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Description of two new species in the genus *Glyphodes* Guenée from Indonesia (Lepidoptera: Crambidae, Spilomelinae)

JACKSON F. WATUNG[1], DARMAWAN DARMAWAN[2,3], AWIT SUWITO[2,4], RADEN PRAMESA NARAKUSUMO[2,5], HARI NUGROHO[2,6], ENCILIA ENCILIA[2,7], AGMAL QODRI[2,8], DJUNIJANTI PEGGIE[2,9], ROSICHON UBAIDILLAH[2,10] & HARI SUTRISNO[2,11*]

[1]*Faculty of Agriculture, Sam Ratulangi University, Manado, 95115, Indonesia*
jacksonwatung@gmail.com; https://orcid.org/0000-0002-7753-5869
[2]*Museum Zoologicum Bogoriense, Research Center for Biosystematics and Evolution, National Research and Innovation Agency, Jl. Raya Jakarta-Bogor Km 46, Cibinong 16911, Indonesia*
[3] *darmawan.ento@gmail.com; https://orcid.org/0009-0004-3777-4891*
[4] *awitswt@yahoo.com; https://orcid.org/0000-0003-2600-2488*
[5] *pramesa.narakusumo@gmail.com; https://orcid.org/0000-0002-3087-61724*
[6] *hntawon@gmail.com; https://orcid.org/0000-0002-7985-2825*
[7] *encilia27@gmail.com; https://orcid.org/0000-0001-6780-7456*
[8] *agmal.qodri@yahoo.co.id; https://orcid.org/0000-0003-4569-5259*
[9] *peggie94@yahoo.com; https://orcid.org/0000-0002-2718-1281*
[10] *r.ubaidillah@gmail.com; https://orcid.org/0000-0002-0385-3629*
[11] *sutrisnohari@yahoo.com; https://orcid.org/0000-003-4108-4354*
[*]*Corresponding author*

Abstract

Two new species of *Glyphodes* Guenée, 1854 from Indonesia are proposed as new to science, namely *G. nurfitriae* **sp. nov.** and *G. ahsanae* **sp. nov**. The total number of recorded *Glyphodes* for Indonesia is 48 at present. Images of adults and genitalia are provided for both new species.

Key words: *Agrioglypta*, *Chabulina*, diversity, genitalia, moth, morphology, Papua, Sulawesi

Introduction

The genus *Glyphodes* Guenée, 1854 was established with the type species *Glyphodes stolalis* Guenée, 1854 from India and comprises a diverse array of species that are widely distributed throughout tropical regions, including subtropical to warmer temperate zones. This genus is estimated to include approximately 154 species distributed across tropical and subtropical areas (Common 1990; Robinson *et al*. 1994; Shaffer *et al.* 1996). A total of 46 species inhabit Indonesia based on the literature (Clerck 1764; Swainson 1821; Guenée 1854; Walker 1859, 1866; Lederer 1863; Snellen 1880, 1895, 1899, 1901; Butler 1882; Meyrick 1889; Hampson 1896, 1898, 1899, 1912, 1918; Druce 1902; Kenrick 1907, 1912; Rothschild 1915; Turner 1922; Janse 1928; Munroe 1959, 1960, 1976; Nuss *et al*. 2003–2023).

The most recent publication on new *Glyphodes* species dated back to Munroe (1960), providing descriptions primarily from Papua and Sulawesi, and no further species have been described from this region since. The diagnostic characters of *Glyphodes* have primarily relied on external morphological characters, such as (i) the labial palpi upturned, (ii) the 2nd segment broadly scaled in front, (iii) the 3rd segment porrect and lying above scales of the 2nd segment, (iv) maxillary palpi triangularly dilated with scales, (v) the inner spur of the mid-tibia always less than half the length of the outer spur, and (vi) the male abdomen features an anal scale tuft (Guenée 1854). However, these characters have led to the recognition that this genus is a paraphyletic group, encompassing taxa like *Agrioglypta* Meyrick, 1932 and *Talanga* Moore, 1885 (Sutrisno 2002, 2003; Sutrisno *et al*. 2006). Recent studies by Mally *et al*. (2019) and Matsui *et al*. (2022) further accept the paraphyletic nature of *Glyphodes*.

