

Visiana sordidata (Moore), a complex of species from the Indo-Pacific region

(Insecta, Lepidoptera, Geometridae, Larentiinae)

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The present study clarifies the taxonomy of the Indo-Pacific species-group *Visiana sordidata* (Moore), a representative of the geometrid subfamily Larentiinae. Historically, *V. sordidata* comprised three subspecies: *V. s. robinsoni* (Prout), *V. s. inimica* (Prout), and *V. s. tamborica* (Prout). However, examination of about 80 specimens revealed that all supraspecific taxa should be regarded as distinct species: *V. robinsoni*, stat. nov., *V. inimica*, stat. nov., and *V. tamborica*, stat. nov. Furthermore, the specimens from Borneo (Malaysia) are assigned to a new species, *V. hollowayi*, spec. nov. The five *Visiana* species belong to two different species-groups for which the diagnostic characters are defined. Lectotypes are designated for *V. sordidata*, *V. robinsoni*, and *V. tamborica*. The new species, *V. hollowayi*, is described and illustrated. Redescriptions of *V. sordidata*, *V. robinsoni*, *V. inimica*, and *V. tamborica* are provided. Figures of adults, genitalia, and tympanal organs of all five species are given.

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Introduction

The genus *Visiana* Swinhoe (1900) contains medium-sized to relatively large-sized geometrid moths of the subfamily Larentiinae, of which the mainly dark, brownish colouration resembles that of species of the Australasian genus *Scotocyma* (Holloway 1997, Schmidt 2003, 2005, in press). The genus is widely distributed within the Indo-Pacific region, from north-eastern Himalaya to Papua New Guinea and eastern Australia, including the Greater- and the western part of the Lesser Sunda Islands, including the Moluccas.

According to Scoble (1999), the genus *Visiana* currently comprises the following species: *V. brujata* (Guenée, [1858]), *V. excentrata* (Guenée, [1858]), *V. hyperctenista* (Prout, 1939), *V. sordidata* (Moore, 1888) [with three subspecies, *V. s. inimica* (Prout, 1937), *V. s. robinsoni* (Prout, 1939) and *V. s. tamborica*

(Prout, 1939)], and *V. vinosa* (Warren, 1907) with one subspecies *V. v. ranensis* (Prout, 1939). Although the species of the genus were listed or briefly discussed in several studies (Holloway 1979, 1986, McQuillan & Edwards 1996, Holloway 1997, Scoble 1999, Schmidt 2003), examination of the genitalia was still mostly lacking. Holloway (1997) discussed generic limits of the *Visiana* in general outline, published for the first time several photographs of *Visiana* genitalia and discovered an undescribed species within the genus.

Examination of phylogenetic relationships of *Visiana* and related larentiine genera suggested *Visiana* was not monophyletic (Schmidt 2005 and unpublished data). Consequently, the status of several subspecies needed to be reconsidered, and species had to be described as new. The primary aim of this paper is to solve the taxonomic problems within the species-complex of *V. sordidata*. The paper is part of



Fig. 1. *Visiana robinsoni*, male palp.

a comprehensive revision of the genus *Visiana* based on adult and genitalic morphology which is currently in progress (Schmidt, unpublished data).

Material and methods

About 80 specimens of *V. sordidata* from the Indo-Pacific region were studied from the following institutions: The Natural History Museum (including specimens from the accessions), London (BMNH); Museum für Naturkunde der Humboldt-Universität zu Berlin (MNHU); M. Sommerer Private Collection (MSPC).

Wing expanse was measured as twice the distance from midthorax to the forewing apex. The dissected genitalia and the abdomen have been stained with Chlorazol Black in a 30% solution of alcohol and mounted on slides in euparal. Nomenclature for adult morphology and terminology for genitalia used in this paper is taken from Pierce (1914), Forbes (1948), Klots (1970) and Nichols (1989), terms for tympanal organs follow Cook & Scoble (1992).

