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PAPALLACTA (DIPTERA: DOLICHOPODIDAE),
A NEW STENOPTEROUS GENUS FROM
THE PÁRAMO OF ECUADOR

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Papallacta stenoptera (Diptera: Dolichopodidae) gen. n. & sp. n. is from described from mossy páramo habitat at 4000 m in Ecuador. This species is tiny, body length 1.3 mm, has the wing reduced to a narrow strap, and is the first stenopterous dolichopodid described from the New World. Based on the structure of the head, thorax, and male postabdomen, and the setation, *Papallacta* belongs in the Medeterinae, even though males have large obovate arisal flags, unusual in this subfamily. Ant predation is regarded as a factor limiting the occurrence of flightlessness in Diptera.

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The reduction of wings with accompanying flightlessness is known from more than 20 families of Diptera (review, Hackman 1964), and can be broadly categorized as responses to three general types of selective pressure: a) climactic, especially to cold or overcast habitats, in alpine areas, high latitudes, and islands. b) adaptation to parasitism, either as inquilines in the nests of social insects, or on vertebrate hosts, and c) life in cryptic habitats, where wings would have little function or be easily damaged. There are various categories of wing reduction: shortened or reduced in length (brachyptery), narrowed or reduced in width, but often with a distinct radial vein (stenoptery), reduced to a tiny appendage (microptery), or totally absent (aptery). Flightlessness can have strong synergistic effects on other structures, such as the reduction or loss of halteres, loss of flight muscle and associated thoracic shrinkage, and modification of the legs for cursorial life.

Flies of the family Dolichopodidae are free living and all known instances of wing reduction appear to be adaptations to climatic conditions. Evenhuis (1997) reviewed flightlessness in the family and recorded 15 species with varying degree of wing reduction, with the majority of cases on islands. Eight

stenopterous or micropterous species are known from the tropical Hawaiian Islands, almost all from elevations above 1500 m. Three micropterous or apterous species are known from the cold and windy Campbell and Macquarie islands above 50°S latitude south of New Zealand, and an undescribed stenopterous species from Stewart Island, New Zealand. Two brachypterous species are known from North America, one being a variant of a fully winged species associated with coastal dunes in California, and the other is known from bogs in eastern Canada. Finally, the brachypterous *Hydrophorus celestialis* Takagi is found from 3,500-4,000 m on snow and rocky alpine herb fields in Nepal (Takagi 1972).

Flightlessness in most Dolichopodidae appears to have developed where cold and/or overcast conditions make thermoregulation of thoracic flight muscles difficult. This is the case in the subantarctic islands, wet montane tropics and alpine habitats. As well, strong winds would select against flight on small islands. However, ground predation, particularly from ants, appears to be a major factor limiting wider development of flightlessness in Diptera. Ants are not present on subantarctic islands or in high alpine conditions. And although tropical, the eight flightless Hawaiian

