Nota Lepi. **47** 2024: 57–79 | DOI 10.3897/nl.47.114772 Research Article

Review of the genus *Carriola* Swinhoe, 1922 (Lepidoptera, Erebidae, Lymantriinae), with descriptions of four new species

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https://zoobank.org/18BDAA9F-5AE5-479A-BC3D-1998C8193791

Received 26 October 2023; accepted 22 February 2024; published: 15 March 2024
Subject Editor: Alberto Zilli.

Abstract. The genus *Carriola* Swinhoe, 1922, which is considered a recent synonym of *Arctornis* Germar, 1810, is revised on the basis of the wing pattern, the absence of abdominal tymbal organs and the genitalia of both sexes. Diagnostic and faunistic data are provided for the five known species previously classified as *Carriola*. In addition, four new species are described: *C. witti* **sp. nov.** from Borneo, *C. polyakovi* **sp. nov.**, *C. shorokhovi* **sp. nov.**, and *C. zolotuhini* **sp. nov.** from the Philippines. Comparative diagnoses, illustrations of external characters, including male and female genitalia, and information on distribution are provided for all species.

Introduction

The tussock moth genus *Carriola* was originally established by Swinhoe in 1922 to contain three closely related species from Southeast Asia. These included species *Leucoma ecnomoda* Swinhoe, 1907 from Java, *L. saturnioides* (Snellen, 1879) from Sulawesi in Indonesia and *L. fenestrata* Hampson, [1893] from Sri Lanka. Swinhoe proposed general diagnostic criteria for the new genus *Carriola* based on a brief description of the wing pattern (with hyaline windows) and the characteristic venation of the type species *L. ecnomoda*. Later Bryk (1934) extended the genus by two other similar species with distinct hyaline windows on their wings, namely *L. thyridophora* Hampson, [1893] from Sri Lanka and *L. seminsula* Strand, 1914 from Hong Kong, China.

All members of the genus *Carriola* have common external characteristics, such as a greenish-brown ground colour and the presence of large hyaline windows on both the forewings and hindwings. Due to the intraspecific sexually dimorphic features, the species *C. fenestrata* (Hampson, [1893]) was redescribed as a separate species *Leucoma thyridoptera* Hampson, 1910 on the basis of the female. This species was later synonymised by Collenette (1931). Holloway (1999) grouped the genus *Carriola* and *Arctornis* into a new tribe known as Arctornithini based on a common feature - the broad, sparsely scobinated plate of the signum in the female bursa copulatrix. Speidel and Witt (2011) considered this complex as a subtribe Arctornithini and placed it within the Lymantriinae based on the general similarity of larval characters. Later, Wang et al. (2015) produced an extended molecular phylogenetic analysis and reassigned the Arctornithini as a tribe. Concurrently, their examination of specimens assigned to *Arctornis* and the type species of *Carriola*, *Topomesoides* Swinhoe (1922), and *Sitvia* Walker (1865) recovered the tribe Arctornithini with strong support and revealed that the genus *Arctornis* is polyphyletic. Therefore, *Carriola*, *Topomesoides*, and *Sitvia* were transferred to the genus *Arctornis* based on shared genitalic characters and a parsimonious interpretation of the resulting phylogeny. Although the morphological support for the placement of *Sitvia* within *Arctornis* was relatively weak, it was considered acceptable. Despite the multigene phylogenetic analysis in this study, the limited taxa sampling (18 specimens and 17 species) did not represent well the tribe Arctornithini and the genus *Arctornis* s.l., as it contains more than 130 described species, and thus, it can hardly reflect reliable relationships between species groups within the Arctornithini. Further molecular phylogenetic studies on increasing sampling are required. The synonymization of these genera without a thorough morphological study seems inappropriate, especially considering that the genus *Arctornis* is tentatively a heterogenic group, with the relationships of the species assigned to this genus are yet to be confirmed (Schintlmeister 1994; Holloway 1999; Sutrisno 2015). A comparative study of the morphology of *Arctornis*, based on the type species *Phalaena l-nigrum* Müller, 1764 and some additionally observed oriental species of *Arctornis* (*A. alba* (Bremer, 1861), *A. kohistana* de Freina, 1987, *A. cygna* (Moore, 1879) *A. discirufa* (Swinhoe, 1903)), and *Carriola* revealed differences in the external morphological characters and the structure of the genitalia, which are discussed below. The wing pattern, the absence of tymbals, and a peculiarity of the valvar complex in the male genitalia of *Carriola* set it apart from other *Arctornis* species. The present study therefore attempts to review and revise the taxonomy of *Carriola*, including the examination of five known species on the basis of genitalic and external features, and four new species are described: *C. witti* sp. nov. from Borneo and *C. polyakovi* sp. nov., *C. shorokhovi* sp. nov., *C. zolotuhini* sp. nov. from the Philippines.

Materials and methods

We examined about 400 specimens from the collection of the Entomological Museum Thomas J. Witt, Munich (formerly MWM, now part of the ZSM), and additional material was obtained from various European collections mentioned below.

The specimens were traditionally dried and pinned. The genitalia were dissected after the abdomens had been immersed in 10% potassium hydroxide solution (KOH). The aedeagus was removed from the capsule and photographed after the vesica had been everted with a syringe containing 99% isopropyl alcohol (C_3H_8O). The genitalia and abdomen were stained with eosin and were slide-mounted with Euparal. The dissection of the genitalia was usually performed according to standard techniques (Robinson, 1976), which were adapted for the male and female genitalia of Lymantriinae by the 'unrolling technique' for males and females described by us previously (Trofimova et al. 2016). The dissection of the genitalia and the designations for the genital structures and wing markings follow Maes (1984) and Holloway (1999). The nomenclature of the wing venation follows Kristensen (2003).

The genitalia were photographed with a ToupCam camera mounted on an Olympus BX43 stereomicroscope. The specimens were photographed at different times using different cameras with macro lenses, namely a SONY digital compact camera and a CANON digital SLR camera. The genitalia were edited for publication using Adobe Photoshop Express (a free application for Android).

Repositories, institutional acronyms or institutional abbreviations

MfN Museum für Naturkunde, Berlin, Germany;
MSW Private collection Mr. Manfred Ströhle, Weiden, Germany;
MWM Museum Witt, Munich, Germany (transferred to Zoologische Staatssammlung);
RMNH Nationaal Natuurhistorische Museum Naturalis, Leiden, Netherlands;
NHM Naturhistorisches Museum Wien, Austria;
SMF Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt-am-Main, Germany;
SSU Samara National Research University, Samara, Russia;
ZISP Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia;
ZSM Zoologische Staatssammlung, Munich, Germany.

Taxonomy

Carriola Swinhoe, 1922, stat. rev.

Carriola Swinhoe, 1922. Type species: *Leucoma ecnomoda* Swinhoe, 1907; by monotypy.

Diagnosis. Externally, *Carriola* is recognized by the beige-green ground colour of the wings and the unique pattern of hyaline windows, the largest of which occupy the discal cell and the hyaline satellite spot between it and the apex. In females, the wings are almost entirely transparent, with the exception of the basal and marginal areas, where the scale covering is preserved. A characteristic feature of the *Carriola* forewing venation is the presence of the R_{S1}–R_{S4} cell (Fig. 2) which not present in the *Arctornis* species we studied (Fig. 1). The R_{S1} vein anastomoses briefly with $R_{S2\text{-}S3}$. R_{S2} and R_{S3} is also anastomosed over a third of the length of R_{S3} (Fig. 2). The tymbal organs on the third abdominal sternum of the male *Carriola* are absent (Fig. 4), unlike in *Arctornis*, where they are pocket-like and well developed (Fig. 3). The male genitalia of *Carriola* are similar in general structure to those of *Arctornis* (Fig. 5c), but differ clearly in the absence of the saccular pocket at the base of the valva and the peculiar long and slender harp that emerges from this saccular pocket in *Arctornis* species (Fig. 5b). *Carriola* females have a medial oval projection of sternum VII covering the anterior margin of the antrum, whereas in *Arctornis* females sternum VII is unmodified (Fig. 6). The shape and size of the pseudopapillae differ in *Arctornis* and *Carriola*: in *Carriola* the pseudopapillae of the females are weakly sclerotised, with small setae, elongated and uniformly narrow; in *Arctornis* the pseudopapillae are broader and gradually narrow towards the apex. The female genitalia are characterised by a reduction of the anterior apophyses, as found in some *Arctornis* species. The signum in the bursa is large and scobinated, but in contrast to *Arctornis* it is not elongated but clearly heart-shaped (***ecnomoda*** species group) or triangular with rounded edges (***fenestrata*** species group).

Description. ***Head.*** Frons and vertex golden-brown or black (see *C. zolotuhini* sp. nov.) and covered with dense drooping scales, with small tufts at base of antennae. Eyes large and round. Labial palpi bent obliquely upwards, densely hairy, pale on the underside in the same colour as abdomen, orange above. Male antennae bipectinate with long branches, female antennae similar in structure but less developed. ***Thorax.*** Patagia, tegulae and thorax golden-beige in colour and covered with dense hair scales. Legs covered with golden-brown scales for most species of *Carriola* except *C. zolotuhini* sp. nov. (see under this species). Tibiae of forelegs densely covered with orange-coloured hair scales. Epiphysis present in males and absent in females. The ‘formula' of the tibial spur is 0–2–4 (Figs 7–9). ***Forewings*** (Figs 10–27) triangular, forewing margin/costa in both sexes in a ratio of about 1.2:1. The upper side of forewing of male beige-green in colour, with two hyaline windows. Central window occupies the central cell and covers up to half the length of cells M_2–M_3, M_3–CuA_1, CuA_1–CuA_2, and CuA_2–1+2A, and bordered by clearly visible antemedial and subterminal lines (Fig. 2). Hyaline satellite located between it and apex in Rs_4–M_1, and confined to postmedial and subterminal lines. Chevron-shaped discal spot forming a characteristic triangle with postmedial line. Underside of forewings lighter and less contrasting background, without distinct pattern of bands, hyaline windows lined outwards with brown or black scales.

Hindwings (Figs 10–27) triangular with rounded apex. General outline of pattern, colour, and the way the hyaline windows are arranged repeat the forewing. There are often two hyaline satellite windows, the second of which is located between the veins Sc+R_1–Rs. Hindwings of females with more extensive hyaline areas, which include satellite spots extending over the entire wing from the subbasal to terminal line. Live moths with light green veins and hyaline windows also greenish in colour. However, this pigment is not permanent and changes to yellow in collections. ***Abdomen***. Abdominal segments hairy, comparatively slender, mostly covered with beige scales. Underside with lighter golden tones. ***Male genitalia*** (Figs 28–36). Uncus short, broad towards base and supplemented by modified caudal process of tergum VIII – superuncus. Valva elongate, one third to one quarter as wide as long, simple, undivided, without processes or with medial costal process. Juxta U-shaped with distinct lateral lobes. Aedeagus short, half as wide as long, strongly bevelled at its anterior and posterior end. The everted vesica round, without cornuti, covered with very small spines. ***Female genitalia*** (Figs 37–44). Posterior margin of sternum VII with medial oval projection covering antrum. Papillae anales weakly sclerotised, broad and rounded. Pseudopapillae membranous, uniformly narrow and covered with small setae. Anterior apophyses reduced. Posterior apophyses slender and as long as lobes of papillae anales. The antrum bowl-shaped, small. Ductus bursae membranous, as long as lobe of papillae anales, strongly narrowed before antrum, and gradually widened before corpus bursae. Corpus bursae rounded, rather short, and as long as ductus. Signum present, as large as a third or half of corpus bursae, generally scobinated and distinctly heart-shaped (***ecnomoda*** species group) or triangular with rounded edges (***fenestrata*** species group).

Remarks. The differences in the configuration of the valva, and the shape of the signum, indicate a division into two morphological species groups within *Carriola*. The species of the ***ecnomoda*** group have a simple, elongated valva without sclerotised processes, and a heart-shaped signum, while the group of ***fenestrata*** species is characterised by the presence of well-sclerotised costal processes in the valva and a rounded, triangular signum in the bursa of the female genitalia.

Biology. The flight period is from January to December in lowland and mountain forests. *Carriola zolotuhini* sp. nov., *C. polyakovi* sp. nov., *C. shorokhovi* sp. nov., prefer lowland forests, although the last species also occurs at an elevation of 1140 m.a.s.l.; *C. ecnomoda*, *C. witti* sp. nov., *C. thyridophora C. seminsula*, *C. saturnioides*, and *C. fenestrata* occur at elevations of up to 1200–1600 m.a.s.l.