Photomicrographs were taken using a digital camera (ProgRes 3012, Jenoptik Laser Systems GmbH) attached to a microscope and processed with the Auto-Montage system (version 4.03 Synoptics Ltd). Photographs of adults were taken with a Nikon Coolpix 990. The digital images were enhanced and the plates compiled with Adobe Photoshop™.

Notes on taxonomic history

Scotosia sordidata was described by Moore (1888), and later it was placed in the newly described monotypic genus *Visiana* by Swinhoe (1900). Prout (1937) described the first subspecies *Xanthorhoe sordidata inimica* from east Java. Two years later Prout (1939) described two new subspecies, *X. s. robinsoni* from west Sumatra and *X. s. tamborica* from Sambawa in the Lesser Sunda Islands. Holloway (1986) briefly reviewed the genus and gave the distribution of *V. sordidata* in the Himalaya and the mountains of

Sumatra, Java, Sumbawa, and Kinabalu. Holloway (1997) in his comprehensive review of the geometrid moths of Borneo, being under time constraints, did not go into the details and listed the species *V. sordidata* with three subspecies, figured a male from Kinabalu (Borneo) as *V. sordidata* and also figured the genitalia of a female from Sambawa (Lesser Sunda Islands). At present, *V. sordidata* contains three subspecies, *V. s. inimica*, *V. s. robinsoni* and *V. s. tamborica* (Scoble 1999).

Visiana Swinhoe, 1900

Visiana Swinhoe, 1900: 335.

Type species: *Scotosia sordidata* Moore, 1888 (by monotypy).

Diagnosis. Labial palpus rather thick, very short, curved, with terminal segment very small. Antenna in male bipectinated. Forewing with two areoles, brownish coloured, with a discal dot, with median band forming a tooth-like medial projection outwards, underneath rather uniformly coloured. Coremata in males shaped like a broad pocket laterally on each side of the seventh segment. A broad, weakly sclerotised ring between the seventh and the eighth segments is present. The ventral surface of the seventh abdominal segment in females is rough. Tympanal ansa hammer-shaped, with medial rounded broadening, without a scoloparium (Schmidt 2005, in press; Figs 29-33). In the male genitalia tegumen shorter than vinculum, with sclerotised lateral arms, valvae with costa projecting in an apical process and with basal projection, vinculum with distinct saccus, juxta with lateral papillae, calcar absent. In female genitalia antrum without folds of sclerotisation, corpus bursae medium-sized to large, membranous, with a small diverticulum, signum usually present.

Visiana sordidata (Moore)

Figs 2, 14, 15, 16, 26, 32

Scotosia sordidata Moore, 1888: 274.

Visiana sordidata (Moore): Swinhoe 1900: 335; Holloway 1997: 192.

Xanthorhoe sordidata (Moore): Prout 1939: 257.

Types. Lectotype: ♂, India. Darjeeling, 2121 m, no other data; lectotype hereby designated (BMNH, examined).

Other material examined. 5♂♂, India, Moore coll., no further data (BMNH); 3♂♂, India, Darjeeling, coll. Atkinson or coll. Staudinger, no collector, no date (MNHU); 1♂, near Darjeeling, W. H. Bath, no date (BMNH);



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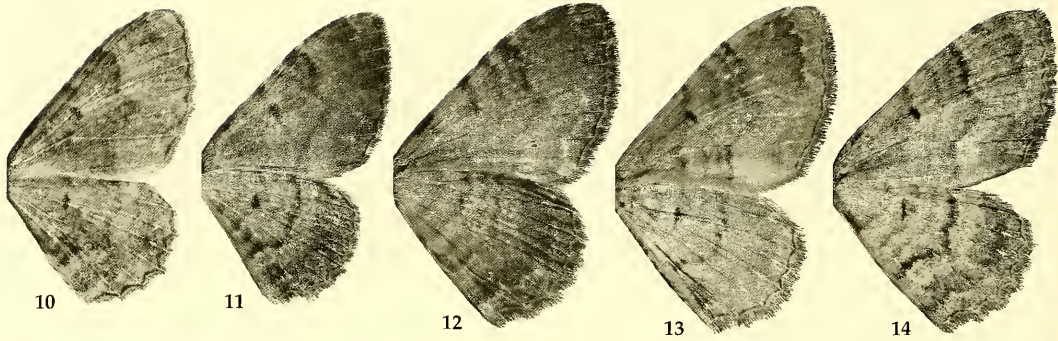


