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New species of *Myolepta* Newman, 1838 (Diptera, Syrphidae) from the Indomalayan Realm

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Abstract. Three new species of *Myolepta* Newman, 1838 are described from Thailand (*M. iota* sp. nov.), Laos (*M. diaphora* sp. nov.) and Indonesia (*M. geras* sp. nov. from Java), and new records of *Myolepta petiolata* Thompson, 1971 from Thailand are also provided. Diagnoses, illustrations and known distributional data are given. In addition, the generic affinities and subdivision of *Myolepta* are discussed based on these newly described taxa.

Key words. Flower flies, hoverflies, Oriental Region, new records, identification key.

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Introduction

Myolepta Newman, 1838 is a genus of small to medium-sized (5–12 mm) flower flies (Diptera, Syrphidae) present in all biogeographic realms except Australasia (Thompson & Vockeroth 1989; Reemer *et al.* 2005). There currently are 45 described species of *Myolepta*: three from the Afrotropics, seven Nearctic species, 12 from the Neotropical Realm, 17 from the Palaearctic, and six from the Indomalayan Realm (Reemer *et al.* 2005; Thompson 2014; Gilasian *et al.* 2016; van Steenis 2020; Hassan *et al.* 2021). These flies can be easily identified by the presence of strong ventral setae (usually referred to as spines) on all femora, which are more or less swollen, males with a distinct facial tubercle and females without facial tubercle (concave face), and the placement of the crossvein r-m in the basal half of the cell dm.

Myolepta shares some diagnostic characteristics with *Lepidomyia* Loew, 1864, such as all femora with ventral setae (in all species of both genera) and body partly covered with scale-like hairs (in some species of *Myolepta* and all species of *Lepidomyia*), but they differ by both sexes having a facial tubercle in *Lepidomyia* (only males in *Myolepta*) (Thompson 1974). Furthermore, *Lepidomyia* is restricted to the Americas (Thompson *et al*. 2010).

Ecological and biological data of *Myolepta* are biased towards Palaearctic taxa, with some knowledge from Nearctic species. Adults of *Myolepta* species occur in mature deciduous and evergreen forests with overmature trees, but also in old orchards with ancient trees (Reemer *et al.* 2005; Skevington *et al.*

2019; Speight 2020), where both sexes visit sap runs, but also flowers and herbs (Thompson 1974; Speight 2020; Reemer pers. obs.). Their saproxylic larvae have been found in rotten heartwood and water-containing rot-holes (Dušek & Láska 1960; Hartley 1961; Rotheray 1991; Dussaix 1997a, 1997b; Svivova *et al.* 1999; Ricarte *et al.* 2007).

In the present study three new Indomalayan species of *Myolepta* are described from Thailand, Laos and Indonesia (Java), and new records of *Myolepta petiolata* Thompson, 1971 are also given. In addition, the generic affinities and subdivision of *Myolepta* are discussed based on these new described taxa.

Material and methods

Morphological terminology follows Cumming & Wood (2017). Thompson *et al.* (2017) was used to determine the genus and the identification keys by Thompson (2014) and Hassan *et al.* (2021) were utilized for species determination. Then, specimens were compared against digital images of the type specimens of the already published Indomalayan species of *Myolepta*.

Images of the syntypes (female and male) of *Myolepta himalayana* Brunetti, 1915 can be accessed using the Faunal Information System of the Zoological Survey of India, at https://zsifis.nic.in/ImageRequest/GetByCategory/14. Images of the holotype male of *Myolepta graciliventris* Wiegmann, 1986 are available from http://n2t.net/ark:/65665/333808d3a-e7cf-406c-adb5-257f19ce8794 (see also Fig. 2). Thompson (2014)

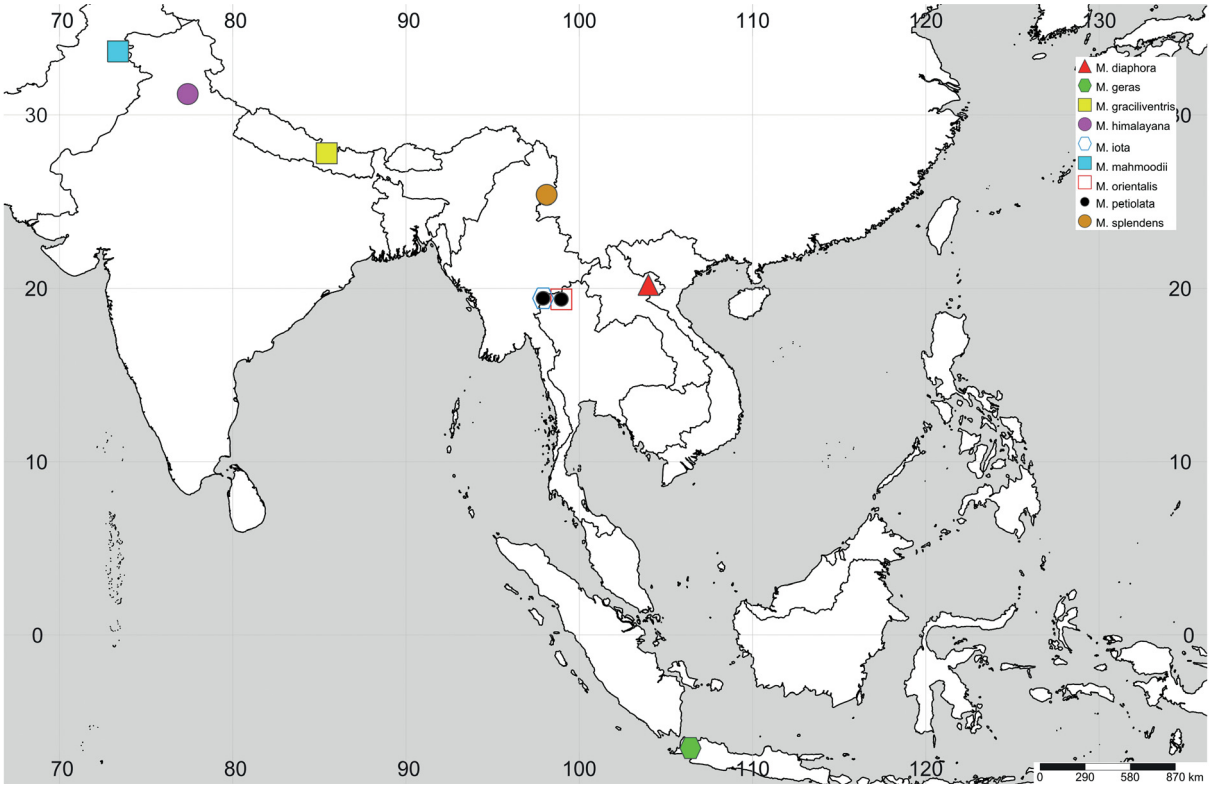

Fig. 1. Geographic distribution of the species of *Myolepta* in the Indomalayan Realm: *M. diaphora* sp. nov. (red triangle), *M. geras* sp. nov. (green hexagon), *M. graciliventris* Wiegmann, 1986 (yellow square), *M. himalayana* Brunetti, 1915 (pink circle), *M. iota* sp. nov. (blue open hexagon), *M. mahmoodii* Hassan & Bodlah, 2021 (light blue square), *M. orientalis* Thompson, 1971 (red open square), *M. petiolata* Thompson, 1971 (black circle), and *M. splendens* Thompson, 2014 (light brown circle).

provided good-resolution images for the holotype male of *Myolepta splendens* Thompson, 2014, and Hassan *et al.* (2021) did the same for the holotype male of *Myolepta mahmoodii* Hassan & Bodlah, 2021 in Hassan *et al.* 2021. For the type material of *Myolepta orientalis* Thompson, 1971 and *Myolepta petiolata* Thompson, 1971, Jeremy Frank (Bernice Pauahi Bishop Museum, Honolulu, USA) kindly photographed the holotype female of both taxa and shared the images for publication (Fig. 3D–F). Permission to reproduce images of the type material was not granted by the Zoological Survey of India, neither for the publications of Thompson (2014) and Hassan *et al.* (2021); thus, referencing the aforementioned Faunal Information System and publications is recommended when the provided identification key is used.

Unique specimen identifiers are provided for each examined individual at the end of each record (ZFMK-DIP numbers).

Institutional abbreviations

BPBM = Pauahi Bernice Bishop Museum, Honolulu, USA
NBC = Naturalis Biodiversity Center, Leiden, The Netherlands
NMP = National Museum, Prague, Czech Republic
ZFMK = Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany

Fig. 2. *Myolepta graciliventris* Wiegmann, 1986, ♂, holotype (USNMENT01754756). **A**. Habitus, dorsal view. B. Habitus, lateral view. **C**. Head, frontal view. **D**. Labels. Scale bars: 1 mm.

