Zootaxa 5715 (1): 300–307
https://www.mapress.com/zt/
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Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.5715.1.28
http://zoobank.org/urn:lsid:zoobank.org:pub:CB872C73-408A-4924-8ADD-C735B4BB1097

New genus and two new species of gelechiid moths (Lepidoptera, Gelechiidae) from Malaysia and Indonesia

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Abstract

A new genus *Mercedula* **gen. nov.** and two new species (*M. fuscomarginata* **sp. nov.**, type species, and *M. storozhenkoi* **sp. nov.**) are described and illustrated from Sabah, East Malaysia, and North Sumatra, Indonesia. The taxonomic position of the new genus within the family Gelechiidae is discussed.

Key words: micromoths, new taxa, Southeast Asia

Introduction

The taxonomic diversity of gelechiids has been studied extremely unevenly in different regions of the world. This family, like other microlepidopterans, has been studied especially poorly in the tropical regions of the Old and New Worlds. In Southeast Asia, about 350 species of gelechiids were known by the end of the 20th century (Meyrick 1925, Gaede 1937, Robinson *et al.* 1994), which is only about 8.5% of the known species diversity of this family in the world fauna, numbering about 4,700 species (van Nieukerken *et al.* 2013). From the end of 20th century, the fauna of gelechiids in some countries of the Southeast Asia has been intensively studied. Over the past three decades, 12 genera and more than 70 species have been described from Thailand, Laos, Cambodia, Vietnam, Sumatra, East Malaysia and the Philippines (Moriuti & Ueda 1993; Park & Ponomarenko 1996, 1998, 1999; Ponomarenko & Ueda 2004; Bae *et al.* 2016, Omelko & Omelko 2017, 2018a, 2018b, 2019a–c, 2020a–c, 2021a–c, 2022a–b, 2024a–c, Ponomarenko *et al.* 2021a–c, 2023; Ponomarenko & Omelko 2024). The fauna of gelechiids of Malaysia and Indonesia has recently been intensively studied due to active collecting of these moths by the second author of the present paper. To date 68 species of 38 genera are known from West and East Malaysia and 73 species of 39 genera from Indonesia. The present work continues a series of papers devoted to the study of gelechiid moths from this region and includes the description of a new genus with two new species with unique specialisations.

Material and methods

The specimens belonging to the new species were collected in the vicinity of Tawau and Keningau in the East Malaysian state of Sabah, and in the Bukit Lawang village in North Sumatra, Indonesia by the second author. The moths were attracted to mercury-vapor lamps. The material was processed using a standard lepidopterological technique (Falkovitsh & Stekolnikov 1978), included maceration of the soft tissues of abdomen in 10–15 % KOH. The membranous parts of the male and female genitalia were stained using chlorazol black. After their examination, the genitalia of both sexes were slide-mounted using Euparal following the technique by Robinson (1976). Photographs of adults were made with a Nikon D300 camera equipped with 50 mm Macro lens. Photographs of slide-mounted genitalia were made with an Olympus SZX16 microscope with an incorporated digital camera DP74 Nikon. Some

 Accepted by V. Loktionov: 25 Aug. 2025; published: 28 Oct. 2025

photographs of genital structures in larger magnification were taken using microscope Zeiss Axioskop 40 equipped with digital camera AxioCam HRc.

In description the genital morphological terminology follows Klots (1970) with modifications by Ponomarenko (2005, 2009).

The holotypes and paratypes of the new species are deposited in the Bioresource collection (registration number 2797657) of the Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of Russian Academy of Sciences (Vladivostok).

The following abbreviations were used in the text: FSCB—Federal Scientific Center of the East Asia Terrestrial Biodiversity, place of type material depository; GS—genital slide; MP—slide prepared by M.G. Ponomarenko.

Descriptions of new taxa

Mercedula Ponomarenko & M. Omelko, gen. nov.

Type species. *Mercedula fuscomarginata* Ponomarenko & M. Omelko, **sp. nov.** by present designation.