8



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Figs 2-9. *Visiana* spp., wings above. 2. *V. sordidata*, male, India, Darjeeling. 3. *V. inimica*, male, Bali, Mondoktoempang. 4. *V. robinsoni*, male, Sumatra, Sungeikumbang. 5. *V. robinsoni*, female, Sumatra, Sindar Raya. 6. *V. tamborica*, male, Tambora, Sambawa. 7. *V. tamborica*, female, Tambora, Sumbawa. 8. *V. hollowayi*, spec. nov., male, Borneo, Mt. Kinabalu. 9. *V. hollowayi*, spec. nov., female, Borneo, Sabah, Brumas.



Figs 10-14. *Visiana* spp., wings underneath. 10. *V. tamborica*, male, Tambora, Sumbawa. 11. *V. inimica*, male, Bali, Mondoktoempang. 12. *V. hollowayi*, spec. nov., male, Borneo, Mt. Kinabalu. 13. *V. robinsoni*, male, Sumatra, Sungeikumbang. 14. *V. sordidata*, male, India, Darjeeling.

5♂♂, India, Assam, Khasia Hills, no date or 1893, or iii.1894, no collector or Hamilton; 7♂♂, India, Assam, Cherrapunj, no collector, iv.1893 or xi.1893, or xii.1893, or no date, ex. coll. Swinhoe; 1♂, India, Assam, Jaintia Hills, ex. coll. Swinhoe, no further data; 1♂, India, Assam, Margarita, v.1889, W. Doherty; 2♂♂, India, Assam, Shillong, no further data (all BMNH); 16♂♂, India, Sikkim, Guntok, 1894, no collector or Möller; Kurseong, Vallée de la Teesta, no further data; Interior, 1-1212 m, or 17.x.1888; Mana, no date or 20.iv.1888 (BMNH); 1♂, Myanmar, Mishmi Hills, Dingliang, 742 m, M. Steele, 13.iii.1935; 4♂♂, Hills E of Toungho, no collector, iii.1896; 2♀♀, Myanmar, (in one female abdomen missing), East Pegu (Bago), 152-606 m, W. Doherty, iii-iv.1890 (BMNH).

Description

Labial palpi brown, with light brown scales at the apex. Wing expanse 36-44 mm. Forewings above ochreous-brown to brown, with median band brown, narrowing to the hind margin, with a broad medial projecting tooth, edged with thin, dark brown and ochreous-brown wavy lines, underneath pale ochreous-brown, with a few median wavy, brownish lines, forming a medial projecting tooth outwards, and brownish postmedian band. Hind wings above coloured as forewings, with wavy, brown, median and postmedian lines, underneath coloured and patterned as forewings but with discal dot much less distinct (Figs 2, 14).

Male genitalia (Figs 15, 16). Uncus very small, triangular, fused with tegumen; tegumen broad, hemispherical, with long, almost straight lateral arms protruded to the base of juxta; valvae short, with rather long, basal, inwardly directed projection, with costa broad, sclerotised, slightly twisted, with relatively long and thick projecting apical process; sacculus massive, protruded; juxta with small, apically flattened lateral papillae; aedeagus curved, with anellus covered with fine spines, weakly sclerotised

apically, without cornuti or distinct scobination in vesica.

Female genitalia (Fig. 26). Antrum relatively small, completely sclerotised; ductus bursae weakly sclerotised, hardly differentiated from corpus; corpus bursae very large, elongated, retort-shaped, membranous, with a small diverticulum connected to the corpus by a short, thin tube, with ductus seminalis set medially on corpus bursae near the signum; signum a relatively small patch of stout, inwardly directed spicules.

Distribution. India (north), Myanmar.

Remarks. A single female of *V. sordidata* available for study from Myanmar was dissected in 1948 (slide number 137, BMNH). The slide is in good condition but the seventh abdominal segment is missing. Therefore it is not possible to discuss the presence or shape of the "pockets" in this species.

