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TAXONOMIC STUDIES ON THE *LYGEPHILA PROCAX* (HÜBNER, 1813) SPECIES-GROUP, WITH DESCRIPTIONS OF THREE NEW SPECIES (LEPIDOPTERA, EREBIDAE, TOXOCAMPINAE)

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Abstract: The *Lygephila procax* species-group is revised, three new species, *Lygephila asiatica* **sp. n.***, Lygephila frosya* **sp. n.** and *Lygephila intermedia* **sp. n.** are described; the taxonomic identity of *Lygephila decolor* (Bang-Haas, 1912) and *Lygephila nigricostata* (Graeser, 1890) **stat. rev.** are clarified. The lectotypes of *Lygephila limosa* (Treitschke, 1826), *L. nigricostata* and *L. decolor* are designated. The male and female genitalia of *L. decolor* are described and illustrated for the first time, treated here as good species, distinct from *L. procax*, **stat**. **rev**. The first record of *L. procax* from Spain is provided.

Key words: Lepidoptera, Erebidae, Toxocampinae, *Lygephila procax* species-group, new species*,* vesica structure, Dauria, China, Inner Mongolia, Caucasus

INTRODUCTION

The first attempt to prepare the Eurasian check list of the genus *Lygephila* was made by GOATER et al. (2003) in the Noctuidae Europaeae, Vol. 10. This work listed *L. decolor* as synonym of *L. procax* and *L. nigricostata* as a good species. The subsequent authors controversially interpreted the taxonomic position of these taxa, see KONONENKO (2005), FIBIGER & KONONENKO (2008), MATOV et al. (2008), KONONENKO (2010), BABICS (2014) and KONONENKO (2016). Present paper is dedicated to clarify the taxonomic status of the taxa belonging into the *L. procax* species group, which is proved to contain more than two taxa.

MATERIAL AND METHODS

Male and female genitalia were dissected and mounted in Euparal on glass slides. Photos of genitalia where made by Svitlana Pekarska using microscope Nikon SMZ745T and camera Moticam 2500. Photos of imagoes were taken by the author using camera Nikon D3000/Sigma 105, f/2.8.

Abbreviations: HNHM = Hungarian Natural History Museum Budapest (Hungary); MNHU = Museum für Naturkunde der Humboldt-Universität zu Berlin (Germany); NHMW = Naturhistorisches Museum Wien (Vienna, Austria); ZISP = Zoological Institute, Russian Academy of Sciences St. Petersburg (Russia); ZFMK = Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn; GB = Gottfried Behounek (Grafing, Germany); GR = Gábor Ronkay (Budapest, Hungary); OP = Oleg Pekarsky (Budapest, Hungary); PGM = Péter Gyulai (Miskolc, Hungary); RFE = Russian Far East; LR = László Ronkay (Budapest, Hungary); ZSM = Zoologische Staatssammlung München; WM = slide made by Edward P. Wiltshire).

SYSTEMATIC PART

Description of the *Lygephila procax* species-group

Medium-sized moths (wingspan 28–40 mm) with slender body. Head and body blackish brown with frons and collar dark chocolate brown. Forewing broad, apex pointed, costa darkened, ground colour chocolate brown or greyish-yellow with indistinct crosslines; orbicular stigma as a small white dot, reniform stigma poorly defined, indistinct in most cases, approximately triangular or lunulate, dark brown thickened at inner corner; claviform stigma absent; hindwing as ground colour, with lighter inner area and with small discal spot and slightly darkened outer (marginal) third on underside. Male genitalia nearly symmetrical (right valva slightly narrower); uncus well developed, long, narrow, rod-like; valva with roundish dorsal and straight ventral margins; ampulla sclerotized, clavate, located subapically; aedeagus cylindrical, long, distal third slightly curved with developed carinal tooth; vesica membranous, multidiverticulate consisting of one subbasal diverticulum topped with large claw-like cornutus, five or six medial diverticula various in shape and size and one terminal diverticulum; terminal tube long, membranous with ribbed sclerotized plate (Figs 25–32, 49–56, 79–86) at base. In the female genitalia, ostium bursae large, sclerotized, with slightly concave posterior margin; antrum elongated, tapering; ductus bursae very small, corpus bursae elliptical, membranous with thickened, hardened walls of upper third and with sclerotized areas near appendix bursae (sclerotized plate and coffee-bean-like fold).

The *L. procax* species-group comprises the following six Palearctic species: *L. procax* (Hübner, 1813), *L. nigricostata* (Graeser, 1890), *L. decolor* (Bang-Haas, 1912) **stat. rev**., *L. asiatica* **sp. n.**, *L. intermedia* **sp. n.**, and *L. frosya* **sp. n.**

***Lygephila procax* (Hübner, 1813)** Figs 1–8

Noctua procax Hübner, [1813], Sammlung europäischer Schmetterlinge. Volume 4. Eulen. Augsburg. J. Hübner. 185 plates, pp [i]-[iii]-iv-vi-[7]-8-24 (TL: [Europe])

Synonymy:

Asticta proclivis Hübner, [1823], Verzeichniss bekannter Schmetterlinge. pl. 266. An unjustified emendation;

Ophiusa limosa Treitschke, 1826, Die Schmetterlinge von Europa. 10 (2), Gerhard Fleischer, Leipzig, 226 pp. (TL: [Hungary, Budapest, Buda] Ofen).

