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Description of two new endemic species of the closely related genera, *Glyphodella* and *Chabulina* Shaffer & Munroe, 2007, from Indonesia (Lepidoptera: Crambidae: Spilomelinae)

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Abstract. A study of the genera *Glyphodella* Shaffer & Munroe, 2007 and *Chabulina* Shaffer & Munroe, 2007 was conducted to update their diversity in Indonesia. Two new endemic species from these closely-related genera, *Glyphodella fojaensis*, new species, and *Chabulina celebesensis*, new species, were discovered. *Glyphodella fojaensis*, new species, is the only species of this genus found in Indonesia, while three species of *Chabulina* are present: *C. celebesensis*, new species, *C. onychinalis*, and *C. tenera*. *Glyphodella fojaensis*, new species, can be distinguished from the allied species *G. savyalis* by the presence of a yellow circular spot of the postmedial line at the costa, a small process on the distal expansion of the uncus, and a subtriangular valva. *G. savyalis* also lacks the small process on the distal expansion of uncus, and its valva is subrhomboid, not subtriangular. *Chabulina celebesensis*, new species, can be distinguished from the allied species *C. onychinalis* by simple dark brown basal, medial, postmedial and subterminal lines on the white ground colour of the forewing. The last two oblique lines, the postmedial and subterminal lines, run parallel from the costa toward the dorsum, which are diagnostic characters for this species. *Chabulina celebesensis*, new species, is additionally characterised by a V-shaped vinculum and scattered thorn-like cornuti in the male, and a sinuate signum and calyx shaped ostium bursae in the female. *Chabulina onychinalis* is characterised by a broadly rounded vinculum with a transverse ventral plate expansion, curved spines cornuti in the male, a cone-shaped ostium bursae and a bipartite signum medially bearing tiny denticles in the female. This study enhances our knowledge on species diversity within Spilomelinae, and specifically of the genera *Glyphodella* and *Chabulina* in Indonesia. Images of adults and genitalia are provided for the two new species.

Key words. cornuti, diagnostic characters, genitalia, phallus, valva, vinculum

INTRODUCTION

The genera *Glyphodella* and *Chabulina* were established by Shaffer & Munroe (2007) and were placed in the tribe Margaroniini by Mally et al. (2019). These genera are morphologically similar and can only be easily distinguished through the examination of the genitalia. Based on male genitalia, *Glyphodella* can be differentiated by the presence of a strong sagittal keel on the distal expansion of the uncus (absent in *Chabulina*), a curved clasper (straight in *Chabulina*), and the absence of a sharp angle at the middle of the ventral margin of the valvae (present in *Chabulina*) (Shaffer & Munroe, 2007).

The genus *Glyphodella* was established with *Diastictis savyalis* Legrand, 1965 (type locality: Aldabra Atoll) as the type species. Shaffer & Munroe (2007), in their intensive study, included *Bocchoris flavibrunnea* Hampson, 1899 and *Diastictis vadonalis* Viette, 1958 along with a new combination, *Glyphodella savyalis*, in this genus. All three species were described from the Afro-tropical region, and no species from Indonesia have been described so far (Shaffer & Munroe, 2007).

Similarly, the genus *Chabulina* was established by Shaffer & Munroe in 2007, based on both morphological and genital characters with *Diastictis putrisalis* Viette, 1958 (type locality: Comoro Islands: Grand Comoro) as the type species. It was defined by a complex pattern of white and greyish-brown transverse markings on the wings. Shaffer & Munroe (2007) included three species: two described species (*C. putrisalis* and *C. tenera* Butler, 1883) and one unnamed species from Africa which has been misidentified in collections as being in the genus *Glyphodes*, but is closer to *C. putrisalis*. Further study on *Chabulina* was conducted by Maes (2022), who included ten species from a broader geographic range, most of which are distributed primarily in the Afro-tropical region, with only two species occurring in Indonesia (*C. onychinalis* Guenée, 1854 and *C. tenera*) (Guenée, 1854; Felder & Rogenhofer, 1875; Butler, 1883; Oberthür, 1887; Hampson, 1912; de Joannis, 1927, 1932; Klima, 1939; Meyrick, 1939; Viette, 1958; Shaffer & Munroe, 2007; Maes, 2022; Nuss et al., 2023). The last description

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of a new *Chabulina* species was published by Butler in 1883, and since then, no new species from Sulawesi have been described.

To investigate the diversity of the genera *Glyphodella* and *Chabulina*, field studies were conducted in Sulawesi and Papua from 2002–2017. The results of this study aim to enhance existing knowledge of Indonesian moth diversity, especially within the genera *Glyphodella* and *Chabulina*.