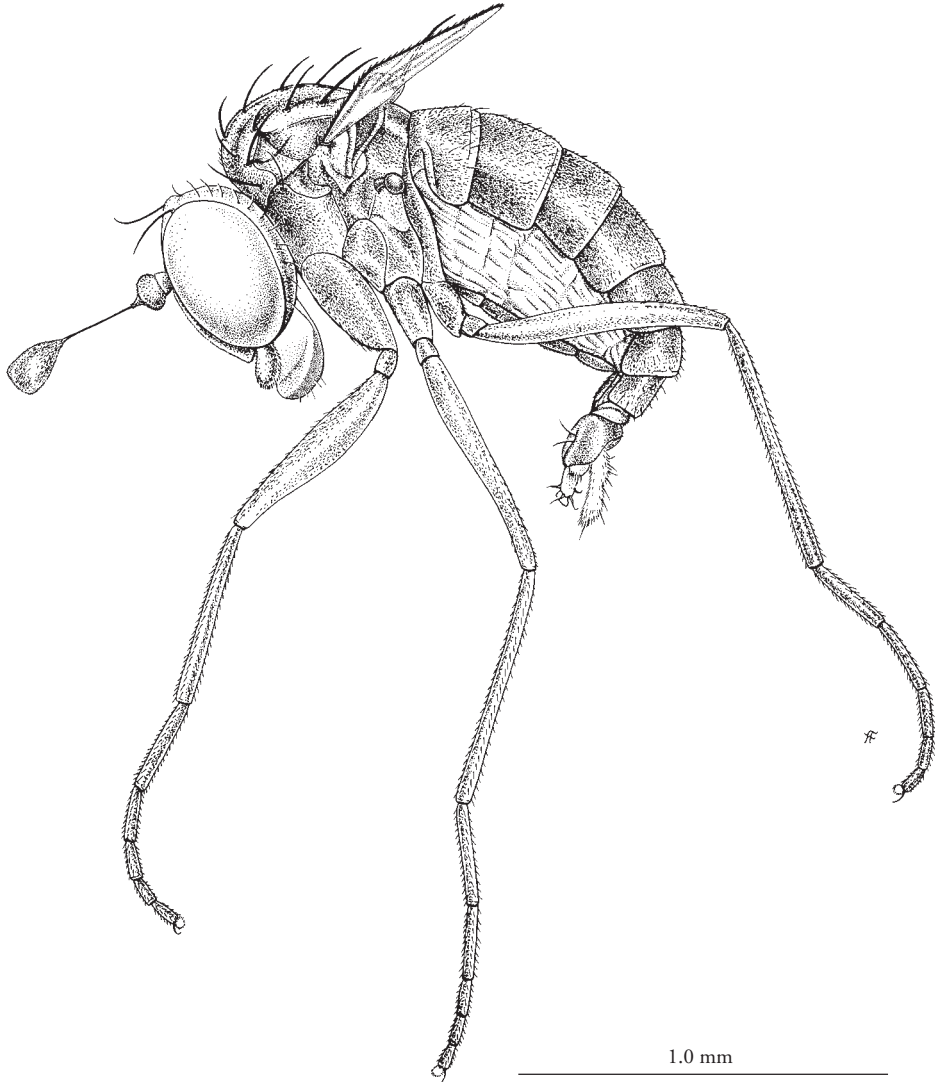


Fig. 1. – *Papallacta stenoptera* sp. n., male habitus.

dolichopodids evolved on overcast wet mountains in a biota that lacked ants. Since human settlement, several accidentally introduced invasive ant species have had profound impacts on native ground dwelling fauna, and are thought to be responsible for the extermination of at least one flightless dolichopodid, *Emperoptera mirabilis* Grimshaw (Krushelnicky et al. 2005, Evenhuis 1997).

In the tropics generally, ants are ubiquitous except

at high elevations, where they appear to be limited by temperature. Brown (1973) noted that ants are usually absent in tropical montane forests above 2,300 m, but can survive in higher treeless habitat if there is sufficient radiant heat. This background provides context for the new genus of flightless Dolichopodidae discovered in páramo near 4,000 m in Ecuador, a habitat free of ants.

MATERIALS AND METHODS

This study is based on specimens in the Insect Collection of the University of Guelph (DEBU), Guelph, Ontario. In describing the hypopygium, 'dorsal' and 'ventral' refer to morphological position prior to genitalic rotation and flexion. Thus, in figures showing a lateral view of the hypopygium, the top of the page is morphologically ventral, while the bottom is dorsal. The relative lengths of the podomeres should be regarded as representative ratios and not measurements. The ratios for each leg are indicated in the following formula and punctuation: trochanter + femur; tibia; tarsomere 1/ 2/ 3/ 4/ 5. The following abbreviations and terms are used: I, II, III: pro-, meso-, metathoracic legs; ac, acrostichal setae; ad, anterodorsal; av, anteroventral; dc, dorsocentral setae; dv, dorsoventral; pd, posterodorsal; pv, posteroventral; MSSC, male secondary sexual character(s), non-genitalic structures found only on males.

