ARTICLE

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A REVIEW OF THE *BARSINE FLAMMEALIS* SPECIES-COMPLEX WITH DESCRIPTION OF A NEW SPECIES FROM HIMALAYA (LEPIDOPTERA, EREBIDAE, ARCTIINAE)

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The paper contains a review of the Barsine flammealis species-complex. The status of Barsine pretiosa Moore, 1879 is revised, diagnoses for B. flammealis Moore, 1878 and B. pretiosa are given. A new species, Barsine pseudomactans Volynkin & Černý, **sp. nov.** is described from Himalaya (eastern India, Bhutan and Nepal). Adults, male and female genitalia of all species mentioned are illustrated.

Key words: Lepidoptera, Erebidae, Lithosiini, Barsine, new species, Asia, Himalaya.

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INTRODUCTION

Barsine Walker, 1854 is a large genus of lichen-moths (family Erebidae, subfamily Arctiinae, tribe Lithosiini) including about a hundred of described species and widely distributed in Oriental tropics. A number of species is also known from the Himalayan Region, Russian Far East, Japan, Korea, China and Taiwan. The diagnosis of the genus was given by Holloway (2001).

Species of *Barsine* sensu stricto (close to the type species of the genus, *B. defecta* Walker, 1854) are mediumsized moths widely distributed in Eurasian tropic and temperate zones, and much less diverse in Sundaland and the Philippines. The group is most diverse in the wide sense Himalayan Region. The group subdivides into several well separated morphologically species-groups and complexes according to the male genitalia structure. The main features of the species groups are the shape and size of the distal saccular process, presence/absence and a shape of its dorsal lobe, and a configuration of the vesica diverticuli.

The present paper is devoted to the taxonomy of the *Barsine flammealis* species-complex. The status of *Barsine pretiosa* Moore, 1879 is revised, diagnoses for *B. flammealis* Moore, 1878 and *B. pretiosa* are given. A new species, *Barsine pseudomactans* Volynkin & Černý, **sp. nov.** is described from Himalaya (eastern India, Bhutan and Nepal).

MATERIAL AND METHODS

The paper is based on the materials of collections of the Natural History Museum, London (formerly British Museum of Natural History, NHM, London, Great Britain), Zoologisches Forschungsmuseum Alexander Koenig (ZFMK, Bonn, Germany), Karel Černý (CKC, Innsbruck, Austria) and Anton Volynkin (CAV, Barnaul, Russia). The genitalia were dissected and mounted in euparal on glass slides. Photos of imago where taken using the camera Nikon D3100/AF-S Nikkor, 18–55 mm. Photos of the genitalia where taken by same camera attached to a microscope with an LM-scope adapter, and further processed by Adobe Photoshop CS4® software. The terminology of the genitalia structure was given by Volynkin & Černý (2016).

The Barsine flammealis species-complex

Medium-sized moths with a wing pattern and a coloration typical for *Barsine* sensu stricto. The main features of the group are in the male genitalia: in all species the distal saccular process is bilobate with a distal lobe much longer than a dorsal one, and both 1st and 2nd medial diverticuli are bilobate (Figs 18–21). The male genitalia structure is close to that of *B. defecta* species-complex (Figs 14, 15, 22), but the latter has the medial costal process claw-like curved apically, the 1st medial diverticulum not bilobate and C-like curved, and the 2nd medial diverticulum not bilobate. The species-complex includes three known species: *B. flammealis* Moore, 1878, *B. pretiosa* Moore, 1879 and *B. pseudomactans* **sp. nov.**

Barsine flammealis Moore, 1878

(Figs 1-3, 18, 26)

Barsine flammealis Moore, 1878, Proceedings of the general meetings for scientific business of the Zoological Society of London 1878: 28, pl. 3, fig. 15 (Type locality: "India").

Type material examined: Type (Fig. 2), female, yellowish-grey handwritten label "N. India" [upper side] | "Barsine flammealis Moore (Type)" [underside] / printed yellowish-grey label "Moore Coll. 94–106" / printed round yellowish-grey label with a red circle "Type" / printed white label with QR-code "NHMUK010604334" (Coll. NHM).