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Moreover, *Glyphodes* can be categorized into three groups, each defined by specific morphological characteristics (Sutrisno 2002). *Glyphodes* group 1 comprises *G. multilinealis* Kenrick, 1907, *G. pulverulentalis* Hansen, 1896, *G. cosmarcha* Meyrick, 1887, and *G. caesalis* Walker, 1859. They can be recognized by: (i) tegumen broadly rounded, sharply invaginated at apex, (ii) juxta narrow, curved anteriorly in dorsal half, with lateral extension at base and dorsal single road-like medial processed with their tips curved ventrally, and (iii) medial plate valva connected to base of fibula. The *Glyphodes* group 2 encompasses species such as *G. onychinalis* Guenée, 1854, *G. conjunctalis* Walker, 1866, *G. bicolor* Swainson, 1821, *G. microta* Meyrick, 1889, *G. flavizonalis* Hampson, 1898, and *G. apiospila* (Turner, 1922). *Glyphodes onychinalis* has undergone reassignment to the genus *Chabulina* Shaffer & Munroe, 2007 (Maes 2022). This group has been defined based on the light sclerotization of the base of tuba analis, U- or V-shaped. Finally, *Glyphodes* group 3 is defined by: (i) distal end of male patagia with a well-developed brush-like extension, (ii) uncus tip forming a large globose head with a series of thorn-like spines at apex, and (iii) signum rounded or ovate with pointed denticles. The three species within group 3 are *G. conjunctalis* Walker, 1866, *G. doleschalii* Lederer, 1863, and *G. bivitralis* Guenée, 1854 (Sutrisno 2002).

This research aims to enhance previous knowledge of Indonesian moth diversity, with particular focus on describing two new species that align with species of *Glyphodes* group 1 *sensu* Sutrisno (2002), especially on the genitalia characteristics.

Materials and methods

Most of the examined material was collected using a light trap at various locations in Java, Sulawesi, and Papua during 2000–2012 and all are deposited in the Museum Zoologicum Bogoriense (MZB), Bogor, Indonesia. Additional material was examined at the Naturalis Biodiversity Center (RMNH), Leiden, The Netherlands.

Morphological characters were observed under a stereo microscope. The genitalia dissections were prepared following the techniques outlined by Robinson (1976) and Maes (1995). In addition, the terminology for genitalia is consistent with Zimmerman (1958), Tuxen (1970), Munroe (1976), and Maes (1995).

The labels of the holotypes are given verbatim, in quotation marks, and are separated by a forward slash ("/").

Other species used for comparison is: *Glyphodes stolalis*, 1 ♂ 1♀, Papua, Membaramo Raya, Kwerba, Mt. Foja, S 02°142′2″ E 138°43′02″, 11.XI.2008, leg. Hari Sutrisno (MZB. Lepi. 715 & 716), MZB.

Checklist of *Glyphodes* species in Indonesia based on Pyraloid Database Online (Nuss *et al.* 2003–2023) with the two new species included

G. actorionalis Walker, 1859
G. agathalis (Walker, 1859)
G. ahsanae Sutrisno **sp. nov.**
G. anomala Janse, 1928
G. apiospila (Turner, 1922)
G. argyritis Hampson, 1912
G. aurantivittalis Munroe, 1960
G. badialis (Walker, 1859)
G. bicolor (Swainson, 1821)
G. bilunalis (Snellen, 1895)
G. bivitralis Guenée, 1854
G. bocchorialis Hampson 1912
G. caeruleiceps Hampson, 1912
G. caesalis Walker, 1859
G. canthusalis Walker, 1859.
G. chalcicraspis Hampson, 1912
G. chlorophylalis Hampson, 1912
G. conjunctalis Walker, 1866

G. doleschalii Lederer, 1863
G. eurygania Druce, 1902
G. flavizonalis Hampson, 1899
G. iridescens Rothschild, 1915
G. kunupialis Janse, 1928
G. lachesis Butler, 1882
G. magnificalis Kenrick, 1912
G. margaritaria (Clerck, 1764)
G. metastictalis Hampson, 1899
G. microta Meyrick, 1889
G. militaris Munroe, 1976
G. multilinealis Kenrick, 1907
G. nurfitriae Sutrisno **sp. nov.**
G. obscura Munroe, 1959
G. orbiferalis Hampson, 1896
G. pandectalis Snellen, 1895
G. perspicualis Kenrick, 1907
G. polystrigalis (Hampson, 1918)
G. principalis Walker, 1866
G. proximalis Snellen, 1899
G. pseudocaesalis Kenrick, 1912
G. pulverulentalis Hampson, 1896
G. pyloalis Walker, 1959
G. rotundalis Snellen, 1901
G. serenalis Snellen, 1880
G. stolalis Guenée, 1854
G. streptostigma Hampson, 1899
G. terealis Walker, 1859
G. umbria Hampson, 1898
G. vagilinea Hampson, 1912