Visiana robinsoni (Prout), stat. nov.

Figs 1, 4, 5, 13, 23, 24, 25, 29

Xanthorhoe sordidata robinsoni Prout, 1939: 257.

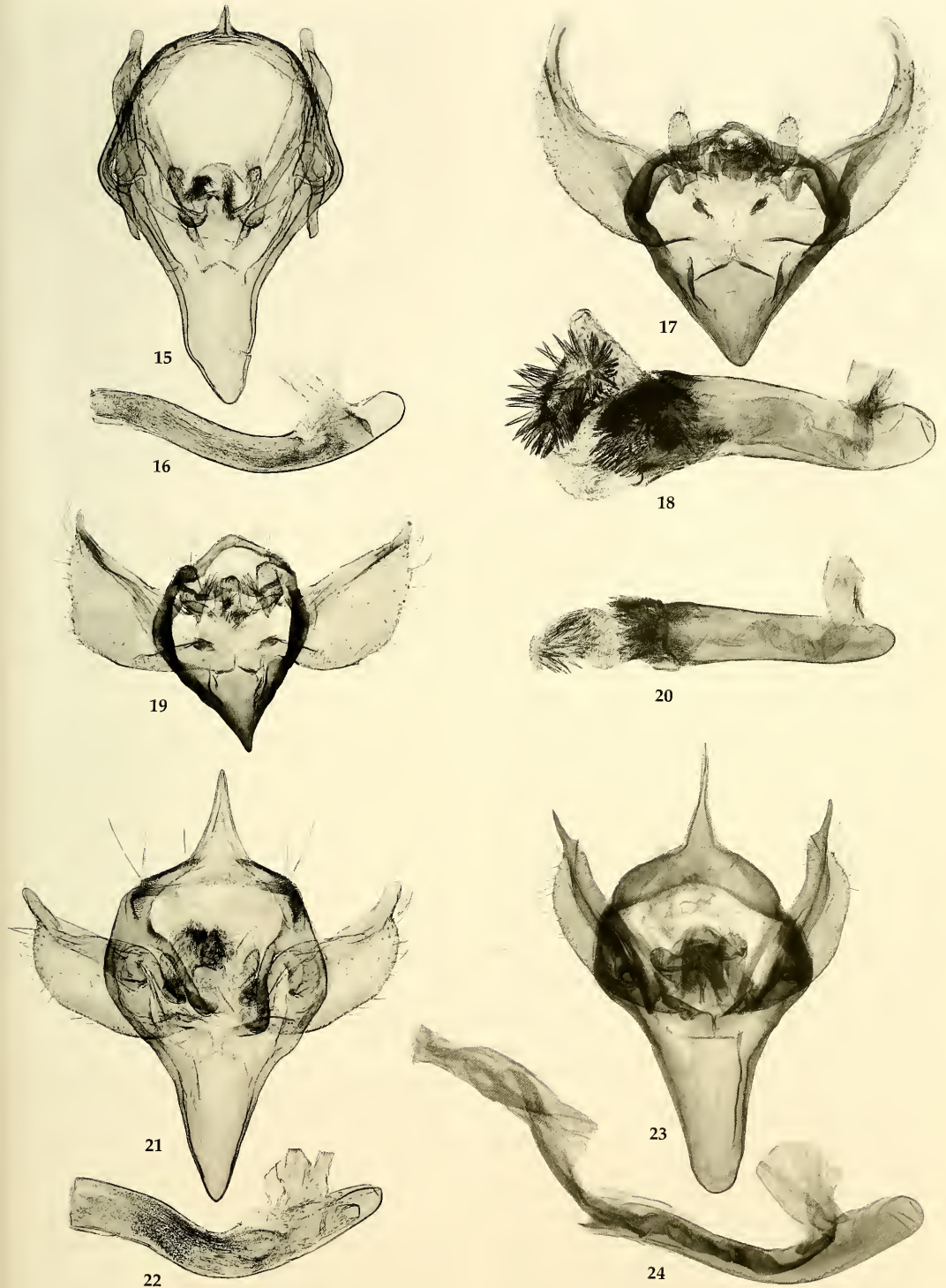
Visiana sordidata robinsoni (Prout): Holloway 1997: 192.

