

# A New Species of *Teratomyza*, the First Fern Fly from New Guinea (Diptera, Teratomyzidae)

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**ABSTRACT.** A distinctive new species of the genus *Teratomyza* Malloch, 1933 (s.l.) from high elevation mainland Papua New Guinea, *Teratomyza ismayi* sp. nov., is described and illustrated. Its affinities with other species of Australasian and Asian *Teratomyza* are discussed. This is the first species of Teratomyzidae described from New Guinea.

## Introduction

Teratomyzidae, the fern flies, have been little studied, mainly because the family consists of small, inconspicuous insects of somewhat restricted geographic distribution. Fern flies are relatively rarely collected by passive methods such as malaise traps and most adult specimens are obtained by sweeping their host plants. Teratomyzidae are generally classified as members of the cyclorrhaphous superfamily Opomyzoidea (Pape *et al.*, 2011), but evidence for this association is incomplete and its placement within that superfamily, including the identity of its sister-group, has not been demonstrated with convincing support (Winkler *et al.*, 2010). Alternatively, an affinity with Sphaeroceroidea was recently proposed, with fern flies placed as close relatives of Heleomyzidae (or Heteromyzidae) and Paraleucopidae (Bayless *et al.*, 2021).

Of the seven described fern fly genera, only one, *Teratomyza*, spans multiple biogeographic regions. The type species is the only known fern fly from New Zealand (Rodrigues *et al.*, 2016). Three *Teratomyza* species are endemic to Australia, and thirteen have been described from Southeast Asia. McAlpine & de Keyzer (1994) established the subgenus *Vitila* for all *Teratomyza* not occurring in New Zealand, and Papp (2011) separated some Asian species into *Teratomyza* (*Poecilovitila*), but all subgenera were later synonymized (D. K. McAlpine, 2012).

Herein the first fern fly from Papua New Guinea, the only known member of its species group, is described. It is distinct from Asian, Australian, or New Zealand *Teratomyza* in terms of wing venation, head shape, head chaetotaxy (Fig. 1), and male genitalia (Fig. 2). The ventral processes of the tarsal claws (Figs 3, 4) are reduced compared to other *Teratomyza*. Small acalyptrate flies of Papua New Guinea deserve greater attention as much remains to be discovered.

## Materials and methods

Morphological terminology specific to Teratomyzidae follows that of D. K. McAlpine & de Keyzer (1994), D. K. McAlpine (2012). Thoracic pleural sclerites and wing venation terminology follows Cumming & Wood (2017). In wing venation, crossvein *dm-m* is the “discal crossvein” *sensu* D. K. McAlpine & de Keyzer (1994), which is *m-cu* *sensu* J. F. McAlpine, 1981;  $M_4 = \text{vein5} = \text{CuA}; \text{CuA} + \text{CuP} = \text{vein6} = \text{CuA}_2 + \text{A}_1$ . The structure that D. K. McAlpine & de Keyzer (1994) termed the propleuron is considered to be the proepimeron *sensu* Cumming & Wood (2017), the sternopleuron is the katapisternum, and postvertical setae refer to postocellar setae.

Macrophotography was performed on a Visionary Digital BK Plus photography system using a Canon EOS 7D Mark II camera (Canon Inc, Tokyo) with macro lenses attached to Mitutoyo microscope objectives. Series of images were

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stacked in Helicon Focus Pro v.7.6.1 (HeliconSoft, Ukraine). Images were manually adjusted in Adobe Photoshop 2020 (Adobe Inc, San Jose). Scanning electron micrography was performed in the Australian Museum (Sydney). Due to the paucity of specimens, male genital illustrations were prepared with a camera lucida on the pinned holotype, without dissection. Specimens here described are deposited in the Australian Museum, Sydney (AMS), Australian National Insect Collection, Canberra (ANIC), and the Natural History Museum, London (BMNH).

## Results and discussion

### Genus *Teratomyza* Malloch

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*Teratomyza* Malloch, 1933: 113–114. Type species (by original designation): *T. neozelandica* Malloch, 1933.

*Vitila* D. K. McAlpine & de Keyzer, 1994: 321. Type species: *Teratomyza (Vitila) undulata* D. K. McAlpine & de Keyzer, 1994 (as subgenus of *Teratomyza*, synonymized D. K. McAlpine, 2012).