The host plant is only known for *C. ecnomoda*, whose caterpillars feed on *Durio zibethinus* (Bombacaceae) according to Holloway (1999).

Distribution. (Figs 45–53). China, Vietnam, Laos, Cambodia, Myanmar, India, Sri Lanka, Thailand, Peninsular Malaysia, Sundaland, the Lesser Sunda Islands and Sulawesi, and the Philippines.

Check-list of *Carriola* Swinhoe, 1922

ecnomoda species group

C. ecnomoda (Swinhoe, 1907)
C. thyridophora (Hampson, [1893])
C. witti sp. nov.
C. seminsula (Strand, 1914)
C. saturnioides (Snellen, 1879)
C. polyakovi sp. nov.
C. shorokhovi sp. nov.

fenestrata species group

C. fenestrata (Hampson, [1893])
C. zolotuhini sp. nov.

Review of species

Carriola ecnomoda (Swinhoe, 1907)

Figs 2, 4, 7–10, 19, 28, 37, 45

Leucoma ecnomoda Swinhoe, 1907, The Annals and Magazine of Natural History; zoology, botany, and geology (7) 20 (115): 77. Type locality: Java, Buitenzorg [Jakarta] [Indonesia].

Material examined. INDONESIA JAVA • 12 ♂, Meru Betiri National Park, 25 km S Kalibaru village 300–500 m, v.–vi.1996; ZSM • 3 ♂, Mt. Ranung, Sempoian, Secondary Rainforest, 08°10'N, 113°40'E, 28.i.1998, leg. Jakl (GU 21.965); ZSM • 4 ♂, Ujung Kulon, N. Park, 6°50'S, 105°35'E, 100 m, viii.1996; ZSM • 1 ♂, Sukanegara, Cianur reg. 7°06'S, 107°07'E, 1050 m, 18.–21.iii.2007 leg. Jakl; ZSM • 9 ♂, 5 ♀, Mt. Baluran, 7°52'S, 114°23'E, 600–1000 m, iv.1995 (GU 26698, 26.699); ZSM • 1 ♂, 1 ♀, Gunung Argopuro, 15 km SW Bondowoso, 8°04'S, 113°45'E, 7.–13.x.2004 leg. Jakl; ZSM.

FLORES ISLAND • 22 ♂, 3 ♀, Nusa Tenggara Timur, 15 km E Labuhanbajo, 200 m, forest, 9.–22.iv.1996, leg. Dr. R. Brechlin (GU 26.703, 27.969, 21.971, 21.616, 25.846); ZSM.

ALOR ISLAND • 22 ♂, Nusa Tenggara Timur, 8°16'S, 125°05'E, Moru, 500 m, 1.–8.iii.2006, leg. Jakl (GU 25.847); ZSM • 11 ♂, 8 ♀, the same data, but 22.iii.–03.iv.2006, (GU 27.967); ZSM.

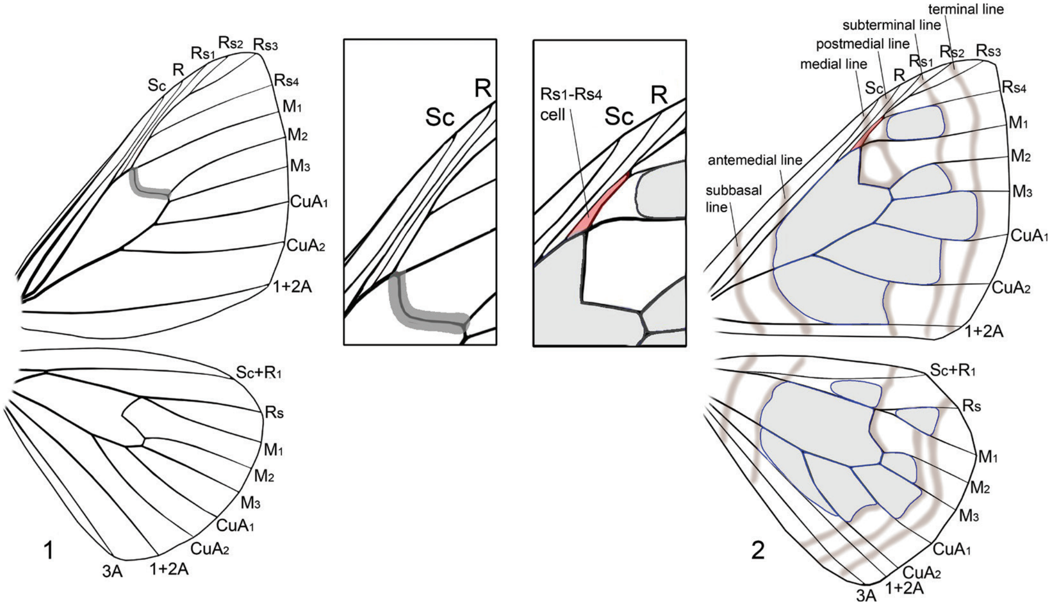
SUMBAWA • 5 ♂, Nusa Tenggara Barat, Kempo, 30 km W Dompu, 80 m, forest, 17.–18.iii.1996, leg. Dr. R. Brechlin (GU 26.702); ZSM.

SUMBA ISLAND • 1 ♂, Nusa Tenggara Barat, Gunung Mt., 50 m, iii.1997, leg. Andang (GU 25.848); ZSM.

BALI ISLAND • 3 ♂, Central Bali, Bedugul District, Tamblingan lakes, 1250 m, 8°14'S, 115°08'E, iii.2005, leg. Jakl (GU 26.700); ZSM • 1 ♀, 550 m, 8°25'S, 114°58'E, 29.–30.i.1998, leg. Jakl, Schintlmeister & Cervenca; Lombok; ZSM • 14 ♂, Mt. Rinjani, S of Tanjung, 8°26'S, 116°10'E, 700 m, 16.–22.iii.2009, Pusok Hill, leg. St. Jakl (GU 27.966); ZSM • 1 ♂, 350 m, Pusuk Pas, 12.–13.iv.2000, leg. S. Naumann; ZSM.

PANTAR ISLAND • 1 ♂, 1 ♀, east coast 350 m Tanah Laband 9.–21.iii.2006, coll. Ströhle, leg. St. Jakl; MSW.

Diagnosis. *C. ecnomoda* differs from related species by the concave margin of the hyaline window CuA_2–1+2A. In most *Carriola* species the hyaline windows on the underside of the wings are edged by dark scales. In *C. ecnomoda* this feature is absent or only very indistinct. (Fig. 19b). The female is characterised by the white-green colouration of the wings, which contrasts with the



Figures 1, 2. Wing venation. **1.** *Arctornis l-nigrum* (Müller, 1764); **2.** *Carriola ecnomoda* (Swinhoe, 1907).

dark olive-coloured background of the other species. The male genitalia are similar to those of *C. thyridophora* and *C. witti* sp. nov., but differ by an elongated valve, which is 1.2 times as long as the tegumen and uncus combined, with a characteristic narrow, pointed tip of the valva (Fig. 28a). The aedeagus is shorter and more slender and strongly bevelled at its anterior and posterior ends (Fig. 28b). The female genitalia (Fig. 37) are very similar to those of the *ecnomoda* species group, but differ from related species in the shape of the signum, which is clearly V-shaped. The lobes of signum are only slightly pronounced and as long as ⅓ of width of the signum.

Biology. The species is associated with *Durio zibethinus* (Bombacaceae) (Holloway, 1999). Adults have been found from May to November in lowland and mountain forests up to an elevation of 1250 m.a.s.l.

Distribution. (Fig. 45). The distribution of *C. ecnomoda* is restricted to the Indonesian islands of Java and the Lesser Sunda Islands (Alor, Bali, Flores, Lombok, Pantar, Sumba, Sumbawa).

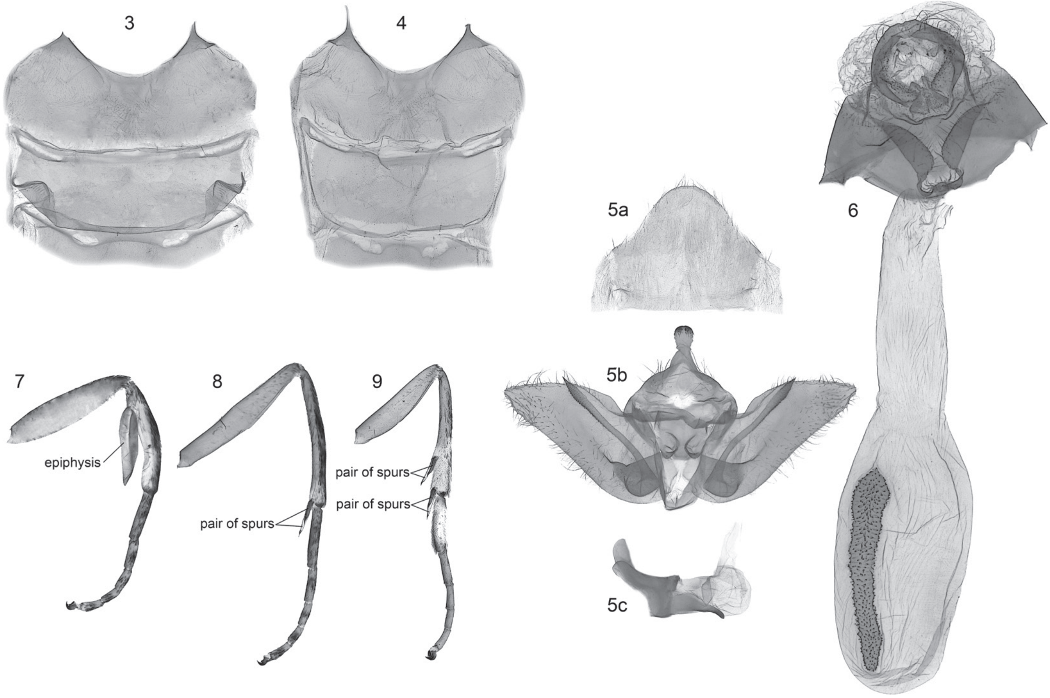
Notes. The species was erroneously recorded for the fauna of Borneo by Holloway (1999) and by Kemal et al. (2019) for the Philippines (Panay).

Carriola thyridophora (Hampson, [1893])

Figs 11, 20, 29, 38, 46

Leucoma thyridophora Hampson, [1893], The Fauna of British India, including Ceylon and Burma, edited by W.T. Blanford. Moths, Vol. 1: 488. Type locality: Sikkim [India].

Material examined. INDIA: ASSAM • 27 ♂, Assam, Nambor Forest res., Garampani, 100 m, 26°30'N, 93°55'E, 21.29.xi.1997, leg Siniaev (GU 27.442); ZSM • 1 ♂, Dibru-Saikova Wildlife Sanktuary Assam, 27°35'N, 95°22'E, 20 km N.



Figures 3–9. Abdominal structure and legs of *Arctornis l-nigrum* (Müller, 1764) and *Carriola ecnomoda* (Swinhoe, 1907). **3, 4.** Third abdominal sternum of males; **3.** *A. l-nigrum*; **4.** *C. ecnomoda*; **5.** Male genitalia of *A. l-nigrum*. **a.** Superuncus (VIII tergum); **b.** Apparatus; **c.** Aedeagus; **6.** Female genitalia of *A. l-nigrum*; **7–9.** Legs of *C. ecnomoda*; **7.** Foreleg; **8.** Mid leg; **9.** Hind leg.

Tinsukia, 120 m, 1.–5.xii.1997, leg. V.Siniaev, V. S., M. Murzin (GU 27.443); ZSM • 1 ♂, Assam, 27°08'N, 94°00'E, Pan Bari Reserv Forest, 4.–7.vii.1997, leg. Siniaev; ZSM • 2 ♂, Nameri N. Park, 60 km N Tezpur, 27°20'N, 93°15'E, 150 m, 24.vii.–2.viii.1997, leg. Afonin, Siniaev (GU 25.860); ZSM • 2 ♂, Assam, Kaziranga Wild Life res., Pan Bari, 100 m, 26°45'N, 93°10'E, Secondary Forest, 12.–21.xi.1997, leg. Siniaev, Murzin; ZSM.