TAXONOMY

Papallacta gen. n.

Etymology. – *Papallacta* is a place name of indigenous origin, Papallacta Pass, Ecuador, where all known specimens were collected. The gender is feminine.

Type species. – *Papallacta stenoptera* sp. n.

Diagnosis. – This generic diagnosis is based on the single included species, and lists features considered to be of generic importance.

Length, less than 1.5 mm; dorsal postcranium slightly concave; face distinctly separating eyes; first flagellomere rounded; arista apical; posterior mesonotum distinctly flattened and slightly depressed; ac absent; 5 dc setae present; coxae with only short setae; coxa III laterally bare; legs without major setae; wing short, narrow, stenopterous with residual venation evident; halter reduced in size, short; segment 7, exerted as hypopygial peduncle, with tergum enclosing ovate sternum; left lateral hypopygial foramen; hypopygium with wide cercus; hypandrium fused at base to epandrium; ventral surface of epandrium with 2 pairs of strong setae; surstylus with dorsal arm bearing field of subequal setae, visible in lateral view, and ventral arm of surstylus with row of strong modified ventral seta; cercus broad; oviscapt with tergum 9+10 split medially into two hemitergites, each bearing 2 strong, slightly curved setae. MSSC (on single described species): apical arista flag.

Papallacta stenoptera sp. n.

(figs. 1-4)

Type material. – Holotype ♂: ECUADOR: Napo / Pichincha, Quito-Baeza Road, Papallacta Pass, 0°19'15"S, 78°11'51"W, 4000 m, yellow water traps in moss, 4-8.xi.1999, S.A. Marshall (DEBU). – Paratypes, 6♂, 1♀: as holotype (DEBU).

Description Male

Body length, 1.3 mm; wing: 0.6 × 0.2 mm; habitus (fig.1).

