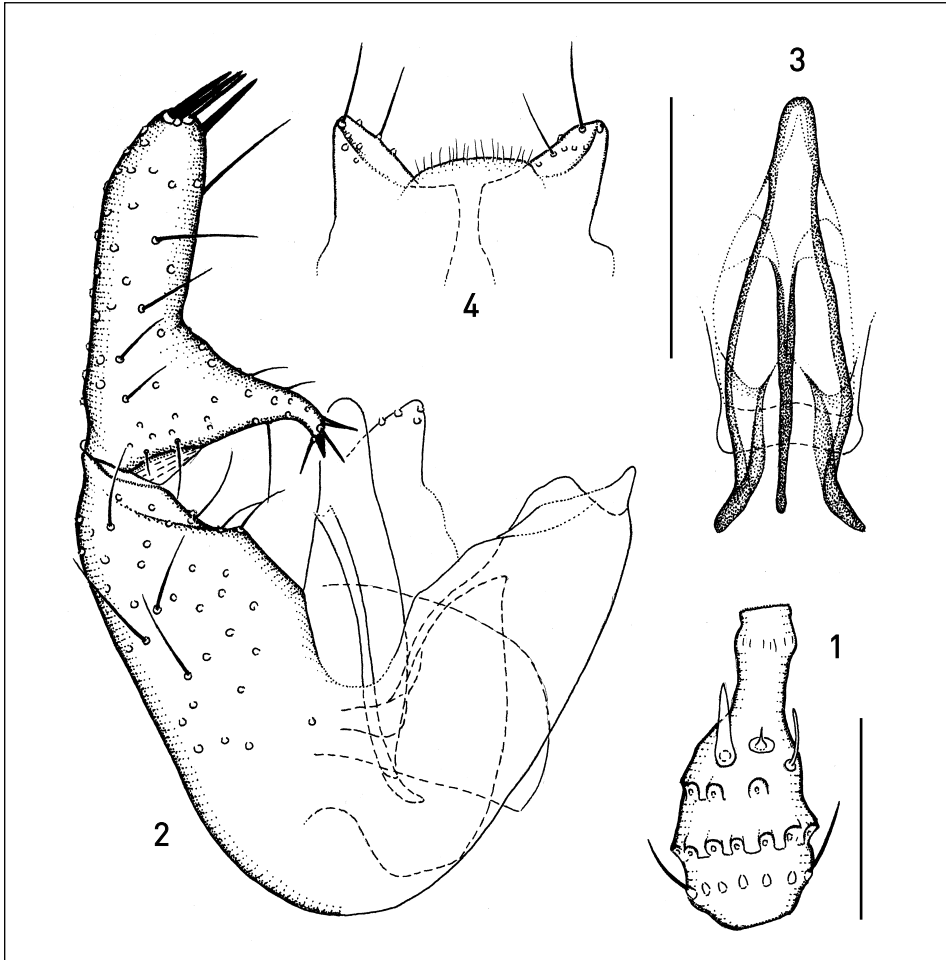
Thorax (Fig. 5): Postpronotum forming well developed bulge above neck. Antepronotum long and narrow, bare. Episternum 1 long, bare. Epimeron 1 barely traceable. Scutum with dorsal surface evenly arched to slight degree; with anterior parapsidal suture weak, no median transverse suture traceable, and bearing lateral and dorsocentral rows of setae. Paratergite distinct from scutum and well sclerotized. Scutellum setose. Mediotergite short. Postphragma large, produced into abdominal cavity for at least half the length of abdominal segment 1. Laterotergites unpronounced. Anepisternum 2 subtriangular, much smaller than preepisternum 2; the latter subtriangular ventrally. Pleural pit indistinct. Epimeron 2 not subdivided into anterior and posterior portions. Metanotum not traceable. Episternum 3 high, not subdivided. Epimeron 3 not traceable. **Wing** (Fig. 6): Blade rather short and broad. Calypteral area not lobed. Anal lobe pronounced. Membrane transparent, evenly covered with setae. Venation: C with break clearly before wing apex; Sc long, ending free; R1 very short; Rs and ta extremely short; M1+2-fork longer than stem, diverging in distal third; CuA1 free proximally; CuP pale, more than half as long as CuA2; A1 traceable as row of setae. M, CuA and CuP wide but pale. Setae along wing margin and dorsally on Sc, R, R5, M1+2-stem and fork, CuA1, CuA2, A1, and on R5 also ventrally. Halter with short setae in medial portion, club-shaped with comparatively short stem. **Legs:** Longer than body, with short setae most dense on tarsi. Coxae shorter than half height of thorax. Tarsomeres 1–4 decreasing in length, tarsomeres 4 and 5 subequal in length. Pulvilli not traceable.