*Poecilovitila* Papp, 2011: 11. Type species *P. elegans* Papp, 2011 (as a subgenus of *Teratomyza*, synonymized D. K. McAlpine, 2012).

### Remarks

*Teratomyza* is differentiated from all other Teratomyzidae by the reduced or absent subscutellum and the reduced or absent palpus. However, the morphological disparity between species of *Teratomyza*, and the broad geographic range of the genus compared to narrow areas of endemism of most species, are notably greater than in other fern fly genera. This led to difficulties for taxonomists who have disagreed as to the limits of the genus and use of subgenera. At present a broad monophyletic genus is supported by a combination of distinctive apomorphies (D. K. McAlpine & de Keyzer, 1994; D. K. McAlpine, 2012), despite diversity in colour pattern and wing vein contours. The most consistent classification follows D. K. McAlpine (2012) who provisionally clustered *Teratomyza* into seven numbered informal species-groups. An identification key was also provided to differentiate these groups, of which 3, 4, and 6 comprised only undescribed species known from scant material. Part of the type series of *T. ismayi* sp. nov., the sole constituent of group 6, are the same specimens examined by D. K. McAlpine (2012).

### *Teratomyza ismayi* sp. nov.

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Figs 1–4

**Holotype** ♂, PAPUA NEW GUINEA, Oro (or Northern) Province: Myola, 2080 m, 4.vi.1984, J. W. Ismay, forest (AM K.300570). **Paratypes**. PAPUA NEW GUINEA, Oro (or Northern) Province: 1♂, 1♀, same locality as holotype, except 2080–2200 m, 1.iv and 3.iv.1984 (AM K.580252 ♂, K.580254 ♀). PNG, Central Province: 1♂, Aieme River, 11.v.1986, J. W. Ismay (AM K.580253); 1♀, 5 km S of Sirinumu Dam, 21.ix.1986, J. W. Ismay (AM K.580255).

### Diagnosis

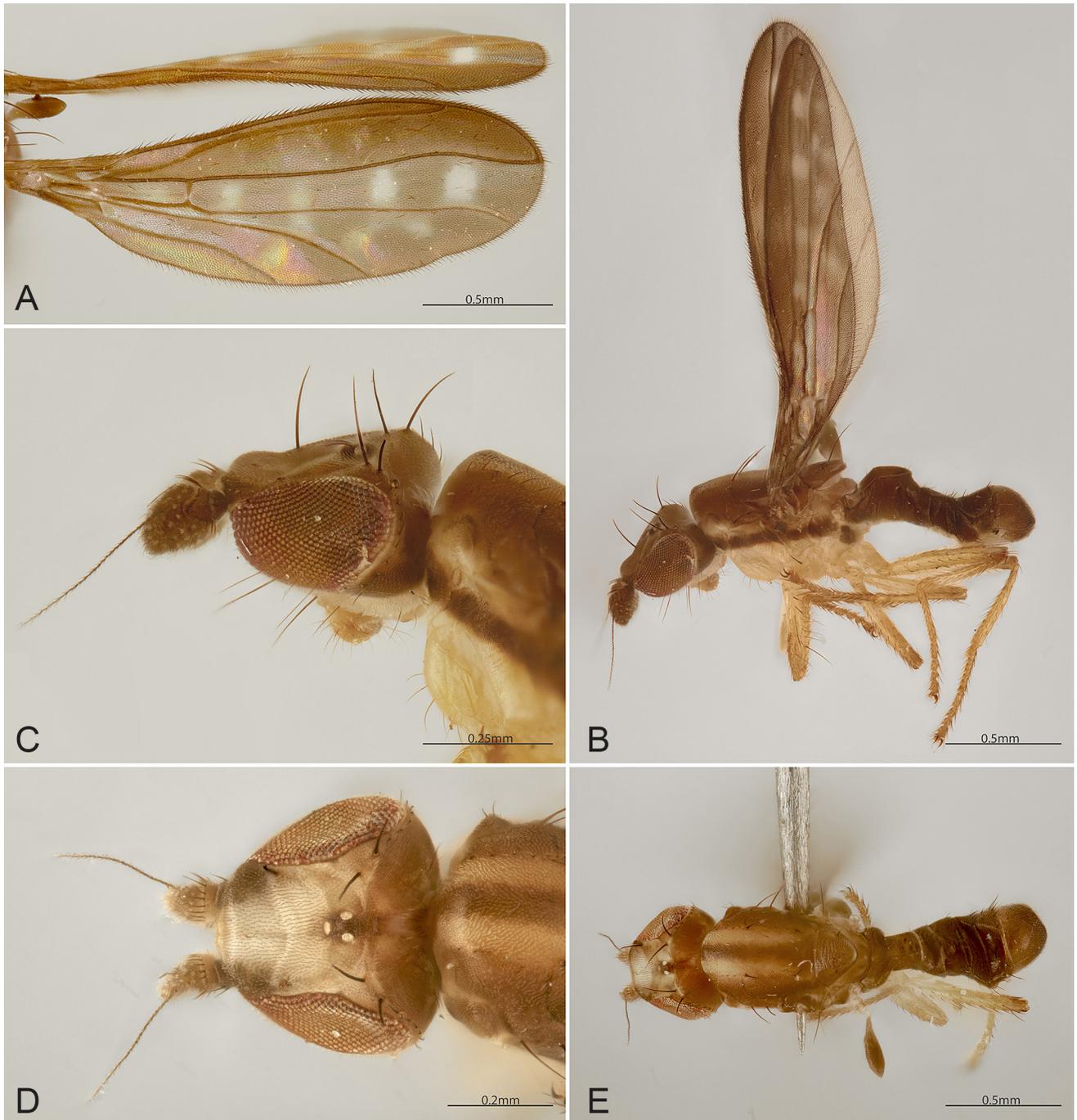
*Teratomyza ismayi* is differentiated from other *Teratomyza* most readily by the following combination of characters: wing membrane markings relatively diffuse and indistinct (Fig. 1A);  $R_{2+3}$  thickened and sinuous at midlength, with single undulation approximating costa;  $r-m$  crossvein more than twice as long as  $dm-m$ ;  $M_{1+2}$  arched posteriorly proximal to  $r-m$  insertion, so that cell  $br$  is much wider than  $dm$ ; head broadly depressed so that the eye is much longer than high in profile (Fig. 1C); single series of setulae present on gena (cheek *sensu* D. K. McAlpine, 2012); postvertical (= paravertical) seta absent; one katepisternal seta (Fig. 1B). In addition, the form and armature of the surstylus is distinctive in the male (Fig. 2). The compressed tarsal processes (Figs 3, 4) are relatively small and few, but these structures are only detectable under high magnification and are not adequately known for some species groups.