Type material examined. *Ophiusa limosa* Treitschke, 1826 (Fig. 3) **Lectotype** (here designated) male, square label with black frame: TREITS. 2420, slide OP2454m (coll. HNHM Budapest).

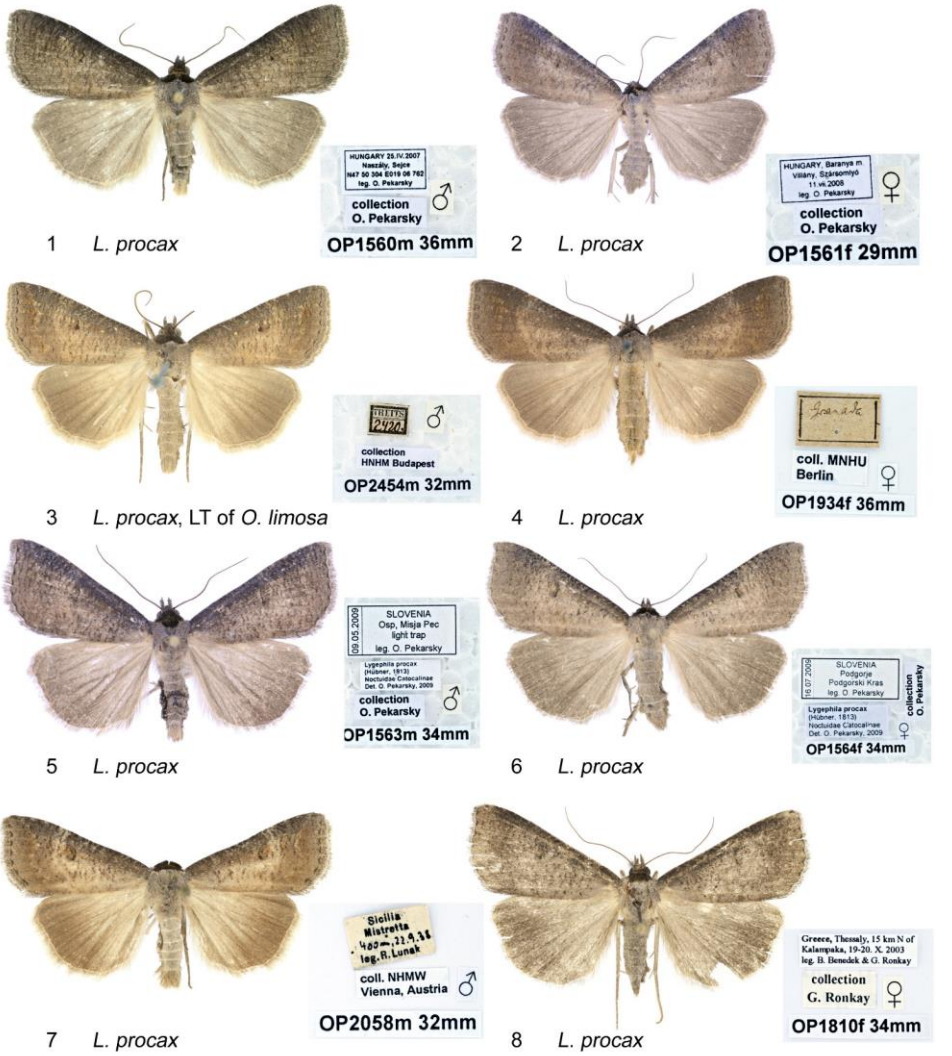
Additional material examined. 1 ♂, **Hungary:** Naszály, Sejce, N47°50'34'', E019°06'762'', 25.IV.2007, leg. O. Pekarsky, slide OP1560m; 1 ♀, Villány, Szársomlyó, 11.VII.2008, leg. O. Pekarsky, slide OP1561f; 1 ♂, Pilisvörösvár, near Kopár Csárda, 6.VI.2014, leg. O. Pekarsky (coll. O. Pekarsky); **Slovenia:** 1 ♂, Osp, Mišja Peč, 9.V.2009, leg. O. Pekarsky, slide OP1563m; 1 ♀, Podgorje, Podgorski Kras, 16.V.2009, leg. O. Pekarsky, slide OP1564f (coll. O. Pekarsky); **Makedonia:** 1 ♂, Pestani, 1000 m, 5.V.1972, leg. Schacht, slide GB2573m (coll. G. Behounek); **Italy:** 1 ♂, Sicily, Mistretta, 400 m, 22.IX.[19]38, leg. R. Lunak, slide OP2058m (coll. NHMW); **Spain:** 1 ♀, Granada, slide OP1934f (coll. MNHU); **Greece:** 1 ♀, Thessaly, 15 km N of Kalampaka, 19–20.X.2003, leg. B. Benedek & G. Ronkay, slide OP1810f (coll. G. Ronkay).

Note. Type locality of *Ophiusa limosa* known as Ofen, a German name of the old Hungarian city Buda which is a western part of modern Budapest.

Taxonomy. Polytypic species. Practically all European populations are slightly different externally.