Abdomen: Segment 1 very short. Tergites 1–8 and sternites 2–8 setose. Pattern of tergal plaques: 0/2/2/1/1/1/1/0. **Terminalia:** See under type species, *I. sinclairi*.

Female. Head: Antennal flagellum with less than 14 flagellomeres, each flagellomere with very short stem and cylindrical node; node with 4 flattened, one- to two-pointed sensillae arising from very large basal pores.

Terminalia: Ovipositor short, without striking modifications. Sclerotized spermathecae absent.

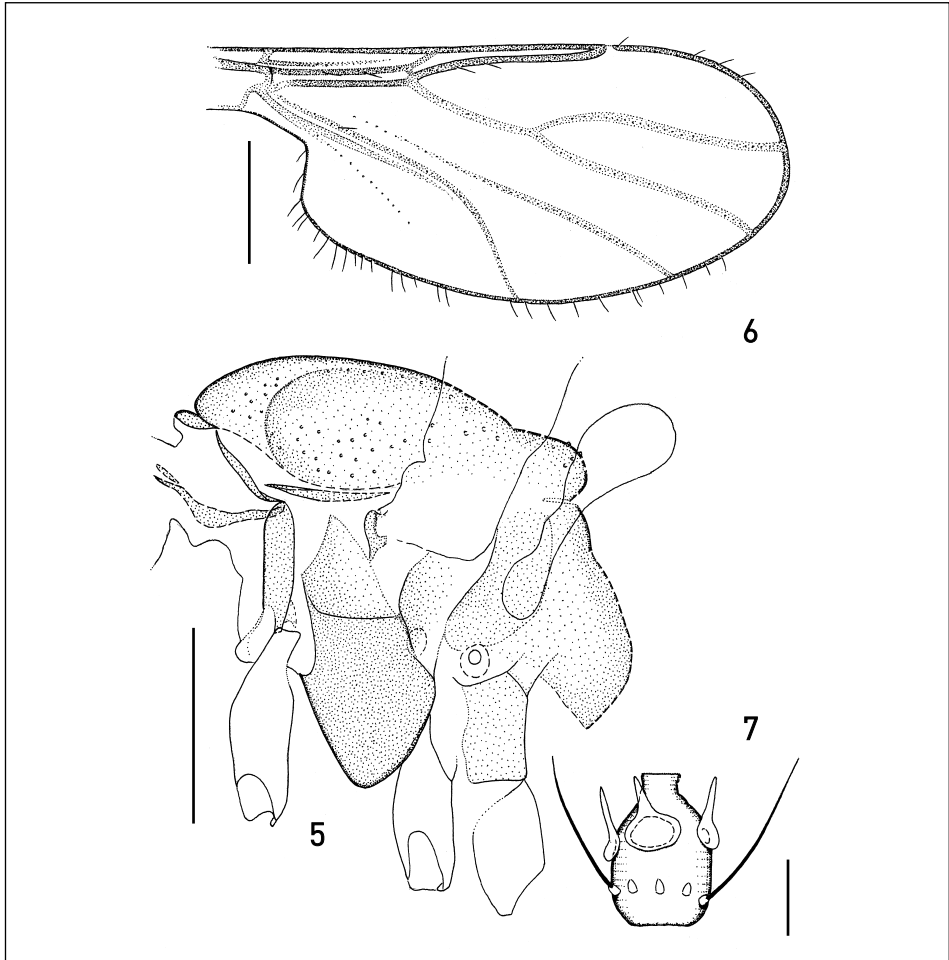
Diagnosis and discussion. *Insulestremia* is the only genus within the tribe Lestremiini where the antennal flagellum bears flattened sensillae that in females arise from very large basal pores (autapomorphy). Male terminalia of the type species, *Insulestremia sinclairi*, show other apomorphic features, such as bilobed gonostyli; gonocoxites with a complete dorsal trans-