ANDAMAN ISLANDS • 16 ♂, Middle Andaman, Tagapure, rainforest, 12°50'72"N, 92°49'29"E, 12.26.xi.2000, leg. J.P.Rudloff (GU 25.858); ZSM • 17 ♂, Tagapure, 3 km, sudl. 12°4889'N, 92°4929'E, 14.16.viii.2001, leg. J.P.Rudloff; ZSM • 1 ♂, Middle Andaman, Mayabander, 20.iii.1998; ZSM • 4 ♂, Middle Andaman, 1.5 km, E Karnatang, 12.5072°N, 92.5610°E, 17.–22.viii.2001, leg. J.P.Rudloff; ZSM • 3 ♂, 1 ♀, South Andaman, Mt. Harriet Nat. Park, near Port Blair, 200 m, 4.–6.iii.1998, leg. V. Siniaev & Kamenev (GU 21.969, 52.859); ZSM • 1 ♂: South Andaman, Mt. Harriet, Port Blair, 11.4321°N, 92.4403°E, 23.–24.viii.2001, leg. J.P.Rudloff; ZSM • 3 ♂, South Andaman, Bambooflat, Rainforest, 11°42'82"N, 92°42'02"E, 27.–28.XI.2000, leg. J.P.Rudloff; ZSM • 8 ♂, North Andaman, 6 km S. Mayabunder, Karnateny Rainforest, 12°50'61"N, 92°56'06"E, 17.–21.xi.2000, leg. J.P.Rudlof; ZSM • 2 ♂: North Andaman, Avis Island, near Soulund Il. 8.–9.iii.1998, leg. V. Siniaev & Kamenev (GU 27.426); ZSM.

LAOS • 1 ♂, Prov. Vientiane, Ban Viang Kham, 1000 m, 19°21.793'N, 102°25.408'E, 15–16.vii.2009, leg. K. Cerny (GU 28.074); ZSM.

CAMBODIA • 10 ♂, 1 ♀, Kirirom Nat. Park, 11°19'N, 104°05'E, 650 m, 9.–16.xii.1999, leg. M & S Murzin (GU 28.070, 28.073); ZSM • 1 ♂, 1 ♀, Kirirom Nat. Park, 11°21'N, 104°04'E, 650 m, 2.–17.i.2000, leg. M & S Murzin;

ZSM • 7 ♂, 4 ♀, Phnom Bokor Nat. Park, 10°38'N, 104°06'E, 550 m, 25.xi.–6.xii.1999, leg. M & S Murzin (GU 28.071, 28.072); ZSM • 3 ♂, 15 km SE Tuol Kruos, 11°11'N, 104°00'E, 100 m, 20.28.xii.1999, leg. M & S Murzin; ZSM.

THAILAND • 1 ♂, 1 ♀, Prov. Nakhon Ratchasima, Ban San Chao Po, 720 m, 14°22.544'N, 101°51.891'E, 01.–08. ix.2008, leg. T. Ihle (GU 27.423, 27.424); ZSM • 1 ♂, SE Thailand, Prov. Chanthaburu Suan Pojana, Soi Dao, 300 m, 13°06'N, 102°13'E, 23.x.2005, leg. A. Schintlmeister; ZSM.

MYANMAR • 1 ♂, Tenasserim, Maliwun, 500 m, 10°14'N, 98°40'E, x.–xi.1995, leg. Steinke & Lehm (GU 28.076); ZSM • 2 ♀, Birma merid., Tenasserim, 800 m, 20.iv.1995, leg. Steinke; ZSM • 1 ♀, N. Myanmar, Kaung Mu long, 16 km E Putao, 500 m, 27°21'N, 97°34'E, 28.–30.iv.1998, leg. S Murzin & V. Siniaev (GU 27.430); ZSM • 3 ♂, Nan Sa Bon, 25 km E Putao, 800 m, 27°21'N, 97°40'E, 6.–9.v.1998, leg. S Murzin & V. Siniaev (GU 27.429); ZSM • 1 ♂, Nan Sa Bon, 21 km E Putao, 550 m, 27°21'N, 97°37'E, 1.5.v.1998, leg. S Murzin & V. Siniaev (GU 27.440); ZSM.

MALAYSIA • 2 ♂, Pahang, Genting Paβ - Teeplantage, Haus Barlow, 1000 m, 29.ii.–1.iii.1984 leg. Nässig & Barlow (GU 27.427); ZSM • 1 ♂, Pahang state, Pulau Tioman, Kg. Juara, 7,9–16.III.1995, leg. G. Ronkay (GU 27.964); ZSM • 1 ♂, Selandor, Genting Tee Estate, 650 m, 21.–23.ii.1986, leg. Nässig & Barlow (GU 28.077); ZSM • 1 ♀, Perak, 60 km NNE Taiping, 100 m, 12.xi.1994, leg. Görgner; ZSM • 1 ♂, Fraser Hill, 1500 m, 03.viii.1995, leg. Loh Shi Wui (GU 27.965); ZSM • 1 ♂, Malacca, Tengah Gebirge P. Zibris. V.; MfN.

INDONESIA: SUMATRA • 4 ♂, North Sumatra, Huta Padang, 310 m, 2°48'N, 99°11'E, 18.x.1990, leg. Dr. E.W. Diehl; ZSM • 3 ♂, Aceh, 30 km E Banda Aceh, 24.iii.1993, leg. R. Brechlin; ZSM • 1 ♀, Aceh, Katambe, 1.xii.1980, leg. Diehl; ZSM • 6 ♂, Aceh, Mt. Silaw, 600 m, 84 km E Banda Aceh 5°25'N, 95°40'E, 23.9.iii.1993, leg. R. Brechlin; ZSM • 3 ♂, W. Mt. Sanggul, Landai, 1200–1300 m, 0°00'N, 100°38'E, I-ii.2004, leg. St. Jakl; ZSM • 1 ♂, the same data, but 1250 m, 25 km N of Payakumbuh, v.2004, leg. St. Jakl; ZSM • 2 ♂, 1 ♀, Padang Panjang, Lembah, Anai, 300 m, 0°27'N, 100°23'E, i.2004, leg. St. Jakl; ZSM • 3 ♂, Aceh, 20 km NW Langsa, 4°32'N, 97°45'E, 22.–24.viii.1979, leg. Diehl & Schintlmeister; ZSM • 2 ♂, Huta Padang, 2°49'N, 99°14'E, 1.–4.ix.1991, forest, 500 m, leg. Graul & Schintlmeister; ZSM • 1 ♂, 15 km SW Sindar Raya, 500 m, 3°10'N, 98°58'E, forest, 31.viii.1991, leg. Graul & Schintlmeister (GU 25.854); ZSM • 3 ♂, 2 ♀, Prapat, HW 2, 24.xi.1985, leg. Diehl; ZSM • 2 ♀, Sindar Raya, 3°09'N, 98°57'E, 350 m, 11.–14.viii.1979, leg. Diehl & Schintlmeister; ZSM • 1 ♀, Berastagi, 1600 m, Mt. Sibayak, 3°10'N, 98°30'E, 16.–20.iii.1993, leg. R. Brechlin (GU 25.855); ZSM.

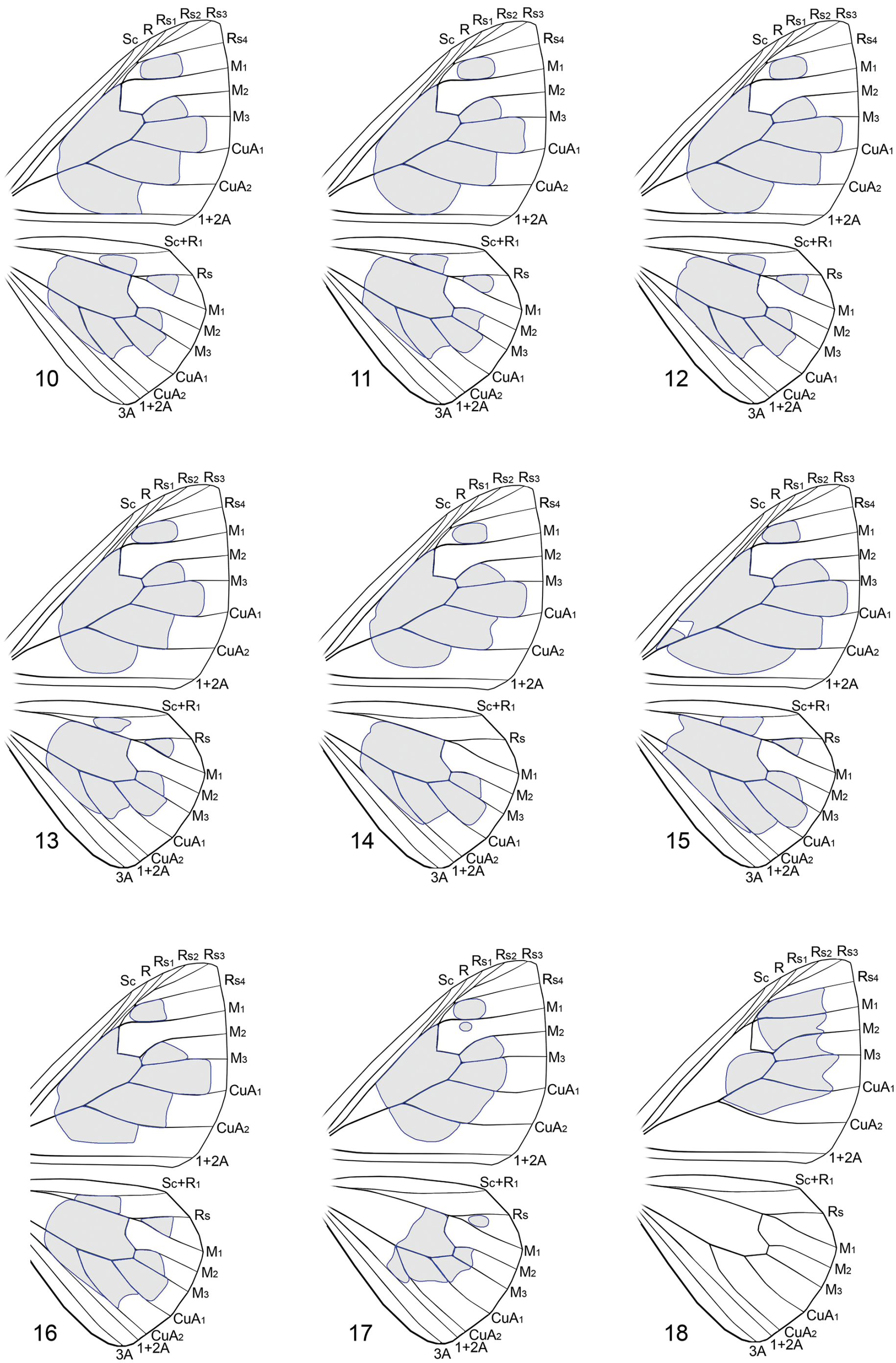
SIBERUT ISLAND • 1 ♂, ii.1995, leg. Graul & Schaarschmidt (GU 21.967); ZSM • 1 ♂, Labuhan Bajan, 100 m, 0°58'N, 98°56'E, i.2004, leg. St. Jakl; ZSM • 1 ♀, Bojakan, 100 m, iv.2004, leg. St. Jakl; ZSM.

NIAS ISLAND • 4 ♂, 1 ♀, 10 km SW Idano Gawo, Flussufer [riverside], 24.vii.1979, leg. Diehl & Schintlmeister (GU 25.856, 25.857); ZSM.

Diagnosis. Externally, the males and females of *C. thyridophora* strongly resemble *C. seminsula*, with which they can be confused in specimens from Thailand, and *C. witti* sp. nov. from Borneo. Externally, the male can be distinguished by the concave margin of the hyaline windows between the veins M_2–M_3 (Fig. 11). However, an exhaustive identification can only be made by examining the genitalia. The male genitalia are characterised by a comparatively short and almost regularly trapezoidal valva: the base of the trapezium is in a ratio of 2:1 to the apex, and the width of the valva is in a ratio of 1:2.5 to the base (Fig. 29a). The female genitalia differ from those of related species by the V-shaped signum, which has longer and thinner lobes. The lobes of the signum are well separated and as long as ½ the width of the signum (Fig. 38).

Biology. Unknown. The flight period is from January to December in the forests. The species occurs from the lowlands up to an elevation of 1600 m.a.s.l.

Distribution. (Fig. 46). India, Andaman Islands, Laos, Cambodia, Thailand, Myanmar, Peninsular Malaysia, Indonesia (Sumatra, Nias and Siberut).