Descriptions of new species

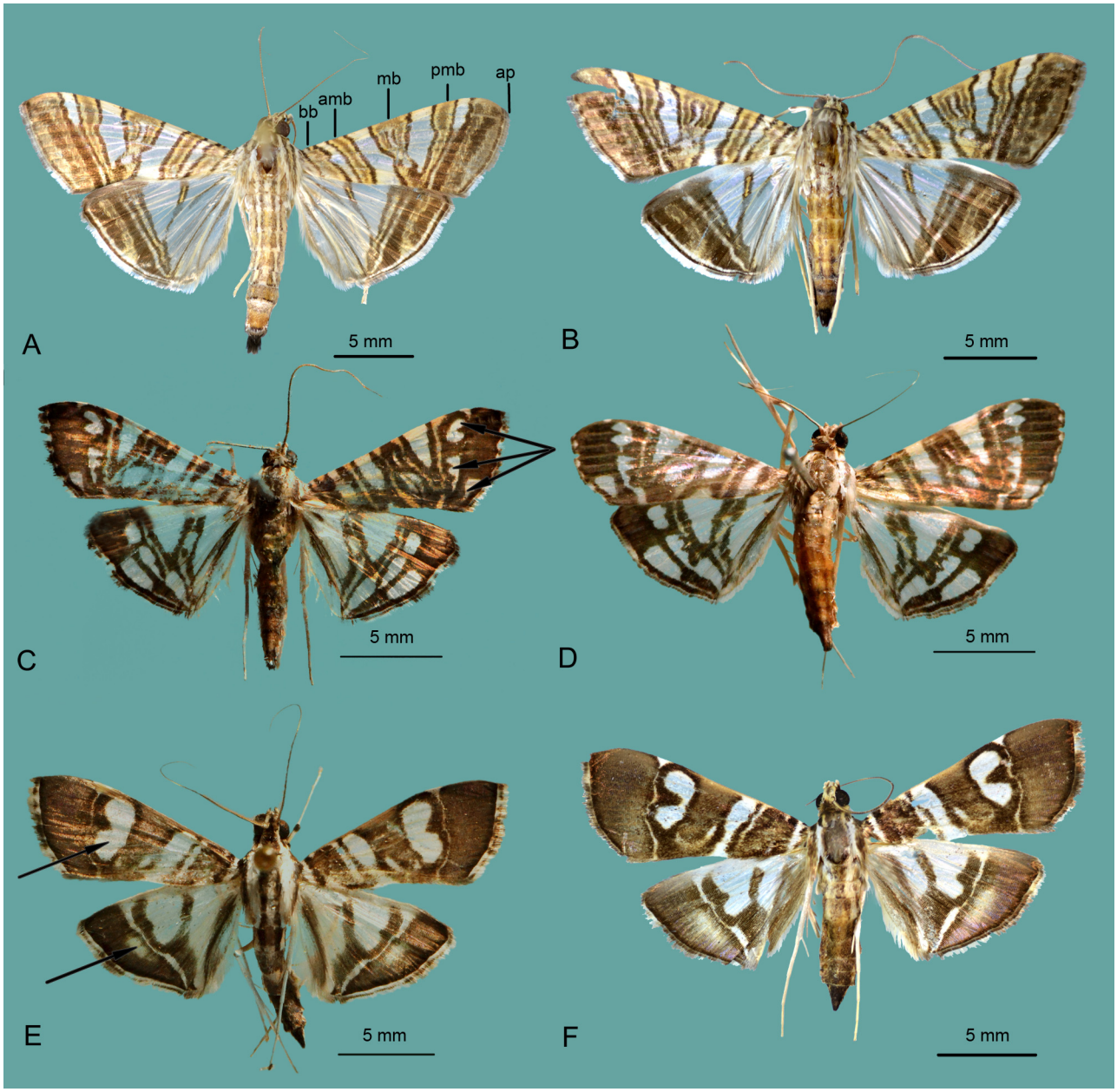
Glyphodes nurfitriae Sutrisno sp. nov.