Additional material examined: series of specimens of both sexes from Nepal, East India (Sikkim, north of West Bengal, Meghalaya), North Thailand (Chiang Mai and Nan provinces), Central Vietnam (Quang Ngai and Kon Tum provinces) (Colls NHM, ZFMK, CKC, CAV).

Diagnosis. Externally, *B. flammealis* (Figs 1–3) differs from other relatives by its forewings broad, the dark pattern elements blackish, the reddish pattern elements broad and bright red or dark red. The male genitalia structure (Fig. 18) is very close to that of *B. pseudomactans* **sp. nov.** and *B. pretiosa*, but differs from *B. pseudomactans* **sp. nov.** (Figs 20, 21) by the uncus slightly longer, the medial costal process slightly broader subapically, the apex of distal saccular process pointed, the 1st medial diverticulum stronger bilobate, the apical lobes smaller and cornuti in the 2nd medial diverticulum smaller, and the 3rd medial diverticulum distally narrower and covered by smaller cornuti; from *B. pretiosa* (Fig. 19) differs by the medial costal process narrowed subapically and lobe-like broadened apically, the dorsal lobe of distal saccular process broader and blunt, the 1st medial diverticulum less bilobate, and the apical lobes of the 2nd medial diverticulum larger. The female genitalia of *B. flammealis* (Fig. 26) differ from those of *B. pseudomactans* **sp. nov.** (Fig. 24) by the sclerotized section of corpus bursae slightly shorter, the sclerotization of posterior section of corpus bursae more rugose, the medial signum much longer, and the anterior signum slightly shorter; from *B. pretiosa* (Fig. 25) differ by the sclerotized section of ductus bursae shorter and broadened anteriorly, the appendix bursae larger and apically more rounded, the medial signum much longer and the anterior signum slightly shorter.

Distribution. Himalaya (Nepal, N and E India) (Strand, 1922; Kishida, 1993 [as *B. orientalis* (Daniel,1951)]; Černý & Pinratana, 2009), N Thailand (Černý & Pinratana, 2009), Vietnam. The species is reported here for Vietnam for the first time.

Note. The populations from Thailand and Vietnam (Fig. 3) have the red elements of forewing pattern larger and darker than the Himalayan populations (Figs 1, 2), but no significant differences in the genitalia. To clarify a status of the eastern populations of the species molecular studies are needed.

Barsine pretiosa Moore, 1879, stat. rev.

(Figs 4–6, 19, 25)

Barsine pretiosa Moore, 1879, Proceedings of the general meetings for scientific business of the Zoological Society of London 1879: 394 (Type locality: "Dharmsala, N.W. Himalaya").

Type material examined: Type (Fig. 4), male, yellowish-grey handwritten label "Dharmsala" [N India, Himachal Pradesh] / yellowish-grey handwritten label "*Barsine pretiosa*, ♂ (Type) Moore" / printed yellowish-grey label "Moore Coll. 94–106" / printed round yellowish-grey label with a red circle "Type" / printed white label with QR-code "NHMUK010604324" (Coll. NHM).

Additional material examined: 1 male, 1 female, [N India, Himachal Pradesh] Dharmsala / Moore Coll. 94–106 (Coll. NHM); 1 female, [N India, Himachal Pradesh] Dharmsala (Hocking [leg.]) (Coll. NHM); 2 males, 2 females, [N India, Himachal Pradesh] Kangra (Hocking [leg.]) (Coll. NHM); 1 female, [N India, Himachal Pradesh] Kulu, Kangra, Punjab, A. Young [leg.] (Coll. NHM); 1 male, India, U.P. [Uttar Pradesh], Kumaon-Himalaya, Bhimtal, 1500 m, 24.IX.1975, leg. F. Smetacek (Coll. ZFMK); 1 female, same locality and collector, but 3.V.1975 (Coll. ZFMK); 1 female, same locality and collector, but 8.X.1975 (Coll. ZFMK).

Slides BMNH(E) Arct-6489m, AV2121m Volynkin (males), AV2122f, AV2123f Volynkin (females).