Diagnosis. Externally different from *L. nigricostata* and *L. intermedia* by its unicolorous blackish-brown ground colour of forewings and hindwings; from *L. asiatica* by its larger size and more intensive colouration of the wings. Comparing the genitalia of the six species of the group, in males the ampulla of *L. procax* is shorter than in *L. nigricostata* and *L. intermedia*, also the clasping apparatus and aedeagus are significantly larger in size than in *L. asiatica*; in the females, the antrum of *L. procax* is longer than in *L. nigricostata* with shallower cleft on posterior margin and roundish posterior ends (Figs 87–90), being significantly narrower in upper part than in *L. intermedia*. The entire female genitalia of *L. procax* is much larger than those of *L. asiatica* (Figs 91, 92), *L. decolor* (Figs 94, 95) and *L. frosya* (Fig. 93), whereas in *L. intermedia* the posterior part of antrum is wider with almost parallel lateral edges, in *L. nigricostata* from the type locality

(Russian Far East) and Japan the antrum is shorter, ostial cleft deeper, posterior ends of antrum sharper (Figs 101–104).



Figures 1–8. *Lygephila procax*, adults. 1, male, Hungary, Sejce (OP); 2, female, Hungary, Villány (OP); 3, Lectotype of *Ophiusa limosa*, male, Hungary, Budapest, Buda (HNHM); 4, male, Spain, Granada (MNHU); 5, male, Slovenia, Osp (OP); 6, female, Slovenia, Podgorje (OP); 7, male, Italy, Sicily (NHMW); 8, female, Greece, Thessaly (GR).

Description. Wingspan 28–40 mm, on average 34–36 mm. Head and body blackish grey brown; collar dark brown (almost black). Forewing elongated, its apex pointed, blackish brown, unicolorous, irrorated sparsely with short rows and scattered single blackish scales, costal and subterminal area more darkened, subbasal and medial area somewhat lighter; reniform stigma inconspicuous, lunulate; orbicular stigma as white dot; crosslines absent except for pale subterminal line; terminal line fine, composed by black streaks; cilia as ground colour. Hindwing ground colour as of forewing, outer half slightly darker; fringes as ground colour.

Male genitalia (Figs 19–23, 25, 26, 29, 30). Nearly symmetrical (right valva slightly narrower). Uncus long, narrow, evenly curved; valva with roundish dorsal and straight ventral margins; ampulla short, clavate, located subapically. Aedeagus cylindrical, medium-long, distal third slightly curved with developed carinal tooth. Vesica membranous, multidiverticulate, subbasal diverticulum topped with large claw-like cornutus, medial part has six diverticula various in shape and size, terminal diverticulum triangulate, pocketed, consists of two pockets (one quadrangular and one angular) at base and elongated, triangular terminal part with three small pockets, terminal tube long, membranous with ribbed sclerotized plate at base (Figs 25, 26, 29, 30).

Female genitalia (Figs 87–90). Ovipositor relatively large, broad, papillae anales hairy with long setae Apophyses anteriores long, straight, apophyses posteriores thin, longer than apophyses anteriores. Antrum elongated, flattened, belt-like, ostium bursae large, sclerotized, with slightly concave posterior margin; ductus bursae very small, corpus bursae membranous, ovoid with sclerotized patches near appendix bursae.

Distribution. Northern Mediterranean.

***Lygephila asiatica* sp. n.** Figs 9–18

Type material. Holotype: Male (Fig. 9), Kazakhstan, Zaisan distr., SW coast of Zaisan lake, sands, 390 m, N48°03'01.0'', E83°22'15.4'', 22–24.08.2012, leg. A. Volynkin, slide OP3150m (coll. O. Pekarsky).