MATERIAL AND METHODS

Materials for this study were collected using a mercury light trap with two lamps of 120 watts at several locations from Sulawesi (Mt. Kaluppini, Sigi, Central Sulawesi Tinukari; Wawo, North Kolaka, South-East Sulawesi; Boganinani Wartabone National Park, North Sulawesi) and Papua (Mount Foja, Mamberamo Raya, Kwerba) Indonesia from 2002–2017 and old specimens collected from Sumatra (Mangol, Bangka). All study materials were deposited in the Museum Zoologicum Bogoriense (MZB), Bogor, Indonesia.

Morphological characters were observed under a dissecting microscope, Leica Z6 APO with Leica DMC5400 camera mounted. The genitalia were prepared according to Robinson (1976) and Maes (1995). The terminology of general morphology follows Zimmerman (1958), Munroe (1976), and Maes (1995), wing pattern terminology follows Maes (1995); and genitalia terminology follows Tuxen (1970) and Maes (1995).

The labels for the holotype *Glyphodella fojaensis*, new species and *Chabulin*a *celebesensis*, new species, were written in the following order: number of specimens and sex (depository catalogue number if available), locality, collector's name preceded by "Coll.", date of collection. Specimen lots are to be separated by semi-colons. Locality information was recorded using GPS coordinates.

Specimens of *Chabulina onychinalis* (Guenée, 1854) used for comparative study include: 1 male (MZB.Lepi.53163), Indonesia, North Sulawesi, Boganinani Wartabone National Park (N.P.), Dumoga Timur, Mainakum, 0°41′57″ S 124°05′30″ E, Coll. Suwito, A. & Cholik, E., 25 May 2002; 4 males (MZB.Lepi.53164–53167), Indonesia, North Sulawesi, Boganinani Wartabone N.P., Dumoga Timur, Mainakum, 0°41′57″ S 124°05′30″ E, Coll. Suwito, A. & Cholik, E., 25 May 2002; 1 female (MZB.Lepi. 53168 (genitalia slide no.692)), Indonesia, Bangka, Mangol 20–100 m, Coll. A. J. Kostermans, 6 October 1949.

TAXONOMY

Family Crambidae Latreille, 1810

Genus *Glyphodella* Shaffer & Munroe, 2007

Type species: *Diastictis savyalis* Legrand, 1965

Glyphodella fojaensis, new species

(Fig. 1A; Figs. 2A–C)

Material examined. Holotype: male (MZB.Lepi.53157 (genitalia slide no.686)), Indonesia, Papua, Mamberamo Raya, Kwerba, Mount Foja, 02°42′2″ S 138° 25′02″ E; Coll. Sutrisno H, 11 November 2008.

Diagnosis. Externally, *Glyphodella fojaensis*, new species shares superficial similarities in adult wing pattern and colouration with *Chabulina onychinalis* (Figs. 1A & 1D). *Glyphodella fojaensis*, new species, is characterised by a circular yellow spot at the costa of the postmedial line on the white ground colour of the forewing (Fig. 1A; see arrows) whereas in *C. onychinalis* the yellow spot is diagnostically triangular-shaped. Additionally, the male genitalia of *Glyphodella fojaensis*, new species, exhibit key diagnostic features that align more closely with the genus *Glyphodella* as defined by Shaffer & Munroe (2007). Specifically, the presence of a strong sagittal keel on the distal expansion of the uncus is a defining character of *Glyphodella*, and is absent in *Chabulina*. Within *Glyphodella,* the male genitalia of *G. fojaensis*, new species, can be distinguished from the allied species *G. savyalis* by the shape of the valva and the distal expansion of the uncus. The subtriangular valva without lamellar scales along the costa and a small process on the distal expansion of the uncus are the diagnostic characters of *G. fojaensis* (Figs. 2A–C; see black arrows). In contrast, the subrhomboid valva with lamellar scales and the distal expansion without a small process, set at 90° to the basal stem of the uncus, are the diagnostic characters of *G. savyalis* (Shaffer & Munroe, 2007: Fig. 179).