Figures 10–18. The wing venation and hyaline window mapping of *Carriola* species. **10.** *C. ecnomoda* (Swinhoe, 1907); **11.** *C. thyridophora* (Hampson, [1893]); **12.** *C. witti* sp. nov.; **13.** *C. seminsula* (Strand, 1914); **14.** *C. saturnioides* (Snellen, 1879); **15.** *C. polyakovi* sp. nov.; **16.** *C. shorokhovi* sp. nov.; **17.** *C. fenestrata* (Hampson, [1893]); **18.** *C. zolotuhini* sp. nov.

Carriola witti sp. nov.

https://zoobank.org/BC60E0B5-0FAC-4097-9B62-EEF66EEB8B0C

Figs 12, 21, 30, 39, 47

Material examined. ***Holotype*****:** MALAYSIA: BORNEO • 1 ♂; Borneo, Sabah, Trus Madi, 1200 m. 1.–14.iv.2005, leg. Martini (GU 25.852); ZSM.

Paratypes [40 ♂, 28 ♀]: MALAYSIA: BORNEO • 1 ♀; Sabah, Mount Trus Madi, 1200 m. 1.–14.iv.2005, leg. Martini; ZSM • 4 ♂, 4 ♀; Mount Trus Madi Höhe, 1150 m, 9.–14.iv.1996, leg. Martini; ZSM • 2 ♀; Sabah, Mount Trus Madi, 1200 m, III.2004, leg. Martini; ZSM • 8 ♂, 8 ♀; Mount Trus Madi, 1150–1200 m, 1.–7.iv.1997, leg. B. & K. Martini; ZSM • 3 ♂, 2 ♀; Sabah, Mt. Trus Madi, 1150 m, 20.iii.–18.iv.2005, leg. B. & K. Martini.; SSU • 1 ♂, 3 ♀; Sabah, Mt. Trus Madi, bei Apin Apin, 1450 m, iii.1998, leg. B. & C. Martini; ZSM • 1 ♀; Sabah, Mt. Trus Madi, Apin Apin, 950 m, 17.iv.1993, leg. Martini.; (GU 25.853); ZSM • 3 ♂; Kalimantan Selatan, 30 km E. Kandangan, Rainforest, 15 km NE of Loksado, 1100 m, 2°52'N, 115°38'E, 3.–22.ix.1997, leg. Jakl; ZSM • 1 ♂; Tambunan, 5°40'86"N, 116°"22'52"E, 22.vii.2007. A. Pashenkov; ZISP.

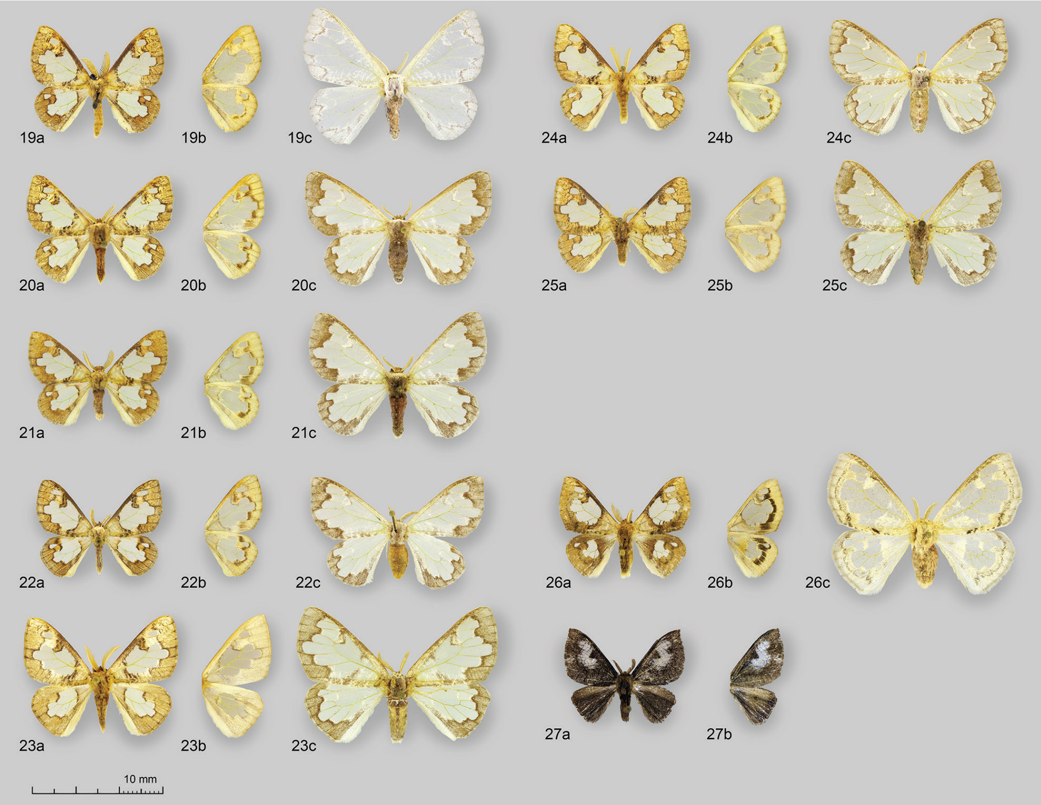
PHILIPPINES: PALAWAN ISLAND • 4 ♂; Palawan, E of Tarusan Sandobal, Gangob limestone hill forest, 10 m, 08°27.184'N, 117°28.216'E, 06.xii.2007, leg. JH. Lourens; ZSM • 1 ♂; S. Palawan, Rizal prov. Mantalingajan range Pinagar/Culasian, 50 m, primary forest, 08°51'N, 117°51'E, 3.–4.iii.2006, leg. JH. Lourens; ZSM • 1 ♂; NE. Palawan, foot Mt. Ilian, 70 m, 3 km W of Bagon Bayan, 10°26'N, 119°34'E, 7.iii.2006, leg. JH. Lourens; ZSM • 1 ♀; C. Palawan, E of napsan, prim. for. edge Salacot Falls, 250 m, 09°50'N, 118°37'E, 12.iii.2006, leg. JH. Lourens; ZSM • 4 ♂; Irawan, 50 m, 5.viii.1997; ZSM • 4 ♂, 2 ♀; Nord Palawan, S. Vicente, 20 km NEE Roxas, 10°21'N, 119°10'E, 400 m, 12.–17.i.1988, leg. Cerny & Schintlmeister (GU 26.688); ZSM • 1 ♂, 1 ♀; Mt. Mantalingahan, 800 m,xii.1997, leg. Bal (GU 26.690); ZSM • 1 ♂; Mt. Mantalingahan, 950 m (Kibyawon) in prim. rainforest 8°46'59,0"N, 117°42'06,7"E 23.–30.v.2001, MV-lamp coll. Ströhle leg. A.&S. Zwick; MSW • 1 ♂, 1 ♀; Philippinen, Insel Palawan, Magcasaw, Mainit Brooke's point, 3.–6.x.1996, 900 m, leg. Bal; ZSM 1 ♀; Mt. Salacot Res., 800 m, 9°51'N, 118°38'E 10.–27.ii.2000, leg. Gorbatshev & Siniaev; ZSM • 1 ♂; Calabayong, Bar Tanabag, Tanabag river valley, 200 m, forest. 10.–21xii.1991, leg. Cerny; ZSM.

TAWI-TAWI ISLAND • 2 ♂; Tarawakan, north of Batu Batu, 11.xi.1961 (GU 26.693, 28.078); ZSM.

Diagnosis. Externally (Figs 12, 21) *C. witti* sp. nov. can be confused with *C. seminsula* and *C. thyridophora*, and any identification must be confirmed by examination of the genital structures. The male genitalia differ in the shape of the valva. As in *C. thyridophora*, it is isosceles trapezoidal, but more elongated and pointed. The base of the trapezium is in a ratio of 2.5:1 to the apex and the length of the valva is in a ratio of 3:1 to the base of the valva (Fig. 30a). The female genitalia differ from those of related species by the scobinate heart-shaped signum, which is about one third the size of the bursa and has poorly separated lobes, each as long as ½ the width of the signum.

The female genitalia differ from those of the related species by the scobinate heart-shaped signum, which is as large as a third of the bursa, with poorly separated lobes that are as long as ½ the width of the signum (Fig. 39).

Description. ***External appearance.*** Frons and vertex orange and covered with dense, drooping scales, with small tufts at the base of antennae. Eyes large, round. Labial palpi bent obliquely upwards, densely pubescent, on the underside of the same pale olive colour as abdomen, orange above. Patagia, tegulae and thorax golden pale brown. ***Male forewings*** (Figs 12, 21): triangular with rounded apex, length of forewing 10.6–15.3 mm (14 mm in holotype). The ratio between the length of forewing margin and the costa is about 1.2:1 in both sexes. Ground colour of upper side beige-green and typically with two hyaline windows (Figs 12, 21a, b). Central hyaline window occupies central cell up to half the length of cells M_2–M_3, M_3–CuA_1, CuA_1–CuA_2, and CuA_2–1+2A



Figures 19–27. Adults of *Carriola* species. **a.** Male; **b.** Underside wings of male; **c**. Female. **19.** *C. ecnomoda* (Swinhoe, 1907); **a, b.** East Java, Mt. Baluran (GU 26.698; ZSM); **c.** East Java, Mt. Baluran, (GU 26.699; ZSM); **20.** *C. thyridophora* (Hampson, [1893]); **a, b.** NE India. Assam (GU 27.442; ZSM); **c.** SW Kampuchea, Kirirom Nat. Park (GU 28.073; ZSM); **21** *C. witti* sp. nov.; **a, b.** HT (GU 25.852; ZSM); **c.** PT (GU 25.853; ZSM); **22.** *C. seminsula* (Strand, 1914); **a, b.** Sud Vietnam, Bao Loc (GU 27.431; ZSM); **c.** Nord Vietnam, Mai Chau (GU 27.445; ZSM); **23.** *C. saturnioides* (Snellen, 1879); **a, b.** N. Sulawesi, (GU 21.966; ZSM); **c.** Sulawesi, Namo (GU 25.850; ZSM); **24.** *C. polyakovi* sp. nov.; **a, b.** HT (GU 28.779; ZSM); **c.** PT (GU 28.780; ZSM); **25.** *C. shorokhovi* sp. nov.; **a, b.** HT (GU 26.961; ZSM); **c.** PT (GU 28.784; ZSM); **26.** *C. fenestrata* (Hampson, [1893]); **a, b.** Vietnam, prov. Thai Nguyen (GU 27.435; ZSM); **c.** Vietnam, prov. Thai Nguyen, (GU 27.436; ZSM); **27.** *C. zolotuhini* sp. nov.; **a, b.** HT (GU 28.069; ZSM). Scale bar represents 10 mm, all specimens to scale.

and bordered by clearly visible antemedial and subterminal lines. Hyaline satellite oval and located between R_{S4}–M_1, and bordered by postmedial and subterminal lines. Discal spot forms triangle with postmedial line. Underside of forewing with lighter monotonous background, hyaline windows with black borders (Fig. 21b). ***Male hindwings*** (Figs 12, 21): triangular with rounded tip, central hyaline window occupies central part of wing, from ⅓ of area of central cell to the discal veins and to ½ of the area of cells M_2–M_3, M_3–CuA_1, CuA_1–CuA_2 and CuA_2–1+2A. First triangular hyaline satellite window between veins Sc+R_1 and Rs, and second between the veins Rs and M_1 (Fig. 12). ***Female forewings*** of olive colour with large hyaline window bordered by clearly visible terminal line (Fig. 21c). Length of forewing 14.5–16.5 mm. ***Female hindwings*** triangular with rounded tip. The general outline of pattern, colour and the type of arrangement of hyaline window repeat the forewing. ***Male genitalia*** (Figs 30a–c). Superuncus rectangular, slightly divided into two lobes at the apex (Fig. 30c). Uncus (Fig. 30a) looks like a short, apically rounded lobe. Valva trapezoidal, elongate and pointed. Base of the trapezium is in a ratio of 2.5:1 to the apex, the length of valva/width of its base in a ratio of about 3:1. Juxta U-shaped. Aedeagus short, strongly bevelled at its anterior and posterior end (Fig. 30b). ***Female genitalia*** (Fig. 39). Papillae anales weakly sclerotised, broad and rounded, pseudopapillae small and narrow, membranous. Posterior apophyses slender and as long as two thirds of lobes of papillae anales. Antrum cup-shaped, small. Ductus bursae membranous, strongly constricted before antrum and gradually widened before corpus bursae. Corpus bursae rounded, rather short and as long as ductus. Signum scobinate heart-shaped, as large as one third of bursa, with the lobes poorly separated and as long as ½ the width of signum.