### Description (♂, ♀)

**Coloration.** Postfrons dull tawny, becoming paler anteriorly, with dark brown spot at each anterolateral angle, otherwise unmarked; face dull greyish, paler ventrally; dark brown zone present medial to posteroventral margin of eye, gena and postgenal region pale yellow-white. Antenna grey-brown. Thorax with complete horizontal mid-pleural brown-black stripe from middle of proepimeron to base of halter; thorax dorsal to this stripe brown, ventral to stripe yellow-white; mesoscutum with pair of longitudinal intra-dorsocentral yellow stripes. Wing membrane smoky-brown, slightly darker apically and anteriorly to  $R_{4+5}$ , with nebulous whitish zones posteriorly to  $R_{4+5}$  (Fig. 1A); veins (including  $CuA+CuP$ ) brown, without evident paler zones. Halter predominantly dark brown. Legs pale yellowish; femora of most specimens indistinctly brown apically. Abdominal tergites brown, without markings.

**Head** broadly depressed; postfrons longer than broad; height of eye c. 0.6 of length; height of gena c. 0.27 of height of eye in profile; face apparently slightly raised on median line, oblique in profile; postocellar setae scarcely differentiated; ocellar setae small but usually distinct; postocular setulae scarcely extending mesad of outer vertical seta; genal setulae mostly in a single series (Fig. 5), but one small seta usually present well below upper anterior vibrissa. Antenna porrect; segment 1 rounded, exerted, about as long as high in lateral view, setulose dorsally; segment 2 very short, setulose; segment 3 longer than high, broadly rounded distally; arista arising near mid length of segment 3, longer than rest of antenna, with long somewhat sparse pubescence extending to its apex. Palpus absent, not even vestige visible (Fig. 6).