Description. Male (Fig. 1A): Forewing length 6 mm. Frons oblique, shabby white; vertex white. Labial palpus subascending with the first segment covered by white yellowish scales from basal to medial and black scales at tip, the second joint broadly scaled in front, covered by light yellow scales from basal up to medial and black scales at tip, the third segment, very short (less than ⅓ of second segment), white scales. Maxillary palpus prominent, triangularly dilated with white scales at tip. Proboscis light brown, scaled at basal, well-developed. Antennae filiform, extends to approximately ⅔ forewing length. Thorax white at dorsal and brown at ventral part, patagia and tegula white. Legs light brown, epiphysis covered with black scales, inner spur of mid-tibia less than ½ outer spur. Forewings subtriangular, costa straight in basal ⅔ and curved in distal third, wide medial band with complex structure medially running from mid-costa towards mid-dorsum, subterminal line inwardly oblique towards mid- postmedial line. Postmedial line with a yellow spot at costa, running from costa toward ¾ dorsum, termen with snow white fringe from R_3 to R_4, dark brown fringe from R_4 to M_3, and yellowish-white fringe from CuP to just near tornus (Fig. 1A). Hindwing with curved dark brown medial, postmedial and subterminal lines on shabby white ground colour (Fig. 1A).

Male genitalia (Figs. 2A–C): Uncus narrow, tubelike-stem, strongly curved medially; distal expansion well sclerotised,