Diagnosis. The new genus can be distinguished from the genera of tribe Gelechiini by the male genitalia with long narrow uncus; longitudinally elongated tegumen, anterior part of which with complex apodeme; an absent gnathos; valva deeply divided into narrow dorsal part and ventral part broadened distally; shifted caudally phallic complex consisting of vinculum, juxta and aedeagus. Also, it differs by female genitalia with 8th segment, consisting of two lateral sclerotisations and membranous areas between them, and two signa in corpus bursae.

Description. Adult. Head whitish with appressed large scales. Basal antennal segment (scapus) slightly flattened dorso-ventrally, brownish on upper side and light beige on under side, flagellum with light beige segments alternating with ones brownish on upper side and with black ones formed rings. Labial palpi with very short first segment, second segment 1.3–1.8 times longer than third segment, greyish brown on outer side and beige on inner side; third segment beige with two dark brown rings near the base and before apex (Figs 2, 7).

Thorax, patagia and tegulae whitish or light beige. Forewings length 3.1–3.3 mm; light beige, with yellowish-brown stripe along costal margin from base to 3/5 or 4/5 of wing length, which widened distally, distinct small black spot at cell end formed by raised scales and large greyish brown spot posteriad the latter (Figs 1, 5, 6); fringe beige on the costal and outer edges of wing, and grey on posterior margin, with 7 sparse black dots around wing apex. Hindwings and fringe grey. Forelegs and middle legs light beige with brownish darkening on outer side of femur and tibia, and dark brown darkening on tarsi; hind legs light beige with brush of hair-like scales of same colour on upper and under sides of tibia and with light beige spurs, for except the outer spur of second pair, which dark brown.

Second abdominal sternite with well-developed relatively long apodemes curved medially, long and sinuous venulae and medial fold arising from U-shaped narrow sclerotisation in proximal part of sternite (Figs 17, 24).

Male genitalia (Figs 12, 13) (based on the male genitalia of *M. fuscomarginata* **sp. nov.**). Uncus narrow and long. Gnathos absent. Tegumen elongated caudally and widened at basal 2/5, with well-developed apodeme in anterior part bearing two pairs of longitudinal folds and rounded dorsal notch. Valva deeply divided into two separate parts joined with tegumen and vinculum through of short transversal basal sclerite. Valval dorsal part sclerotised, narrow and with pointed apex, broadened basally and parallel-sided beyond basal 2/5. Valval ventral part enlarged at about 3/5 of length and with rounded apex. Sternal phallic complex, consisting of vinculum, juxta and aedeagus, shifted caudally and joined with rest genital structures by lateral arms of vinculum, which long and narrow. Vinculum of complex morphology: two lateral arms widened distally in triangular lateral plates located on sides of aedeagus and fused with juxta, its ventral part scletotised and with narrow band anteriorly; without saccus. Juxta integrated with vinculum, relatively large, with wedge-shaped ventral notch and two ventro-lateral lobes bearing beak-like apices directed ventrally, it wraps aedeagus from ventral and lateral sides. Aedeagus fixed in sternal phallic complex, it curved dorsally at basal 2/5, with inflated basal part and tube-like distal one, without caecum and with truncated apex. Vesica with minute needle-like cornuti (Fig. 13).

Female genitalia (Figs 14–16, 18–23). Papillae anales scletotised. Ovipositor short, membrane between segments 9 and 8 shorter than papillae anales, 8th segment consisting of two lateral sclerotisations with rounded posterior angles and membranous areas between them, of which dorsal one narrower. Ostium and antrum shifted anteriorly, ostium almost at level of posterior edge of 7th segment. Antrum sclerotised, funnel-shaped or cup-

shaped, joined with posterior edge of 7th segment (Figs 18, 20), ductus bursae membranous and tubular. Corpus bursae oval, membranous and with two signa each of which on underlying sclerotisation.

Distribution. Malaysia (Sabah) and Indonesia (Sumatra).

Etymology. The generic name is derived from Latin word "*mercedula*" meaning a small reward, which corresponds to the satisfaction from discovery of the new taxa as a result of tropical material study; generic name is feminine.

Mercedula fuscomarginata Ponomarenko & M. Omelko, sp. nov.