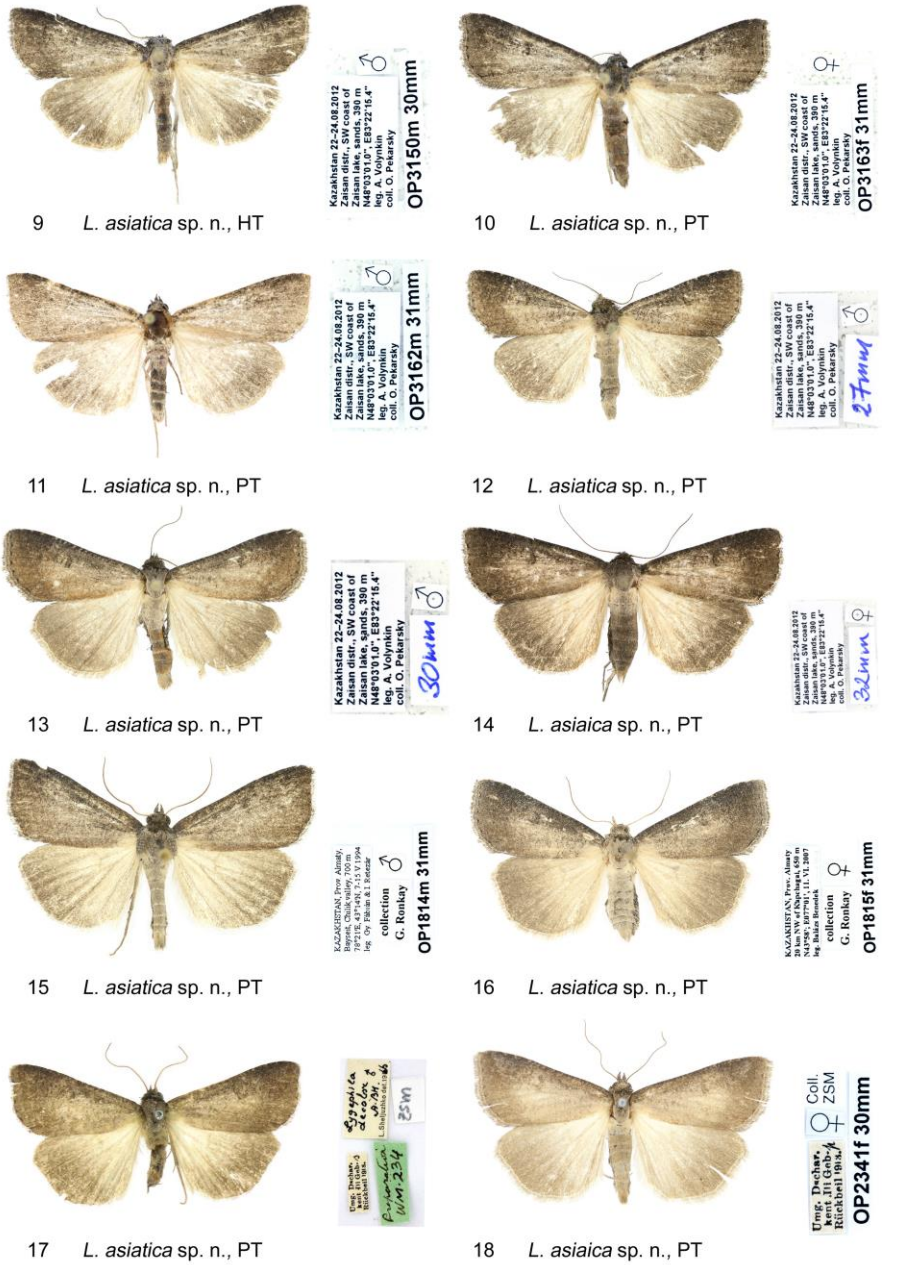
Paratypes. 12 ♂♂ & 2 ♀♀, from the same locality and with same data as the holotype, slides OP3162m, OP3163f; 3 ♂♂ & 1 ♀, S Kazakhstan, Almaty prov., Ili river valley, 5 km S of Aidarly vill., N43°59', E79°32', 19.08.2015, leg. P. Gorbunov (coll. O. Pekarsky); 2 ♂♂, from the same locality and with same data (coll. S. Melyakh); 1 ♂, SE Kazakhstan, Almaty Province, 25 km S of Almaty City, Balshoe Almaatinskoe Lake env., 3200 m, N43°02', E76°57', 12.07.2016, leg. P. Gorbunov, (coll. O. Pekarsky); 1 ♀, Kazakhstan, 77; 1 ♀, Kazakhstan, Prov. Almaty, 22 km N Masak, 600 m, N43°46', E78°27', 27.VII.1995, leg. Gy. Fábián & Z. Varga; 3 ♂♂ &

1 ♀, Kazakhstan, Prov. Almaty, Bayseit, Chilik valley, 700 m, N43°14', E78°21', 7–15.V.1994, leg. Gy. Fábián & I. Retezár, slide OP1814m (coll. G. Ronkay); 1 ♀, Kazakhstan, Prov. Almaty, 20 km NW of Kapchagai, 650 m, N43°58', E077°01', 11.VI.2007, leg. B. Benedek, slide OP1815f (coll. G. Ronkay); 1 ♀, SE Kazakhstan, Almaty Province, 22 km N of Kapchagai, Ili River valley, N44°04', E77°01', 18.VIII.2015, leg. P. Gorbunov, (coll. S. Melyakh); 1 ♀, [Kazakhstan] prov. Syr-darjensis, Perovsk circ., 24.IV.1909, Miller; 1 ♂, Kazakhstan, Dzhelturanga, Bribalkhasie, slide 0319Matov (coll. ZISP); 1 ♂, SE Kazakhstan, Balkhash Lake bank, 15 km S of Kashkankeniz, Salsosa desert, N45°40', E73°23', 9.07.2016, leg. P. Gorbunov, (coll. O. Pekarsky); 1 ♂ & 1 ♀, [Kazakhstan, Panfilov district], "Umg. Dachar. kent [Dzharkent], Ili Geb.[iet], p, 1913, Rückbeil", slides WM234♂, OP2341f (coll. ZSM).