(Figs 1C–D, 2C–D, 3D–F)

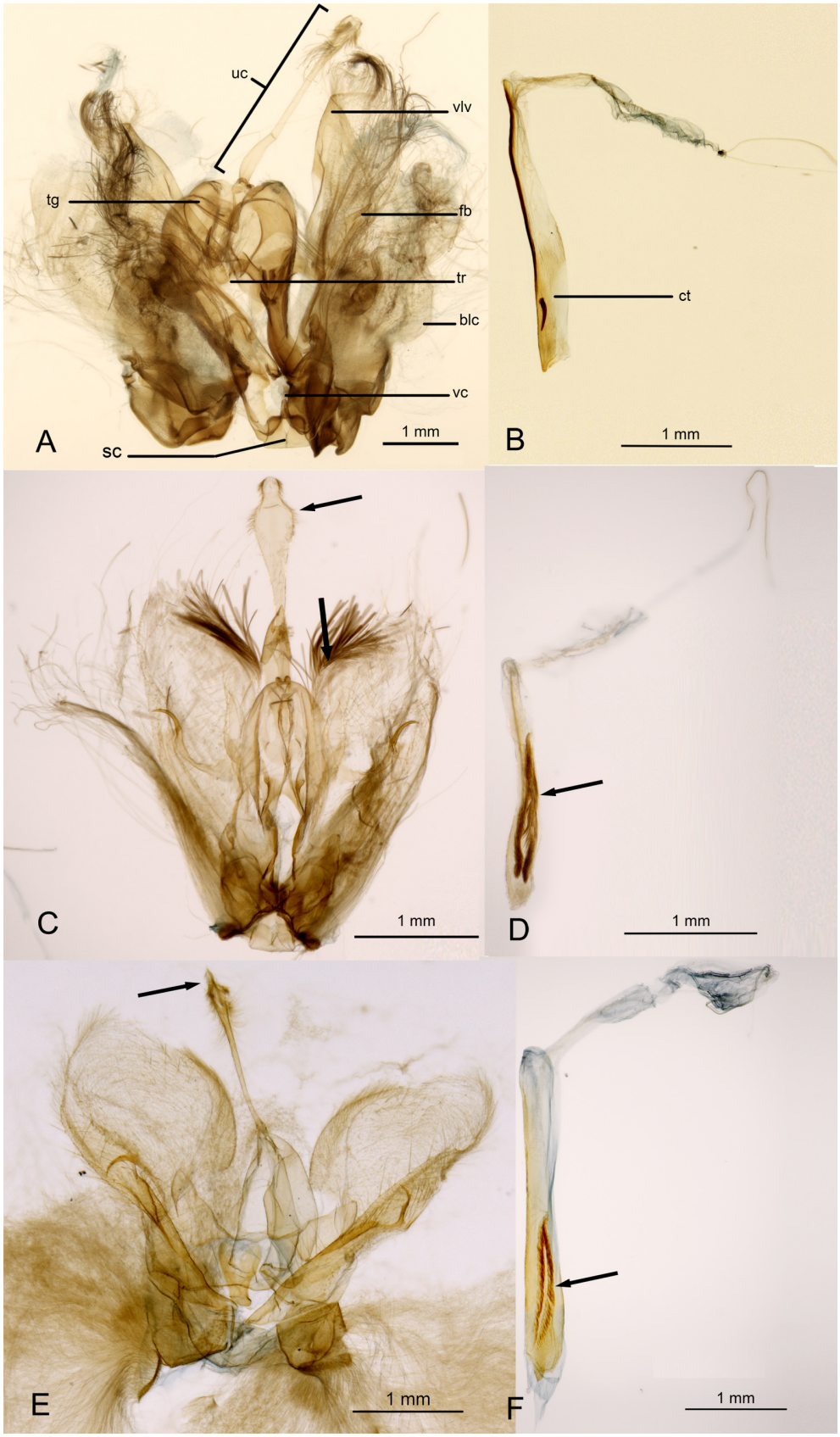
Diagnosis. *Glyphodes nurfitriae* **sp. nov.** is easily distinguished from the most similar species *G. stolalis* by the white reniform and denticulate markings on the postmedial band, the white spot at the posterior margin of the forewing near tornus, and three large white spots in various sizes and shapes on the postmedial band of the hindwing (Figs 1A—D; see arrows). In the male genitalia, the simple uncus dilated subapically (about 3x wider), the simple costa of valva bearing lamellar scales medially and the phallus with a thorn cornutus (Figs 2C–D; see arrows) differ from *G. stolalis*. In the latter, the uncus is slightly dilated subapically (about 1,5x wider), the lamellar scales are absent on the costa and the length of the cornutus is about 1/10 of its total length (Figs 2A–B). In the female genitalia, the globose corpus bursae without a diverticulum and the narrower labial postvaginalis glabrous (Figs 3D–F) differ from *G. stolalis*. In the latter, the globose corpus bursae bear a diverticulum and the labial postvaginalis is wider with scattered setae (Figs 3A–C).