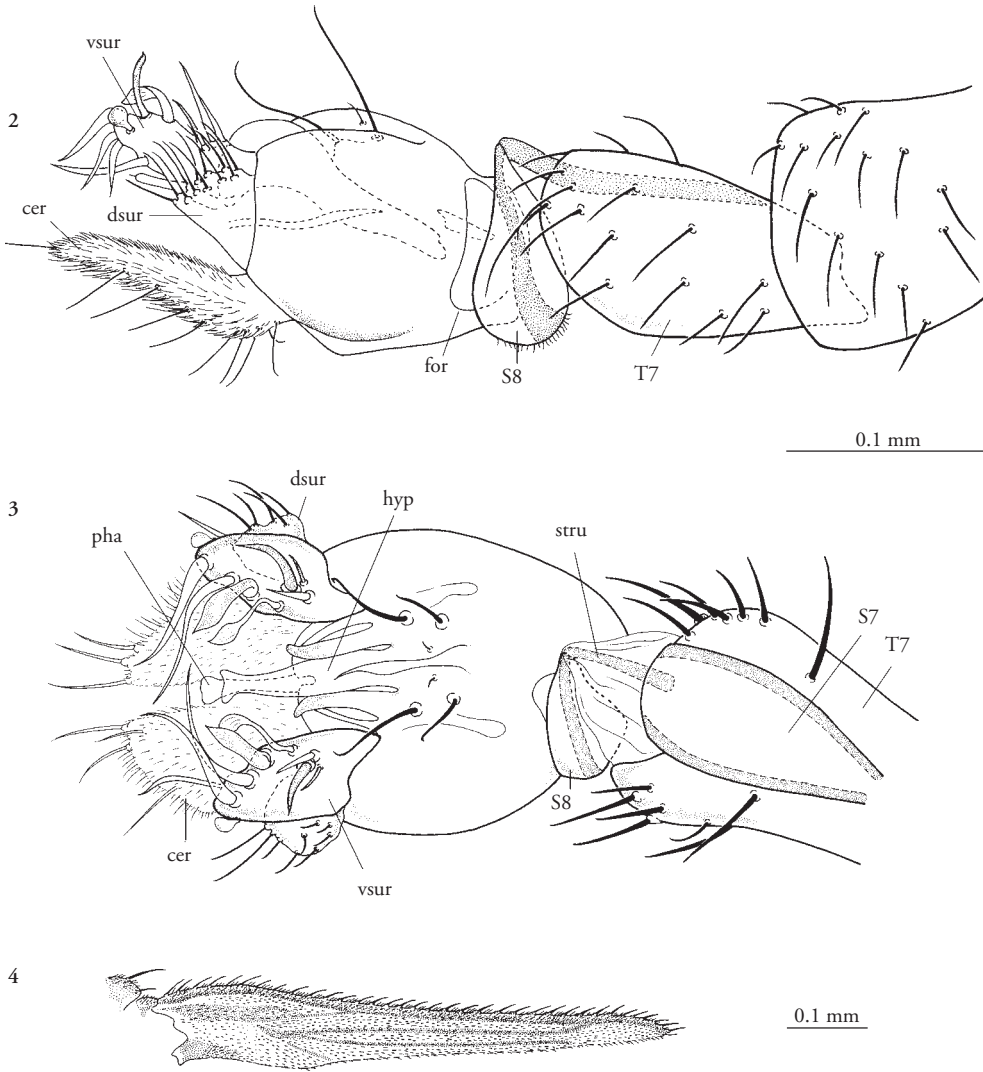
Head. – Dorsal postcranium flat to slightly concave; frons and face black, covered with brown pruinosity; setae black; postvertical setae absent; strong vertical and ocellar setae present; face slightly narrowed beneath antenna, but wide and only slightly converging ventrally; palp brown, ovate, with short apical seta; proboscis dark brown; antenna black; scape and pedicel short; first flagellomere rounded, subrectangular; arista apical, and slightly longer than head height, and with large, black obovate apical flag (MSSC); dorsal postorbital setae short and black, ventral setae whitish and longer.

Thorax. – Mostly black with brown pruinosity; posterior mesonotum distinctly flattened and slightly depressed; setae black; ac absent; 5 short dc present, slightly decreasing in size anteriorly; 1 strong posterior supra-alar seta, 2 post-sutural intralar setae, anteriormost very short; 1 pre-sutural intra-alar seta, 1 postpronotal seta, and 2 notopleural setae; proepisternum bare; scutellum with strong median setae, laterals absent.

Legs. – Coxae and femora black; tibiae and tarsi dark brown; vestiture black; coxa I with a few short apical seta, coxae II and III bare; femora slender; legs without major setae; I: 3.2; 2.6; 1.4/ 0.7/ 0.5/ 0.4/ 0.4; II: 3.6; 3.5; 1.5/ 1.1/ 0.5/ 0.4/ 0.4; III: 3.8; 3.8; 1.2/1.1/ 0.7/ 0.4/ 0.3.

Wing. – Narrow and tapering, with traces of veins Sc, R₁, R₂₊₃, R₄₊₅, and M evident (fig. 4); halter brown, with short stalk and only slightly expanded club.

Abdomen. – Terga and sterna dark brown, and little pruinosity; terga 1-6 with only short black vestiture; lateral abdominal plaques absent; postabdomen (figs. 2-3); segment 7 (hypopygial peduncle) with tergum enclosing ovate sternum, and bearing some setae; melanised internal 'strut' visible from sternum 7 and attached to sternum 8; sternum 8 ovate and covering left lateral hypopygial foramen; hypopygium dark brown with wide whitish cercus; epandrium ovate; hypandrium fused at base to epandrium; phallus rather simple; ventral surface of epandrium with 2 pairs of strong setae; surstylus with dorsal arm being field of subequal setae, visible in