Types. Lectotype ♂, Sumatra (west), Korinchi (Korintji), Sungeikumbang, 1360 m Robinson & Kloss, iv. 1914 (BMNH); lectotype hereby designated (BMNH, examined). – Paralectotypes: 3♂♂, same data as lectotype, but 1360-1420 m (BMNH, examined).

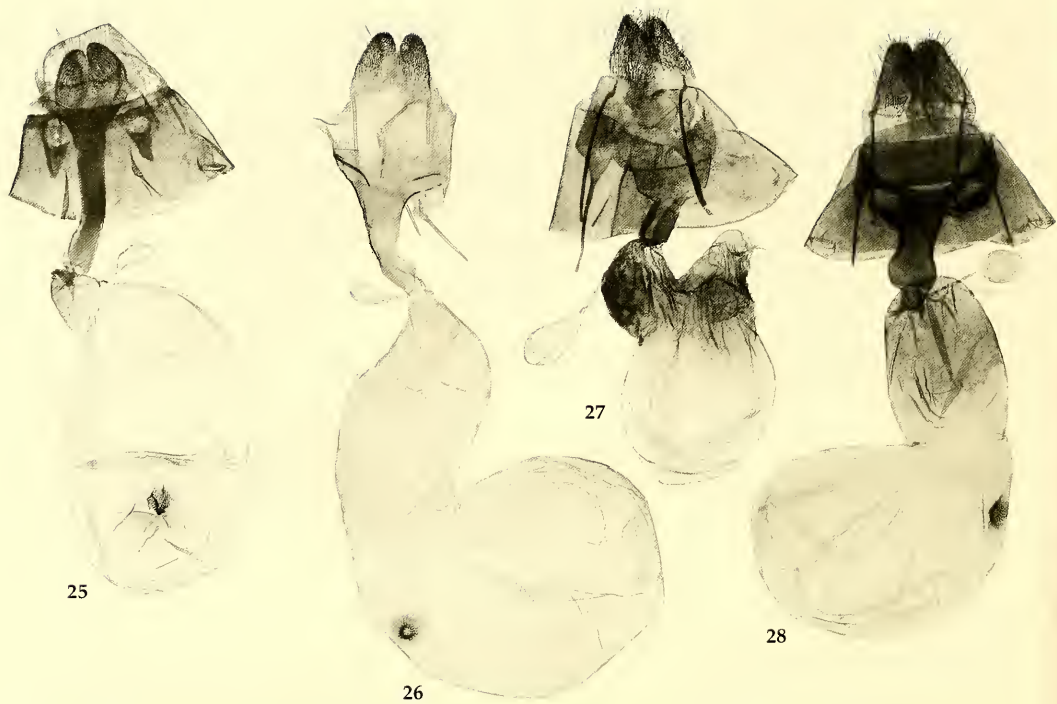
Other material examined. 1♂, Sumatra, M[a]ssn[er] G., no date (MNHU); 1♂, 1♀, Sumatra, Sindar Raya, 400 m and 480 m, E.W. Diehl, 26.v.1995 and 10.iii.1991 (MSPC).

Description

Labial palpi dark brown, with lighter brown scales. Abdomen with darker brown and some pink



Figs 15-24. *Visiana* spp., male genitalia. 15,17,19,21,23: armature, 16,18,20,22,24: aedeagus. 15-16. *V. sordidata*. 17-18. *V. inimica*. 19-20. *V. tamborica*. 21-22. *V. hollowayi*, spec. nov. 23-24. *V. robinsoni*.