**Thorax** slightly elongate, 1.1 times as long at midline than width between notopleural lobes; mesoscutum, in profile, with very straight dorsal outline, anterior margin strongly angularly produced over occiput, extensively rather coarsely microtrichose; scutellum somewhat elongate, 0.9 times as long at midline than width of anterior dorsal margin, slightly convex, broadly rounded posteriorly, shining but coarsely microtrichose; subscutellum vestigial, reduced to a similar degree as Australian *T. undulata*; the following thoracic setae present: two pairs of dorsocentrals, quite small presutural setae situated close to transverse suture, 1 + 1 notopleurals, one postalar, one pair of scutellars, situated laterally near



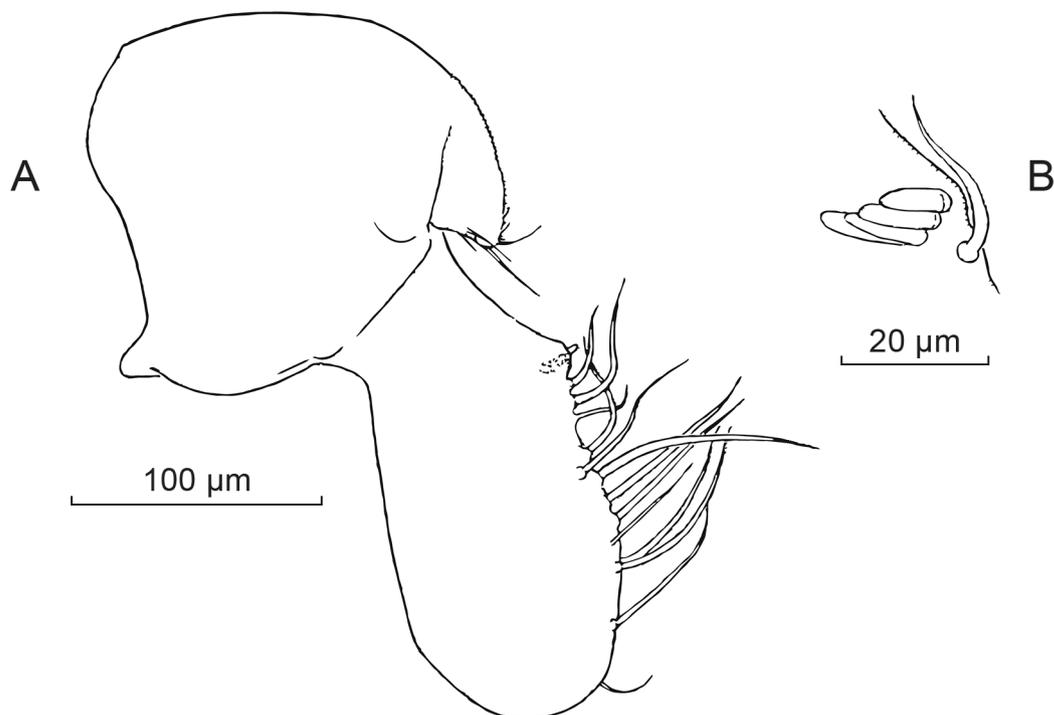
**Figure 1.** *Teratomyza ismayi* holotype. (A) Left wing, ventral side. (B) habitus, left lateral view. (C) Head, left lateral view. (D) Head, dorsal view. (E) Thorax, dorsal view.

mid-length of scutellum, one katepisternal; one to three small setulae situated in front of anterior dorsocentral setae; acrostichal or paramedian setulae absent; few humeral setulae present; few fine setulae near katepisternal seta. Fore femur with a series of fine, long posterodorsal setae and a series of posteroventral setae, one or two of which are larger than the posterodorsal ones (Fig. 7); mid femur setulose, without larger setae; hind femur with setulae of various sizes and usually one larger preapical dorsal seta; mid tibia without apical spurs. Wing:  $R_1$  thickened and closely approximated to costa on short region before mid-length;  $R_{2+3}$  and  $R_{4+5}$  preapically convergent, divergent apically;