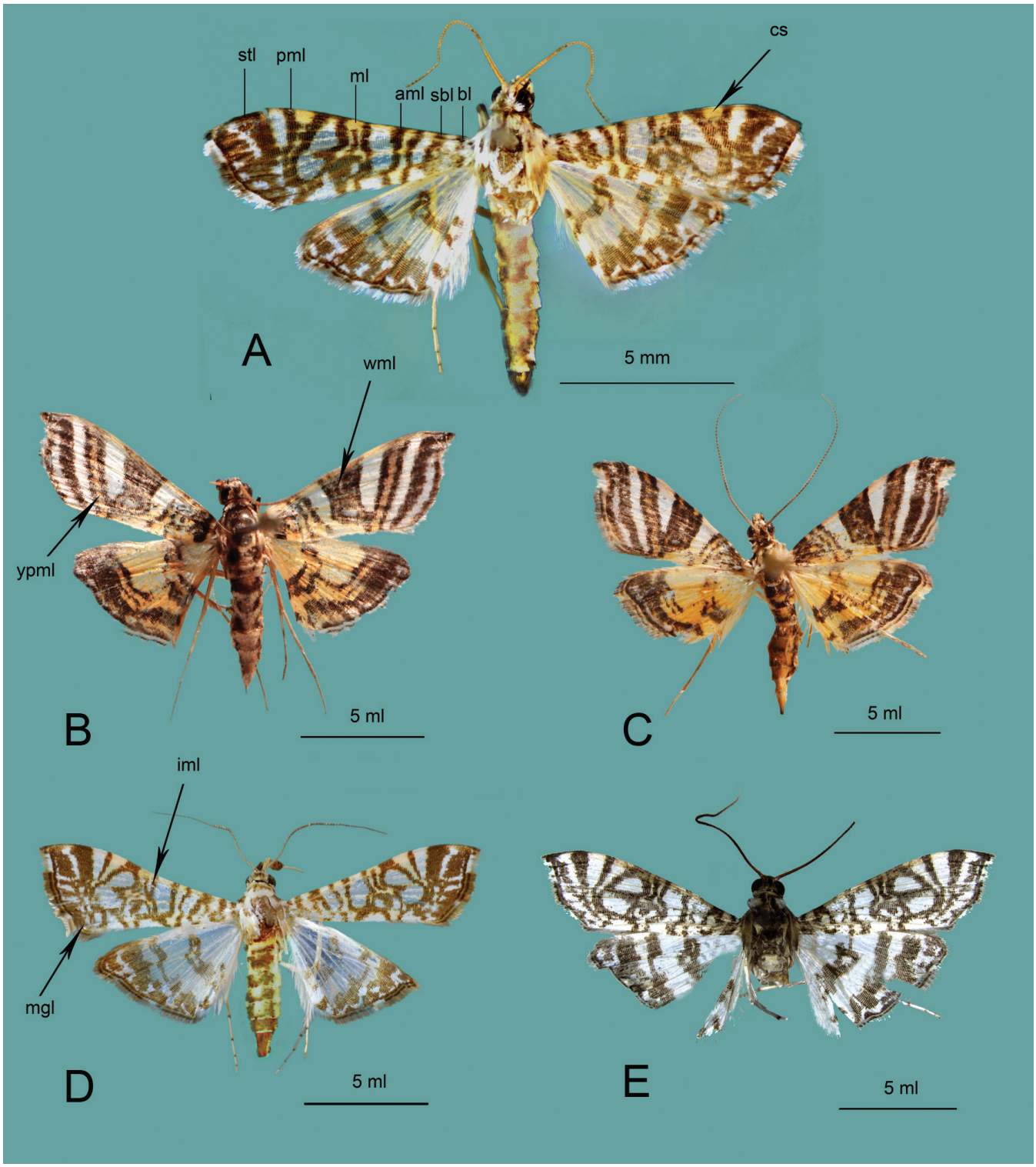

Fig. 1. A, *Glyphodella fojaensis*, new species, holotype male (MZB. Lepi.53157), Papua; B, C, *Chabulina celebesensis* new species: holotype male (MZB. Lepi.53158), Central Sulawesi (B); paratype female, Southeast Sulawesi (C); D, E, *C. onychinalis*, male (MZB. Lepi 53159) (D); female (MZB. Lepi.53168) (E). Abreviations: aml= antemedial line bl= basal line, cs= circular spot, iml= irregular medial line, mgl= marginal line, pml= postmedial line, stl= subterminal line, ypml= yellow postmedial line, wml= wide medial line. Black arrows indicate diagnostic characters.

angled 45° to basal stem, tapering apically, ventral surface smooth, with a small process apically on the strong sagittal keel. Gnathos absent. Transtilla complete. Subscaphium narrow, well sclerotised. Juxta subquadrate, light sclerotised. Valva simple, distal half subtriangular-shaped with a sharp angle margin medially, costa inflated, slightly sclerotised without lamellar scales; fibula straight outwardly, pointed apically (Fig. 2A). Phallus dorsally irregular, well sclerotised, membranous elsewhere; vesica with cluster of dozens of claw-like cornuti (Figs. 2B, C).