Figures 1–10. Barsine spp., adults. 1 – B. flammealis, male, Nepal (ZFMK); 2 – B. flammealis, type female, N India (ONHM); 3 – B. flammealis, female, Vietnam (CAV); 4 – B. pretiosa, type male, N India (ONHM); 5 – B. pretiosa, male, N India (ZFMK); 6 – B. pretiosa, female, N India (ZFMK); 7 – B. pseudomactans, holotype male, E India, Sikkim (ONHM); 8 – B. pseudomactans, paratype male, E India, Meghalaya (ONHM); 9 – B. pseudomactans, paratype female, E India, West Bengal (ONHM); 10 – B. pseudomactans, paratype female, Bhutan (CKC).



Figures 11–17. Barsine spp., adults. 11 – B. mactans, holotype male, E India, West Bengal (\mathbb{O} NHM); 12 – B. mactans, male, E India, Sikkim (ZFMK); 13 – B. mactans, female, E India, West Bengal (ZFMK); 14 – B. defecta, syntype male, Nepal (\mathbb{O} NHM); 15 – B. defecta, male, N India, Uttar Pradesh (ZFMK); 16 – B. gratiosa, male, S India, Nilgiris (\mathbb{O} NHM); 17 – B. gratiosa, female, S India, Maharashtra (\mathbb{O} NHM).

Notes. The name *pretiosa* and many other large-sized *Barsine* taxa were synonymized with *B. gratiosa* (Guérin-Méneville, 1843) by Hampson (1900). Later, *pretiosa* was treated as distinct species by Draudt (1914) and Strand (1922). Daniel (1951, 1952) restored some taxa described from China and Japan (*B. pulchra* (Butler, 1877) and *B. striata* (Bremer & Grey, 1852)), but did not revise Himalayan taxa because of the lack of material. Kaleka (2003) treated *B. pretiosa* as a distinct species, but illustrations in his paper are poorly informative and poorly correspond to the real male genitalia of Indian *Barsine* species (and the genitalia of '*B. gratiosa*' definitely do not belong to *gratiosa* and more resemble those of *B. mactans*), and, in addition, *B. mactans* and *B. flammealis* were not mentioned, so the species treatments in the paper are doubtful and need revision as well as the status of two new species described (*B. valvalis* Kaleka, 2003 and *B. thomasi* Kaleka, 2003). The examination of the type and additional specimens of *pretiosa* confirmed its species-group that differs clearly from other large *Barsine* species by the shape of the medial costal process and the distal saccular process in the male genitalia (Fig. 28), and presence of numerous spinules in the corpus bursae in the female genitalia (Fig. 29). The male genitalia of *B. gratiosa* were correctly illustrated by Daniel (1951).

Diagnosis. Externally, *B. pretiosa* (Figs 4–6) differs from other relatives by its forewings less colorful and the dark patter elements more diffused. The male genitalia structure (Fig. 19) is very close to that of *B. pseudomactans* **sp. nov.** and *B. flammealis*, but differs from *B. pseudomactans* **sp. nov.** (Figs 20, 21) by the uncus slightly longer, the medial costal process evenly narrowed distally, the apex of distal saccular process blunt, the dorsal lobe of distal saccular process narrower and pointed, and the cornuti in the 2nd medial diverticulum larger; from *B. flammealis* (Fig. 18) differs by the medial costal process evenly narrowed distally, the dorsal lobe of distal saccular process narrower and pointed, the 1st medial diverticulum stronger bilobate, and the apical lobes

of the 2nd medial diverticulum smaller. The female genitalia of *B. pretiosa* (Fig. 19) differ from those of *B. pseudomactans* **sp. nov.** (Fig. 18) by the sclerotized section of ductus bursae slightly longer and not broadened anteriorly, the appendix bursae more conical, and the sclerotized section of posterior section of corpus bursae more rugose; from *B. flammealis* (Fig. 20) differs by the sclerotized section of ductus bursae longer and not broadened anteriorly, the appendix bursae shorter and apically more pointed, the medial signum much shorter, and the anterior signum slightly longer.

Distribution. Himalaya: North India (Himachal Pradesh, Uttar Pradesh). The report for the Andamans by Strand (1922) is doubtful and needs a verification.