Figs 1–4: *Insulestremia sinclairi* sp. n., male; 1: Antennal flagellomere 4, lateral view (0.05 mm); 2: Terminalia, ventral view (0.1 mm); 3: Tegmen and aedeagus, ventral view (0.1 mm); 4: Cerci and hypoproct, ventral view (0.1 mm). 1, 2: Holotype; 3, 4: Paratype. In parentheses: Length of scale bar.

verse bridge; and reduced dorsal parameral apodemes. However, these attributes may be found also in other genera of the Lestremiini, despite of that their genus-diagnostic value remains uncertain as long as there is only one species known of the genus *Insulestremia*. Relationships to other Lestremiini are obscure. In two genera, *Allaretella* MEYER & SPUNGIS, 1994 and *Anaretella* ENDERLEIN, 1911, the antennal flagellum bears furcate sensillae, whereas all other Lestremiini are characterized by simple sensory hairs. The presence of non-hairlike sensillae in the genera *Insulestremia*, *Allaretella* and *Anaretella* might indicate their common ancestry, but such a view is not supported by further characters and thus rather speculative.

Etymology. The name is composed of the Latin ‘insula’, for island, and the name *Lestremia* which is the type genus of the tribe Lestremiini where this new genus belongs. The gender is feminine.



Figs 5–7: *Insulestremia sinclairi* sp. n.; 5: Thorax, lateral view (0.2 mm); 6: Wing (0.25 mm); 7: Female antennal flagellomere 4, lateral view (0.025 mm). 5, 6: Holotype; 7: Paratype. In parentheses: Length of scale bar.

Insulestremia sinclairi sp. n. (Figs 1-7)

Description

Male. Body size: 1.6–1.8 mm. **Head:** Postfrons non-setose. Eye bridge 3–4 facets long. Antennal flagellomere 4 (Fig. 1) with neck shorter than node; node with 1 whorl of short setae subbasally, 1 complete and 1 incomplete crenulate whorl of long sensory hairs, some short sensory hairs and spines distally, and 1 flattened, pointed sensillum absent on more distal flagellomeres. Segment 3 of maxillary palpus occasionally with single sensory hairs.

Legs: Tarsal claws crescent-shaped, with very fine teeth. Empodia shorter than claws.

Terminalia: Gonocoxites (Fig. 2) setose on outer surfaces except large portion ventroproximally, with U-shaped emargination ventrally not extending beyond midlength of gonocoxites,

with lip-like sclerotized lobe medio-dorsally; dorsal transverse bridge complete and well sclerotized. Gonostyli (Fig. 2) large, bilobed; with main lobe cylindrical, rounded terminally and bearing 4–5 short megasetae; with side lobe directed inwards, tapering to tip, terminating in small tooth surrounded by 4 short spines; with setae of various lengths elsewhere. Tegmen (Figs 2, 3) as long as gonocoxites, slender, with clear contours; dorsal gonocoxal apodemes just traceable. Aedeagus (Fig. 3) with long sclerotized apodeme without any modifications. Tergite 9 (indicated in Fig. 2) plate-like, with rounded distal margin, setose. Cerci (Fig. 4) comparatively short, subtriangular, setose. Hypoproct (Fig. 4) one-lobed, pubescent. **Female.** Largely corresponding with male. **Body size:** 1.9 mm. **Head:** Antennae with 9 flagellomeres, terminal flagellomere constricted resulting in small additional node. Flagellomere 4 (Fig. 7) with subbasal whorl of long setae; 4 flattened, one- to two pointed sensillae arising from very large basal pores; and short sensory hairs and spines distally.