(Figs 1–5, 10, 12–21)

Type material. Holotype: ♂, Borneo, East Malaysia, state of Sabah, 9 km NNW of Keningau, 23.iii 2018 (leg. M. Omelko), GS 355 MP, FSCB.

Paratypes: 1 ♂, 1 ♀, same locality, date and collector, 354 (♂), 359 (♀) MP; 1 ♂, 24 km north of Tawau, 19.viii 2019 (leg. M. Omelko), GS 353 MP, FSCB.

Additional material. 1 ♀, Indonesia, North Sumatra, Bukit Lawang village, 19.ii 2023 (leg. M. Omelko), GS 356 MP; 1 ♀, same locality and collector, 18.ii 2023, GS 358 MP; FSCB.

Diagnosis. New species is very similar in appearance to *M. storozhenkoi* **sp. nov**. described below. It can be distinguished by the relatively smaller size of moth, head with two tufts of elongated scales, each of which is placed on sides of frons, and forewing with costal stripe not reaching the level of cell end (Fig. 10). The new species also differs by female genitalia with large funnel-shaped antrum, antevaginal plate setaceous and with lateral drop-like lobes, small band-like postvaginal plate without honeycomb-like structure on surface and relatively small thorn-shaped signa (Figs 15, 16).

Description. Adult (Figs 1–5, 10). Head with two dense tufts of elongated scales, each of which extends from behind antennal socket, covers scapus basally and eye anteriorly (Fig. 3). Flagellum in proximal part with one wide ring formed by four blackish segments before middle, in distal part with four black rings, two first of them equal in width and located just beyond the middle (Fig. 4). Forewing length 3.1–3.2 mm. Forewing light beige, interspersed with brownish scales, located more densely along dorsal margin; with yellowish-brown stripe along costal margin from base to 3/5 of wing length, which widened distally and not reaching level of cell end (Figs 1, 5, 10); distinct small black spot of raised scales at cell end; large greyish brown spot posteriad the latter; and with indistinct brownish band along distal third of costal edge; fringe light beige on costal and outer edges and dark grey on posterior margin. Hindwings and fringe dark grey.

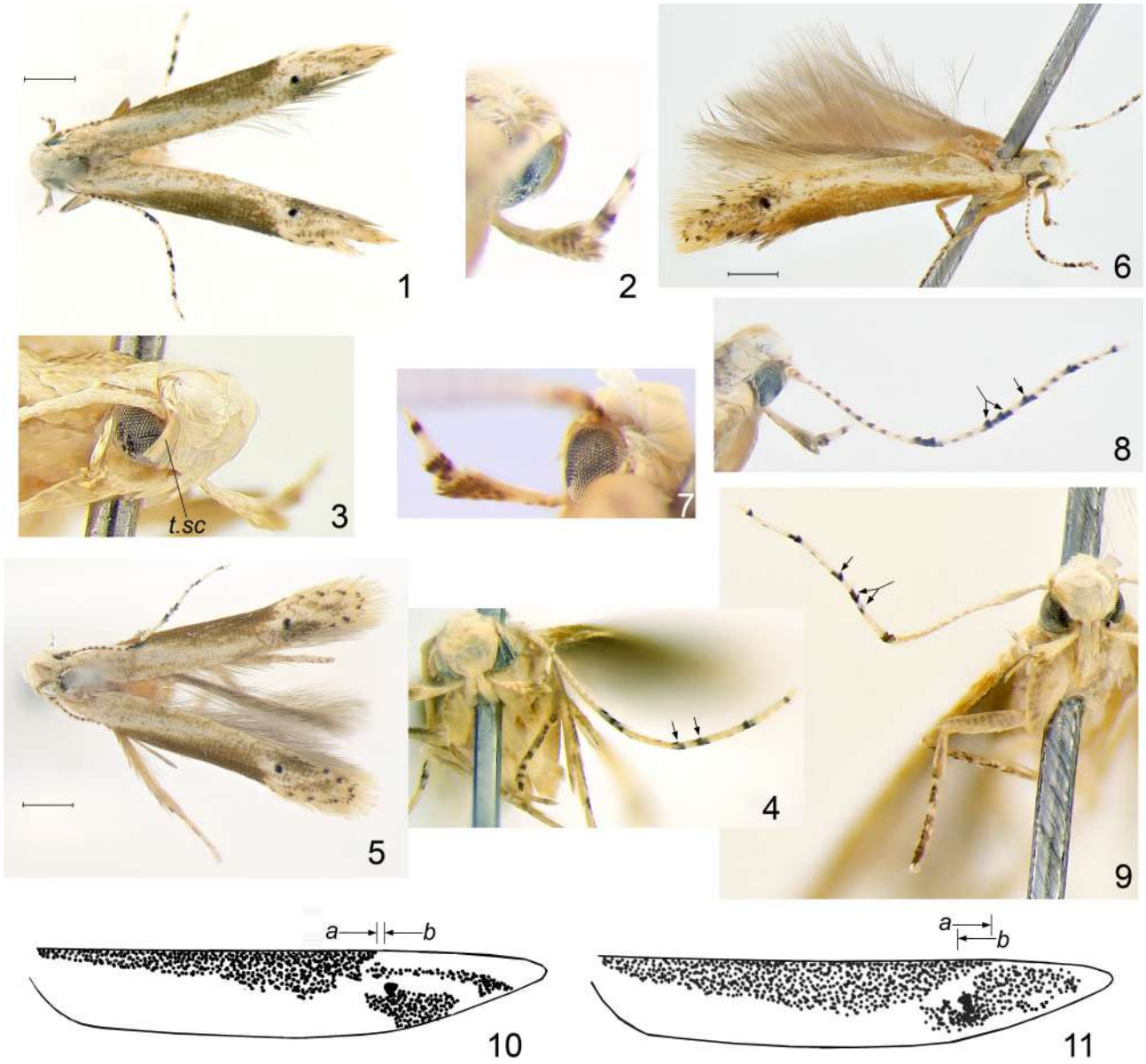
Male genitalia (Figs 12, 13). See the generic description above.