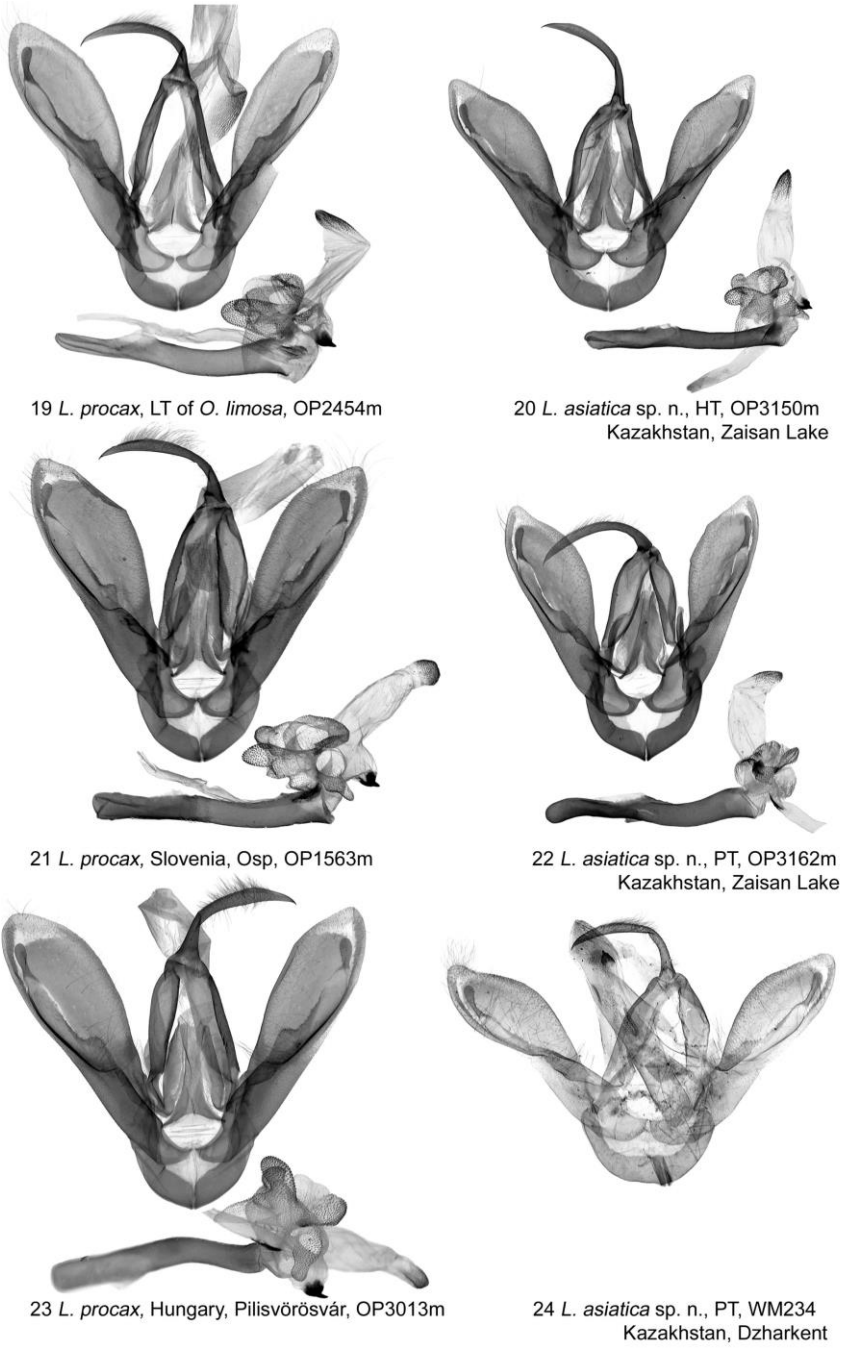
Diagnosis. The new species externally resembles *L. intermedia* and *L. nigricostata,* but differs by its smaller size and less intensive colouration. It differs from *L. procax* and *L. decolor* by lighter medial part of the wings, from *L. frosya* by larger size and more developed reniform stigma. In male genitalia, *L. asiatica* is closest to *L. procax* but differs from it by smaller size, narrower valva with sharper apex and gentle subapical concavity on dorsal margin. It can be distinguished from *L. decolor* by narrower valva with more acute apex, from *L. frosya* by shorter ampulla and absence of costal extension on valva, from *L. intermedia* and *L. nigricostata* by shorter ampulla, narrower and smaller valva. The female genitalia of the new species are confusingly similar to those of *L. decolor* and it is very hard to point any significant difference in their structures, however the male genitalia of these two species are definitely different. The female genitalia of *L. asiatica* differ from *L. frosya* by longer, less sclerotized and more curved anterior part of antrum, from *L. procax*, *L. intermedia* and *L. nigricostata* by smaller size and shorter antrum.

Description. Wingspan 27–32 mm (holotype 30 mm). Head, tegulae, and thorax grey-brown, with sparse black scales, collar dark brown. Forewing narrowed, elongated with pointed apex, greyish-brown, irrorated with black scales, costal and subterminal areas darkened; inner part lighter, greyish, border of medial and postmedial areas strict; reniform stigma weakly developed; crosslines absent; cilia as ground colour. Hindwing light grey-brown, outer part significantly darker; fringes as ground colour.