All measurements were taken using a reticule in a Leica® M165C microscope.

Body length was measured from the anterior oral margin to the posterior end of the abdomen, in lateral view. Wing length was measured from the wing tip to the basicosta.

Focus stacked images were created using the software Zerene Stacker® ver. 1.04 (Richland, Washington, USA), based on photographs of pinned specimens taken with a Canon EOS 7D® camera mounted on a P–51 Cam-Lift (Dun Inc., VA, USA) and with the help of Adobe Lightroom ® ver. 5.6. Later, stacked images were edited with Adobe Photoshop ® ver. CS5.1. Figure 1 was created with the help of SimpleMappr (Shorthouse 2010).

Results

Taxonomy

Phylum Arthropoda Latreille, 1829
Class Insecta Linnaeus, 1758
Order Diptera Linnaeus, 1758
Family Syrphidae Latreille, 1802
Subfamily Eristalinae Newman, 1834
Genus *Myolepta* Newman, 1838

Myolepta diaphora sp. nov.
urn:lsid:zoobank.org:act:F6F8778E-41DE-4EDA-9AC1-399C386A0BCF
Fig. 3A–C

Diagnosis

Black, medium-sized species of *Myolepta*, with lateral white pruinosity on face, long facial sulcus and elongated postpedicel (Fig. 3C). Frontal prominence produced forward and vertex protuberant. Thorax and abdomen conspicuously punctate. Scutum mostly black, very lightly white pruinose except dense white pruinose on transverse suture and remarkable thick white hairs on notopleuron, posterodorsal anterior anepisternum, posterior anepisternum, anterior anepimeron and dorsal part of katepisternum. Wing largely bare basally, with vein R_{4+5} with last section (petiole) shorther than crossvein h. Legs bicolorous (Fig. 3A, C). Abdomen constricted at the base of tergite 2, black with a golden tomentose fascia on the posterior margin of tergite 3, and tergite 4 with a medial patch of adpressed, longer, golden hairs (Fig. 3A–B).

Differential diagnosis

Myolepta diaphora sp. nov. can be distinguished from other species of *Myolepta* of the Indomalayan Realm by having the abdomen basally constricted (only *M. petiolata* has the abdomen petiolate, less than half its maximum width at its minimum), legs bicolorous (legs entirely pale yellow in *M. splendens*) and elongated postpedicel. It differs from *M. graciliventris* by the face shiny medially (entirely golden pruinose in *M. graciliventris*) and abdominal tergite 2 broader than long (tergite 2 longer than broad in *M. graciliventris*). It is very similar to *M. orientalis*, but differs by having femora and tibia partly yellow (metallic bluish-black in *M. orientalis*; Fig. 3D–E), abdominal tergite 3 only with a narrow, dense golden pruinose fascia on posterior margin (tergite 3 black with a medial golden hairy vitta broadening posteriorly in *M. orientalis*; Fig. 3D), and tergite 4 black with a medial patch of adpressed golden hairs (tergite 4 black basally and orange on apical ⅓, completely covered with golden hairs in *M. orientalis*; Fig. 3D).

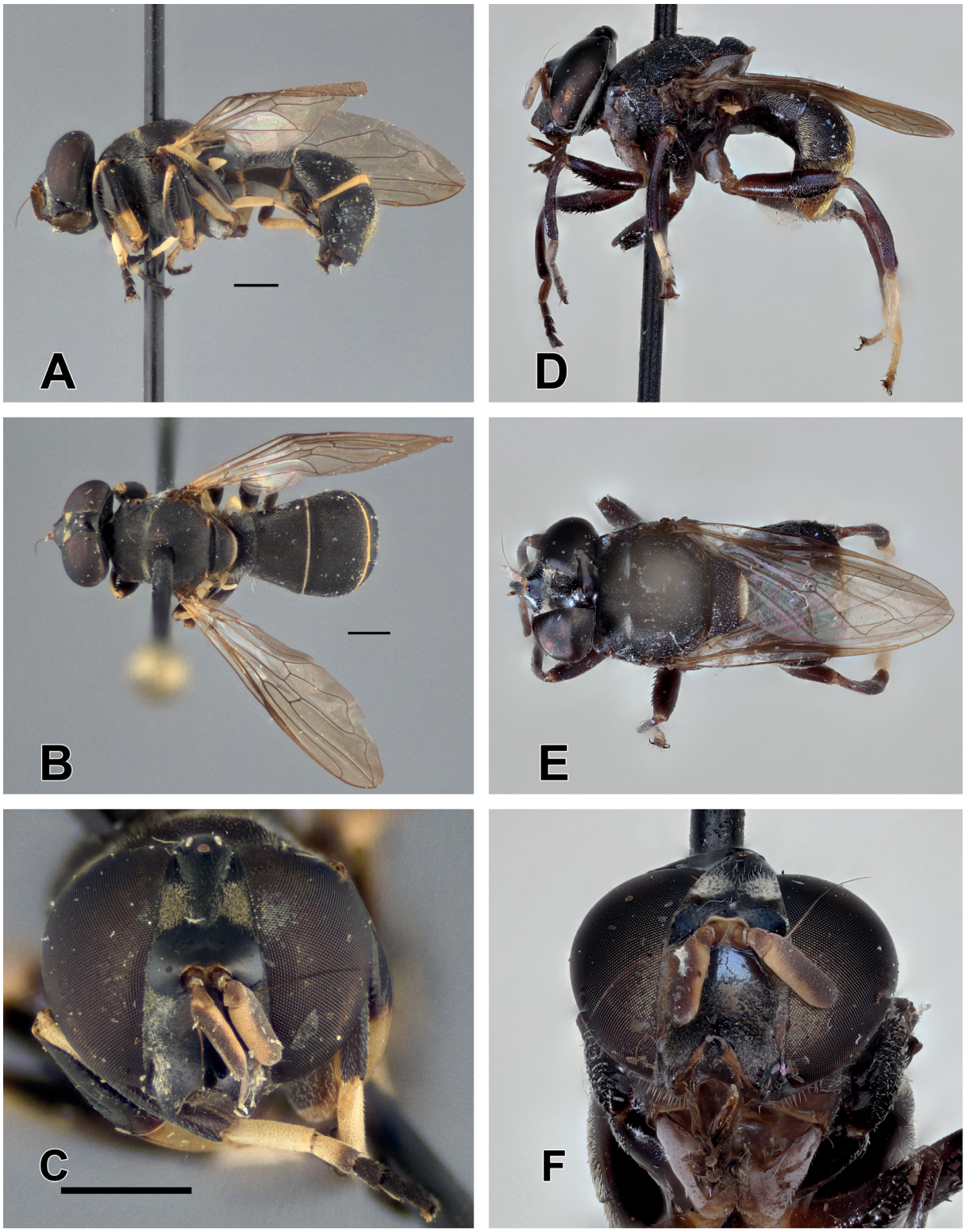

Fig. 3. A–C. *Myolepta diaphora* sp. nov., ♀, holotype (ZFMK-DIP-00082516). **A**. Habitus, lateral view. **B**. Habitus, dorsal view. **C**. Head, frontal view. **D–F**. *M. orientalis* Thompson, 1971, ♀, holotype (BPBM). **D**. Habitus, lateral view. **E**. Habitus, dorsal view. **F**. Head, frontal view. Scale bars: A–C = 1 mm.

Etymology

From Greek 'διάφορος' ('*diáphoros*'), meaning 'different' (Brown 1956: 264). Species epithet is to be treated as an adjective.

Type locality

Laos: Houaphan Province, from Ban Saluei to Phou Pane Mts, 20.20° N, 103.99167° E–20.225° N, 104.01667° E, alt. 1340–1870 m.

Material examined

Holotype

LAOS • ♀; Houaphan Province, from Ban Saluei to Phou Pane Mts; 20.20° N, 103.99167° E–20.225° N, 104.01667° E; alt. 1340–1870 m; 1 May–16 Jun. 2009; V. Kubáň and Lao coll. leg.; primary mountain forest, individual collecting; "Laos 2009 NHMB Basel and NMPC Prague exped."; NMP; ZFMK-DIP-00082516.

Description

Measurements. Body: 8.0 mm; wing: 7.7 mm.