Biology. Unknown. Adults were observed from January to December in the forests at elevations up to 1450 m.a.s.l.

Distribution. (Fig. 47). Borneo, and the nearest Philippine Islands of Palawan and Tawi-Tawi.

Etymology. The species is dedicated to the memory of Dr. Thomas J. Witt, a famous lepidopterist and founder of the Witt Museum in Munich, whose collection fund made this research possible.

Carriola seminsula (Strand, 1914)

Figs 13, 22, 31, 40, 48

Leucoma seminsula Strand, 1914, Die Gross-Schmetterlinge der Erde 10: 309, fig. 42k. Type locality: Hongkong [Hong Kong].

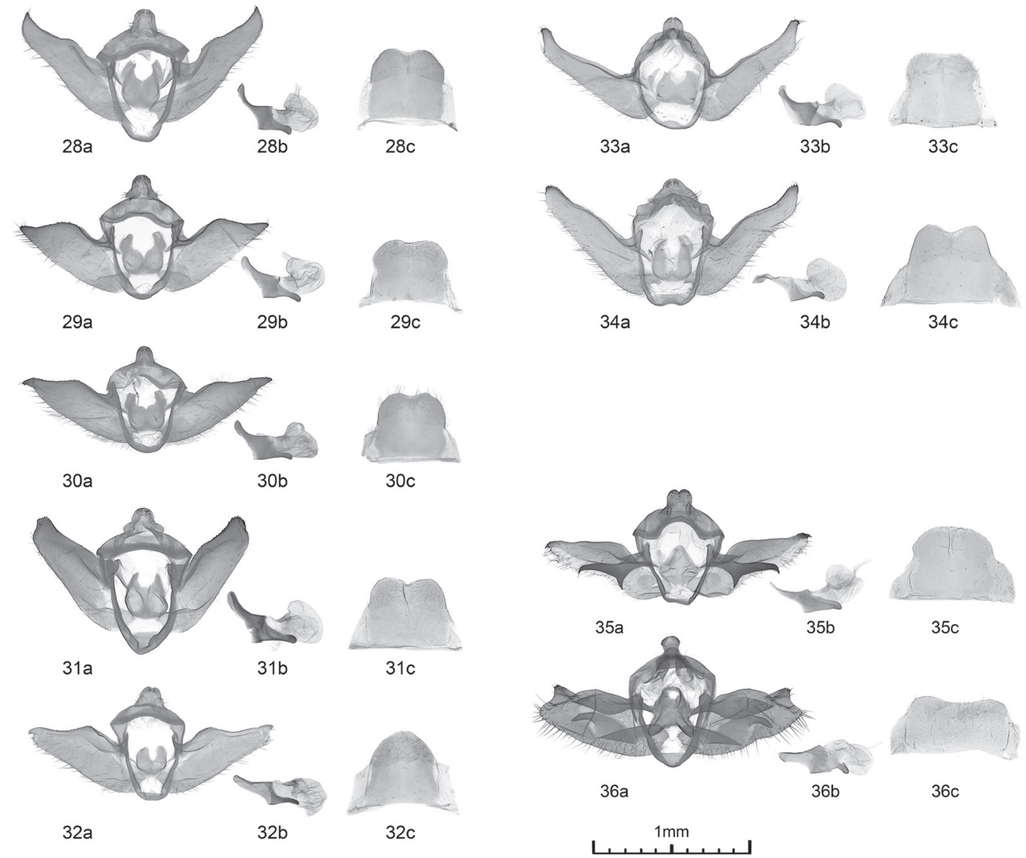
Material examined. ***Holotype*:** • ♂; Hong Kong; 6 Nov.; Coll. A. Seitz; prep. № 597; SMF.

Other material. CHINA • 10 ♂; Hainan, Wuzhi Shan, 1500 m, 109°43'N, 18°57'E, v.2003 leg. local collectors (GU 692); ZSM.

VIETNAM • 11 ♂, Sud Vietnam, Bao Loc, Sec.Wald., Rung Cat Tien, 1500 m, 11°32'N, 107°48'E, 10.20.xii.1992, leg. Sinajev & Simonov (GU 27.431); ZSM • 2 ♂, Nord Vietnam, Farin-Pass, 1600 m, 20 km NW Son-la, 21°22'N, 103°52'E, 11.–13.xi.1994, leg. Sinjaev & Simonov (GU 27.439); ZSM • 1 ♂, Nord Vietnam, Cuc Phuong, 60 km SW Hanoi, 400 m, 20°15'N, 105°20'E, 21.xi.1994, leg. Sinjaev & Simonov; ZSM • 5 ♂, Nord Vietnam, Cuc Phuong, 60 km SW Hanoi, 400 m, 20°15'N, 105°20'E, 18.xi.3.xii.1992, leg. Sinajev & Simonov); ZSM • 1 ♂, Bec Thai prov., Quang Chu, 150 m, 27–30. xi.1993, leg. Bankovics Csorbe (GU 27.441); ZSM • 1 ♂, Prov. Nghe An, Distr. Que Phong, Ban Khom, 300–800 m, 19°40'N, 104°50'E, 17.x.–29.xi.1999, leg F. Kassai (GU 27.432); ZSM • 2 ♂, Nord Vietnam, Mai Chau, 25 km S Moc-chau, 1400 m, 20°50'N, 104°40'E, 14.–18.xi.1994, leg. V. Sinjaev (GU 27.444); ZSM • 1 ♀, Nord Vietnam, Mai Chau, 40 km S Moc-chau, 1400 m, Urwald, 20°50'N, 104°50'E, 7.–15.iv.1995, leg. V. Sinjaev (GU 27.445); ZSM • 1 ♂, Nord Vietnam, Mt. Fan-si-pan, Cha pa, 22°15'N, 103°46'E, 8.–29.v.1993, leg. Sinjaev & Simonov; ZSM • 1 ♂, Quang Tri prov., Da Kong Nature Reserve, near HQ, 16°36'N, 106°52'E, 170 m, 18.x.2007, leg. G. Csorba; ZSM • 1 ♂, Ben En Nat. Park, 200 m, 40 km SW Than Noa, 18°40'N, 105°40'E, 22–30.xi.1994, leg. Sinjaev & Simonov; ZSM • 1 ♂, Mai-chau, 25 km, SE Mutchau, 1400 m, 20°50'N, 104°40'E 14.–18.xi.1994, leg. unknown; ZSM.

THAILAND • 1 ♂, Changwat Nan, 25 km N Bo Luang, 1150 m, 29.iii.1998, leg. T. Csovari & P. Steger (GU 28.081); ZSM • 1 ♂, the same data, but 11.xi.1999, leg. M. Hreblay (GU 26.650); ZSM.

Diagnosis. The male of *C. seminsula* can be recognised externally by the oval, elongated hyaline satellite between R_{S4}–M_1 (Figs 13, 22). The ratio of length to width of the satellite is at



Figures 28–36. Male genitalia of *Carriola* species. **a.** Genitalia; **b.** Aedeagus with everted vesica; **c.** Superuncus **(**VIII tergum). **28.** *C. ecnomoda* (Swinhoe, 1907) (GU 26.698; ZSM); **29.** *C. thyridophora* (Hampson, [1893]) (GU 27.442; ZSM); **30.** *C. witti* sp. nov. HT (GU 25.852; ZSM); **31.** *C. seminsula* (Strand, 1914): HT (prep. № 597; SMF); **32.** *C. saturnioides* (Snellen, 1879) (GU 21.966; ZSM); **33.** *C. polyakovi* sp. nov. HT (GU 28.779; ZSM); **34.** *C. shorokhovi* sp. nov. HT (GU 26.961; ZSM); **35.** *C. fenestrata* (Hampson, [1893]) (GU 27.435; ZSM); **36.** *C. zolotuhini* sp. nov. HT (GU 28.069; ZSM). Scale bar represents 1 mm, all genitalia to scale.

least 2:1. The adults are the smallest of the genus *Carriola*. The length of the male forewings is 9.5–15.5 mm, that of the female forewings 11.5–16.5 mm. The male genitalia (Fig. 31) are characterised by a comparatively short, rectangular valva, which tapers slightly from the base to the rounded and serrated apex. The width of the basal part of the valva is in a ratio of 1:2.5 to the length. The female genitalia differ from those of related species in the size of the signum, which is about two thirds the size of the bursa and forms a distinct V-shape. The lateral lobes of the signum are gently curved outwards and have a constant width. In the centre, the signum is twice as thick as the width of the lobes (Fig. 40).

Biology. Unknown. The flight period is from March to December. The species occurs at elevations ranging from 170 to 1600 m.a.s.l.

Distribution. (Fig. 48). China (including Hong Kong), Vietnam, Thailand.

Carriola saturnioides (Snellen, 1879)

Figs 14, 23, 32, 41, 49

Laelia saturnioides Snellen, 1879, Tijdschrift voor entomologie 22: 105 pl. 8, figs. 7, 7a-c. Type locality: Celebes, Takalar [Indonesia, Sulawesi].

Material examined. INDONESIA: SULAWESI • 7 ♂, Prov. Sulawesi Selatan, Indonesia, Bantimurung, 40 km NNE Ujung Padang, 4°56'S, 119°39'E, Talkessel, 200 m, leg. A. Schintlmeister 2.–9.v.1984; ZSM • 9 ♂, 1 ♀, Prov. Sulawesi Selatan, Indonesia, Bergpass-Südhang, 250 m, Urwald auf Kalk, leg. A. Schintlmeister 6.–7.v.1984 (GU 25.849); ZSM • 3 ♂, 2 ♀, Sulawesi, Selatan, Puncak, Palopo, 900–1300 m, 3°00'S; 120°10'E, iii.1997, ex coll. Dr. Ronald Brechlin; ZSM • 1 ♀, the same data, but iv.1998, 900–1000 m, ex coll. Dr. Ronald Brechlin; ZSM • 2 ♂, 1 ♀, the same data, 2°55'S, 120°05'E, i.1997, 900–1300 m, leg. local collector; ZSM • 1 ♂, 1 ♀, same data, but ix.1997 leg. Einh. Sammer; ZSM • 1 ♂, Puncak, 27 km W Palopo, 10–19.v.1984, 2°59'S, 120°00'E, Bergwald, 1000–1200 m, leg. A. Schintlmeister; ZSM • 2 ♂; Z. Sulawesi, Kulawi, 1°26'S, 120°00'E, 78.ii.1995, 1000 m, leg. Sinjaev & Tarasov; ZSM • 1 ♂, N. Sulawesi, Nr. Tondano, Mt. Makaweiben, 1000 m, xii.1988 (GU 21.966); ZSM • 3 ♂, 3 ♀, C. Sulawesi, Namo, 650 m, 21–22.ix.1995, Straβe Palu-Gimpu, leg St. Naumann (GU 25.850); ZSM.

PELENG ISLAND • 8 ♂, 2 km W Sambuit, 150 m, vii.1998, leg. local collector (GU 25.851); ZSM.

Diagnosis. Externally, the male of *C. saturnioides* is distinguished by the absence of the hyaline satellite spot R_s–M_1 on the hindwing (Figs 14, 23a). The underside of the forewing has a pale, monotonous background without a pronounced banding pattern. The black border around the hyaline windows is also very faint or absent (Fig. 23b). The adults are the largest of the genus *Carriola*. The length of the male forewing is 15–25.5 mm, that of the female forewing 18–30.2 mm. The male genitalia (Fig. 32) are characterised by the conical superuncus (Fig. 23c) and the rhomboid shape of the valva, which is widened in the medial part and narrows strongly towards the curved crochet tip of the valva. The width of the basal part of the valva is in a ratio of 1:2.5 to the length (Fig. 32a). The female genitalia are characterised by the narrow ductus bursae and the clearly regular triangular shape of the signum. In the centre, the signum is 2.5 times as thick as the width of the lobes (Fig. 41).

Biology. Unknown. The flight period is from February to December. The species has been collected in forests at elevations of up to 1300 m.a.s.l.

Distribution. (Fig. 49). Indonesia (Sulawesi, and Peleng Island off the east coast of Sulawesi).