Figs 2-4. *Papallacta stenoptera* sp. n. – 2, Male postabdomen, left lateral. 3, Male postabdomen, ventral. 4, Male wing, dorsal. – Legend: cer, cercus; dsur, dorsal arm of surstylus; for, hypopygial foramen; hyp, hypandrium; pha, phallus; stru, internal melanised 'strut'; vsur, ventral arm of surstylus; T, tergum; S, sternum.

lateral view, and ventral arm of surstylus with row of 7-8 strong variously modified ventral setae; cercus broad, with setae as figured.

Description Female

Similar to male except as noted: no strong secondary sexual differences evident; arista bare; oviscapt with tergum 9+10 split medially into two

hemitergites, each bearing 2 strong, slightly curved setae; cerci slightly longer than tergum 9 + 10, and bear terminal setae.

Etymology

The specific epithet, *stenoptera*, is from the Greek meaning 'narrow wing', and refers to the narrow, reduced wing of this species.

Remarks

Papallacta comprises a single tiny species, *P. stenoptera*, collected in yellow water traps on mosses in páramo near 4,000 m in the Andes of Ecuador. Páramo is an alpine vegetation characteristic of the tropical Andes, variously comprising tussock grasses, ground rosettes, mosses and cushion plants, and often with bogs and mires in flat areas. As noted in the introductory section, this is above the level at which ant colonies can survive, and no ants were observed in the vicinity (S. Marshall, pers. com.).

In addition to the narrow and reduced wing, *P. stenoptera* has the halter shortened with a small knob-like club. Thus both wing homologues have been reduced in size. Perhaps the most unusual feature of this species is the large black obovate flags at the apex of the male arista, a MSSC probably used in mate recognition and courtship.

Systematic position of *Papallacta*

The taxonomic position of secondarily flightless taxa is often problematical due to the modification or loss of diagnostic features associated with flight. In particular, venation is so altered as to be uninformative, and the thorax often loses mass with the reduction of non-functional flight muscles. However, broad experience with the systematics of a family can give clues as to the taxonomic affinity of the taxon.

The following non-wing character states relate *Papallacta* to the Medeterinae (see Bickel 1986). These character states are not necessarily derived.

1. First flagellomere subrectangular to subovate, with apical arista.
2. Dorsal postcranium concave.
3. Face subequal in width in both sexes, and parallel sided or slightly converging ventrally.
4. Posterior mesonotum strongly flattened and slightly depressed. Although the posterior mesonotum is only slightly depressed in *Papallacta*, the muscle mass of the thorax is reduced somewhat. Also, an effect of critical point drying is the tendency to inflate specimens, and can cause the flattened mesonotum of medeterine specimens to bulge.
5. Proepisternum bare of major setae.
6. Lateral scutellar setae reduced to tiny setae or absent.
7. Femora II and III without anterior preapical seta.
8. Tibiae with few, if any major setae.
9. The hypopygial peduncle, formed from segment 7, is prolonged, and often with setae on tergum 7.
10. Hypandrium fused with the epandrium.
11. Oviscapt with terga 9+10 divided into hemitergites, which bear strong setae or spines.

Apart from the reduced wing and halter, the following characters are distinctive to *Papallacta* with respect to other Medeterinae.

1. The male arista has a black obovate apical flag (MSSC). I know of no other Medeterinae with a male arisal flag.
2. A melanised internal 'strut' is visible from sternum 7 to sternum 8.
3. The hypopygium of *Papallacta* is somewhat dorsoventrally flattened, and the ventral arm of the surstylus bears a wide array of modified setae. I have seen undescribed genera from Australasia with have a similar structure. This is quite distinct from the more cylindrical hypopygia with rather bare surstylar arms characteristic of 'typical' medeterine genera, such as *Medetera*, *Corindia*, and *Thrypticus*.

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