Figs 25-28. *Visiana* spp., female genitalia. 25. *V. robinsoni*. 26. *V. sordidata*. 27. *V. tamborica*. 28. *V. hollowayi*, spec. nov.

scales on the third segment dorsally. Wing expanse 40-42 mm. Forewings above ochreous-brown to brown, with some pinkish scales, with basal band with two teeth pointed outwards, with median band darker brown, with distinct medial projection outwards, edged with dark brown and a very thin, interrupted whitish line, underneath pinkish-brown, with a few blackish-brown, wavy lines, with the outer line forming a distinct, rounded projection outwards. Hind wings above of similar colour as forewings, but slightly lighter, with basal area darker, with brown median line, forming a rounded medial projection outwards, underneath coloured and patterned as forewings (Figs 4, 5, 13). Ventral surface of the seventh abdominal segment in females distinctly rough, with a pair of rather long, narrow, cone-shaped "pockets" (Fig. 25).

Male genitalia (Figs 23, 24). Uncus relatively long, slightly thickened at base, tapering towards the apex; tegumen broad, cupola-shaped, with long, almost straight lateral arms protruded to the base of juxta; valvae medium sized, with costa sclerotised, twisted apically, with thin, distally relatively sharp, projecting apical process; saccus massive, elongated; juxta with small, apically rounded lateral papillae; aedeagus curved, thinner than in *V. hollowayi*, with-

out cornuti or distinct scobination in vesica.

Female genitalia (Fig. 25). Antrum medium-sized, evenly sclerotised; ductus bursae relatively long and thin, evenly sclerotised, corpus bursae rather large, asymmetric, somewhat drop-shaped, with a rounded ventro-lateral broadening, membranous, with a small, oval diverticulum connected proximally to the corpus by a short, thin tube, with ductus seminalis set medially on corpus bursae; signum is larger than in all known *Visiana* species, polygonal patch of inwardly directed spicules.

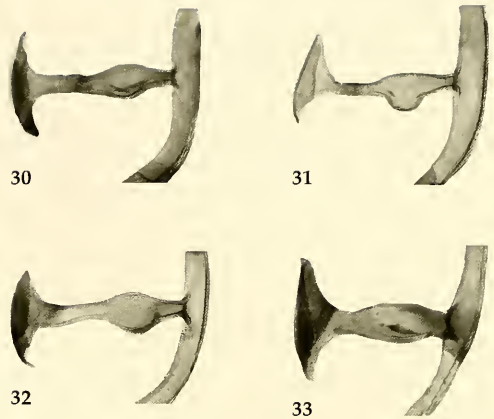
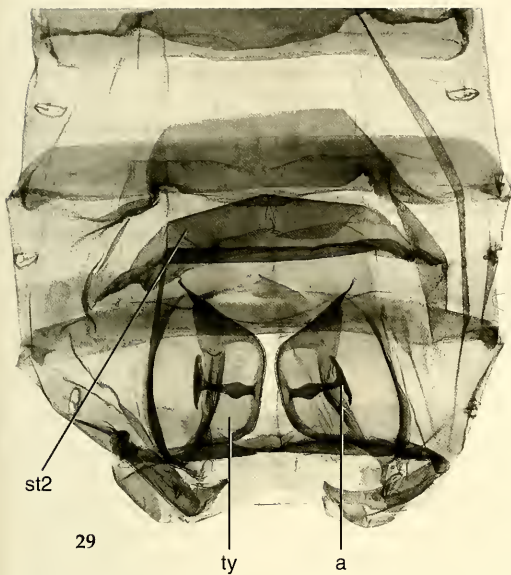
Distribution. Indonesia (Sumatra).

Remarks. In Scoble (1999) this species is listed as a subspecies of *V. sordidata*.

Visiana hollowayi, spec. nov.

Figs 8, 9, 12, 21, 22, 28, 30

Types. Holotype ♂, Borneo (north), Mt. Kinabalu, J. Waterstradt, 5.viii.1903 (BMNH). – Paratypes: 4♂♂, same data as holotype (BMNH); 1♀, Sabah, Brumas, Chey Vun Khen, 7.vii.1991 (BMNH).



Figs 29-33. *Visiana* spp. 29. *V. robinsoni*, female, basal segments of abdomen with tympanal organs. 30-33: ansa. 30. *V. hollowayi*, spec. nov. 31. *V. inimica*. 32. *V. sordidata*. 33. *V. tamborica*. a: ansa; st2: sternum 2; ty: tympanum.