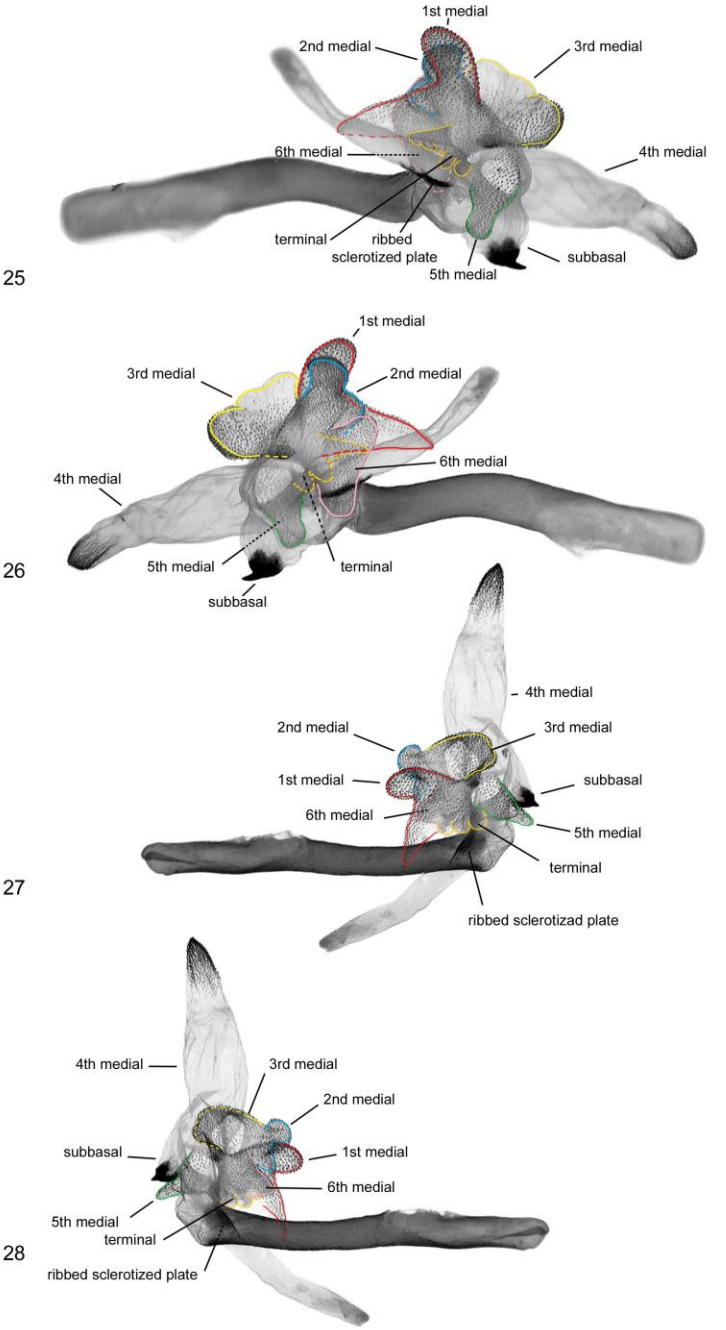
Male genitalia (Figs 20,22, 24, 27, 28, 31, 32). Nearly symmetrical (right valva slightly narrower). Uncus long, narrow, evenly curved, rod-like, valva elongated, oval-shaped, dorsal margin more roundish; ampulla elongated, stick-like (somewhat less clavate than in *L. procax*), located subapically; aedeagus cylindrical, medium-long, straight; vesica membranous, multidiverticulate, subbasal diverticulum topped with sclerotized plate and claw-like cornutus,



Figures 9–18. *Lygephila asiatica* sp. n., adults. 9, Holotype, male, Kazakhstan, Zaisan (OP); 10, Paratype, female, Kazakhstan, Zaisan (OP); 11, Paratype, male, Kazakhstan, Zaisan (OP); 12, Paratype, male, Kazakhstan, Zaisan (OP); 13, Paratype, male, Kazakhstan, Zaisan (OP); 14, Paratype, female, Kazakhstan, Zaisan (OP); 15, Paratype, male, Kazakhstan, Almaty (GR); 16, Paratype, female, Kazakhstan, Almaty (GR); 17, Paratype, male, Kazakhstan, Dzharkent (ZSM); 18, Paratype, female, Kazakhstan, Dzharkent (ZSM).



Figures 19–24. *Lygephila* spp. male genitalia. 19, *L. procax*, Lectotype of *Ophiusa limosa*, Hungary, Budapest, Buda (HNHM); 20, *L. asiatica*, Holotype, Kazakhstan (OP); 21, *L. procax*, Slovenia (OP); 22, *L. asiatica*, Paratype, Kazakhstan (OP); 23, *L. procax*, Hungary (OP); 24, *L. asiatica*, Paratype, Kazakhstan (ZSM).



Figures 25–28. Vesica structure. 25, 26 *Lygephila procax*, Hungary, Pilisvörösvár, slide OP3013m; 25, lateral view; 26, lateral view opposite side; 27, 28 *L. asiatica*, Paratype, Kazakhstan, Zaisan, slide OP3150m; 27, lateral view; 28, lateral view opposite side.