Description. ***Male*** **(Fig. 1C):** Forewing length 9–10 mm. Frons oblique, white; vertex shabby white. Labial palpus sub-ascending with first segment covered by snow white scales from basal to medial and black scales at tip, second segment broadly scaled in front, third segment porrect and embedded in white scales of second segment. Maxillary palpus prominent, triangularly dilated with snow white scales at tip. Proboscis well-developed, white, scaled at base. Antennae filiform, extend to approximately full forewing length, dorsal surface covered with

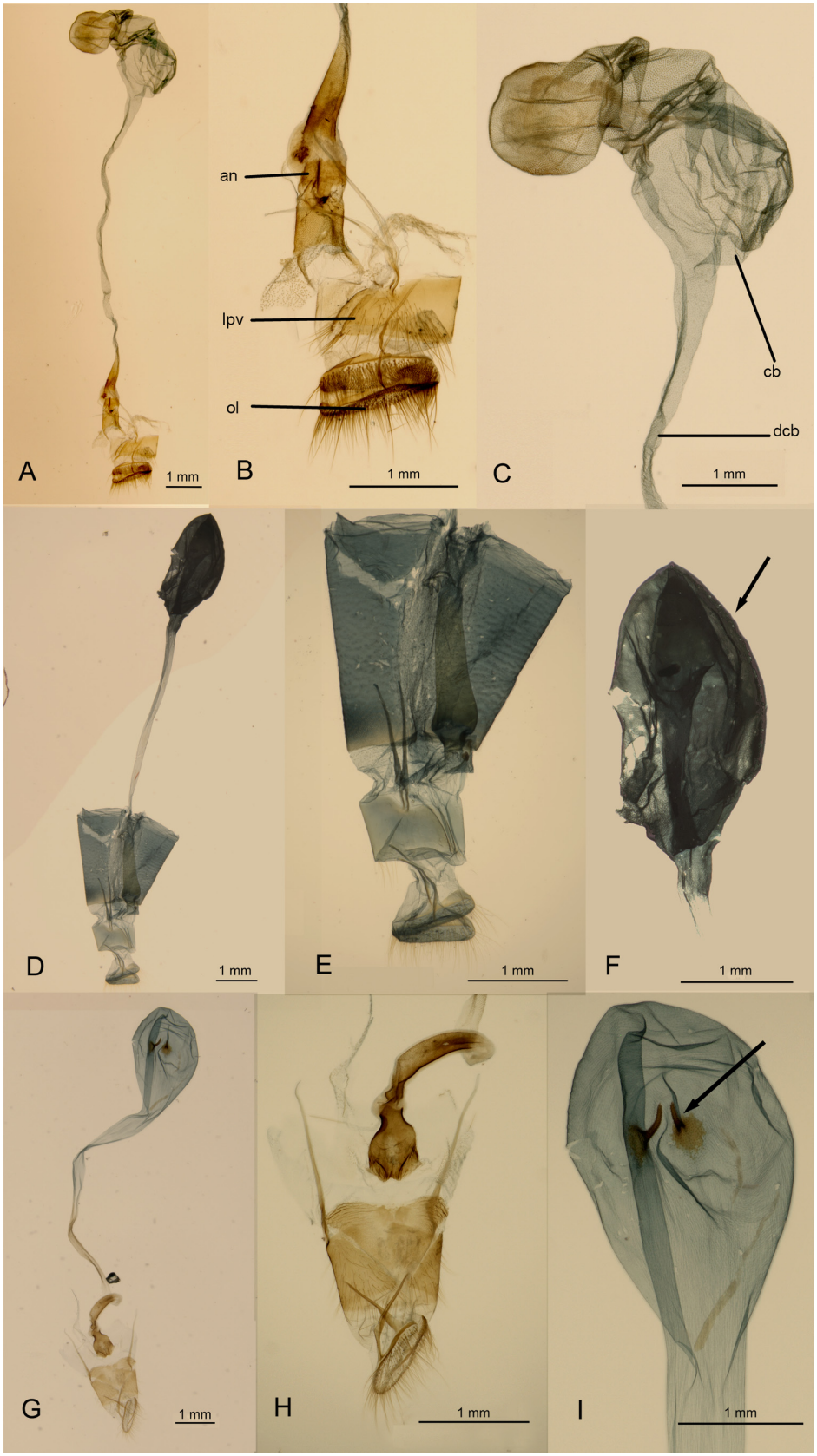
longitudinal row of brown scales, ventral surface with long grey cilia (almost twice of diameter of flagellum). Thorax dorsally brown and ventrally white, patagia dark brown, tegulae white, dark brown at middle. Legs brownish white, epiphysis covered with brownish white scales, inner spur of mid-tibia less than half length of outer spur. Forewing subtriangular, costa straight in basal 2/3 and curved in distal third, basal and antemedial band obliquely (45°) running outward from costa to dorsum, wide medial band with complex structure medially running from mid-costa obliquely outward to 3/4 of dorsum, postmedial band with white, reniform and denticulate markings, posterior margin with white spot, termen with alternate white and black fringes. Hindwing with three large white spots in various sizes and shapes at postmedial band and oblong, white spot at margin. Abdomen brown, slender with anal black scale tuft.