Types. Holotype: male, ECUADOR, Galápagos Islands, San Cristóbal, 3 km E Baquerizo, 100 m, 12–23 Feb. 1989, Malaise trap, S.B. Peck and B.J. Sinclair. **Paratypes:** 4 males, 1 female, same data as holotype.

Etymology. The species epithet is to honour the dipterist Bradley J. Sinclair, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany, who encouraged this study of Galápagos cecidomyiids and collected almost all the specimens examined here.

Additional material studied. San Cristóbal: 4 males, Porto Baquerizo, in arid zone, 20 Feb. 1989, by sweeping, B.J. Sinclair; 1 male, 400 m, in dry *Scalesia* forest, 22 Feb. 1989, at light, B.J. Sinclair; 1 male, 4 km E Baquerizo, 150 m, 12–23 Feb. 1989, flight interception trap, S.B. Peck and B.J. Sinclair.

Supertribe Micromyiidi, tribe Peromyiini

Genus *Peromyia* KIEFFER, 1894

The genus *Peromyia* has 119 valid species in all biogeographic regions of the world. The Holarctic fauna alone comprises 113 species, while all other faunas remain practically unstudied. As regards the Neotropics, more than a dozen species were recently identified from Costa Rican collections (JASCHHOF, unpubl.). *Peromyia* adults, as tiny as one millimetre in body size or less, have been reported from various oceanic islands (for instance, JASCHHOF 2001), and a few species appear to be truly cosmopolitan.

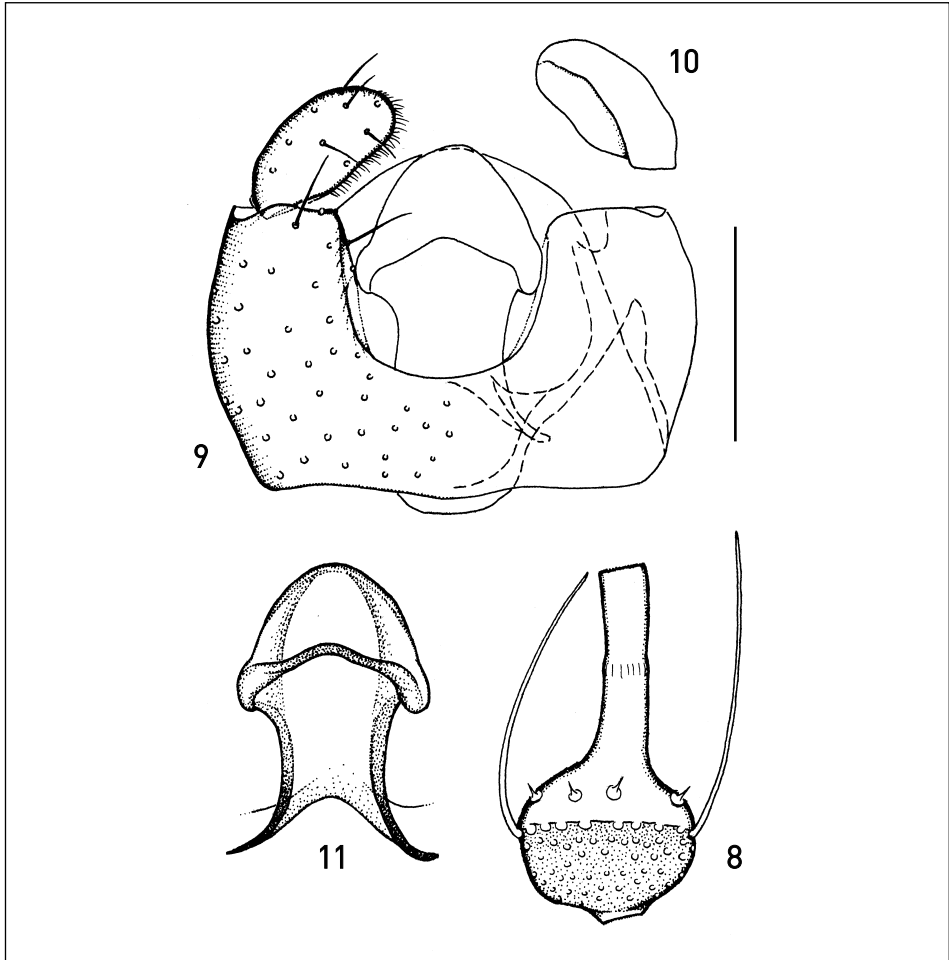
Peromyia galapagensis sp. n. (Figs 8–11)