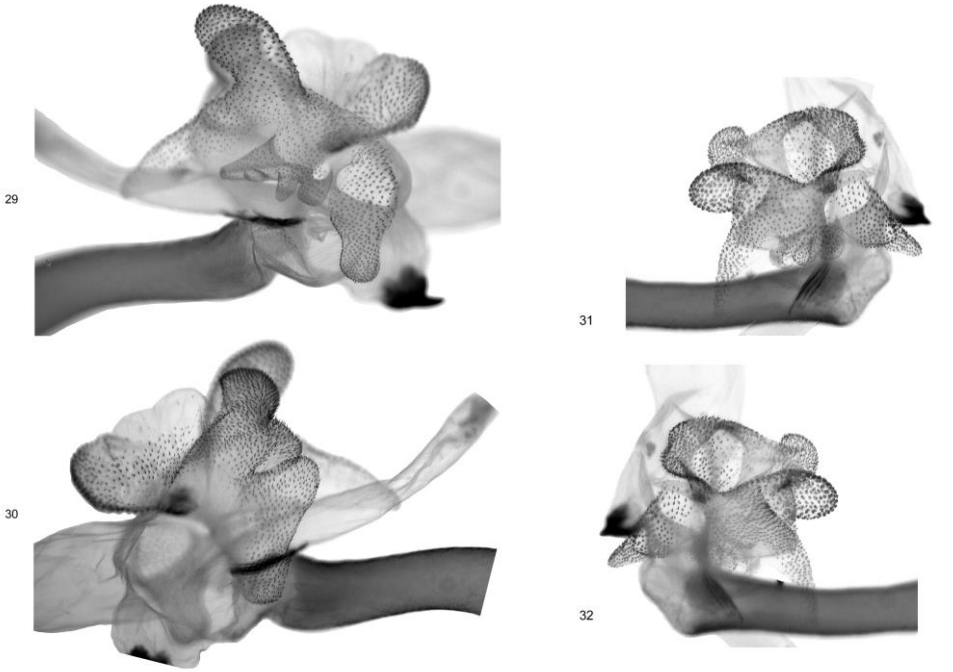
medial part has six diverticula various in shape and size (1st medial diverticulum large, bilobate, 2nd large, globular, 3rd reniform shaped, 4th large, elongated, subconical with dense scobination on top, 5th elongated, 6th triangle), terminal diverticulum tapering, pocketed; terminal tube long (its end reaches bulbus ejaculatorius), membranous with ribbed sclerotized plate (Figs 27, 28, 31, 32) at base.

Female genitalia (Figs 91, 92). Ovipositor relatively large, broad, subconical, papillae anales hairy with long setae on apical edges. Apophyses anteriores thin, long, straight, apophyses posteriores thinner and longer than apophyses anteriores. Antrum well sclerotized, tapering, belt-like with almost parallel lateral edges on distal part and curved proximal end, posterior margin with shallow concavity and roundish posterior ends; ostium bursae large, sclerotized; ductus bursae very small; corpus bursae ovoid membranous, upper part with small sclerotized plate and sclerotized area connecting ductus bursae; appendix bursae prominent, tapering.

Distribution. Kazakhstan: Kyzylorda, Almaty and Zaysan regions.

Etymology. The species name refers to the geographic distribution.

***Lygephila decolor* (Bang-Haas, 1912) Stat. rev.** Figs 33–36



Figures 29, 30. Vesica structure, larger magnification. 29, 30 *Lygephila procax*, Hungary, Pilisvörösvár, slide OP3013m; 29, lateral view; 30, lateral view opposite side.

Figures 31, 32. Vesica structure, larger magnification. 31, 32 *Lygephila asiatica*, Paratype, Kazakhstan, Zaisan, slide OP3150m; 31, lateral view; 32, lateral view opposite side.

Toxocampa decolor Bang-Haas, 1912, Deutsche entomologische Zeitschrift Iris 26 (3): 162, (4): pl. 6, f. 23, (TL: [China] Yarkend, Mustagata)

Type material examined. *Toxocampa decolor* Bang-Haas, 1912 (Fig. 33) **Lectotype** (here designated) male, [China, Xinjiang] Mustagata, Yarkend, Origin., ex coll. Bang-Haas, slide OP2753m, **Paralectotype** (Fig. 34) (here designated) female, [China, Xinjiang] Mustagata, Yarkend, Origin., ex coll. Bang-Haas, Slide OP2754f (coll. MNHU).

Additional material examined. 1 ♂, [China, Xinjiang] Ost-Turkestan, Aksu, 1900, [leg.] Rückbeil, ex coll. Tancré, slide OP2949m (coll. MNHU) (Fig. 35); 1 ♀, China, Xinjiang, W Taklamakan desert, Yarkan He riv. valley, Tugay forest, h-1140 m, N39°21'953'', E078°11'639'', 9–12.VI.2013, leg. Floriani, slide OP2272f (coll. O. Pekarsky) (Fig. 36).

Taxonomy. POOLE (1989) established new combination for the taxon, mentioning it as *Lygephila decolour* and treated it as a good species. GOATER et al. (2003) considered *L. decolor* as a synonym of *L. procax* while BABICS (2014) listed it as a subspecies of *L. procax* without explanations. The type material have, however, never been studied and the taxonomic position of this small, unicolorous *Lygephila* has remained unclear for the long period of time.

Diagnosis. Externally different from *L. procax* and *L. nigricostata* by the unicolorous pale yellow-brown ground colour of forewings and hindwings. In the male genitalia, the ampulla of *L. decolor* is shorter than in the two closely allied species, the uncus is longer in proportion to valva length, the valva is shorter and wider medially, the 2nd medial diverticulum significantly different in shape, the 6th medial diverticulum is absent, and the terminal diverticulum smaller with smaller pockets (Figs 49–52); in the females, the antrum of *L. decolor* is shorter, the apophyses anteriores are thinner and shorter than in *L. procax* and *L. nigricostata*.