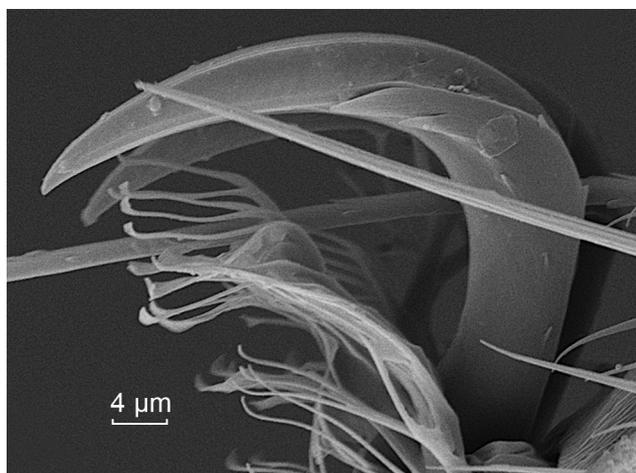
basal section of  $M_{1+2}$  strongly arched so that second basal cell is much broader than first basal cell in this region;  $r-m$  at least twice as long as  $dm-m$ .

*Male postabdomen.* Epandrium extensively microtrichose with relatively few short setulae; surstylus large, almost obovate, rounded distally, with long setulae near posterior margin, no microtrichia, and with very small comb of approximately four blunt spinules on inner surface close on posterior margin; cercus small, setulae not very long and prominent.

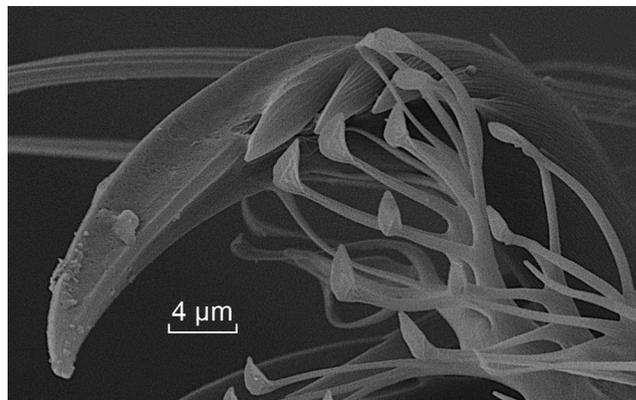
*Dimensions.* Total length, ♂ 1.3–1.7 mm, ♀ 1.6–1.9 mm; length of thorax, ♂ 0.58–0.67 mm, ♀ 0.72–0.86 mm; length



**Figure 2.** *Teratomyza ismayi* male genitalia (A) external features, left lateral view. (B) right surstylus, internal view, illustrating armature.



**Figure 3.** *Teratomyza ismayi*, outer claw of left prothoracic tarsus of male.



**Figure 4.** *Teratomyza ismayi*, inner claw of left prothoracic tarsus of male.

of wing, ♂ 1.6–2.2 mm, ♀ 2.1–2.7 mm.