Description

Labial palpi brown. Wing expanse 41-44 mm. Forewings above brown to purple-brown, with median band forming a medial projection outwards, edged with blackish-brown, underneath mainly dark brown, with a few indistinct dark brown, wavy lines, with a discal dot less distinct than in other species. Hind wings above of the same colour as forewings, with indistinct, brown and ochreous median lines, underneath coloured and patterned like forewings (Figs 8, 9, 12). Ventral surface of the seventh abdominal segment in females distinctly rough, with a pair of medium-sized, shallow, "pockets" (Fig. 28).

Male genitalia (Figs 21, 22). Uncus medium sized, elongate triangular, gradually tapering; tegumen broad, with long, bent lateral arms, thickened at base; valvae short, with costa sclerotised, thick, with thick, distally rounded, projecting apical process; saccus massive, similar to *V. sordidata* but slightly narrower; juxta with small, somewhat oval lateral papillae; aedeagus relatively thick, strongly bent, with anellus covered with spines which are thicker than in *V. sordidata*, weakly sclerotised apically, without cornuti but with distinct scobination in vesica.

Female genitalia (Fig. 28). Antrum medium-sized, evenly sclerotised; ductus bursae shorter than in *V. robinsoni* and *V. sordidata*, sclerotised, with thin lateral stripes of heavier sclerotisation, corpus bursae large, membranous, divided into two bulbs, the proximal one is larger, rounded, the distal one is

narrower, oval, with a small, elongate drop-shaped diverticulum connected proximally to the corpus by a short, thin tube, with ductus seminalis arising close to the ductus bursae; signum a patch of stout, inwardly directed spicules, similar to *V. sordidata* but slightly larger.

Distribution. Malaysia [Borneo] (Sabah: Mt. Kinabalu, Brumas).

Etymology. The species is named after Dr. J. D. Holloway in recognition of his work on the Indonesian and Malaysian moth fauna.

Remarks. The male of this species and its genitalia were illustrated in Holloway (1997) as *V. sordidata*.

Visiana inimica (Prout), stat. nov.

Figs 3, 11, 17, 18, 31

Xanthorhoe sordidata inimica Prout, 1937: 181.

Visiana sordidata inimica (Prout): Holloway 1997: 192.

Types. Holotype ♂, Bali (west), Mondoktoempang, 750 m, J.P.A. Kalis, ix.1934 (BMNH, examined). - Paratypes: 2♂♂, Java (east), Nongkedjadar, 1200 m, A.M.R. Wegner, xii.1933, i.1934; 1♂, Java (east), Tosari, E.A. Cockayne, 4.vii.1910 (BMNH, examined).

Other material examined. 2♂♂, Bali (east), Batoeriti, J. P. A. Kalis, vi.1935 (BMNH).

Description

Labial palpi brown, with light brown scales at the apex. Wing expanse 37–38 mm. Forewings above brown, with some ochreous scales, with median band brown to dark brown, thinner than in *V. sordidata*, with a medial projecting tooth, slightly narrower than in *V. sordidata* and *V. tamborica*, edged with thin, dark brown and ochreous-brown wavy lines, with distinct white scales, underneath brown, with some ochreous scales, with a median dark brown line, forming a medial projecting tooth outwards. Hind wings above coloured as forewings, with median line forming a double medial projecting tooth, underneath coloured and patterned as forewings (Figs 3, 11).

Male genitalia (Figs 17, 18). Uncus almost completely reduced; tegumen very short, broad, with curved lateral arms, thicker than in *V. tamborica*; valvae relatively long, thin, with costa broad, sclerotised, with a large, thick projecting apical process, rounded apically, with a short, curved basal projecting arm; saccus medium-sized, triangular-shaped; juxta with large, apically rounded lateral papillae; aedeagus massive, slightly curved, with anellus covered with relatively thick spines, with a large patch of long for the genus, firm cornuti in vesica. Female unknown.