Female genitalia (Figs 14–16). Ovipositor short, membrane between 9th and 8th segments about two times shorter than papillae anales. Glandular sac located at the base of apophyses posteriores on dorsal side. Apophyses posteriores and apophyses anteriores equal in length. 8th segment consists of two lateral sclerotisations and two membranous areas between them, of which ventral wider. Ostium placed almost at level of posterior margin of 7th segment, wide, about half of 8th segment width, covered by rectangular antevaginal plate bearing small setae on inner surface and two drop-like lobes at each side (Fig. 15). Postvaginal plate as trapezoid transverse band. Antrum funnel-shaped, sclerotised, relatively long, almost equal to 8th segment in length, immerged under 7th segment and joined with its posterior margin, which with rounded sclerotised pockets on medial side at each side of antrum; anterior part of antrum weakly sclerotised and flattened in place where passing into ductus bursae. Ductus bursae membranous, smoothly widened towards corpus bursae. Corpus bursae oval with two small thorn-shaped signa, each placed on oval sclerotisation (Fig. 16).

Distribution. East Malaysia (Sabah) and Indonesia (Sumatra).

Etymology. The name of the new species is derived from the Latin roots "*fusc*-" and "*margin*-", meaning "dark", and "border", referring to the pattern of the moth's forewing with a dark stripe along the costal edge.

Remarks. Two specimens, both females, collected in Sumatra are not included in type series of *M. fuscomarginata* **sp. nov**. since they differ from Malaysian specimens from Sabah by brownish costal stripe (Fig. 5) and some structures of the female genitalia. One of them has relatively narrower and longer antrum and closely placed drop-like lobes of antevaginal plate (Fig. 18), the other female has larger signa and underlying sclerotisation, whereas size of antrum corresponds to that in the paratype (Figs 19–21).