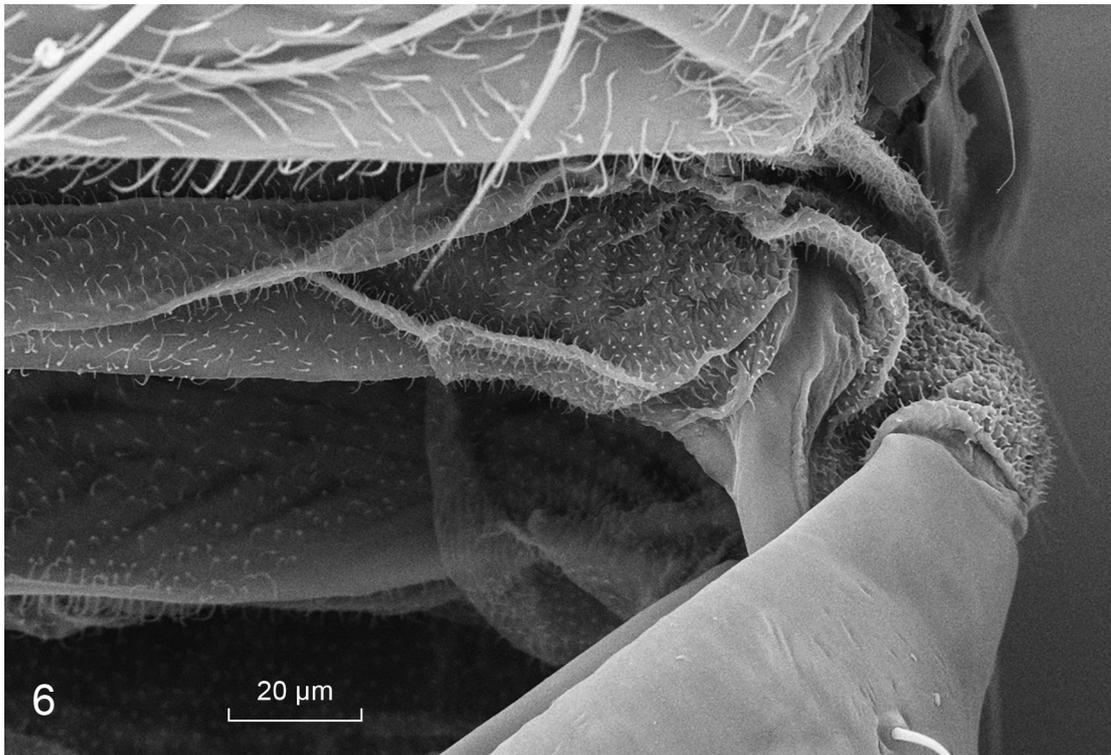
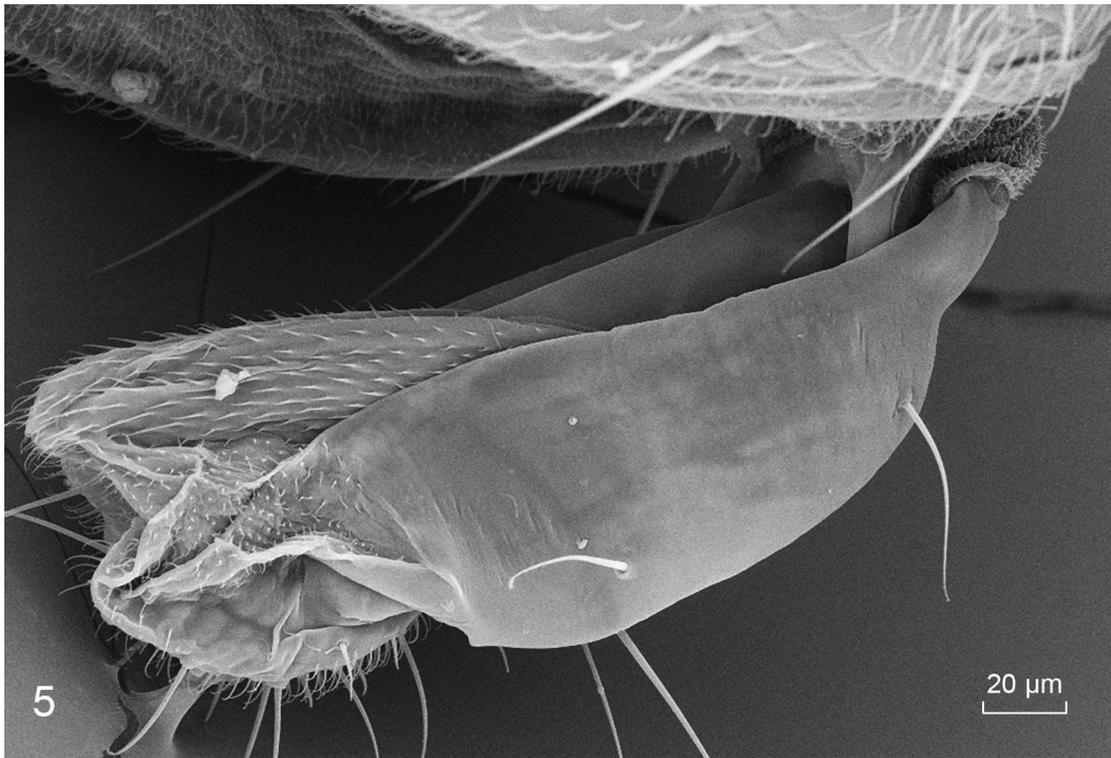
*Distribution.* Only known from a small area in the Owen Stanley Ranges, mainland Papua New Guinea.

*Etymology.* In recognition of his contributions to acalyptate Diptera research, in addition to the fact that he collected all known specimens, this species is named in honour of Dr John W. Ismay (Oxford University Museum of Natural History).