Female

Head (Fig. 3C). Face concave, without facial tubercle, black, shiny medially with very light white pruinosity, dense white pruinose laterally, with some scattered white hairs. White facial pruinosity does not reach antennal insertion level dorsally and expands towards oral margin ventrally, anterior to gena, but it does not reach the oral margin. Gena shiny black ventral to facial sulcus, white pruinose between facial sulcus and eye, with some scattered white pile. Lunule yellow. Frontal prominence conspicuous, produced forward. Frons black, with some scattered white hairs, depressed medially in the area above lunule with vertex protuberant; shiny on ventral ⅓, with two large golden-white pruinose maculae in middle ⅓, light white pruinose medially and dorsally until the anterior ocellus. Vertical triangle shiny black with yellow hairs. Eye bare, dichoptic. Antenna light brown except postpedicel black on dorsal ½ and yellow on ventral ½; postpedicel furry-like, rounded apically, slightly longer than broad, elongated, more than 2× as long as broad. Arista bare, brown. Occiput covered with silvery pruinosity (except posterior margin of vertical triangle), with white hairs ventrally.

Thorax (Fig. 3A–B). Scutum black except postpronotum and postalar callus yellowish anteriorly and posteriorly, punctate, very lightly white pruinose except dense white pruinose on transverse suture, with adpressed, short white-yellowish hairs, which are thicker on the notopleuron. Scutellum rounded with preapical sulcus, punctate, with adpressed, short white-yellowish hairs, black except yellow preapical sulcus. Pleuron black, very lightly white-grey pruinose except densely white-grey pruinose on posterior anepisternum and medial and posterior parts of katepisternum, with thick white hairs on posterodorsal anterior anepisternum, posterior anepisternum, anterior anepimeron and dorsal part of katepisternum; katerpisternal hair patches broadly separated. Plumule yellow, very short. Metaepisternum and metasternum bare. Halter yellow, brownish basally. Posterior spiracular fringes dark brown.

Wings. Membrane hyaline; pterostigma brown basally becoming hyaline apically; extensively microtrichose except cell c on basal ¾, cells r_1 and br anterior to RS bifurcation, and cells bm and cua on basal ¾. Spurious vein absent. Vein RS and basal section of R with black setulae dorsally. Cell r_{4+5} closed very close to the wing margin; vein R_{4+5} with last section (petiole) shorther than crossvein h (Fig. 3A–B).

Legs. Coxae black except fore coxa yellow ventrally, densely grey pruinose. Fore and mid trochanter yellow; hind trochanter brown, yellow apically. Fore femur incrassate, yellow on basal 2/5–½ and black

on apical ½–3/5, with yellow hairs and two rows of black setae on ventral side; fore tibia yellow on basal ¼, black on apical ¾, yellow hairy with black setulae on ventral side; fore basitarsomere yellow, yellow hairy; second fore tarsomere yellow on basal ¾ and black on apical ¼, yellow hairy; three apical fore tarsomeres black, black hairy. Mid femur slightly swollen, yellow on basal 2/5 and black on apical 3/5, with yellow hairs and two rows of black setae on ventral side; mid tibia on basal ¼, black on apical ¾, yellow hairy with black setulae on ventral side; two basal mid tarsomeres yellow, yellow hairy; apical with some black setulae; three apical mid tarsomeres black, black hairy. Hind femur incrassate, yellow on basal 2/5 and black on apical 3/5, with yellow hairs and two rows of black setae on ventral side; hind tibia yellow on basal ½, black on apical ½, yellow hairy with black setulae on ventral side; hind basitarsomere yellow, yellow hairy; second hind tarsomere yellow on basal ¾ and black on apical ¼, yellow hairy; three apical hind tarsomeres black, black hairy. All tibiae narrower basally and broader apically, remarkably hind tibia basally almost half as broad as apically.

Abdomen (Fig. 3A–B). Punctate, constricted basally with anterior margin of tergite 2 narrower than thorax (narrowest point of abdomen until posterior half of tergite 4). Tergite 1 black, lightly grey pruinose medially and densely grey pruinose laterally, white pilose. Tergite 2 black, with adpressed hairs that are black medially and white laterally, with long white hairs on anterolateral corner. Tergite 3 black, with narrow, golden tomentose fascia on posterior margin, with adpressed medially black and laterally white hairs, with narrow patch of adpressed golden hairs posteromedially, anterior to tomentose fascia. Tergite 4 black, with posterior margin dark brown, with adpressed black hairs except patch of adpressed, thicker, longer golden hairs in middle of tergite.

Remark

The holotype female was collected in primary mountain forest.

Myolepta geras sp. nov.
urn:lsid:zoobank.org:act:BA8D954A-E641-4FD0-9093-91A5B4E362C2
Fig. 4

Diagnosis

Myolepta geras sp. nov. has short antenna, shorter than face, with postpedicel less than 2× longer than broad (Fig. 4C). Face black, shiny medially, with grey pruinosity along the eye margin (Fig. 4C). Black scutum with adpressed black hairs mixed with yellow scale-like hairs. Legs bicolorous (Fig. 4A). Cell r_{4+5} distinctly petiolate; vein R_{4+5} with last section longer than crossvein h (Fig. 4B). Abdomen parallel-sided, tergites 2 and 3 black, pruinose, with two elongated orange maculae on anterior margin not reaching the posterior margin, and tergite 4 black with posterior margin brown, shiny except a medial brown pruinose macula on anterior margin (Fig. 4A–B).

Differential diagnosis

Myolepta geras sp. nov. differs from other Indomalayan species of *Myolepta* (except *Myolepta iota* sp. nov.) by the presence of scale-like hairs on the scutum and pleuron (Fig. 4A–B), and by the cell r_{4+5} distinctly petiolate, with petiole longer than crossvein h (Fig. 4B). It differs from *Myolepta iota* sp. nov. by the coloration of the legs (see identification key), the shiny anterodorsal part of the anterior anepisternum not covered with scale-like hairs (grey pruinose in *Myolepta iota* sp. nov.), the absence of scale-like hairs on scutellum (present in *Myolepta iota* sp. nov.), abdominal pattern, and the membrane between tergites and sternites partly black (entirely yellow in *Myolepta iota* sp. nov.). Male genitalia quite similar to those of *Myolepta iota* sp. nov., but different in the dorsal margin of the surstylus and the size and arrangement of the lateral setae on the hypandrium (see Figs 4–5).