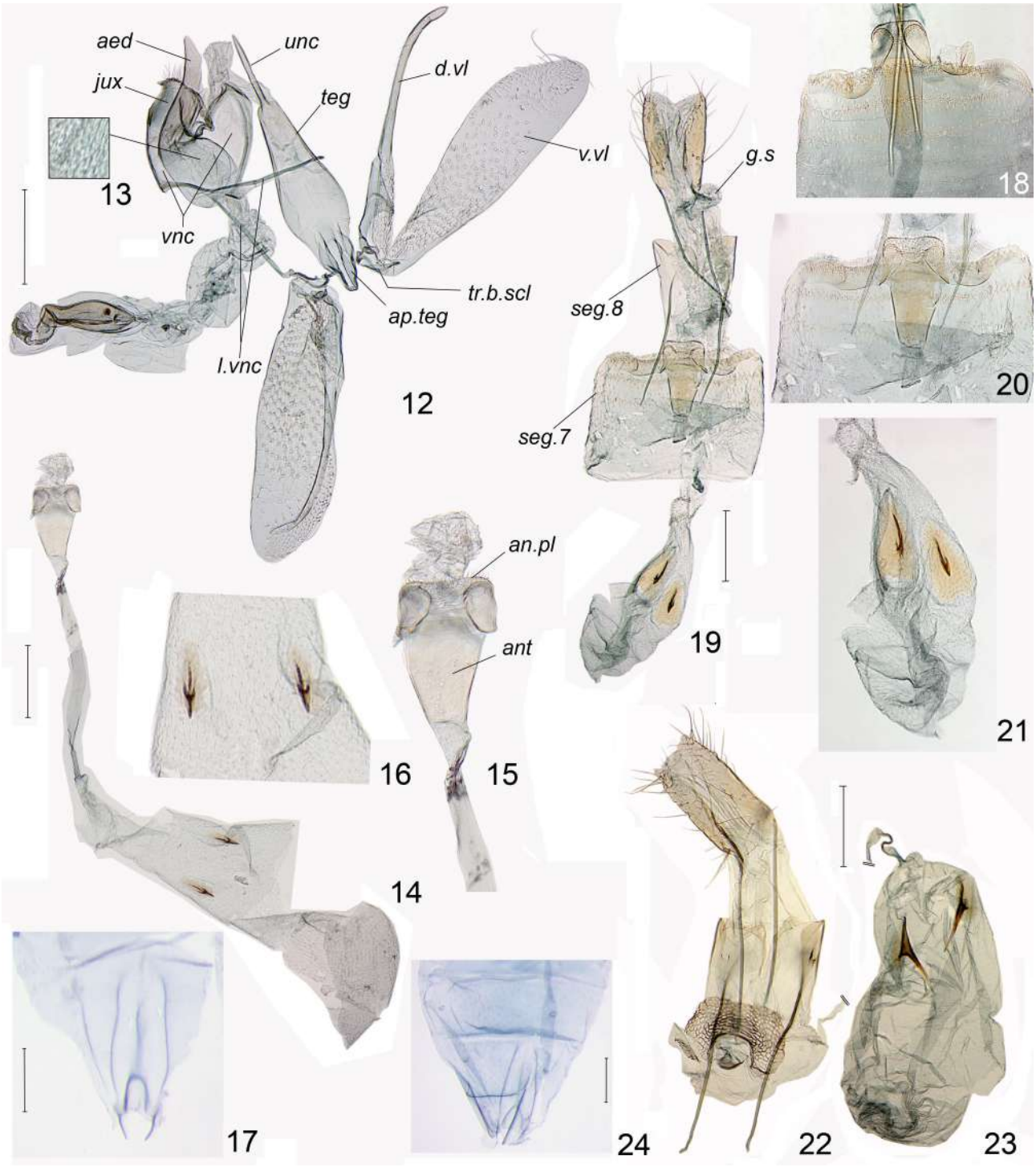
FIGURES 1–11. *Mercedula* spp., adults, heads with appendages and schemes of forewing pattern. 1–5—*M. fuscomarginata* **sp. nov.:** 1—male, holotype, Sabah; 2—ditto, labial palpus; 3—ditto, head; 4—ditto, head and antenna; 5—female, Sumatra. 6–9—*M. storozhenkoi* **sp. nov.,** female, holotype, Sabah: 6—adult; 7—labial palpus; 8—head and antenna, dorsal view; 9—head, antero-ventral view. 10, 11—schemes of forewing pattern: 10—*M. fuscomarginata* **sp. nov.**, 11—*M. storozhenkoi* **sp. nov.** Figures 2–4, 7–9 enlarged. Scale bar for figures 1, 5 and 6—0.5 mm. Abbreviations: a—level of distal end of costal stripe, b—level of proximal edge of black spot placed at cell end, both levels are shown by arrows; t.sc—tuft of elongated scales.