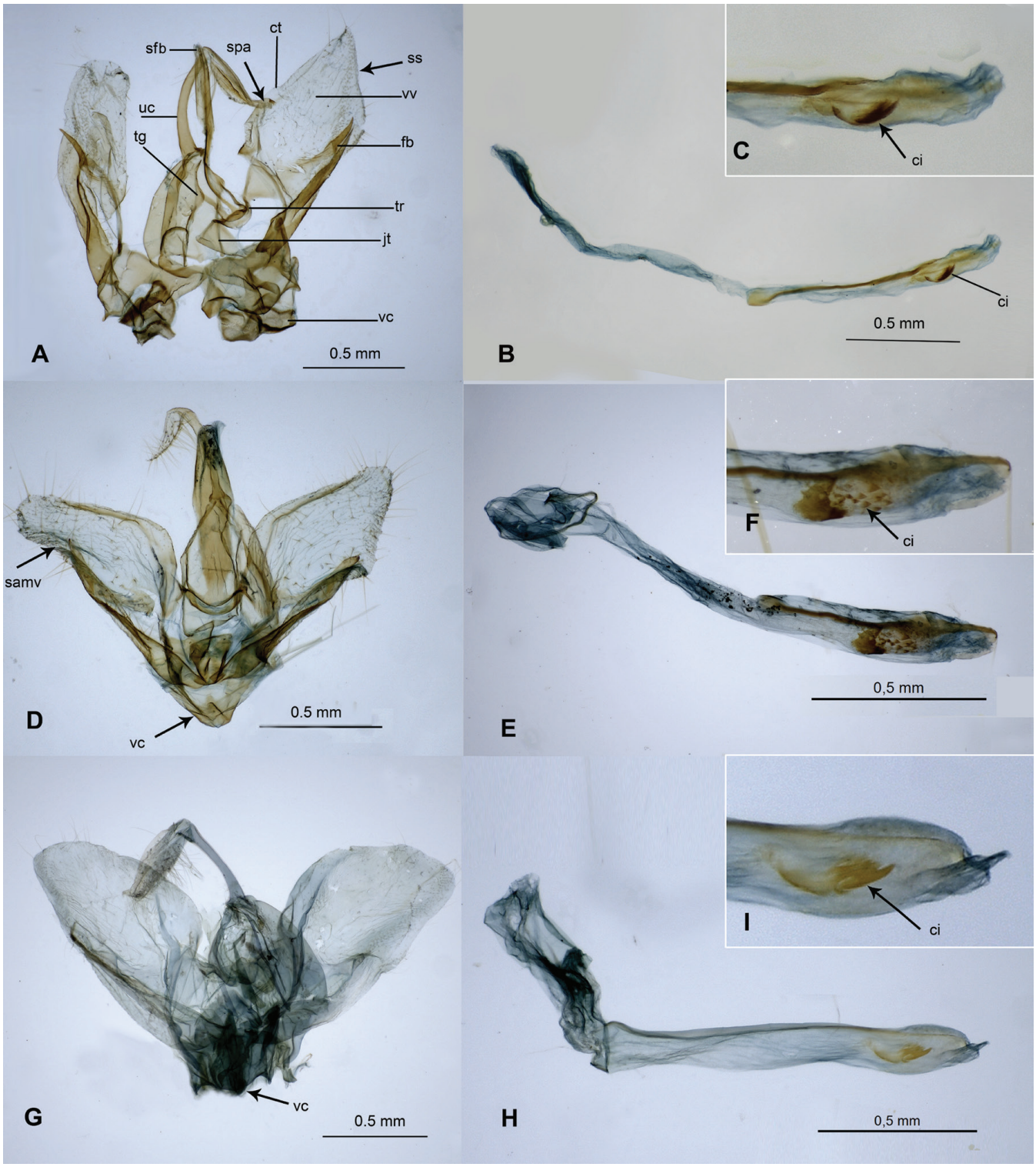

Fig. 2. Male genitalia. A–C, *Glyphodella fojaensis*, new species: complete genitalia (slide no. 686) (A); phallus (B).; cornuti (C); D–F, *C. celebesensis*, new species: complete genitalia (slide no. 684); (D); phallus (E); cornuti (E); G–I, *C. onychinalis*: complete genitalia (G); phallus (H); cornuti (I). Abreviations: cornuti, ct= costa, fb= fibula, jt= juxta, samv= sharp angle margin valve, sc= saccus, sfb=straight of fibula, spa= small process apically, ss= subtriangular-shaped, tg= tegumen, tr= transtila, uc= uncus, vc= vinculum, vv= valva. Black arrows indicate diagnostic characters.

Etymology. The specific name *fojaensis* is derived from the type locality. This new species is endemic to Papua. An adjective in the nominative singular.

Distribution. Foja Mountain, Papua (Fig. 4).

Remark: The adults are nocturnal and they are found in the primary tropical forest of the Mamberamo basin of Foja Mountain, Papua.