Barsine pseudomactans Volynkin & Černý, **sp. nov.** (Figs 7–10, 20, 21, 24)

Type material. Holotype (Figs 7, 20): male, [E India] "Sikkim, Phedong, R.P. Desgodins [leg.]" / "Ex Oberthür Coll., Brit. Mus. 1927–3" / label with QR-code "NHMUK010604331", slide BMNH(E) Arct-6491m Volynkin (deposited in coll. NHM).

Paratypes: 2 males, Khasia Hills, Assam, Nissary (Coll. NHM); 1 male, Khasis, Nat. Coll. (Coll. NHM); 1 female, S Sikkim, Tami, 5000 ft., 17.X.1927, F.M. Bayley [leg.] (Coll. NHM); 4 males, 1 female, Gopaldhara, Darjeeling, 4720' (H. Stevens [leg.]) (Coll. NHM); 1 male, Darjeeling, Walkins [leg.] (Coll. NHM); 1 male, Sikkim, I.1889, J.G. Pilcher [leg.] (Coll. NHM); 1 male, Sikkim, 4.VI.1889, J.G. Pilcher [leg.] (Coll. NHM); 1 male, Sikkim, 4.VI.1889, J.G. Pilcher [leg.] (Coll. NHM); 1 male, Sikkim, 2000 ft., VIII.[18]95 (Coll. NHM); 2 males, Gopaldhara, IV.1918 (H. Stevens [leg.]) (Coll. NHM); 1 male, Sikkim, 2000 ft., VIII.[18]95 (Coll. NHM); 1 male, Darjeeling / *Milt. gratiosa* Deless., det. F. Daniel 1953 (Coll. ZFMK); 1 female, Bhutan, Mo Chu river, 27°43'N, 89°45'E, 19–20.X.2008, leg. /coll. Viktor Sinjaev. (Coll. CKC); 3 males India, Sikkim, Pemayangtse, 2000 m, 20–23.VII.1998, leg. W. Thomas (Coll. CKC); 1 male Nepal, Godawani, W. Thomas leg. (Coll. CKC).

Slides AV1993m Volynkin (male), BMNH(E) Arct-6492f AV2437f Volynkin (females).

Diagnosis. Externally, the new species (Figs 7–10) resembles *B. mactans* Butler, 1877 (Figs 11–13), but differs by its larger size, narrower forewings in males, the brick-orange elements of forewing pattern narrower, the postmedial line less curved on the vein 1A, and the male and female genitalia structure (Figs 23, 27). According to the male genitalia structure, B. pseudomactans sp. nov. belongs to the B. flammealis species-complex. Externally, B. pseudomactans sp. nov. (Figs 7-10) is more close to B. pretiosa (Figs 4-6), but differs clearly by its bright wing coloration, the medial line situated far from the antemedial line, and shorter blackish grey strokes of different length between veins in submarginal area. The male genitalia of B. pseudomactans sp. nov. (Figs 20, 21) are very close to those of both B. flammealis and B. pretiosa, and differ from B. flammealis (Fig. 18) by the uncus slightly shorter, the medial costal process slightly broader subapically, the apex of distal saccular process pointed, the 1st medial diverticulum stronger bilobate, the apical lobes of t smaller, the cornuti in the 2nd medial diverticulum smaller, and the 3rd medial diverticulum distally narrower and covered with smaller cornuti; from B. pretiosa (Fig. 19) differ by the uncus slightly shorter, the medial costal process slightly broader medially, the apex of distal saccular process pointed, the dorsal lobe of distal saccular process broader and blunt, and the diverticuli of 2nd medial diverticulum smaller. The female genitalia of B. pseudomactans sp. nov. (Fig. 24) differ from those of *B. pretiosa* (Fig. 25) by the sclerotized section of ductus bursae slightly shorter and posteriorly broadened, the appendix bursae broader and more rounded, and the sclerotization of posterior section of corpus bursae less rugose; from B. flammealis (Fig. 26) differ by the sclerotized section of corpus bursae slightly longer, the sclerotization of posterior section of corpus bursae less rugose, the medial signum shorter, and the anterior signum longer.