FIGURES 1A–F. (**A**) *Glyphodes stolalis* ♂ (MZB. Lepi. 715), (**B**) *G. stolalis* ♀ (MZB. Lepi. 716), (**C**) *G. nurfitriae* **sp. nov.** ♂ (holotype; MZB. Lepi. 687.01) **(D**) *G. nurfitriae* **sp. nov.** ♀ (paratype; MZB. Lepi. 678.01) (**E**) *G. ahsanae* **sp. nov.** ♂ (holotype; MZB. Lepi. 682.01), (**F**) *G. ahsanae* **sp. nov.** ♀ (paratype; MZB. Lepi. 713.01). Abbreviations, amb= antemedial band, ap= apex, bb= basal band, mb= medial band, pmb= postmedial band. Arrows indicate diagnostic characters.



FIGURES 2A–F. Male genitalia of *Glyphodes* spp.: *G. stolalis* (MZB. Lepi. 715): (**A**) whole apparatus, (**B**) Phallus. *G. nurfitriae* **sp. nov.** (holotype; MZB. Lepi. 687): (**C**) whole apparatus, (**D**) Phallus. *G. ahsanae* **sp. nov.** (holotype; MZB. Lepi. 682): (**E**) whole apparatus, (**F**) Phallus. Abbreviations, blc= bundle lamellar coremata, ct= cornuti, fb= fibula, sc= saccus, tg= tegumen, tr= transtilla, uc= uncus, vc= vinculum, vlv= valva. Arrows indicate diagnostic characters.



FIGURES 3A–3I. Female genitalia of *Glyphodes* spp.: *G. stolalis* (MZB. Lepi. 716): whole apparatus (**A**), ovipositor lobe (**B**), corpus bursae (**C**). *G. nurfitriae* **sp. nov.** (paratype; MZB. Lepi. 678): whole apparatus (**D**), ovipositor lobe (**E**), corpus bursae (**F**). *G. ahsanae* **sp. nov.** (paratype; MZB. Lepi. 713): whole apparatus (**G**), ovipositor lobe (**H**), corpus bursae (**I**). Abbreviations, an= antrum, cb= corpus bursae, dcb= ductus corpus bursae, lpv= lamella postvaginalis, ol= ovipositor lobe. Arrows indicate diagnostic characters.

***Male genitalia* (Figs 2C–D):** Tegumen subtriangular, subscaphium slightly sclerotized; uncus simple, medially narrow, gradually widened towards subapex, subapically dilated, blunt apically with scattered setae; valva simple, leaf-shaped, mid-costa with dense lamellar scales; fibula short, curved inwardly, pointed apically; transtilla prominent, well-sclerotized; saccus simple, triangular. Coremata base simple, with bundle of long scale. Phallus weakly sclerotized ventrally with a thorn cornutus.

***Female* (Fig. 1D):** Similar to male, except abdomen without anal scale tuft and ventral surface of antennae with short grey cilia less than 1/4 of flagellomere diameter.