Mercedula storozhenkoi Ponomarenko & M. Omelko, sp. nov.

(Figs 6–9, 11, 22–24)

Type material. Holotype: ♀, Borneo, East Malaysia, state of Sabah, 24 km north of Tawau, 22.viii 2019 (leg. M. Omelko), GS 357 MP, FSCB.

Diagnosis. New species differs from *M. fuscomarginata* **sp. nov.** by the relatively larger size of moth, head without tuft of elongated scales on each side of frons and forewing with costal stripe exceeding the level of cell end (Fig. 11). It can be also distinguished by female genitalia with small ostium about ¼ of 8th segment width, smaller cup-shaped antrum, postvaginal plate with honeycomb-like sculpture on surface and relatively large thorn-shaped signa in corpus bursae.



FIGURES 12–24. *Mercedula* spp., male and female genitalia, and basal abdominal segments. 12–21—*M. fuscomarginata* **sp. nov.**: 12—male genitalia, holotype, GS 355 MP, Sabah; 13—ditto, fragment of vesica with cornuti; 14–17—female, paratype, GS 359 MP, Sabah: 14—genitalia (antrum, ductus bursae and corpus bursae); 15—antrum and posterior part of ductus bursae; 16—signa; 17—2nd abdominal sternite; 18—antrum and posterior edge of 7th segment, GS 358 MP, Sumatra; 19–21—female genitalia, GS 356 MP, Sumatra: 19—ventral view; 20—antrum and posterior edge of 7th segment; 21—corpus bursae with signa. 22–24—*M. storozhenkoi* **sp. nov.**, female, holotype, GS 357 MP, Sabah: 22—ovipositor and genitalia (8th segment with postvaginal plate, ostium, antrum and posterior part of ductus bursae), ventral view; 23—corpus bursae with signa; 24—1st tergite and 2nd sternite of abdomen. Figures 13, 15, 16, 18, 20 and 21 enlarged. Scale bar for figures 12, 14, 19, 22–24—0.2 mm. Abbreviations: aed—aedeagus, an.pl—antevaginal plate, ant—antrum, ap.teg—apodeme on anterior part of tegumen, d.vl—dorsal part of valva, g.s—glandular sac, jux—juxta, l.vnc—lateral arms of vinculum, seg.7—segment 7, seg.8—segment 8, teg—tegumen, tr.b.scl—transverse basal sclerite, unc—uncus, v.vl—ventral part of valva, vnc—vinculum.

Description. Adult, female (Figs 6–9). Head without tufts of elongated scales. Flagellum in proximal part with one wide ring formed by three blackish segments before middle, in distal part with four black rings, first of which wider, than in *M. fuscomarginata* **sp. nov.** (Figs 8, 9). Forewing length 3.3 mm. Forewing light beige, interspersed with brownish scales located more densely on distal ¼ of wing before apex; with yellowish-brown stripe along costal margin from base to almost 4/5 of wing length, which exceeds level of cell end (Fig. 11); small black spot of raised scales at cell end and greyish brown spot posteriad the latter; fringe light beige on costal and outer edges and dark grey on posterior margin. Hindwings and fringe dark grey.

Female genitalia (Figs 22, 23). Papillae anales oblong and scletotised. Ovipositor short, membrane between 9th and 8th segments slightly shorter than papillae anales. Apophyses posteriores and apophyses anteriores equal in length. 8th segment with wide ventral membranous area and narrower dorsal one. Ostium small, about 1/5 of 8th segment width. Postvaginal plate more or less trapezoidal, with flat posterior edge and deep rounded notch on anterior half, in which ostium and posterior edge of antrum placed. Antrum cup-shaped, sclerotised and relatively short, about 1/4 of 8th segment length. Ductus bursae membranous, narrow and tubular, slightly shorter than corpus bursae. Corpus bursae oval with two thorn-shaped signa in posterior half, each signum with oval underlying sclerotisation.