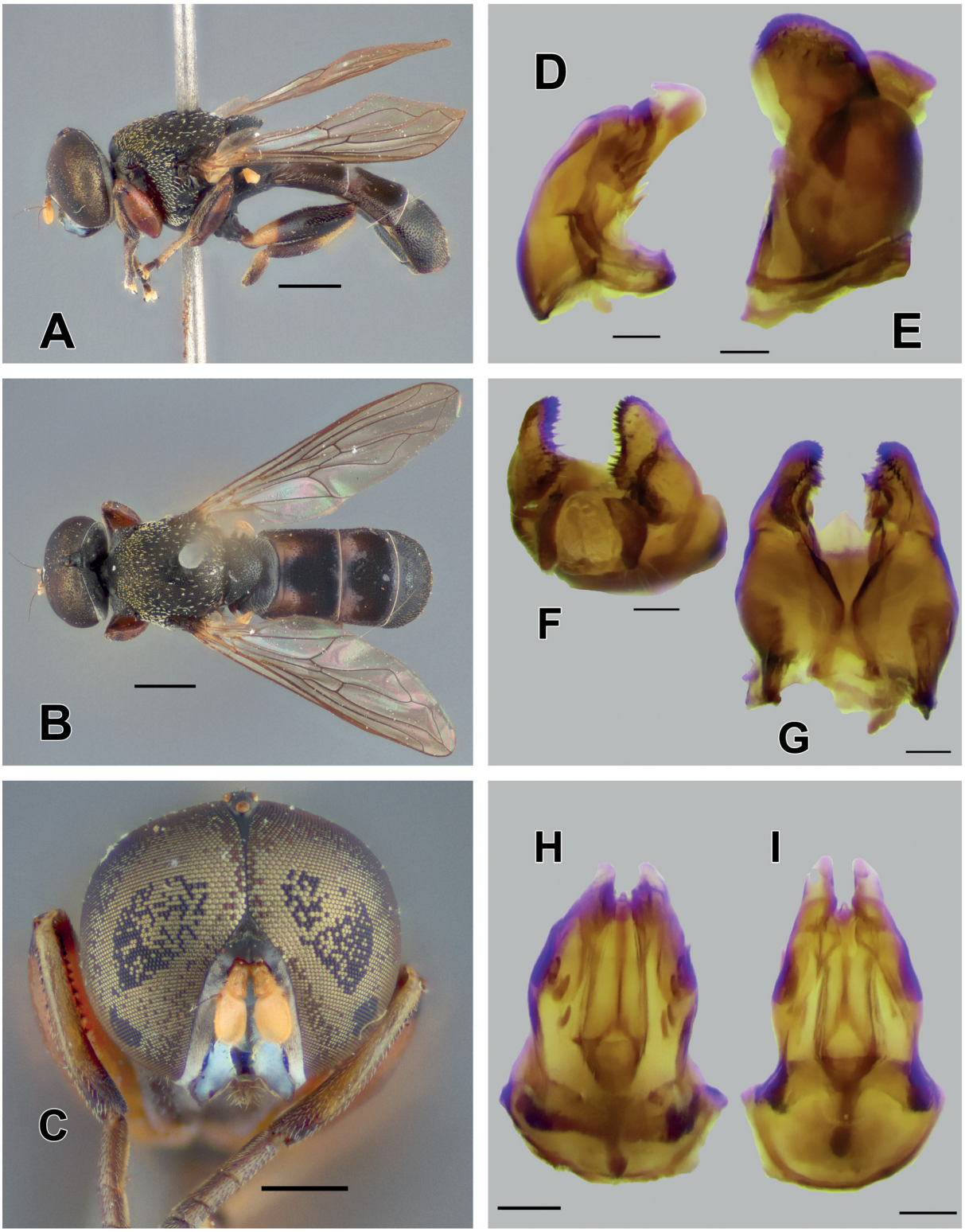

Fig. 4. *Myolepta geras* sp. nov., ♂, holotype (ZFMK-DIP-00082513). **A**. Habitus, lateral view. **B**. Habitus, dorsal view. **C**. Head, frontal view. **D**. Genitalia, hypandrium, lateral view. **E**. Genitalia, epandrium, lateral view. **F**. Genitalia, epandrium, dorsoposterior view. **G**. Genitalia, epandrium, ventral view. **H**. Genitalia, hypandrium, dorsal view. **I**. Genitalia, hypandrium, ventral view. Scale bars: A–C = 1 mm; D–I = 0.1 mm.

Etymology

From Greek 'γῆρᾰς' ('*gêras*'), meaning 'old age' (Brown 1956: 569); it refers to the age of the specimen, which was collected 90 years ago. Species epithet is to be treated as a name in apposition.

Type locality

Indonesia: West Java, Dungus Iwul [Nature Reserve], [6.523347° S, 106.418324° E], alt. 100 m.

Material examined

Holotype

INDONESIA • ♂; West Java Province, Dungus Iwul [Nature Reserve]; [6.523347° S, 106.418324° E]; alt. 100 m; 4 Nov. 1932; M.A. Lieftinck leg.; NBC; ZFMK-DIP-00082513.

Description

Measurements. Body: 7.2 mm; wing: 6.0 mm.

Male

Head (Fig. 4A, C). Face with small facial tubercle, bare medially, shiny black, densely silvery pruinose laterally along eye margin from the antennal insertion to gena (pruinosity continuing until the occiput) with scattered thick white hairs, and lightly grey pruinose above antennal insertion. Gena narrow, shiny black and bare ventrally, dorsally completely silvery pruinose and with scattered thick white hairs. Lunule shiny black, dark brown medially. Frontal triangle shiny black on ventral ½, silvery pruinose on dorsal ½; pruinosity from dorsal part of frontal triangle not joining with lateral pruinosity of face. Eye bare, with slightly enlarged ommatidia on dorsofrontal part; holoptic. Eye contiguity longer than frontal triangle. Antenna yellow; scape and pedicel with yellow hairs and 2 and 3 brown setulae dorsally, respectively; postpedicel furry-like, rounded apically, slightly longer than broad. Arista bare, brown. Vertical triangle black, shiny, with adpressed yellow setulae. Occiput covered with silvery pruinosity (except the posterior margin of vertical triangle), with white hairs ventrally and scattered short, black setulae along margin, more abundant on dorsal ⅓.

Thorax (Fig. 4–B). Scutum black, densely grey pruinose anteriorly, including anterior ½ of postpronotum, lightly grey pruinose on notopleuron. Postalar callus and posterior part of postpronotum brown. Scutum with adpressed black hairs mixed with scale-like hairs, which are dark yellow and more dense anterior to transverse suture and white and more scattered posterior to transverse suture. Short black setulae on supra-alar area. Scutellum rounded, black, without subscutellar fringe, with adpressed yellow hairs; posterior margin with short black setulae with thick, expanded alveolus, making posterior margin to look serrate. Pleuron black, with grey dense pruinosity on proepisternum and proepimeron; with white scale-like hairs on posterodorsal part of anterior anepisternum, posterior anepisternum, dorsal part of katepisternum and anterior anepimeron (posterior anepimeron with 1–2 white scale-like hairs anteriorly); anatergum with yellow hairs, lightly grey pruinose. Plumule yellow, very short. Metaepisternum and metasternum bare. Halter yellow, brownish basally. Posterior spiracular fringes dark yellow to brown.

Wings. Membrane hyaline; pterostigma yellow; extensively microtrichose except cell c on basal ¼, cell br anterior to RS bifurcation, and cells bm and cua on basal ¾. Spurious vein absent. Vein RS and basal section of R with black setulae dorsally. Cell r_{4+5} petiolate; vein R_{4+5} with last section longer than crossvein h and slightly shorter than crossvein r-m.

Legs. Coxae black (fore coxa yellowish ventrally), partly lightly grey pruinose; trochanters yellow. Fore femur incrassate, yellow except black on apex forming subapical black ring, with yellow hairs and two rows of short black setae on ventral side; fore tibia yellow on basal ⅔, black on apical ⅓, yellow

hairy with black setulae on ventral side; basal three fore tarsomeres black with dorsal part yellow, black hairy dorsally and yellow hairy ventrally with some black setulae; apical two fore tarsomeres black with yellow hairs; apical tarsomere yellowish at apex. Mid femur slightly swollen, yellow except black on apex forming a subapical black ring, with yellow hairs and two rows of short black setae on ventral side; mid tibia yellow, yellow hairy with black setulae on ventral side; basal three mid tarsomeres yellow, apical two mid tarsomeres black, black hairy dorsally and yellow hairy ventrally with some black setulae. Hind femur yellow on basal ⅓, black on apical ⅔, yellow hairy with two rows of short black setae on ventral side, and 4–5 long (half as long as femur's width), yellow setae on dorsal side; hind tibia yellow on basal ½, black on apical ½, yellow hairy with black setulae on ventral side; hind basitarsomere yellow, black and yellow hairy dorsally and yellow hairy ventrally.

Abdomen (Fig. 4A–B). Parallel-sided, unmargined. Tergite 1 black, grey pruinose, yellow-white hairy. Tergite 2 black, with two lateral elongated orange maculae on anterior margin not reaching lateral or posterior margins, lightly grey pollinose (clearly visible along anterior margin), with adpressed black hairs medial and laterally, with a group of 6–7 long, yellow setae on anterolateral margin. Tergite 3 black, with two lateral elongated orange maculae on anterior margin not reaching lateral or posterior margins, lightly grey pollinose (clearly visible along anterior margin) but shiny on posterior margin and lateral margins, with adpressed black hairs medial and laterally. Tergite 4 black, shiny with some light grey pruinose on anterior margin, with adpressed golden-brownish hairs. Sternites black except sternites 2 and 3 brown, with short yellow hairs, shiny except sternite 1 entirely grey pruinose and sternite 4 with medial grey pruinose vitta. Membrane between tergites and sternites 2 and 3 black, between tergite and sternite 4 yellow.

Male genitalia. As in Fig. 4D–I. Epandrium subquadrate (Fig. 4E); surstylus with dorsal margin undulate with strong setae (Fig. 4F); hypandrium with 4–5 strong and thick setae on lateral and dorsal medial portion (Fig. 4D, H).

Remarks

The original label states "Dungus Iwul" as the sampling locality of the holotype, and I assume this refers to the Dungus Iwul Nature Reserve in West Java province. This is the single species of *Myolepta* known from Indonesia, representing the southernmost record of this genus in the Indomalayan Realm.

Myolepta iota sp. nov.
urn:lsid:zoobank.org:act:261854F9-52BC-4262-BB21-FF61375E3501
Fig. 5

Diagnosis

Species with short antenna, shorter than face, with postpedicel less than 2 × as long as broad (Fig. 5C). Face black, shiny medially, with grey pruinosity along the eye margin. Black scutum with adpressed black hairs mixed with yellow scale-like hairs (Fig. 5B). Legs bicolorous (Fig. 5A). Cell r_{4+5} distinctly petiolate; vein R_{4+5} with last section longer than crossvein h (Fig. 5B). Abdomen almost parallel-sided, tergites 1–3 brown, brown pruinose, tergite 4 black with posterior margin brown, shiny except a medial brown pruinose macula on anterior margin (Fig. 5B).