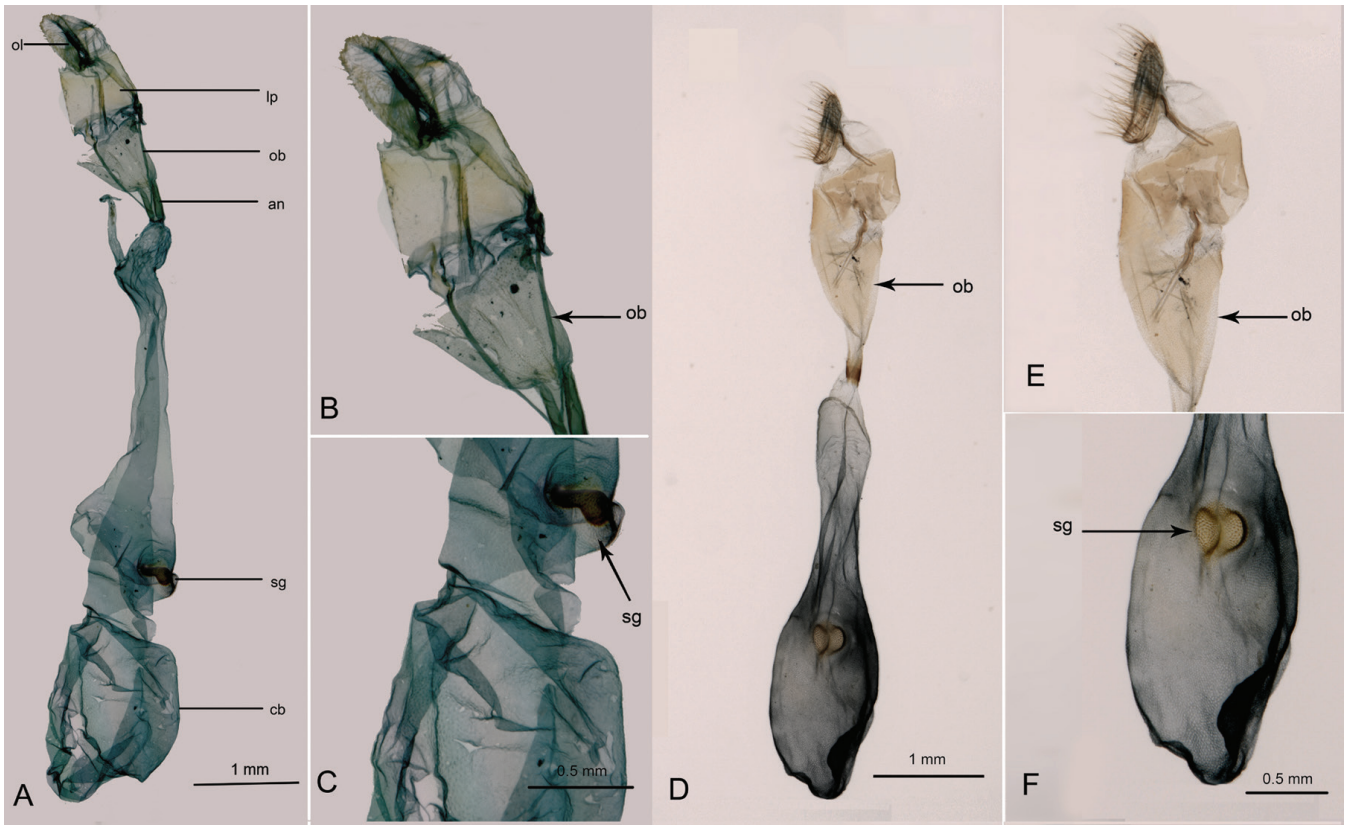

Fig. 3. Female genitalia. A–C, *C. celebesensis*, new species: complete genitalia (A); ostium bursae (B); signum (C); D–F, *C. onychinalis*: complete genitalia (slide no. 692) (D); ostium bursae (E); signum (F). Abbreviations, an= antrum, cb= corpus bursae, lp= lamella postvaginalis, ob= ostium bursae, ol= ovipositor lobe, sg= signum. Black arrows indicate diagnostic characters.

Genus *Chabulina* Shaffer & Munroe, 2007

Type species: *Diastictis putrisalis* Viette, 1958

***Chabulina celebesensis*, new species**
(Figs. 1B–C; Figs. 2D–F; Figs. 3A–B)

Material examined. Holotype: male (MZB.Lepi.53158 (genitalia slide no.684)); Indonesia, Central Sulawesi, Sigi, Kulawi, Sadaunta, Mount Kaluppini, 01°24′10.2″ S 119°56′39.8″ E, Coll. Darmawan, Lupiyaningdyah P, Sarino, 23 September 2017.

Paratypes: 1 female (MZB.Lepi.53159 (genitalia slide no.677)); Indonesia, Southeast Sulawesi, North Kolaka, Wawo, Tinukari. 03°38′39″ S 121°07′33.2″ E, Coll. Ubaidillah R, Kimsey B, Nugroho H, Lupiyaningdyah P, Darmawan, 23 November 2010; 1 male (MZB.Lepi.53160); Indonesia, Southeast Sulawesi, North Kolaka, Wawo, Tinukari, 03°64′46.1″ S 121°09′85.9″ E, Coll. Ubaidillah R, Kimsey B, Nugroho H, Lupiyaningdyah P, Darmawan, MZB, 30 November 2010; 2 males (MZB.Lepi.53161 and MZB.Lepi.53162), Indonesia, North Sulawesi, Boganinani, Wartabone National Park, Dumoga Timur, Mainakum, 0°41′57″ S 124°05 ′30″ E, Coll. Awit S & Cholik E, 25 May 2002.

Diagnosis. *Chabulina celebesensis*, new species, can easily be distinguished from the allied species, *C. onychinalis* by the curved basal and antemedial lines running outwardly from the costa towards the dorsum, a wide medial line with a complex structure running medially from the mid-costa outwardly towards CuP, and subterminal line running inwardly from the costa towards ¾ dorsum on the white ground colour of the forewing (Figs. 1B–C; see black arrows). Other diagnostic characters of the genitalia include a V-shaped vinculum and scattered small thorn-like cornuti in the male (Figs. 2D–F; see black arrows), and a sinuate signum and calyx shaped ostium bursae in the female (Figs. 3A–B; see black arrow). The diagnostic characters of *C. onychinalis* include an irregular medial line running from the mid-costa outwardly towards the mid-dorsum, and a marginal line running from the apex inwardly towards the tornus on the white ground colour of the forewing (Figs. 1D–E). Additionally, *C. onychinalis* is characterised by a broadly rounded vinculum with a transverse ventral plate expansion, aligned spines cornuti in the male (Figs. 2G–I; see black arrows), the ovate bipartite signum, medially bearing tiny denticles, and a cone shaped ostium bursae in the female (Figs. 3D–F; see black arrows).