Description. Adult (Figs 7–10). Length of forewing 17–18 mm in males and 21–23 mm in females. Females larger than males and have slightly broader forewings. Male antennae fasciculate, female antennae filiform. Head and thorax brick-orange; abdomen pinkish brown. Forewing background dark yellow; pattern consists of long brick-orange strokes between veins in subbasal and medial areas, brick-orange range lines on veins in submarginal and marginal areas, two blackish grey dots at the wing base on anterior and posterior wing margins, one blackish grey dot subbasally, crosslines presented as rows of diffuse blackish grey dots on veins, and diffuse blackish grey strokes of different length between veins in submarginal area. Antemedial line strongly curved in cell; medial line smoothly curved in cell, noticeably distant from both antemedial and postmedial lines; postmedial line arcuate. Cilia dark yellow. Hindwing pinkish ochreous in male and pale pink in female; cilia ochreous pinkish. Male genitalia (Figs 20, 21). Uncus long, narrow, laterally flattened, with small pointed claw-like tip. Tuba analis broad, membranous; scaphium narrow, moderately sclerotized; subscaphium as narrow scobinate area. Tegumen moderately long and broad; juxta long, broadly X-like; vinculum short, broadly V-like. Valva moderately broad, medially slightly broadened; medial costal process of moderate size, basally broad,



Figures 18–21. *Barsine* spp., male genitalia. 18 – *B. flammealis*, Vietnam, slide AV2304m Volynkin; 19 – *B. pretiosa*, N India, Uttar Pradesh, slide AV2121m Volynkin; 20 – *B. pseudomactans*, holotype, slide BMNH(E) Arct-6491m Volynkin (©NHM); 21 – *B. pseudomactans*, paratype, E India, West Bengal, Darjeeling, slide AV1993m Volynkin.



Figures 22–29. Barsine spp., male (22, 23, 28) and female (24–27, 29) genitalia. 22 – B. defecta, N India, slide AV1997m Volynkin; 23 – B. mactans, E India, slide AV1994m Volynkin; 24 – B. pseudomactans, paratype, Bhutan, slide AV2437f Volynkin; 25 – B. pretiosa, N India, slide AV2122f Volynkin; 26 – B. flammealis, Vietnam, slide AV2342m Volynkin; 27 – B. mactans, E India, slide AV1995f Volynkin; 28 – B. gratiosa, S India, slide BMNH(E) Arct-6493m Volynkin (©NHM); 29 – B. gratiosa, S India, slide BMNH(E) Arct-6494f Volynkin (©NHM).

subapically narrowed and slightly broadened apically; distal costal process reduced; apical lobe of valva short, narrow, apically rounded; sacculus strongly sclerotized, its basal process with broad base, long, strongly curved, apically pointed; distal saccular process long, narrow, apically pointed, well separated from the apical lobe of valva and protruding over its tip, its dorsal lobe triangular thorn-like, broad, apically blunt. Aedeagus large, narrow, slightly curved; vesica broad, its structure typical for Barsine s. str. Basal diverticulum of moderate size, trianguar; 1st medial diverticulum moderately long, sack-like, bilobate, apical lobe larger than lateral one, both with scobination; 2nd medial diverticulum bilobate, covered by very small but strong cornuti of different size; 3rd medial diverticulum moderately long, slightly curved, with broad base, distally narrowed, with strong short cornuti of different size; 4th medial diverticulum small, globular, with several large short cornuti; 5th medial diverticulum very short but broad, with large strong cornuti of different size; basal plate of ductus ejaculatorius very broad, triangular, strongly sclerotized. Female genitalia (Fig. 24). Papillae anales broad, rectangular with rounded edges; apophyses anteriores and posteriores of approximately equal length, long and thin. Ostium bursae broad; antrum broad, strongly rugose; ductus bursae strongly sclerotized, flattened dorso-ventrally, anteriorly broadened, its anterior membranous sections short. Corpus bursae globular, membranous, with two large elliptical signa in medial and anterior sections, and strong sclerotization near base of appendix bursae and band of strong scobination along border of sclerotized area. Appendix bursae strongly sclerotized, conical, situated latero-dorsally, curved.

Etymology. The species name refers to its external resemblance with B. mactans.

Distribution. The species is known from the Himalayan Region: Nepal, Bhutan and eastern India (Sikkim, north of West Bengal, Meghalaya).

Note. The species was reported for Darjeeling [West Bengal] by Daniel (1951) as one of specimens of *B. gratiosa* (in ZFMK, examined).

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