Differential diagnosis

Small species of *Myolepta* that differs from other Indomalayan species of *Myolepta* (except *Myolepta geras* sp. nov.) by the presence of scale-like hairs on scutum, pleuron and scutellum, and by the cell r_{4+5} distinctly petiolate, with petiole longer than crossvein h. It differs from *Myolepta geras* sp. nov. by the coloration of the legs (see identification key), the grey pruinosity on the anterior part of the anterior

anepisternum not covered with scale-like hairs (shiny in *Myolepta geras* sp. nov.), the presence of scale-like hairs on scutellum (absent in *Myolepta geras* sp. nov.), and the membrane between tergites and sternites entirely yellow (partly black in *Myolepta geras* sp. nov.). Male genitalia quite similar to those of *Myolepta geras* sp. nov., but different in the dorsal margin of the surstylus and the size and arrangement of the lateral setae on the hypandrium (see Figs 4–5).

Etymology

From Greek 'ἰῶτα' ('*iôta*'), the name of the ninth letter of the Greek alphabet and used to name anything very small (Brown 1956: 488). Species epithet is to be treated as a name in apposition.

Type locality

Thailand: Mae Hong Son Province, Ban Huai Po, [19.4246° N, 97.9148° E], alt. 480 m.

Material examined

Holotype

THAILAND • ♂; Mae Hong Son Province, Ban Huai Po; [19.4246° N, 97.9148° E]; alt. 480 m; 1–5 May 1992; Stmad leg.; NMP; ZFMK-DIP-00082514.

Paratype

THAILAND • 1 ♂; same collection data as for holotype; ZFMK; ZFMK-DIP-00082515.

Description

Measurements. Body: 5.0–5.2 mm; wing: 4.2–4.5 mm.

Male

Head (Fig. 5C). Face with a small facial tubercle, bare medially, shiny black, densely silvery pruinose laterally along eye margin from antennal insertion to gena (pruinosity continuing until occiput) with scattered thick white hairs, and lightly grey pruinose above antennal insertion. Gena narrow, shiny black and bare ventrally, dorsally completely silvery pruinose and with scattered thick white hairs. Lunule shiny brown. Frontal triangle shiny black on ventral ½, silvery-grey pruinose on dorsal ½; pruinosity from dorsal part of frontal triangle not joining with lateral pruinosity of face. Eye bare, with slightly enlarged ommatidia on dorsofrontal part; holoptic. Eye contiguity as long as frontal triangle. Antenna yellow; scape and pedicel with yellow hairs; pedicel with 3 brown setulae dorsally; postpedicel furry-like, rounded apically, longer than broad. Arista bare, brown. Vertical triangle black, shiny, with adpressed yellow setulae. Occiput covered with silvery pruinosity (except the posterior margin of the vertical triangle), with white hairs ventrally and scattered short, black setulae along margin, more abundant on dorsal ⅓.

Thorax (Fig. 5A–B). Scutum black, densely grey pruinose anteriorly, including anterior ½ of postpronotum. Postalar callus brown. Scutum with adpressed black hairs mixed with yellow scale-like hairs. Short black setulae on supra-alar area. Scutellum rounded, black, without subscutellar fringe, with adpressed yellow hairs mixed with yellow scale-like hairs; posterior margin with short black setulae with thick, expanded alveolus, making the posterior margin to look serrate. Pleuron black, with grey dense pruinosity on proepisternum, proepimeron and anterior bare part of the anterior anepisternum; with white scale-like hairs on posterodorsal part of the anterior anepisternum, posterior anepisternum, dorsal part of katepisternum and anterior anepimeron (posterior anepimeron with 2–3 white scale-like hairs anteriorly); anatergum with yellow hairs, lightly grey pruinose. Plumule yellow, very short. Metaepisternum and metasternum bare. Halter yellow. Posterior spiracular fringes yellow.

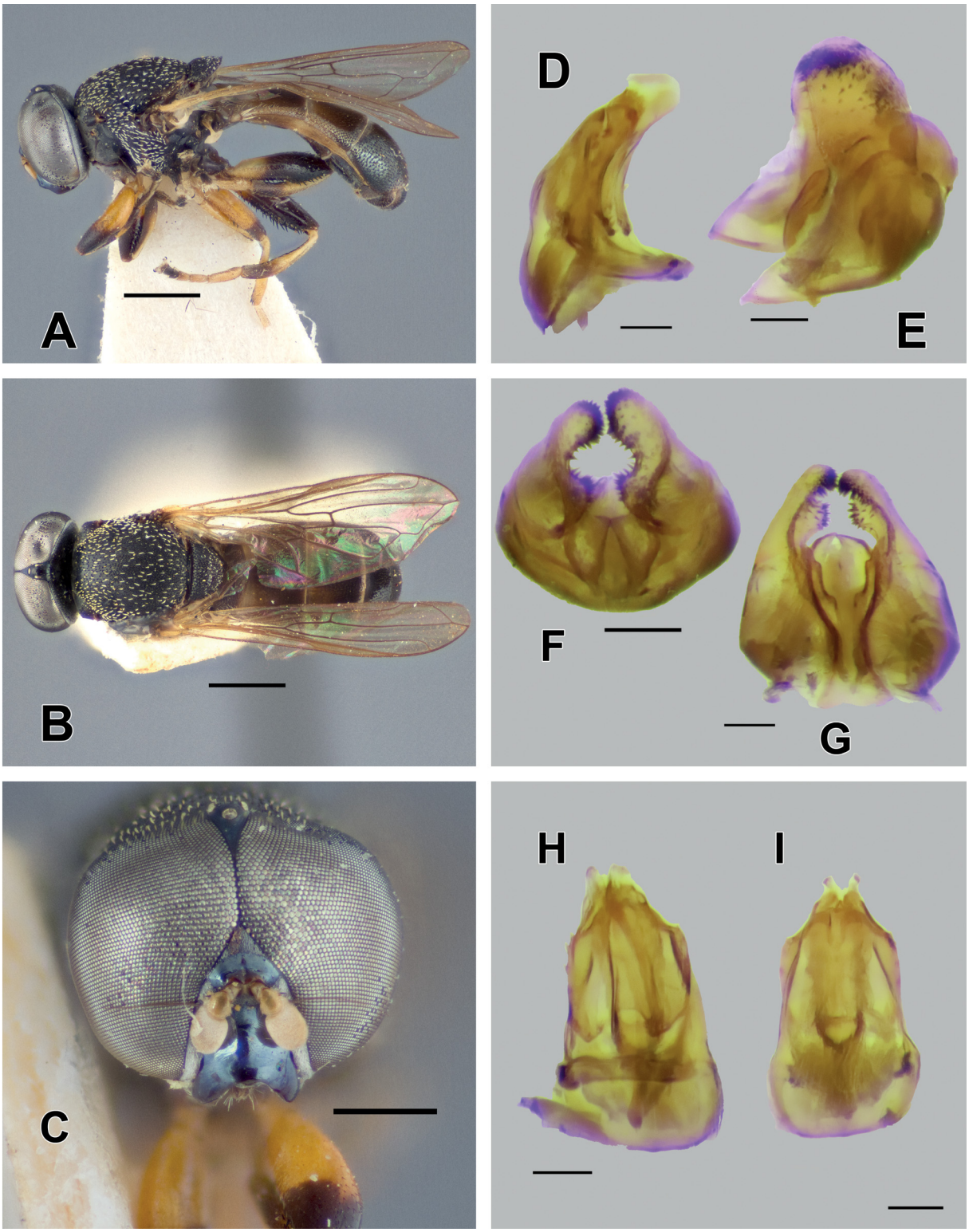

Fig. 5. *Myolepta iota* sp. nov., ♂, holotype (ZFMK-DIP-00082514). **A**. Habitus, lateral view. **B**. Habitus, dorsal view. **C**. Head, frontal view. **D**. Genitalia, hypandrium, lateral view. **E**. Genitalia, epandrium, lateral view. **F**. Genitalia, epandrium, dorsoposterior view. **G**. Genitalia, epandrium, ventral view. **H**. Genitalia, hypandrium, dorsal view. **I**. Genitalia, hypandrium, ventral view. Scale bars: A–B = 1 mm; C = 0.5 mm; D–I = 0.1 mm.