***Female genitalia* (Figs 3D–F):** Ovipositor lobe ovate with scattered faint setae; lamella postvaginalis moderately sclerotized; anterior apophyses as long as posterior apophyses; entrance to ostium bursae narrow, antrum very short (less than 1/5 length of anterior apophyses); ductus bursae weakly sclerotized at basal 1/3; corpus bursae globular, without signum (Figs 3D–F; see arrow).

Holotype ♂ (Fig. 1C): "Holotype: ♂; Indonesia, Papua, Membaramo Raya, Kwerba, Mt. Foja. S 2°42′02.0″ E 138°43′02.0″, 18.XI.2008; leg. Hari Sutrisno, MZB. Lepi. 687 (MZB). / HOLOTYPE"; MZB.

Paratypes: 2 ♂ 1 ♀; Same data as holotype (MZB).

Etymology. The specific name *nurfitriae* is derived from the name of the first daughter, Nur Fitria, of the senior author, Hari Sutrisno. This name is dedicated to her support during our preparing of this manuscript. A noun in the genitive case.

Distribution. Kwerba, Mt. Foja, Papua only (Indonesia) (Fig. 4).

Remark: The adults are nocturnal.

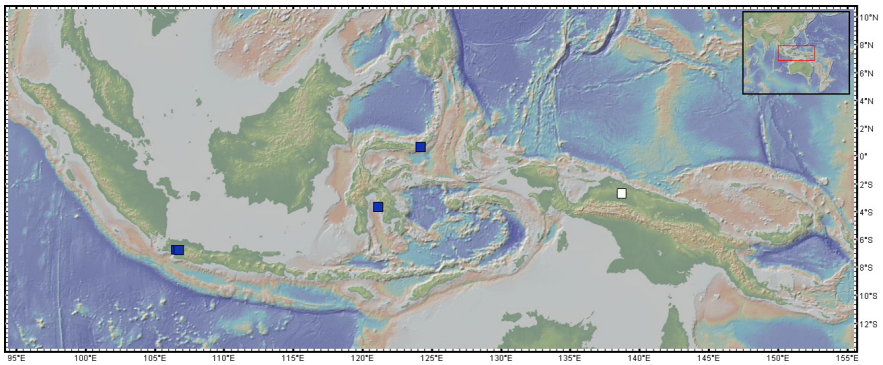


FIGURE 4. Distribution of the two new species in Indonesia: *Glyphodes nurfitriae* **sp. nov**. (white dot) and *G. ahsanae* **sp. nov.** (blue dots).

Glyphodes ahsanae Sutrisno, sp. nov.

(Figs 1E–F, 2E–F, 3G–I)

Diagnosis. *Glyphodes ahsanae* **sp. nov.** is easily distinguished from the most similar species, *G. stolalis* by the white, cashew nut-shaped marking in between the dark brown medial and postmedial bands, the oblong white spot at the posterior medial band, and the white medial spot at the margin of the hindwing (Figs 1A–B, 1E–F; see arrows). The simple uncus, apically pointed, with dense setae, the phallus with a thorn cornutus and corpus bursae with a pair of signa, medially bearing a spur, are also diagnostic characters of this species (Figs 2E–F, 3G–I; see arrows). In the male genitalia of the *G. stolalis*, the uncus is blunt apically, the phallus bears a single thorn cornutus without accessories, and the corpus bursae lack a signum (Figs 2A–B, 3A–C).

Description. *Male* (Fig. 1E): Forewing length 10–11 mm. Frons oblique, white; vertex shabby white. Labial palpus sub-ascending with first segment covered by yellowish-white scales from base to middle and black scales at tip, second segment broadly scaled in front, third segment porrect and embedded in white scales of second segment. Maxillary palpus prominent, triangularly dilated with white scales at tip. Proboscis well-developed, white, scaled at base. Antennae filiform, extend to approximately full forewing length, dorsal surface covered with longitudinal row of brown scales, ventral surface with long white cilia (almost twice diameter of flagellum). Thorax dorsally brown and ventrally white, patagia dark brown, tegulae white at middle. Legs white, epiphysis covered with black scales, inner spur of mid-tibia less than half length of outer spur. Forewings subtriangular, costa straight in basal 2/3

and curved in distal third, basal and antemedial bands obliquely (45°) running outward from costa to dorsum, wide medial band with complex structure medially running from mid-costa obliquely outward to 3/4 of dorsum, margin with white terminal cilia from apex to M_3 and in between CuA_1 and CuP. Hindwing with white and diffuse medial spot at postmedial band. Abdomen slender with anal black scale tuft.