Description

Male. Body size: 0.6–0.7 mm. **Head:** Postfrons non-setose. Eye bridge 2 facets long laterally and 2–3 facets at vertex. One dense row of postocular bristles. Antennae broken in specimens available for study, with maximally 8 flagellomeres retained. Flagellomere 4 (Fig. 8) with neck longer than node. Node pigmented in proximal half; vestiture consisting of numerous short setae (or possibly scales) scattered in basal third, single to triple whorl of long setae medially, dense whorl of long sensory hairs beyond the setae, and some sensory spines distally. Maxillary palpus 4-segmented; all segments with fairly long sensory hairs.

Legs: Pretarsal claws crescent-shaped, without teeth. Empodia as long as claws. **Wing:** R1 3 times as long as Rs, and strong anterior portion of C ending at crossing point with R5.

Terminalia: Gonocoxites (Fig. 9) covered with setae (and scales?) ventrally; ventral emargination U-shaped, reaching beyond midlength of gonocoxites; dorsal transverse bridge extending slightly beyond proximal margin of gonocoxites. Gonostyli (Figs 9, 10) small, longer than wide, rounded distally, somewhat excavated inside, with sharply demarcated



Figs 8–11: *Peromyia galapagensis* sp. n., holotype male; 8: Flagellomere 4, lateral view; 9: Terminalia, ventral view; 10: Gonostylus, dorsal view; 11: Tegmen, ventral view. Length of scale bar: 0.05 mm.

longitudinal rim dorsally; with some short setae and dense hairs inside. Tegmen (Figs 9, 11) large, as long as gonocoxites, with clear contours, fungus-shaped with broad, rounded cap. Tergite 9 (indicated in Fig. 9) forming complete sclerotized semicircle, with setae along distal margin. Cerci and hypoproct not recognizable due to paleness of the specimens available for study.

Female. Unknown.

Discussion. Among *Peromyia* species known, *P. galapagensis* is readily identified by the combination of bicoloured antennal flagellomeres and the tegmen with a broad, rounded cap. The shape of the tegmen in *P. galapagensis* in particular is quite distinct and comparable only to that in *P. mitrata* JASCHHOF, 1997 from the Palearctic region. *Peromyia galapagensis* cannot be assigned to any species groups known from the Holarctic (JASCHHOF 1998b, 2001). I expect its closest relatives to be found in Central and/or South America.

Types. Holotype: male, ECUADOR, Galápagos Islands, Santa Cruz, Los Gemelos, 31 km N

Santa Rosa, in *Scalesia* forest, 570 m, 1–13 July 1985, flight interception and Malaise traps, S.B. & J. Peck. **Paratypes:** 2 males, same data as holotype.

Etymology. The species epithet is derived from the island group in question, Galápagos.

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