Wings. Membrane hyaline; pterostigma yellow; extensively microtrichose except cell c on basal ⅓, cell br anterior to RS bifurcation, cell bm on basal ¾ and cell cua on basal ½. Spurious vein absent. Vein RS and basal section of R with black setulae dorsally. Cell r_{4+5} petiolate; vein R_{4+5} with last section longer than crossvein r-m.

Legs. Coxae black; fore coxa densely grey pruinose; trochanters yellow. Fore femur incrassate, yellow on basal ½–3/5 and black on apical 2/5–½, with apex yellow, with yellow hairs and two rows of short black setae on ventral side; fore tibia yellow on basal ⅔ with black elongated macula on posterior side, black on apical ⅓, yellow hairy with black setulae on ventral side; basal three fore tarsomeres yellow with black hairs dorsally, black with yellow hairs ventrally; apical two fore tarsomeres black with yellow hairs. Mid femur slightly swollen, yellow on basal 4/5 and black on apical 1/5, with yellow hairs and two rows of short black setae on ventral side; mid tibia yellow, yellow hairy with black setulae on ventral side; basal three mid tarsomeres yellow, apical two mid tarsomeres black, black hairy dorsally and yellow hairy ventrally with some black setulae. Hind femur yellow on basal ⅓, black on apical ⅔, yellow hairy with two rows of short black setae on ventral side, and long (half as long as femur's width) black setae on the dorsal side; hind tibia yellow on basal ⅔, black on apical ⅓, yellow hairy with black setulae on ventral side; basal three hind basitarsomeres yellow, yellow hairy, and apical two hind basitarsomeres black, black and yellow hairy.

Abdomen (Fig. 5A–B). Almost parallel-sided, with the maximum width between tergites 3 and 4, unmargined. Tergite 1 dark brown, brown pruinose, yellow hairy; tergite 2 broader than long, brown with diffuse yellow fascia on anterior margin broadening laterally, brown pruinose, yellow hairy with tuft of long yellow setae on anterolateral corner; tergite 3 brown becoming black posteriorly with diffuse yellow marking on anterior margin, brown pruinose, yellow hairy; tergite 4 black with posterior margin brown, shiny except medial, triangular brown pruinose macula on anterior margin, yellowish brown hairy. Sternites with addressed yellow hairs; sternite 1 dark brown to black, densely grey pruinose; sternite 2 dark brown medially and yellow laterally; sternite 3 dark brown with two yellow macula anterolaterally; sternite 4 dark brown. Membrane between tergites and sternites entirely yellow.

Male genitalia. As in Fig. 5D–I. Epandrium subquadrate; surstylus with dorsal margin strongly undulate forming two clear lobes, with strong setae (Fig. 5F); hypandrium with 4–5 small and thin setae at margin (on rim) between dorsal and lateral parts plus three additional small setae at lowest part of this rim in the dorsal part.

Remark

I assume that these specimens were collected with a Malaise trap, based on the sampling dates, and that it co-occurs with *Myolepta petiolata*.

Myolepta petiolata Thompson, 1971
Fig. 6

Diagnosis

Black *Myolepta* species with long antenna, as long as face, with elongated postpedicel (Fig. 6C, F). Black body with a yellow pruinose fascia on posterior margin of tergite 3, and black legs, except basal 1/5–¼ of femora yellow, fore basotarsomere yellow and two basal mid tarsomeres yellow (Fig. 6). Scutellum orange. Pterostigma dark brown with apical part hyaline. Cell r_{4+5} closed at wing margin, with petiole shorter than crossvein h. Abdomen strongly petiolate, less than half its maximum width at its minimum (on tergite 2).

Differential diagnosis

Myolepta petiolata differs from all other described species of *Myolepta* by the strongly petiolate abdomen, which is less than half its maximum width at its minimum (Fig. 6B, E). It differs from all other Indomalayan species of *Myolepta* by the orange scutellum (bicolorous or black in other species).

Type locality

Thailand: Northwest Chiang Mai Province, Ching Dao, 19.366467° N, 98.964902° E, alt. 450 m.

Material examined

Holotype

THAILAND • ♀; Northwest Chiang Mai Province, Ching Dao; [19.366467° N, 98.964902° E]; alt. 450 m; 5–11 Apr. 1958; T.C. Maa leg.; BPBM [photographs examined].

Other material

THAILAND • 1 ♀; Mae Hong Son Province, Ban Huai Po; [19.4246° N, 97.9148° E]; alt. 480 m; 1–5 May 1992; Stmad leg.; ZFMK; ZFMK-DIP-00082511 • 1 ♀; same collection data as for preceding; NMP; ZFMK-DIP-00082512.

Remarks

No male specimen is known of this species. These are the first published records of this species after its original description, and the new record locality is 105 km west of the type locality. I assume that the specimens were collected with a Malaise trap, based on the sampling dates, and that it co-occurs with *Myolepta iota* sp. nov. Thompson (1971) described this species and *Myolepta orientalis* from the same locality and date; thus, I deduce that *M. petiolata* and *M. orientalis* also co-occur.

Key to the Oriental species of Myolepta Newman, 1838

1. Abdomen strongly petiolate, less than half its maximum width at its minimum (Fig. 6B, E). Scutellum orange (Fig. 6A–B, D–E) .....***Myolepta petiolata*** Thompson, 1971 [Thailand]
– Abdomen not petiolate, oval, parallel-sided (Fig. 4B) or only slightly constricted basally (Figs 2A, 3B), greater than half its maximum width at its minimum. Scutellum partially black (Fig. 3B, E) 2

2. Legs unicolorous, entirely pale yellow except apical tarsomeres slightly brownish. Thorax densely silvery pruinose. Abdomen mainly orange ..... ***M. splendens*** Thompson, 2014 [Myanmar]
– Legs bicolorous, partially or mainly black (Figs 2B, 3A, D). Thorax and abdomen variable, but never as in the previous combination 3

3. Antenna long, about as long as or longer than height of face (i.e., distance between antennal fossa and anterior oral margin); postpedicel elongate, more than 2× as long as broad (Fig. 3C, F). Scutellum bicolorous, black basally and yellow to white apically (Fig. 3B, E) 7
– Antenna short, much shorter than height of face; postpedicel oval, less than 1.7× as long as broad (Fig. 4A, C). Scutellum bicolorous or entirely black 4

4. Thorax with scale-like hairs (Fig. 4A). Vein R_{4+5} with last section (=petiole) longer than crossvein h and usually longer than crossvein r-m; cell r_{4+5} distinctly petiolate (Fig. 4B) 6
– Thorax without scale-like hairs. Vein R_{4+5} with last section (=petiole) nearly absent; cell r_{4+5} closed at wing margin, not petiolate, or with petiole shorter than crossvein h 5