Male genitalia **(Figs 2E–F):** Tegumen subtriangular; uncus simple, narrow from base to medial part, gradually widened towards subapex, apically pointed, with dense setae; valva simple, semi-ovate, medial costa convex; fibula curved outwardly, pointed apically; juxta prominent, tongue-shaped, weakly sclerotized; transtilla wide, weakly sclerotized; saccus simple, triangular. Coremata base simple, with a bundle of long setae. Phallus weakly sclerotized ventrally, with a single thorn cornutus.

Female **(Fig. 1F):** Similar to male, except abdomen without anal scale tuft and ventral surface of antennae with short grey cilia, less than 1/4 of flagellomere diameter.

Female genitalia **(Figs 3G–I):** Ovipositor lobe ovate with scattered faint setae**;** lamella postvaginalis moderately sclerotized; posterior apophyses short, anterior apophyses as long as posterior apophyses; entrance to ostium bursae narrow, antrum very short (less than 1/5 length of anterior apophyses); ductus bursae weakly sclerotized at basal 1/3; corpus bursae globular with a pair of signa, medially bearing a spur.

Holotype ♂ (**Fig. 1E**): "Holotype: ♂; Indonesia, Southeast Sulawesi, North Kolaka, Wawo, Tinukari, S 3°38′53.3″ E 121°07′22.0″**,** 22.vi.2010; Ubaidillah R, Kimsey B, Nugroho H, Lupyaningdyah P, Darmawan, MZB. Lepi. 682 (MZB) / HOLOTYPE"; MZB.

Paratypes: 2 ♂; same data as holotype; 1 ♂; same data as previous, but 25.vi.2010 (MZB); 5 ♂; N. Sulawesi, Boganinani, Wartabone NP, Dumoga Timur, Mainakum, N 0°38′57.0″ E 124°05′30.0″E, 25.v. 2002; Awit S & E. Cholik (MZB); 1 ♀; Indonesia, West Java, Gunung Halimun National Park, Cikaniki, S 06° 44′ E 106° 32 ′, 28.X. 2000; leg. Woro, E. Cholik, Sarino (MZB); 2 ♂; Indonesia, West Java, Sukabumi, Cikaniki, TNGHS S 06° 43′ 49″ E 106° 42′ 23″; 08.X.2009. Legs. Woro AN, Yayuk RS, E. Cholik, Sarino (MZB); 1 ♀; Indonesia, West Java; Sukabumi, Cijeruk, TNGHS S 06° 45′ 14″ E 106° 43′ 13″; Legs. Woro AN, Yayuk RS, E. Cholik, Sarino (MZB).

Etymology. The specific name *ahsanae* is derived from the name of the 2nd daughter, Annisa Ahsan, of the senior author, Hari Sutrisno. This name is dedicated to her support during the preparation of this manuscript. A noun in the genitive case.

Distribution. West Java, Southeast Sulawesi and North Sulawesi in Indonesia (Fig. 4).

Remark: The adults are nocturnal.

Discussion

The description of two new species of *Glyphodes*, *G. nurfitriae* **sp. nov.** and *G. ahsanae* **sp. nov.**, aligns with the genitalia characteristics of *G. stolalis* and conforms to the traits identified in *Glyphodes* group 1 *sensu* Sutrisno (2002). This study reveals a more detailed examination of relevant morphological features in the male and female genitalia. Noteworthy characters shared by these new species include (i) a simple uncus, dilated subapically, apex setose, (ii) a complex basal structure of the coremata with bundle of long setae (iii) phallus with cornutus, and (iv) corpus bursae with or without signum and/or with or without a pair of signa. The inclusion of these characters enhances the understanding of *Glyphodes* species group 1.

These genitalia characteristics emphasize their reliability and relevance in defining *Glyphodes*, particularly group 1 *sensu* Sutrisno (2002), in contrast to external characters such as the shapes of labial and maxillary palpi, mid-tibia spurs and anal tuft scale on male diagnosed by Guenée (1854).

Furthermore, we suggest that the presence of basal, antemedial, medial, postmedial bands on the forewings could be potential morphological characters to corroborate the group 1. This finding adds a new dimension to the morphological criteria for categorizing *Glyphodes* species and underscore the importance of comprehensive morphological studies in refining the taxonomy and the systematics within the genus. The emphasis of genitalia characteristics and the identification of potential new diagnostic features contribute to a more nuanced understanding of *Glyphodes* diversity.

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