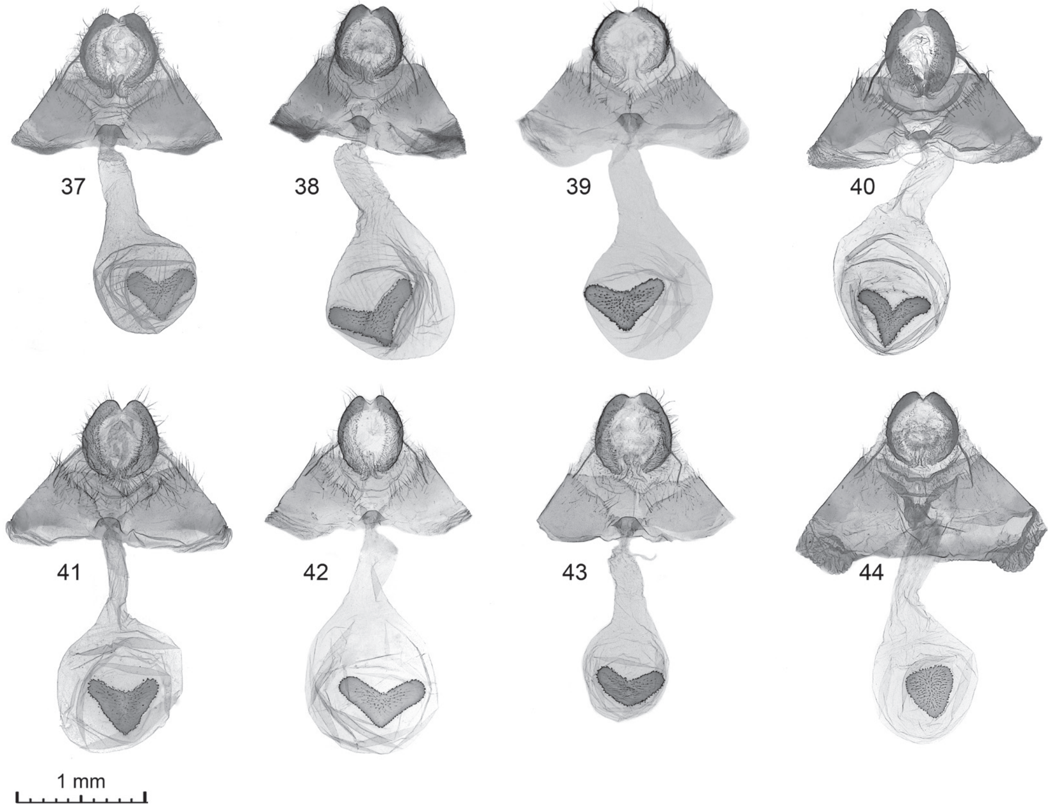
Carriola polyakovi sp. nov.

https://zoobank.org/B6A088C5-B9FD-4979-85FB-759C79D63262

Figs 15, 24, 33, 42, 50

Material examined. ***Holotype.*** PHILIPPINES: LUZON ISLAND • 1 ♂ Philippines, N.Luzon, 5 km S of Adams 350 m 6+7 Apr[il]. 2008, 18°31.338'N, 120°55.690'E (GU 28.779); ZSM.

Paratypes [71 ♂, 27 ♀]: PHILIPPINES: LUZON ISLAND • 1 ♀; Philippinae Zentral Luzon, Prov. Rizal Pilla ca. 200 m Januar [i].1988 D. Schintlmeister (GU 28.780); ZSM • 1 ♂; C. Luzon, Kalinga, 2 km E of Supau, 480 m, Acacia escarpment, 7.ii.2007, 17°23.166'N, 121°11.252'E, leg. JH Lourens; ZSM • 1 ♂; E. Luzon, Aurora, prov. Sierra Madre, 14 km S of Dilalongan, Dapalan river, 50 m, 11–12.iii.2008, 16°02.709'N, 121°42.667'E, leg. JH. Lourens & K. Knoblich; ZSM • 1 ♂; E. Luzon, Isabela, prov. Sierra Madre, 550 m, Dinapique, 17 km NW Dibulo, 21–22.ix. 2006. 16°32'N, 122°14'E,



Figures 37–44. Female genitalia of *Carriola* species. **37.** *C. ecnomoda* (Swinhoe, 1907) (GU 26.699; ZSM); **38.** *C. thyridophora* (Hampson, [1893]) (GU 28.073; ZSM); **39.** *C. witti* sp. nov. PT (GU 25.853; ZSM); **40.** *C. seminsula* (Strand, 1914) (GU 27.445; ZSM); **41.** *C. saturnioides* (Snellen, 1879) (GU 25.850; ZSM); **42.** *C. polyakovi* sp. nov. PT (GU 28.780; ZSM); **43.** *C. shorokhovi* sp. nov. PT (GU 28.784; ZSM); **44.** *C. fenestrata* (Hampson, [1893]) (GU 27.436; ZSM). Scale bar represents 1 mm, all genitalia to scale.

leg. JH. Lourens; ZSM. • 3 ♂; Z. Luzon, Quezon, Quezon forest Nat. Park, 250 m, 14°01'N, 122°11'E, Primärurwald, 8–10.x.1988, leg. Cerny & Schintlmeister (GU 26.684); ZSM • 2 ♂; Luzon, Quezon, Tanawan, 14 km S Real, 14°34'N, 121°33'E, 600 m, 23.i.1988, leg. Cerny & Schintlmeister; ZSM • 1 ♂; Luzon, Quezon, Lucena, 17.iii.5005, leg. JH Lourens (GU 28.079); ZSM • 1 ♀; Z. Luzon, Rizal prov., 45 km SEE Manila, 300 m, 14°28'N, 121°19'E, 24.i.1988, leg Cerny & Schintlmeister (GU 26.685); ZSM • 1 ♀; Z. Luzon, Rizal prov., Pilla ca. 200 m, i.1988, leg. Schintlmeister; ZSM • 1 ♀; Luzon, Nueva Vizcaya, Dalton Paβ, Santa Fe, 800 m, 15°07'N, 120°36'E, Secundarbusch, 21.ix.17.x.1988, leg. Cerny & Schintlmeister; ZSM • 1 ♂; Luzon Benguet, 19–21.xi.97 Adunot-river Unterlauf leg. Mey, Ebert, Nuβ; MfN • 1 ♀; Luzon Zambales Mts, Coto 9–10.xi.98, 150 m leg. Mey & Speidel; MfN • 1 ♀; Luzon Zambales Mts, Coto 6–7.v.99, 250 m, LF leg Mey & Ebert; MfN • 1 ♀; Luzon Bataan, Dinalupihan 11.xi.98, LF leg. Mey & Speidel; MfN • 1 ♀; Luzon Mt. Malinao, Amater 25–26.iii.2000, LF leg. Mey & Ebert; MfN.

PANAY ISLAND • 2 ♂; Panay occ., Sibalom, Bontol, sec. forest 50 m, 10.xii.1991, leg. Cerny (GU 21.972 26.694) ZSM • 1 ♂, 1 ♀; Panay occ., Sibalom, Bontol, 9–10.xii. 1991, Secundarwald, 50 m, leg. Cerny (GU 26.695); ZSM.

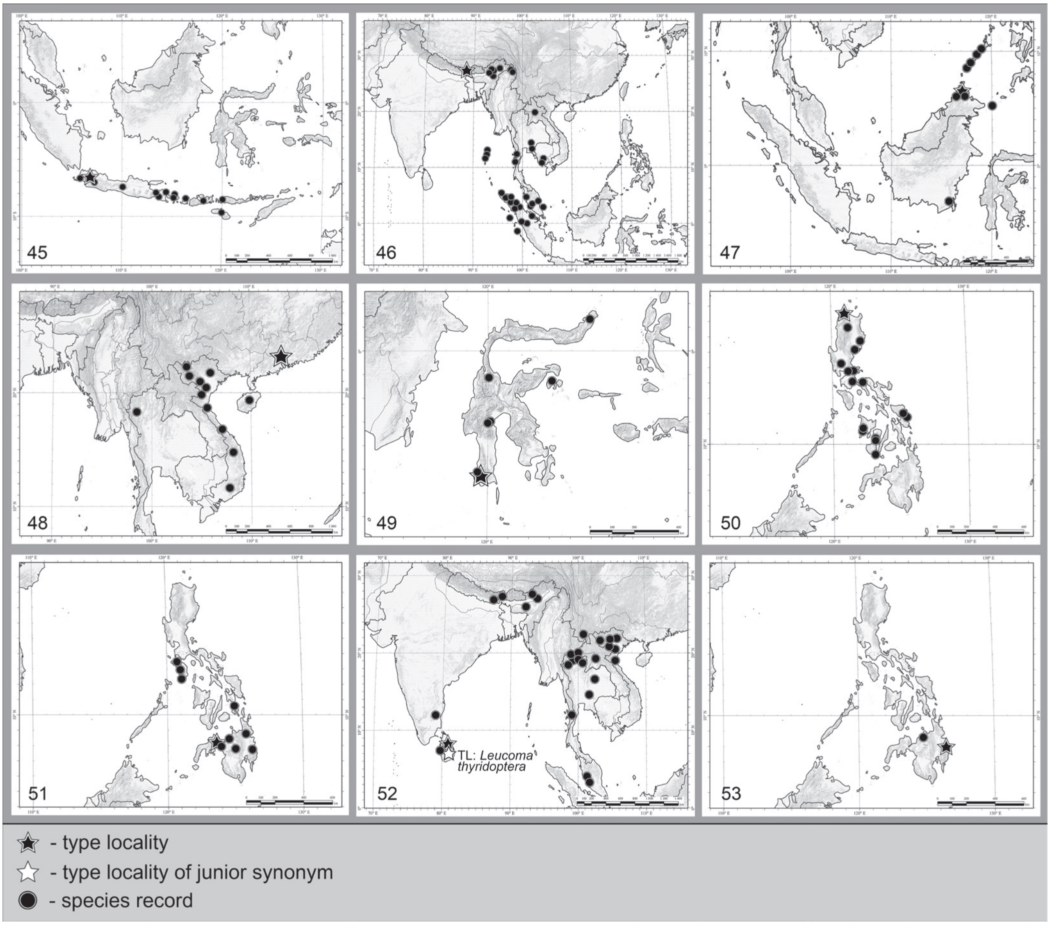
NEGROS ISLAND • 12 ♂, 2 ♀; Negros occ., Mt. Canlaon, 600 m, W-route via Mambucal, ix.1997, Primärwald, leg. Dr. R. Brechlin; ZSM • 7 ♂, 2 ♀; Negros Occidental, Mt. Kanlaon, W Route via mambucal, 600–800 m, ii.1998, ex coll.

Dr. R. Brechlin; ZSM • 3 ♂, 3 ♀; Negros, Mt. Canlaon, 600 m, W. Route via Mambucal, viii.1998, 10°22'N, 123°12'E, ex coll. Dr. R. Brechlin (GU 26.697); ZSM • 1 ♂, 1 ♀; Negros, Mt. Canlaon, 600 m, W. Route via Mambucal, x.1998, 10°22'N, 123°12'E, ex coll. Dr. R. Brechlin (GU 26.681); ZSM • 5 ♂, 2 ♀; Negros occ, Mt. Canlaon, 600 m, W-Route via Mambucal, 600 m, x.1996, prim. forest, ex coll. Dr. R. Brechlin (GU 26.681); ZSM • 3 ♂, 4 ♀; Negros occ., Mt. Canlaon, 600 m, W-Route via Mambucal, iii.1997, Primärwald, leg. Dr. R. Brechlin; ZSM • 3 ♂; Negros occ., Mt. Kanlaon, 1010 m, W- route via Mambucal, 3.–18.viii.1996, Primärwald, leg. Dr. R. Brechlin; ZSM • 2 ♂; Negros, prov. Negros occ., 600 m, Mt. Kanlaon, W-route via Mambucal, 19.vii.1997, Primärwald, leg. Dr. R. Brechlin; SSU • 2 ♂; Negros, prov. Negros occ., Mt. Canlaon, 800 m, W-route via Mambucal, ix.1998, Primärwald, leg. Dr. R. Brechlin; ZSM • 2 ♂; Negros Occidental, Mt. Kanlaon, Prim. forest, 600–800 m, W-Route via Mambucal, vi.1998, leg. Dr. R. Brechlin; ZSM • 1 ♂, 2 ♀; Negros, prov. Negros Occidental, Mt. Kanlaon, 600 m, W-Route via Mambucal, x.1997, Prim. forest, leg. Dr. R. Brechlin; ZSM • 1 ♂; Negros, prov. Negros Occidental, Mt. Kanlaon, 600–800 m, W-Route via Mambucal, i.1998, Prim. forest, leg. Dr. R. Brechlin; ZSM • 7 ♂; Negros, prov. Negros occ., Mt. Canlaon, 600 m, W-route via Mambucal, vi.1997, Primärwald, leg. Dr. R. Brechlin; ZSM • 1 ♂; Negros, prov. Negros occ., Mt. Canlaon, 600 m, W-route via Mambucal, v.1997, Primärwald, leg. Dr. R. Brechlin; ZSM • 1 ♂; Negros, prov. Negros occ., Mt. Kanlaon, 600 m, W-route via Mambucal, vii.1997, Primärwald, leg. Dr. R. Brechlin; ZSM • 1 ♂; Negros Occidental, Mt. Kanlaon, W-route via Mambucal, 600–800 m, ii.1998, leg. Dr. R. Brechlin; ZSM • 1 ♂; Negros, Mt. Canlaon, 600 m, W-route via Mambucal, vii.1997, 10°22'N, 123°12'E, ex coll. Dr. R. Brechlin; ZSM • 1 ♂; Negros, Mt. Canlaon, 600 m, W-route via Mambucal, ii.1997, 10°22'N, 123°12'E, ex coll. Dr. R. Brechlin; ZSM • 1 ♀; Negros, Mt. Canlaon, 600 m, W-route via Mambucal, xii.1996, 10°22'N, 123°12'E, ex coll. Dr. R. Brechlin; ZSM • 1 ♀; S. Negros, Mt. Talinis, 1200 m, iii.1998, leg. Bal; ZSM • 1 ♂; Negros Mt. Canlaon ix-x.1990 leg. Garzon; MfN • 1 ♀; Philippinen / Negros (Prov. Negros Occidental), Mt. Kanlaon, 600–880 m W-Route via Mambucal, ix/1997; Prim forest ex. coll. Dr. Ron Brechlin; MSW.