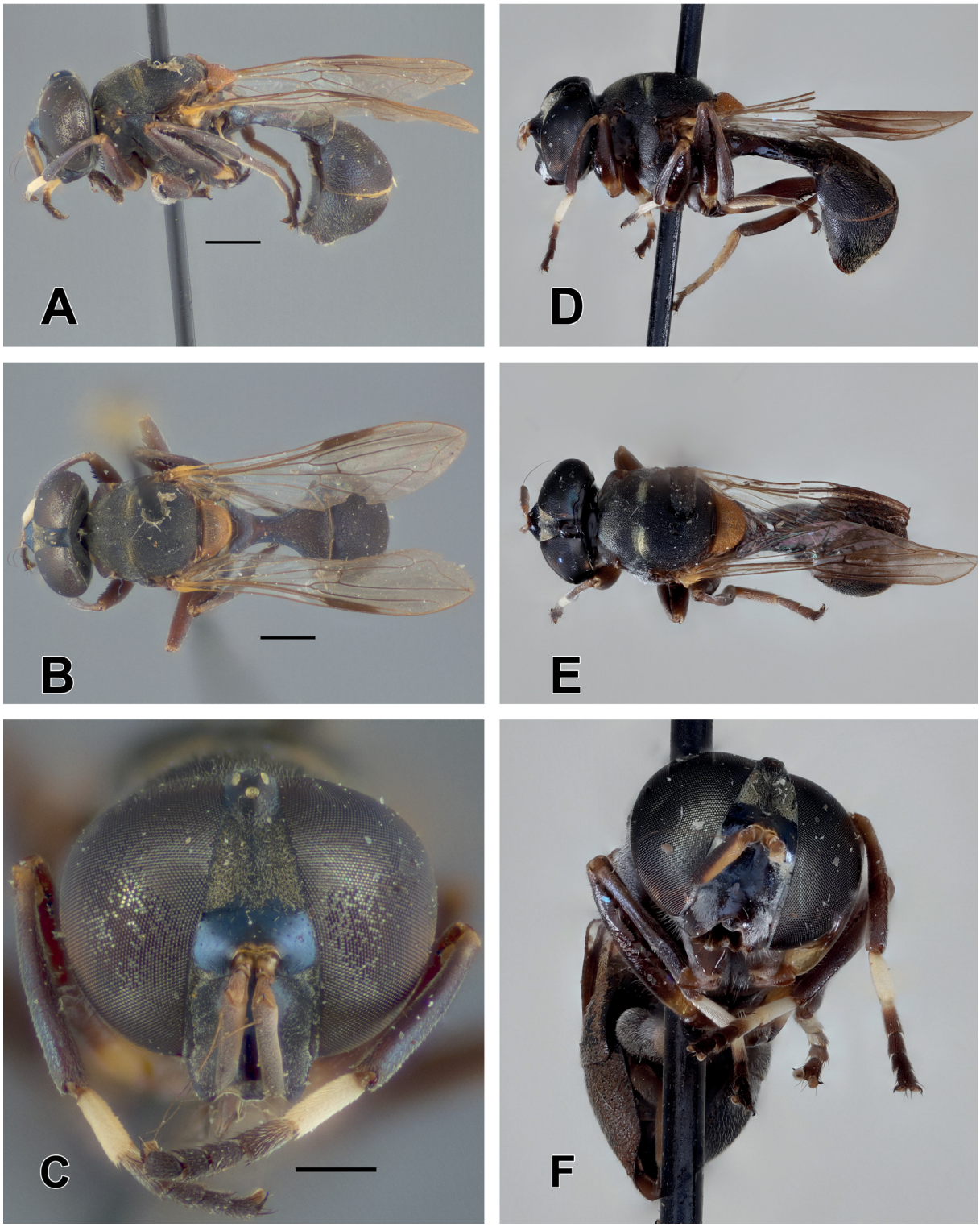

Fig. 6. A–C. *Myolepta petiolata* Thompson, 1971, ♀ (ZFMK-DIP-00082511). **A**. Habitus, lateral view. **B**. Habitus, dorsal view. **C**. Head, frontal view. **D–F**. *M. petiolata*, ♀, holotype (BPBM). **D**. Habitus, lateral view. **E**. Habitus, dorsal view. **F**. Habitus, frontal view. Scale bars: A–B = 1 mm; C = 0.5 mm.

5. Scutellum bicolorous, black with yellow apical margin. Occiput and gena narrow; face not strongly produced forward, with frontal prominence not developed and facial tubercle less prominent. Antenna yellow ..... ***M. mahmoodii*** Hassan & Bodlah, 2021 [Pakistan]
– Scutellum entirely black. Occiput and gena broad; face produced forward, with frontal prominence developed and facial tubercle round and prominent. Antenna brown .... ***M. himalayana*** Brunetti, 1915 [India, Himachal Pradesh]

6. Fore femur black on apical 2/5–½ and yellow on basal ½–3/5; mid femur mostly yellow, except black on apical 1/5 (Fig. 5A). Anterodorsal part of the anterior anepisternum not covered with scale-like hairs grey pruinose, not shiny (Fig. 5A). Membrane between tergites and sternites entirely yellow. Male genitalia as in Fig. 5D–I ..... ***M. iota*** sp. nov. [Thailand]
– Fore and mid femur orange, with a black ring at apex (Fig. 4A). Anterior anepisternum with area not covered with scale-like hairs shiny black (Fig. 4A). Membrane between tergites and sternites 2 and 3 black, between tergite and sternite 4 yellow. Male genitalia as in Fig. 4D–I ..... ***M. geras*** sp. nov. [Indonesia, West Java]

7. Face entirely golden pruinose (Fig. 2C). Abdominal tergite 2 longer than broad (Fig. 2A) .... ***M. graciliventris*** Wiegmann, 1986 [Nepal]
– Face shiny medially, at least below antennae (Fig. 3C, F). Abdominal tergite 2 broader than long (Fig. 3B, E) 8

8. Femora and tibiae bluish-black to dark brown (Fig. 3D). Abdominal tergite 3 black with a medial golden hairy vitta broadening posteriorly; tergite 4 black basally and orange on apical ⅓, completely covered with thick, golden hairs (Fig. 3D) ..... ***M. orientalis*** Thompson, 1971 [Thailand]
– Femora and tibiae yellow basally (Fig. 3A). Abdominal tergite 3 black with a narrow golden tomentose fascia on apical margin; tergite 4 black, without tomentum, medially with black hairs, with scattered white hairs laterally and with adpressed golden hairs medially (Fig. 3A–B) ..... ***M. diaphora*** sp. nov. [Laos]

Discussion

Generic affinities and subdivision of *Myolepta*

The current generic concept of *Myolepta* derives from the diagnosis made by Shannon (1922): small dark flies; face concave in the females, but tuberculate in males; antennae short; abdomen short oval; scutellum with preapical margin; femora moderately swollen with short spines ventrally; wing cell r_{4+5} not petiolate and veins R_{4+5} and M_1 meet close to the apex of the wing. Within his Cheilosinae, Shannon (1922) defined the tribe Myoleptini [as Myioleptini] by the last section of vein R_{4+5} (=petiole) shorter than crossvein r-m; another way of saying that cell r_{4+5} has an acute distal corner, close to the wing margin. From the identification key by Shannon (1922), it is clear that he considered the genera *Myolepta*, *Eumyiolepta* Shannon, 1921 (now a junior synonym of *Myolepta*) and *Apicomyia* Shannon, 1922 (now a junior synonym of *Cynorhinella* Curran, 1922) as members of the Myoleptini. Later, Hull (1949) moved *Cynorhinella* to his Cheilosini and left *Myolepta* in Myoleptini, together with a fossil genus. Within *Myolepta*, Hull (1949) recognized four subgenera: *Myolepta* sensu stricto, *Eumyiolepta* (species with scale-like hairs), *Sericolepta* Hull, 1945 (fossil subgenus with cell r_{4+5} closed quite some distance from the wing margin, petiolate, scutellum without preapical margin and numerous ventral setae on hind femora), and *Arctolepta* Hull, 1945 (fossil subgenus with setae on the scutellum, cell r_{4+5} with a long petiole and "hind femora stout with many bristly spines").

At the same time, Hull (1949) placed *Lepidomyia* (as *Lepidostola*) in his Chrysogasterini for those peculiar small flies with scale-like hairs; elongated antennae; inconspicuous facial tubercle, sometimes with two tubercles; ventral setae on all femora; hind femur considerably swollen; vein M_1 long, with or

without spur, meeting vein R_{4+5} at wing apex. Hull (1949) created the subgenus *Protolepidostola* Hull, 1949 for his species *Lepidostola scintillans* Hull, 1946 (now *Myolepta scintillans*) characterized by the short, oval postpedicel.

Thompson (1968) defined his concept for Myoleptini and provided a historical view of *Protolepidostola*, besides describing two new species of *Protolepidostola*. He divided *Myolepta* into three subgenera (*Myolepta*, *Eumyiolepta* and *Protolepidostola*) and pointed out several diagnostic characteristics for *Protolepidostola*: short head compressed antero-posteriorly; small, compact flies with scale-like hairs present; reduced occiput laterally; cell r_{4+5} acute and drawn out to the wing margin; and spurious vein absent.

A few years later, Thompson (1972) placed *Lepidomyia* and *Myolepta* (now with only two subgenera: *Myolepta* and *Protolepidostola*) in his new concept of Chrysogasterini, together with another group of genera, different from those of his Myoleptini from 1968. In his definition of the tribe, Thompson (1972: 114) already mentioned numerous exceptions for Chrysogasterini and concluded that *Lepidomyia* and *Myolepta* were distinguished by the presence or absence of a facial tubercle in females and the shape of the postpedicel (two or more times as long as broad in *Lepidomyia* and short, oval in *Myolepta*). Thompson needed to modify again his concept of *Myolepta* even before the publication of his PhD [presented in 1970 (Thompson 1970) and finally published in 1972 (Thompson 1972)] when he discovered two new *Myolepta* species from Thailand with elongated postpedicel (Thompson 1971). Consequently, the differences between *Lepidomyia* and *Myolepta* were reduced to the presence of a facial tubercle in the females and restricting *Lepidomyia* to the New World, from the southern USA (Texas) to Argentina, although it is absent from the Chilean subregion (Thompson *et al.* 2010).