Description. Male (Fig. 1B) Forewing length 7 mm. Frons oblique, shabby white; vertex black. Labial palpus subascending with first segment covered by snow white scales from basal to medial and black scales at tip, the second joint broadly scaled in front, covered by yellow scales at basal, black at medial and white scales at tip, the third porrect and lying on white scales of the second joint. Maxillary palpus prominent, tri-angularly dilated with white scales at tip. Proboscis yellowish-white, scaled at basal, well-

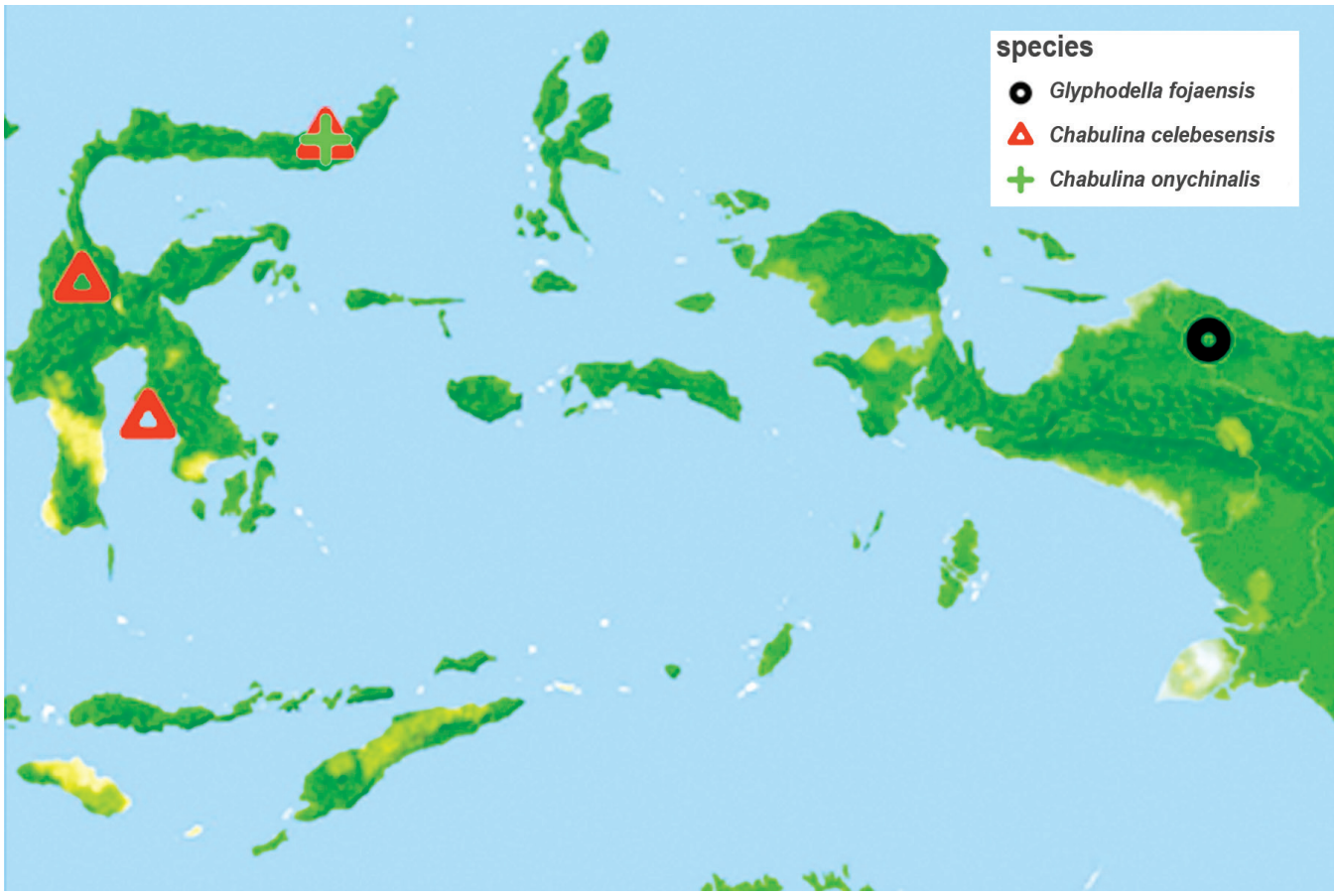

Fig. 4. Distribution of *Glyphodella fojaensis*, new species (black circle), *Chabulina celebesensis*, new species (red triangle), and *C. onychinalis* (green plus sign) in Indonesia.