Distribution. Indonesia (Bali, Java).

Remarks. In Scoble (1999) this species is listed as a subspecies of *V. sordidata*.

Visiana tamborica (Prout), stat. nov.

Figs 6, 7, 10, 19, 20, 27, 33

Xanthorhoe sordidata tamborica Prout, 1939: 257.

Visiana sordidata tamborica (Prout): Holloway 1997: 192.

Types. Lectotype: ♂, [Lesser Sunda Islands], Tambora, Sambawa, 700–1200 m, W. Doherty, vi.1896; lectotype hereby designated (BMNH, examined). – Paralectotypes: 2♂♂, 2♀♀, same data as lectotype, but iv. or vi.1896 (BMNH, examined).

Other material examined. 2♂♂, [Lesser Sunda Islands], Lombok, Everett, v.1896 or Swinhoe coll. (BMNH).

Description

Labial palpi dark brown, with ochreous-brown scales at the apex. Wing expanse 36–42 mm. Forewings above ochreous-brown to brown, with median band distinct, especially in males, with a medial projecting tooth outwards, with postmedial area ochreous, underneath brown in basal half, ochreous-brown towards the termen, with a median brown line, forming a medial projecting tooth outwards.

Hind wings above of similar colour as forewings, with median line forming a rather sharp medial projecting tooth, underneath coloured and patterned as forewings (Figs 6, 7, 10).

Male genitalia (Figs 19, 20). Uncus almost completely reduced; tegumen short, with very thin, curved lateral arms; valvae of medium length, relatively broad, with costa thin, sclerotised, with a very short for the genus projecting apical process, with a small, curved basal projecting arm; saccus relatively small, more or less triangular-shaped; juxta with relatively large, apically rounded lateral papillae; aedeagus thick, straight, with anellus covered with fine spines, weakly sclerotised apically, with a patch of rather thin cornuti in vesica.

Female genitalia (Fig. 27). Antrum broad and short, with a ring of weak sclerotisation distally; ductus bursae relatively short, sclerotised, with distinct lateral stripes of heavier sclerotisation, corpus bursae medium-sized, asymmetric, sack-shaped, with medium-sized distal extension, membranous, with wrinkles distally, with an elongate drop-shaped diverticulum, larger than in all species discussed here, connected to the corpus by a short, thin tube, with ductus seminalis arising from the extension of corpus bursae; signum absent.

Distribution. Indonesia [Lesser Sunda Islands] (Sambawa, Lombok).

Remarks. In Scoble (1999) this species is listed as a subspecies of *V. sordidata*. The female (genitalia only) is illustrated in Holloway (1997) as *V. sordidata*.

Discussion

The five species revised in this paper share the characters of the genus *Visiana* and form two distinct groups within the genus. The first group, including *V. sordidata*, *V. robinsoni*, and *V. hollowayi* is defined by the following genitalia characters: in **males** uncus developed, tapering apically, tegumen cupola-shaped, with long lateral arms, directed towards basis of juxta, costa of valvae with long basal projection, saccus very large, protruded, aedeagus curved; in **females** corpus bursae very large, without lateral stripes of sclerotisation apically.

The second group of species includes *V. inimica* and *V. tamborica* and can be defined as follows: in **males** uncus strongly reduced, tegumen shortened, with short, rather thin lateral arms, directed somewhat horizontally, costa of valvae with short basal projection, saccus medium-sized, triangular-shaped, not protruded, aedeagus almost straight; in **females** corpus bursae medium-sized, with lateral stripes of sclerotisation apically.

The first group of species is distributed in northern India, Myanmar, Indonesia (Sumatra) and Malaysia (northern Borneo). The second group occurs on the Greater and Lesser Sunda Islands (Java, Bali, Sumbawa and Lombok).

The biology of the species discussed is still unknown, including the food plants of the larvae. The species occur in the forest zone, from low elevations to about 2000 m. All specimens were collected at light at night. The species of the genus exhibit weak dimorphism of pattern in the forewing above, that of the female being less distinct. Males predominate in collections, comprising about 90 % of the specimens.

Acknowledgements

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