All these rapid changes in the generic concept of *Myolepta* culminated with another publication where Thompson (1974) proposed a new subgeneric division. Instead of subgenera, he divided *Myolepta* into six species groups and suggested the possibility that *Lepidomyia* could be a species group within *Myolepta*. Thompson (1974) stated the variability of certain morphological characters within the genus: head shape normal/compressed longitudinally; male holoptic/narrowly dichoptic; fore femora with one/two rows of setae or without; metasternum pilose/bare; postpedicel oval/elongate; scutellum rounded/triangular; scutellum with/without preapical sulcus; presence/absence of scale-like hairs; katatergum hairy/bare; cell r_{4+5} with very short/long petiole; and abdomen petiolate/oval. It seems that each new species of *Myolepta* from the Indomalayan Realm is so distinct from the previously known, that it can be assigned to its own species group. This occurred with *Myolepta graciliventris*, which lacks a prominent facial tubercle in males (another variable diagnostic character to add to the list) and has a petiolated cell r_{4+5} (Wiegmann 1986). Similarly, an own separated species group can be argued for *M. iota* sp. nov. and *M. geras* sp. nov.

Until now, an elongate postpedicel was found in the Afrotropical species of *Myolepta* (*africana* group) and three Indomalayan taxa (*M. graciliventris*, *M. petiolata* and *M. orientalis*); scale-like hairs were diagnostic of the *strigilata* (=*Eumyiolepta*), *scintillans* (=*Protolepidostola*), *africana* and *orientalis* groups; and a long petiole closing cell r_{4+5} was only found in the Afrotropical species, *M. graciliventris*, and *Myolepta minuta* Fluke, 1956 (a small species from Argentina with dark maculae on the wing). Newly described species *M. iota* sp. nov. and *M. geras* sp. nov. do present the long petiole condition and the lack of prominent facial tubercle (males do have a relative small facial tubercle). These two new species do not key out properly to any Indomalayan group using the key to *Myolepta* species groups by Thompson (1974), as they do not have a preapical sulcus in the scutellum (*orientalis* group), nor a petiolate abdomen (*petiolata* group). On the other hand, *M. diaphora* sp. nov. can be considered a member of the *orientalis* group, as *M. orientalis* and *M. diaphora* sp. nov. are quite similar morphologically as stated earlier.

The support of the species group proposed by Thompson (1974) is not strong as already pointed out by Reemer *et al.* (2005) and the whole genus needs a re-evaluation of the morphological characters and affinities. In addition, it is necessary to explain more in detail certain morphological characteristics, such as scale-like hairs. Thompson (1974) considered that *M. orientalis* has scale-like hairs, but hairs in this species are not modified (expanded laterally; flattened with rounded apex) like in *M. iota* sp. nov. and *M. geras* sp. nov., and they are just thicker (and mostly longer; with sharp-pointed apex) than the other body hairs, which one could call setulae or setae. These are also present in *M. diaphora* sp. nov. As an example of how difficult defining these scale-like hairs is, Fluke & Weems (1956) mentioned that the Argentinian *Myolepta greenei* Hull, 1941 "is a transitional form between *Myolepta* [with regular body hairs] and *Eumyolepta* [with scale-like hairs]". Moreover, the new Indomalayan species challenge the use of published identification key even at genus level, as cell r_{4+5} without petiole is commonly used in the literature to key out *Myolepta* (Thompson *et al.* 2017).

Although the phylogenetic relationships within the paraphyletic Eristalinae are in need of revision (Mengual *et al.* 2015; Moran *et al.* 2022), *Myolepta* is currently placed in the Brachyopini, subtribe Brachyopina (see http://syrphidae.myspecies.info/node/6170 for the intrafamilial classification based on Thompson's unpublished concepts), but the most recent molecular phylogenetic analysis recovered *Myolepta* as sister to Volucellini with poor support (Bayesian inference) or as sister to the rest of Eristalinae (Maximum Likelihood) (Moran *et al.* 2022). In other words, the phylogenetic placement of *Myolepta* and its generic limits are unclear.

Comments on biology and geographical distribution

The Indomalayan flower flies are clearly understudied. Recent taxonomic revisionary works brought to attention this fact by the high number of new species discovered (Mengual & Ghorpadé 2010; Mengual 2012, 2016; van Steenis & Hippa 2012; Thompson 2013, 2015, 2017a, 2017b, 2020; van Steenis 2014; Hippa *et al.* 2015; van Steenis *et al.* 2018, 2019; Mengual & Barkalov 2019; van Steenis & Wyatt 2020; Sankararaman *et al.* 2022; among others). The syrphid fauna of all major biogeographic realms are covered by published Manuals of Diptera (Vockeroth & Thompson 1987; Thompson & Rotheray 1998; Thompson *et al.* 2010; Ssymank *et al.* 2021) and unpublished revisionary works by F.C. Thompson (Thompson 2006 for South America; Thompson *et al.* unpub. for Australia), except the Indomalayan Realm. Ghorpadé (1994, 2014) covered the flower flies of the Indian subcontinent, but he did not provide identification keys for all the genera, and taxonomists still need to use Brunetti (1923) for Indian flower flies, with the help of the published catalogues (Knutson *et al.* 1975). For the Malayan part of this realm (Myanmar to Vietnam and Philippines south to Java; see Thompson & Vockeroth 1989) there are no recent taxonomic revisions or identification keys, not even to genus level. More taxonomic work is needed focusing on this part of our planet. This is evident by the fact that the holotype of *M. geras* sp. nov. was collected 90 years ago and the type material of *M. iota* sp. nov. 30 years ago, both above the average 21 years of 'shelf life' or the time between the first collection of a specimen of a new species and its formal description and naming in the scientific literature (Fontaine *et al.* 2012).

As mentioned in the introduction, *Myolepta* is absent from the Australasian Realm, and Thompson (2014) stated that the genus is absent from "oceanican islands" (he might refer to oceanic or Oceanian islands). The new species *M. geras* sp. nov., then, represents the first species of *Myolepta* from an oceanic island (Java), but the genus has not been reported from Oceania yet. With the new taxa described here, the total number of described species of *Myolepta* in the Indoamalayan realm is nine. It is important to remark that all Indomalayan species of *Myolepta* are described based on singletons (seven taxa) or doubletons (*M. himalayana* and *M. iota* sp. nov.), and that we only know both sexes of one species (*M. himalayana*). A recent publication of a DNA Barcode library from Mount Halimun-Salak (West Java, Indonesia) reports that almost 70% of their BINs (Barcode Index Number; Ratnasingham & Hebert 2013) were singletons and more than 90% had less than five specimens (Cancian de Araujo *et al.* 2018); their field

work ran for eight months using 34 Malaise traps. Among their BINs, only one out of 1149 belonged to Syrphidae. As stated by Lim *et al.* (2012) "Singletons-species only known from a single specimen – and uniques-species that have only been collected once – are very common in biodiversity samples", especially in tropical areas (Coddington *et al.* 2009). True rarity, small geographic ranges of the species and problems with logistics of fieldwork, combined with the difficulty of comprehensive sampling, enhance the presence of singletons (Ahrens *et al.* 2016). Coddington *et al.* (2009) suggested that the major cause for singletons is the undersampling, but a recent review affirms that additional sampling helps little to eliminate rarity and new fieldwork will sample more singletons (Lim *et al.* 2012). Kurina & Kirik (2021) advocate to describe new species based on singletons to promote further research on the new taxa rather than keeping the specimen for decades until additional specimens become available. The last argument is valid and appropriate for the present work, where the new species are not described in isolation and an identification key is provided for the Indomalayan species of *Myolepta*.

Tropical species of *Myolepta* are not numerous in collections and as explained above, new species are usually based on singletons. There are several reasons for this fact; among them: adult behavior (it is assumed that adults are canopy flyers, but there is little evidence), their larval biology (saproxylic in forest with overmature trees, which are not common in forests anymore) and undersampling in the tropics, as already mentioned. Related to the larval biology of *Myolepta*, forest management techniques are important for the survival of saproxylic flower flies (Reemer 2005) and traditional silvicultural practices promote the presence of tree rot holes (Sebek *et al.* 2013). Besides human activities, the tree hollow microhabitats define the diversity and complexity of saproxylic networks (Quinto *et al.* 2015) and the presence or activity of other taxa groups in a trunk cavity may facilitate or be a pre-requisite for the development of larvae of *Myolepta*, together with hollow orientation and water content (Sánchez-Galván *et al.* 2014). In conclusion, more fieldwork is needed to have a true overview of the flower fly diversity in the Indomalayan realm, together with more taxonomic work to understand their diversity, without neglecting that the particular biology of certain taxa may hinder our knowledge.

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