developed. Antennae filiform, extends to approximately ⅔ forewing length, dorsal surface covered with a longitudinal row of brown scales, and ventral surface has very short cilia (less than ¼ diameter of flagellum). Thorax brown at dorsal and white at ventral part, patagia and tegula dark brown at medial. Legs light brown, epiphysis covered with black scales, inner spur of mid-tibia less than ½ outer spur. Forewings subtriangular, with costa straight in basal ⅔ and curved in distal third, wide medial band with complex structure medially running from mid-costa outwardly oblique towards CuP, never reach mid-dorsum, subterminal line inwardly oblique towards ¾ dorsum, termen with snow white fringe from R_3 to R_4, brown fringe from R_4 to M_2, and yellowish-white fringe from M_2 to tornus. Hindwing ground colour yellow, with curved dark brown subdorsal medial and postmedial lines that are conjoined, and a distinct subterminal line. (Fig. 1B).

Male genitalia (Figs. 2D–F): Tegumen subtriangular, subscaphium slightly sclerotised; uncus unsclerotised, slightly curved medially with distal expansion set at 90° to uncus stem, valva simple with a sharp angle margin (samv) medially, costa inflated, tapering distally; fibula short, curved outwardly, pointed apically; juxta weakly sclerotised; vinculum simple, V-shaped (Fig. 2D). Phallus with scattered thorn cornuti (Figs. 2E–F).

Female (Fig. 1C): Similar to male, except abdomen without anal tuft hair.

Female genitalia (Figs. 3A–B). Ovipositor lobe ovate with scattered faint setae**;** lamella postvaginalis moderate sclerotised; length of anterior apophyses almost double of posterior apophyses; antrum short (less than ⅓ anterior apophyses); ductus bursae membranous and short (as long as diameter of corpus bursae); ostium bursae calyx shaped, corpus bursae with a sinuate signum (Figs. 3A–B).

Etymology. The specific name *celebesensis* is derived from the type locality. This new species is endemic to Celebes (= Sulawesi). An adjective in the nominative singular.

Distribution. Southeast Sulawesi, Central Sulawesi and North Sulawesi (Fig. 4).

Remark: The adults are nocturnal and they are found in the tropical secondary forest of Sulawesi.

DISCUSSION

The two new species described here, belonging to two closely related genera, contribute to a growing understanding of the biodiversity and evolutionary relationships of Spilomelinae moths in Indonesia (Watung et al., 2023). This finding also increases the known species within these genera. Both new species were identified by mainly morphological characters of the male genitalia and wing colour pattern.

In *G. fojaensis*, new species, two diagnostic characters that separate it from *Chabulina* are present: the sagittal keel and the absence of a sharp angle at the ventral margin of the valve. The distal expansion of the uncus in this species is positioned at a 45° angle to the basal stem and features a small apical process. In contrast, in *G. savyalis*, the expansion is oriented at a 90° angle to the basal stem and lacks any distal process (Shaffer & Munroe, 2007). This variation in the orientation and structure of the distal expansion of the uncus stem suggests morphological diversity within the genus *Glyphodella*.

We propose *C. celebesensis*, new species, as new to science based on comparisons with the original description of *C. tenera* and the male genitalia of the allied species *G. savyalis*. While *C. tenera* has been reported in Sulawesi, its original description from 1883 is minimal, based solely on wing patterns, and lacks genitalia details. Our study shows that *C. celebesensis*, new species, differs from *C. tenera* in lacking the black spot at the end of the forewing discal cell and in having a golden-yellow hindwing with curved medial, postmedial, and subterminal lines. These features are not mentioned in the description of *C. tenera.*

Chabulina celebesensis, new species, is also clearly distinct from *C. onychinalis* in both wing pattern and genitalia. In *C. celebesensis*, new species, the forewing has basal, medial, and subterminal line on the white ground colour, while the hindwing has medial, postmedial conjoined subdorsally and a distinct subterminal lines on the golden-yellow ground colour. In contrast, *C. onychinalis* has an irregular medial line, a white reniform window between the complex medial and the postmedial and different male genitalia, specifically, a broadly rounded vinculum and the cornuti are scattered thorn-like spines. The postmedial reniform can have variation where it is separated by a black dash in the middle creating two white patches (Fig.1 E). The female genitalia also differ: *C. celebesensis*, new species, has a sinuate signum in the corpus bursae, whereas *C. onychinalis* has a bipartite signum with tiny medial denticles (Maes, 2022). These differences in wing pattern and genitalia highlight the morphological diversity within the genus *Chabulina*.

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