Male unknown.

Distribution. East Malaysia (Sabah).

Etymology. The species is named after Prof. Sergey Yu. Storozhenko, a famous expert with the orthopteroid insects and who made a great contribution to the study of morphology, fauna, taxonomy, and evolution of these insects. A noun in the genitive case.

Remarks. This species is described within genus *Mercedula* **gen. nov.** based on the similarity in appearance and some morphostructures of the female genitalia with those in the type species *M. fuscomarginata* **sp. nov.** However, *M. storozhenkoi* **sp. nov**. has significant differences in the ostial area, namely trapezoidal postvaginal plate with honey-like structure on surface and smaller cup-shaped antrum. Therefore, this species is tentatively placed in this genus until the male morphology will be studied to clarify its taxonomic position.

Discussion and conclusion

New genus *Mercedula* **gen. nov.** possesses complex of characters typical for the family Gelechiidae at whole and combined with features belonging to different subfamilies. The new genus has longitudinally elongated tegumen and valva divided into separated dorsal and ventral parts as well as almost all gelechiid moths. Besides, the described taxon has the following characters found in genera from different subfamilies: widened caudally vinculum as that in the genera of Gelechiini and Gnorimoschemini (Gelechiinae); fused structures of phallic functional morphological complex same as those in genera from the tribes Litini (Gelechiinae), Anacampsini (Anacampsinae), and Dichomeridini (Dichomeridinae), where the aedeagus is not only fixed in this complex, but also ankylosed with juxta and vinculum; the absent gnathos as well as in genera from the tribes Anomologini and Apatetrini (Anomologinae), Litini (Gelechiinae), and Anarsiini (Dichomeridinae).

Moreover, despite the general tendency within Gelechiidae towards integration of juxta and vinculum and subsequent reduction and disappearance of the former, the male of the new genus has juxta well-developed and joined with vinculum, with large ventro-lateral lobes widely wrapping aedeagus. A similar secondary development of the juxta was indicated in Chelariini (Dichomeridinae), but in the last tribe this structure is not joined with vinculum and connected with well-developed muscles (Ponomarenko 1992).

Listed features (fused structures of phallic functional morphological complex and fixation of aedeagus within this complex, secondary complication of the morphology of the juxta with lateral, or latero-ventral lobes wrapping aedeagus, deep splitting of valva into dorsal and ventral parts) are apomorphic states of morphostructures achieved in the course of the main trends of their evolutionary transformations, which were established in the phylogenetic analysis based on the functional morphology of the skeletal-muscular apparatus of the male genitalia in Gelechiidae (Ponomarenko 2005, 2009). However, the new genus shares the apomorphies with various tribes of gelechiids, which does not allow us to unambiguously identify probable synapomorphies with any of these taxa without extensive comparative morphological analysis.

Besides, the genus *Mercedula* **gen. nov.** possesses unique characters, such as tegumen with complex apodeme in anterior part consisting of two pairs of longitudinal folds for tegminal and valval muscles; shifted caudally phallic

functional morphological complex, which joined with the other genital part through unique elongated lateral arms of vinculum. Listed characters were not found in any known gelechiid genera.

Without special study it is impossible to determine the function of the dorsal part of the valva. However, this paired structure is similar to the glandiductors in representatives of the genera of the tribes Gelechiini and Litini, which perform the function of supporting the ductus of the glands (or gland, if unpaired, as in *Mirificarma* Gozmány) in genital segment.

As a result of summarising of morphological characters, the described genus *Mercedula* **gen. nov.** should be considered as a deeply specialised taxon related to genera from the tribe Gelechiini, and tentatively placed in the subfamily Gelechiinae.

Acknowledgments

The authors are very grateful to anonymous reviewers for their constructive comments and recommendations on the text of the manuscript. The research was carried out within the state assignment of Ministry of Science and Higher Education of the Russian Federation (themes Nos 124012400285-7 and 124012200183-8).

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