## Discussion

*Teratomyza ismayi* is a taxonomically isolated species—the only species referred to group 6 (D. K. McAlpine, 2012). However, as acalyptate Diptera of New Guinea are poorly sampled, particularly small-bodied flies, other species of group 6 may yet be discovered. Another undescribed species from New Guinea is known from two female exemplars and placed in group 3 *sensu* D. K. McAlpine (2012). It is morphologically divergent from *T. ismayi*, exemplified by the less modified wing venation. In *T. ismayi* but not group 3,  $R_{2+3}$  is thickened and sinuous, resembling Australian *Teratomyza* and many described and undescribed Asian species distributed from just across Wallace's Line to Nepal. However, *T. ismayi* is distinct from other *Teratomyza* based on multiple compelling head, thorax, and wing characters. The two known species-groups of *Teratomyza* from Papua New Guinea represent isolated lineages and there is no evidence that they are sister groups. Description of the species ascribed to group 3 *sensu* D. K. McAlpine (2012) awaits the discovery of male exemplars.

*Teratomyza ismayi* was collected in middle to high elevation localities in a relatively small region. The vegetation in these areas is generally montane rain or



**Figures 5–6.** *Teratomyza ismayi* sp. nov. (5) proboscis and ventral edge of gena of male, anterolateral view; (6) part of the proboscis, gena, clypeus, and frontoclypeal membrane of male, ventrolateral view.

cloud forest. The fern diversity of this region is high (Kato, 1993), and multiple lineages of tree ferns, which host many Australian species of Teratomyzidae, are present (Korall *et al.*, 2007). However, the plants these flies were swept from were not recorded. Further information is needed to establish whether *T. ismayi* is associated with pteridophytes, as are all other known Australasian Teratomyzidae.

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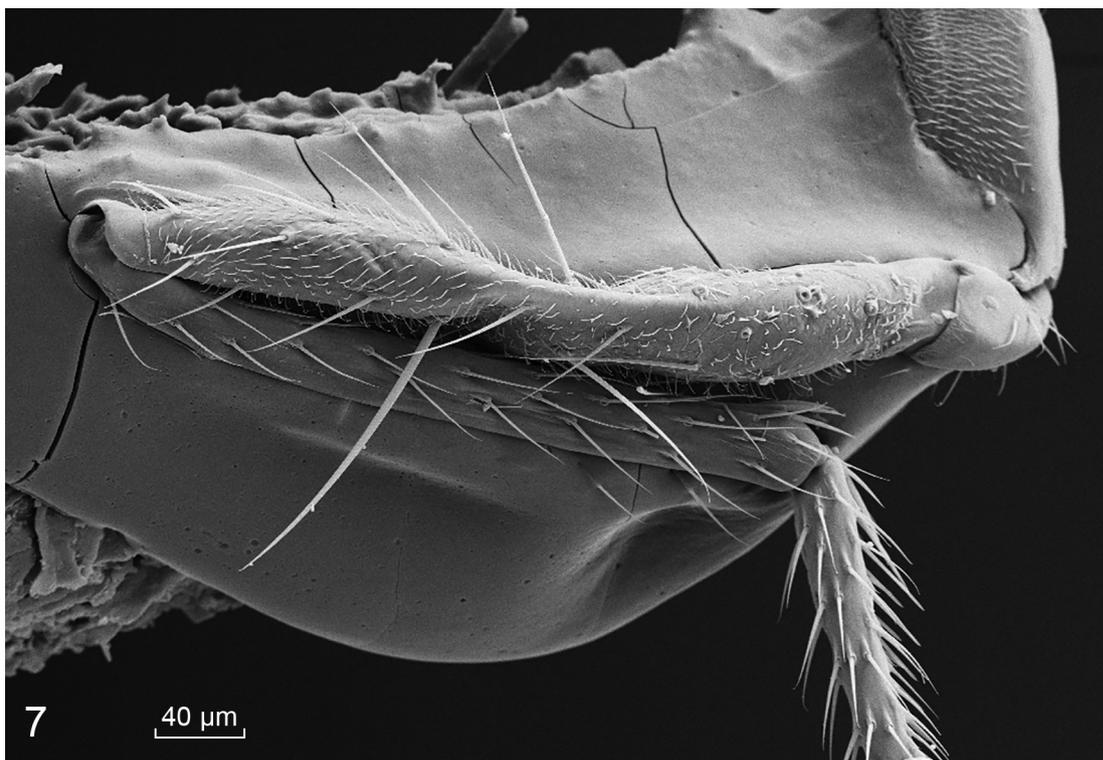


Figure 7. *Teratomyza ismayi* sp. nov., right prothoracic leg of male, lateral view.

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