SAMAR ISLAND • 1 ♂; Isl. Samar, x.2005, Mt. Capoto, 600 m (GU 28.080); ZSM • 1 ♂; W/E Samar, 8 km SE of Bagacay, prim. forest road, 200 m, 11°47'N, 125°15'E, 21.–22.x.2009, leg. JH Lourens; ZSM.

Diagnosis. Externally (Figs 15, 24) the male of *C. polyakovi* sp. nov. differs from other *Carriola* by the presence of a hyaline window at the base of the forewing, which sometimes merges into the central window. The female can only be identified by examination of the genitalia. The male genitalia are characterised by the shape of the valva. It is strongly elongated and tapers from the base to the distal margin, with its tip strongly curved upwards. The tip is rounded and serrated. (Fig. 33). The female genitalia differ from those of related species by the signum, which is as large as ⅓ of the corpus bursae, and distinctly V-shaped with pronounced lateral lobes, which have the same width at the point of closure as along their entire length. The length of lobe is 0.4 times the width of the signum. (Fig. 42).

Description. ***External appearance. Head.*** Frons and vertex golden brown, and covered with dense drooping scales, with small tufts at the base of the antennae. Eyes large and round. Labial palpi bent obliquely upwards, densely hairy, pale on the underside and of the same pale olive colour as the abdomen; dorsally golden brown. Forewing (Figs 15, 24) triangular with rounded apex. The ratio between the length of the forewing margin and costa about 1.2:1 in both sexes. ***Male forewings*** of beige-green ground colour and typically with three hyaline windows (Figs 15, 24a, b). Length of forewing 12.8–16.8 mm (13.5 mm in holotype). Central window occupied central cell and extended to half of the cells: M_2–M_3, M_3–CuA_1, CuA_1–CuA_2, and CuA_2–1+2A and bordered by clearly visible antemedial and subterminal lines. Basal hyaline window located at wing root and bordered by basal and antemedial lines. Hyaline satellite oval and located between R_{S4}-M_1 and bordered by postmedial and subterminal lines; discal spot chevron-shaped. Underside of forewing



Figures 45–53. Distribution maps of *Carriola* species. **45.** *C. ecnomoda* (Swinhoe, 1907); **46.** *C. thyridophora* (Hampson, [1893]); **47.** *C. witti* sp. nov.; **48.** *C. seminsula* (Strand, 1914); **49.** *C. saturnioides* (Snellen, 1879); **50.** *C. polyakovi* sp. nov.; **51.** *C. shorokhovi* sp. nov.; **52.** *C. fenestrata* (Hampson, [1893]); **53.** *C. zolotuhini* sp. nov.

with lighter monotonous background, hyaline windows lined with brown scales (Fig. 24b). ***Male hindwings*** (Figs 15, 24a, b) triangular with rounded tip. General outline of pattern, colour and type of arrangement of central hyaline windows repeat the forewing. Two triangular hyaline satellite windows present, one between veins $Sc+R_1$ and Rs, and the second between veins Rs and M_1 (Fig. 15). ***Female forewings*** of olive colour and with large hyaline window bordered by clearly visible terminal line (Fig. 24c). Length of forewing 14–17 mm. ***Female hindwings*** triangular with rounded tip. The general outline of pattern, colour and type of arrangement of hyaline window repeat the forewing. ***Male genitalia*** (Figs 33a–c). Superuncus rectangular and slightly divided into two lobes at apex (Fig. 33c). Uncus (Fig. 33a) short and rounded. Valva elongated and strongly tapered from base to distal margin, its tip curved upwards, with small teeth at the end. Width of basal part of valva in a ratio of 1:3.5 to length of valva (Fig. 33a). Juxta U-shaped. Aedeagus short, wide as half the length, strongly bevelled at its anterior and posterior end (Fig. 33b). ***Female genitalia*** (Fig. 42). Papillae anales weakly sclerotised, broad and rounded, pseudopapillae small and narrow, membranous. Posterior apophyses slender to ⅔ the length of papillae anales. Antrum bowl-shaped, small. Ductus bursae membranous, strongly constricted before antrum and gradually widening before corpus bursae. Signum scobinate, V-shaped, large as ⅓ of the corpus bursa with distinct elongate, outwardly curved lateral lobes as long as 0.4 times as wide as the signum.

Biology. Unknown. The flight period is from January to December. The species has been collected at elevations ranging from 50 to 800 m.a.s.l.

Distribution. (Fig. 50). Philippines (Luzon, Panay, Negros and Samar).

Etymology. The species is dedicated to the memory of Prof. Viktor P. Polyakov (Samara Province, Russia), an outstanding cardiovascular surgeon, a scientist in the field of cardiology and an organiser of the regional school for training in cardiovascular surgery, which is based on the Samara Regional Clinical Cardiology Dispensary named after V.P. Polyakov and the Samara State Medical University.

Carriola shorokhovi sp. nov.

https://zoobank.org/795C1D90-80D8-4296-A9AB-BF9AB2346776

Figs 16, 25, 34, 43, 51

Material examined. ***Holotype***: PHILIPPINES: MINDANAO ISLAND • 1 ♂ Philippinen, Mindanao Island. Nord prov. Missamis, Secundarveget, 300 m, Melasag Mt., 10.–22.ii.1996, leg. S. Gundorov (GU 26.961); ZSM.

Paratypes [25 ♂, 7 ♀]: PHILIPPINES: MINDANAO ISLAND • 3 ♂, 1 ♀; Mindanao Island. Nord prov. Missamis, Secundarveget, 300 m, Melasag Mt., 10.–22.ii.1996, leg. S. Gundorov (GU 26.962); ZSM • 2 ♂, 1 ♀; Mindanao, Prov. Bucudno, 40 km NW Maramag, Dalongdon, Talakag, Urwaldrang, 800 m, 07°53’N, 123°54’E, 31.xii.1991–02.i.1992 leg. K. Cerny; SSU • 1 ♂; Mindanao, Bucudnon, 15 km NW Maramag, Mt. Bagongsilang, Mt. Kalatungan, 1250 m, 29.xii.1991 Secundarwald, leg. K. Cerny; ZSM • 1 ♂; SE Mindanao, Davao Oriental Aliwagwag Primary forest, 90 m, 07°43.667'N, 126°17.304'E, 30.iii.–01.vi.2008, leg. JH Lourens; ZSM • 1 ♀; Mindanao, Suriago, del Sur, Lianga, 8 km W of Diatagon, 08°42'N, 126°05'E, 200 m, 37.vii.2005, leg. JH Lourens (GU 28.784); ZSM • 1 ♀; Mindanao, N. Misamis prov., Malasag Mt., 300 m, 10–27.ii.1996, leg. S. Gundorov; ZSM.

MINDORO ISLAND • 11 ♂, 2 ♀; Mindoro sept. Mt. Malasembo, Puerto Galero, Halcon Mts., viii.1998, leg. Herman coll. Brechlin (GU 26.686, 26.687); ZSM • 1 ♂; Mindoro Occid. bei S. Jose, 12°15’N, 121°02’E, Secundarveg., 31.i.–1.ii.1988, leg. Cerny & Schintlmeister; ZSM • 3 ♂; Mindoro Occid. 20 km NE Sablayan, Amnay, 13°00'N, 120°55'E, Urwaldrand, Sec. and Secundarvegetat, 150 m, 27.i.1988, leg. Cerny & Schintlmeister; ZSM • 3 ♂; Mindoro, Mt. Malasembo, Puerto Gallero, viii.1998, ex coll. Dr. R. Brechlin; ZSM.

LEYTE ISLAND • 1 ♀; Insel Leyte, 1140 m, Mt. Boloc, 10 km, E of Mahaplag, June [vi].1997, leg. Bal ex coll. Dr. R. Brechlin; ZSM.

Diagnosis. Externally (Figs 16, 25) *C. shorokhovi* sp. nov. can be confused with *C. thyridophora*, *C. witti* and *C. seminsula*, and identification can only be made by examining the genital structures. The male genitalia differ in the shape of the valva. In *C. shorokhovi* sp. nov., the valva is elongated and pointed from the base to the distal margin as in *C. polyakovi*, but its tip is not curved upwards (Fig. 34). The signum is present, scobinate V-shaped and as large as three quarters of the bursa. The lobes of the signum are thickened and poorly separated and as long as 0.4 times as wide as the signum (Fig. 43).

Description. ***External appearance. Head.*** Frons and vertex golden brown, and covered with dense drooping scales, with small tufts at the base of the antennae. Eyes large and round. Labial palpi bent obliquely upwards, densely hairy and golden brown and pale olive coloured on the underside. Male antennae bipectinate with long branches, female antennae similar in structure but less developed. Forewing (Figs 16, 25a b) triangular with a ratio of margin to costa of about 1.2:1 in both sexes, tip of forewing rounded. ***Male forewings*** with beige-green ground colour and typically with two hyaline windows. Length of forewing 12.5–16.5 mm (13.5 mm in holotype). The central window occupies the central cell and covers up to half the length of cells between M_2–M_3, M_3–CuA_1, CuA_1–CuA_2, and CuA_2–1+2A, and bordered by antemedial and subterminal lines. Hyaline satellite oval and located between R_{S4} and M_1, veins and bordered by postmedial and subterminal lines; discal spot chevron-shaped. Underside of forewings with lighter, monotonous background, without pronounced banding pattern, but with distinct brown border around hyaline windows (Fig. 25b). ***Male hindwings*** (Figs 15, 24a, b) with arrangement of central hyaline window repeating pattern of forewing. Length of forewing 14.5–17 mm. Two triangular hyaline satellite windows present, one between veins Sc+R_1 and Rs and the second between veins Rs and M_1 (Fig. 15). ***Female forewings*** olive coloured with large hyaline window bordered by clearly visible terminal line (Fig. 25c). ***Female hindwings*** with general outline of pattern colour, and type of arrangement of hyaline window repeated forewing. ***Male genitalia*** (Figs 34a–c). Superuncus subrectangular and slightly divided into two lobes at apex (Fig. 34c). Uncus (Fig. 34a) with broad base, gradually tapering towards apex. Valva straight, elongate and tapering from base to distal margin, rounded and toothed at apex. Width of basal part of valva in a ratio of 1:3.5 to the length of valva (Fig. 34a). Juxta U-shaped, rectangular, ratio length to width 1:1.5. Aedeagus short, wide as half the length, strongly bevelled at anterior and posterior end (Fig. 34b). ***Female genitalia*** (Fig. 43). Papillae anales weakly sclerotised, broad and rounded, pseudopapillae small, narrow and clearly separated. Posterior apophyses slender to ⅔ the length of lobes of papillae anales. Antrum cup-shaped, small. Ductus bursae membranous, strongly constricted before antrum, and gradually widened before entrance to corpus bursae. Corpus bursae rounded, rather short and as long as ductus bursae. Signum, scobinated, V-shaped, as large as three quarters of bursa. Lobes of signum thickened, weakly separated, as long as 0.4 times as width of signum.

Biology. Unknown. The adults are common all year round and can be found in wooded lowlands up to 1140 m.a.s.l.

Distribution. (Fig. 51). Philippines (Mindanao, Mindoro and Leyte).

Etymology. This species is named after Prof. Sergey E. Shorokhov (Samara Province, Russia), a leading cardiovascular surgeon in the Department of Paediatric Cardiac Surgery and Cardiorheumatology at the Samara Regional Clinical Cardiology Dispensary, who has assembled a team of professional colleagues who save children's lives every day.

Carriola fenestrata (Hampson, [1893])

Figs 17, 26, 35, 44, 52

Leucoma fenestrata Hampson, [1893], The Fauna of British India, including Ceylon and Burma, edited by W.T. Blanford. Moths. Vol. 1: 480. Type locality: Ceylon [Sri-Lanka].
= *Leucoma thyridoptera* Hampson, 1910, Journal of Bombay Natural History Society 20: 144. Type locality: Ceylon [Sri-Lanka].

Material examined. NEPAL • 1 ♀, Teral, Dharan, sal & secondary, forest, 330 m, 15.xi.1983, leg. M.G. Allen (GU 27.420); ZSM.

INDIA • 4 ♂, 1 ♀, Assam, Nambor Forest res., Garampani, 100 m, 26°30'N, 93°55'E, 21–29.xi.1997. leg. Siniaev (GU 25.861 and 25.862); ZSM • 2 ♂, Assam, Nameri N.Park, Tezpur, 60 km 27°20'N, 93°15'E, 150 m, 24.vii.–02.viii.1997, leg. Afonin & Siniaev; ZSM • 2 ♂, W. Megalaya, Urman 33 km N Shillong, 25°45'N, 91°53'E, 23–24.xii.1997, leg. Siniaev & Murzin (GU 25.863); ZSM • 1 ♂, Sikkim, Pemayangtse, 2000 m, 28–31.vii.1989, leg. W. Thomas; ZSM • 1 ♀, Tamil Nadu, 900 m, 11°23'N, 78°55'E, 16.iv.1997 leg. Schintlmeister & Siniaev; all ZSM.

SRI-LANKA • 1 ♂, Westprovinz, 97 km E Colombo, Kitulgala am Kelami Ganga, 150–400 m, 2430.i.1988, leg. de-Freina; ZSM; 1 ♀, Ceylon (GU 118); NHMW.

CHINA • 2 ♂, China, SW Yunnan, Xishuanbanna, 50 km N of Jinghong, Guanping, 1000 m, 22°10'N, 101°E 19–27.i.2003, leg. S. Murzin (GU 27.438); ZSM.

VIETNAM • 2 ♂, 1 ♀, Thai Nguyen, Tan Long, 100 m, 21°42.935N, 105°50.736E, 21.–22.xi.2008, leg. Thomas Ihle (GU 27.435, GU 27.436); ZSM • 1 ♂, 1 ♀, Cao Bang, Ba Be, Lake NP, 300 m, xii.2008, leg. Thomas Ihle (GU 27.433, GU 27.434); ZSM • 2 ♂, Cuc Phuong, 60 km SW Hanoi, 400 m, 20°15'N, 105°20E, 18.xi.–03.xii.1992, leg. Siniaev & Simonov; ZSM • 1 ♂, Ben Nat. Park, 200 m, 40 km SW Than Hoa, 18°40'N, 105°40E, 22–30.xi.1994, leg. Siniaev & Simonov; ZSM • 1 ♂, Tuan-glao, 21°35'N, 103°25E, 1200 m, 5.–10.xi.1994, leg. Siniaev & Simonov; ZSM • 1 ♀, Mai-chau, 25 km SE moc-chau, 1400 m, 20°50'N, 104°40E, 14.–18.xi.1994, leg. Siniaev & Simonov (GU 27.437); ZSM.

THAILAND • 4 ♂, 1 ♀, Nakhon Ratchasima, Ban San Chao, 720 m, 14°22.544N, 101°51.891E, 0108.ix.2008, leg. T. Ihle (GU 27.421, GU 27.422); ZSM • 2 ♂, Chiang mai prov., NW Chiangmai, Doi Suthep, Nature park, Konthatharn Wasserfal, 600 m, 10.iii.1986, leg. Nässig & H.Bänziger; ZSM • 1 ♂, Changwat, Chiang Mai, 6 km, SE of Pang Faen, 1200 m, 20.xii.1998, leg. M. Hreblay, Y. Sherpa, I. Soos; ZSM • 1 ♂, Changwat, Chiang mai, 12 km NW Chiang Dao, 750 m, 12.xi.1998, leg. T. Csovari, L. Mikus; ZSM • 1 ♂, Chiang Mai, prov., Ban Buak Tuey, 1100 m, 01.v.2012, leg. unknown; ZSM • 1 ♂; Changwat, Chiang Mai, 4 km SE of Pang Faen, 1100 m, 27.i.2004, leg. A. Szabo; ZSM • 1 ♂, Chiang Mai, prov., Doi Angkang, 1600 m, 19°54'N, 99°48'E, 10.i.2002, leg. unknown; ZSM • 1 ♂, Changwat Nan, 30 km E of Pua, 1700 m, 10.xi.1999, leg. M. Hreblay; ZSM • 1 ♂, Changwat Phayao, 15 km SE Chiang Muan, 640 m, 26.xi.1998, leg. T. Csovari & L. Mikus; ZSM • 1 ♂, Thailand, Khon, Kaen prov. Si Chom Phu Nat. Park, 16°25.314N, 102°25.269E, 06.xi.2011 leg. unknown; ZSM.

LAOS • 1 ♂, Vientiane, Ban Vang Kham, 1000 m, 19°21.793N, 102°25.408E, 15–16.vii.2009, leg. K. Cerny; ZSM.

MALAYSIA • 1 ♂, West Pahang, Genting Tea Estate, 2000 ft, 13.xii.1976, leg. H.S. Barlow; ZSM • 1 ♂, West Pahang, Genting Tea Estate, 2000 ft, 24.xi.1981, leg. H.S. Barlow (GU 27.428); ZSM • 1 ♂, Malacca, Tengah Gebirge P. Zibris. V.; MfN.

Diagnosis. Externally, *C. fenestrata* can be recognised by the relatively small central hyaline window on the hindwing of both sexes, which is much smaller than in other *Carriola* and begins in the middle of the wing (Figs 17, 26). The ground colour of wings is also characteristic, with the male having a light brown background (Fig. 26a) and the female being milky white (Fig. 26c). A terminal line on the fore- and hindwings of the female consists of scattered black scales. The underside of the male forewing has a lighter, cloudy background, with a comparatively wide dark brown border around the hyaline windows (Fig. 26b). The male genitalia (Fig. 35) are characterised by the rhomboid shape of the valva, with a two-pointed projection on the sacculus (Fig. 35a). The width of the valva is in a ratio of 1:2.5 to the length. The female genitalia are characterised by the size and shape of the signum, which is as large as ⅓ of the bursa and has a triangular shape with rounded edges (Fig. 44).

Biology. Unknown. The flight period is from February to December. The species occurs from the lowlands up to an elevation of 1400 m.a.s.l.

Distribution. (Fig. 52). Nepal, India, Sri Lanka, China, Vietnam, Thailand, Laos, Peninsular Malaysia.

Carriola zolotuhini sp. nov.

https://zoobank.org/6673DB22-97EC-4FE2-ACAD-43BE54AD73B2

Figs 18, 27, 36, 53

Material examined. Holotype: PHILIPPINES: MINDANAO ISLAND • 1 ♂; Philippines, SE Mindanao, Davao Oriental Aliwagwag Primary forest, 90 m, 07°43.667’N, 126°17.304’E, 30.iii.–01.iv.2008, leg. JH Lourens (GU 28.069); ZSM.

Paratypes [4 ♂]: PHILIPPINES: MINDANAO ISLAND • 1 ♂; Philippines, SE Mindanao, Davao Oriental Aliwagwag Primary forest, 90 m, 07°43.667'N, 126°17.304'E, 30.iii.–01.iv.2008, leg. JH Lourens (GU 28.075); ZSM • 3 ♂; N. Mindanao, N. Misamis prov. Mt. Malasag, 300 m, 8–15.02 [ii].1996, leg. S. Gundorov; ZSM.

Diagnosis. Externally, the male of *C. zolotuhini* sp. nov. is easily distinguished from other *Carriola* by its dark grey colour and the absence of a hyaline window on the hindwings (Figs 18, 27). The male genitalia differ from those of the related species by the broad superuncus, the width of which is in a ratio of 2:1 to the length (Fig. 36c). The valva is rectangular and has the characteristic folds: a curved saccular fold with a downwardly curved process and a broad costal fold. The width of the basal part of the valva has a ratio of 1:2.4 to the length of the valva (Fig. 36a).

Description. ***External appearance. Head.*** Frons and vertex dark grey and covered with dense, drooping scales, with small tufts at the base of antennae. Eyes large, round. Labial palpi obliquely curved upwards, densely hairy, on underside of the same grey colour as abdomen; dorsally dark brown. Male antennae bipectinate with long branches. ***Male forewings*** (Figs 18, 27a, b) triangular with pointed tip. Ground colour dark grey, with central hyaline window. Length is 13–13.5 mm (13.2 mm in the holotype). The ratio between the length of forewing margin and costa is 1.2:1. Central hyaline window occupies central cell and covers up to half the length of the cells between veins M_2-M_3, M_3-CuA_1, CuA_1-CuA_2 and CuA_2–1+2A. Hyaline windows covered by sparse black scales, which make them appear blurred and without clear boundaries, and bordered by faintly visible antemedial and subterminal lines of black scales; discal spot chevron-shaped. Underside of forewing with dark grey, monochrome background (Fig. 27b). ***Male hindwings*** (Figs 18, 27a, b) same coloured as forewing without hyaline window, costal margin brownish. ***Male genitalia*** (Figs 36a, b, c). Superuncus very broad, its width in a ratio of 2:1 to length, slightly divided into two lobes at apex (Fig. 36c). Uncus (Fig. 36a) short, with slightly constricted base and apically rounded. Valva rectangular with sclerotised curved fold originating from base of sacculus and ending in downward curved sclerotised pointed process extending to distal ⅓ of valva. Costal margin of valva with additional broad sclerotised pocket-like fold. The ratio of the width of the basal part of the valva to the length of the valva is approximately 1:2.4. Juxta A-shaped, triangular, ratio length to width as 1.5:1. Aedeagus short, strongly bevelled at its anterior and posterior end. Everted vesica round, without cornuti, covered with very small spinules (Fig. 36b). ***Female.*** Unknown.

Biology. Unknown. The flight period is from February to April. The species occurs in wooded lowlands up to an elevation of 300 m.a.s.l.

Distribution. (Fig. 53). Philippines (Mindanao).

Etymology. This species is dedicated to the memory of Dr. Vadim V. Zolotuhin, a famous lepidopterist, whose kind help and support was always invaluable to the authors.

Acknowledgements

We are especially grateful to Vadim V. Zolotuhin† (Ulyanovsk, Russia) for his support during this work, and for providing rare literature sources, additional material, photographs of type specimens and the other valuable advices.

We express our sincere gratitude to Wolfram Mey (MfN, Berlin, Germany), Axel Hausmann (ZSM, Munich, Germany), Erik van Nieukerken and Rob de Vos (both from RMNH, Leiden, Netherlands), Wolfgang Nässig (SMF, Frankfurt-am-Main, Germany), Sergey Yu. Sinev and Alexey Yu. Matov (both from ZISP, St. Petersburg, Russia) for permission to study the material from the collections under their curatorship.

We thank Tony Pittaway (Oxfordshire, England, United Kingdom), David Lees (NHML, England, United Kingdom), Elena Pazhenkova (University of Ljubljana, Slovenia), Sergey A. Sachkov (SSAU, Russia) for very helpful comments and suggestions on the manuscript.

We are very grateful to Nikolay Dvoeglazov (Moscow, Russia), Manfred Ströhle (Weiden, Germany) and Roger Kendrick (Hong Kong) for allowing examination of their private collections.

We are very grateful to the referees and editorial staff for their constructive comments and improvements to the manuscript.

A substantial part of the work presented was carried out by the authors with the financial support of the Thomas-Witt-Stiftung.

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