Description. Wingspan 28–34 mm. Head, thorax, tegulae and body yellow grey irrorated with white spots; collar darker also with white irroration. Forewing elongated, its apex pointed, clay yellow with greyish shining, unicolorous, irrorated sparsely with short rows and single blackish scales, costal and subterminal area more darkened, subbasal and medial area somewhat lighter; reniform stigma inconspicuous, lunulate; orbicular stigma as white dot; crosslines absent except pale subterminal line; terminal line fine, composed by black streaks; cilia as ground colour. Hindwing unicolorous, matching with ground colour of forewing, outer half slightly darker; fringes as ground colour.

Male genitalia (Figs 43, 44, 49–52). Nearly symmetrical (right valva slightly narrower). Uncus long, narrow, evenly curved; valva with roundish dorsal and straight ventral margins; ampulla clavate, short, located subapically. Aedeagus

cylindrical, medium long, thin, distal third slightly curved, small carinal tooth turns into basal crest. Vesica membranous, multidiverticulate, subbasal diverticulum small, topped large claw-like cornutus, medial part has five diverticula various in shape and size, terminal diverticulum elongated, pocketed (Figs 49–52), terminal tube long, membranous with ribbed sclerotized plate at base (Figs 49, 50).

Female genitalia (Figs 94, 95). Ovipositor relatively large, broad, short, subconical, papillae anales hairy with long and short setae. Apophyses anteriores short, straight, apophyses posteriores thin, longer than apophyses anteriores. Antrum elongated, with wider posterior and narrower anterior parts, flattened, sclerotized dorsally; ostium bursae as large as antrum width with slightly concave posterior margin; ductus bursae very small, corpus bursae membranous, ovoid with sclerotized patches near appendix bursae.

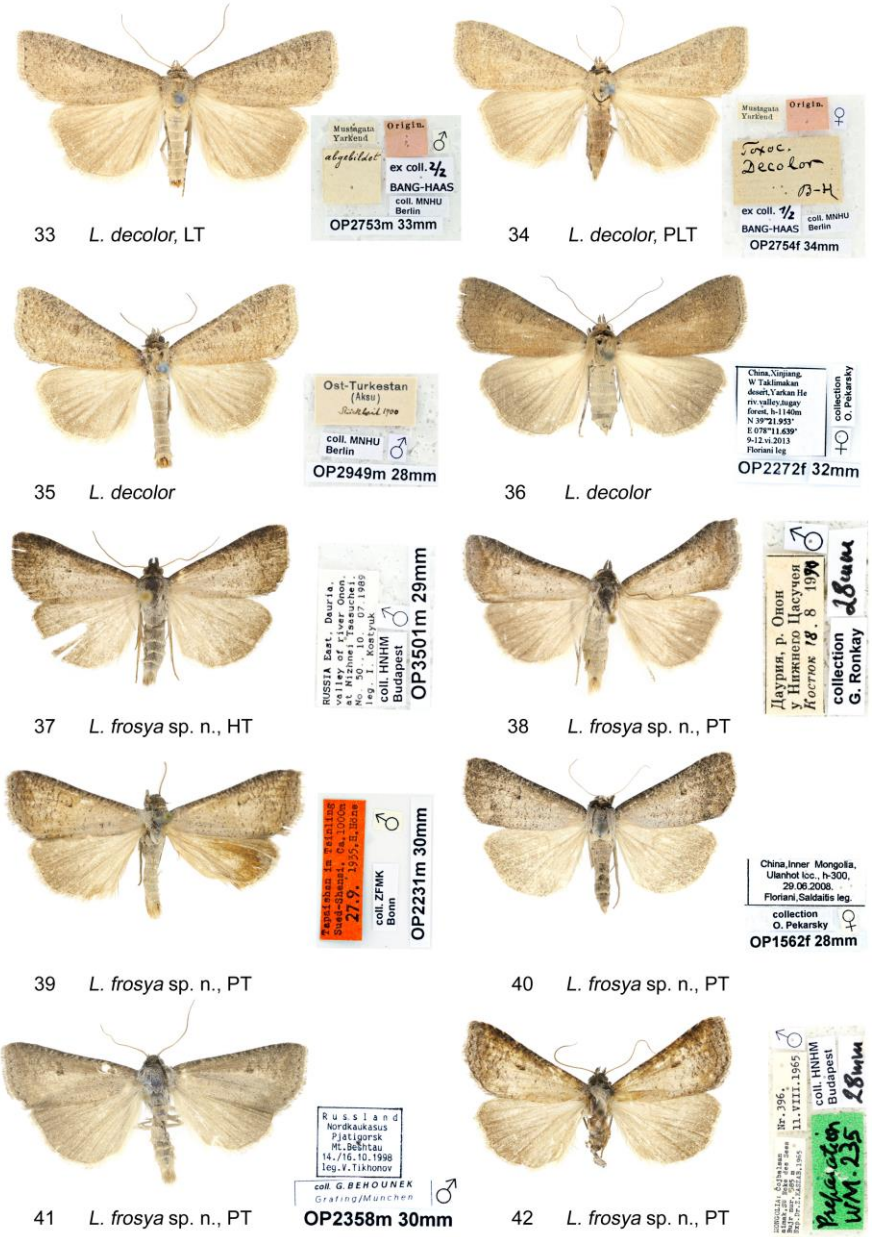
Distribution. China, Xinjiang and Eastern Kazakhstan, Dzharkent.

***Lygephila frosya* sp. n.** Figs 37–42

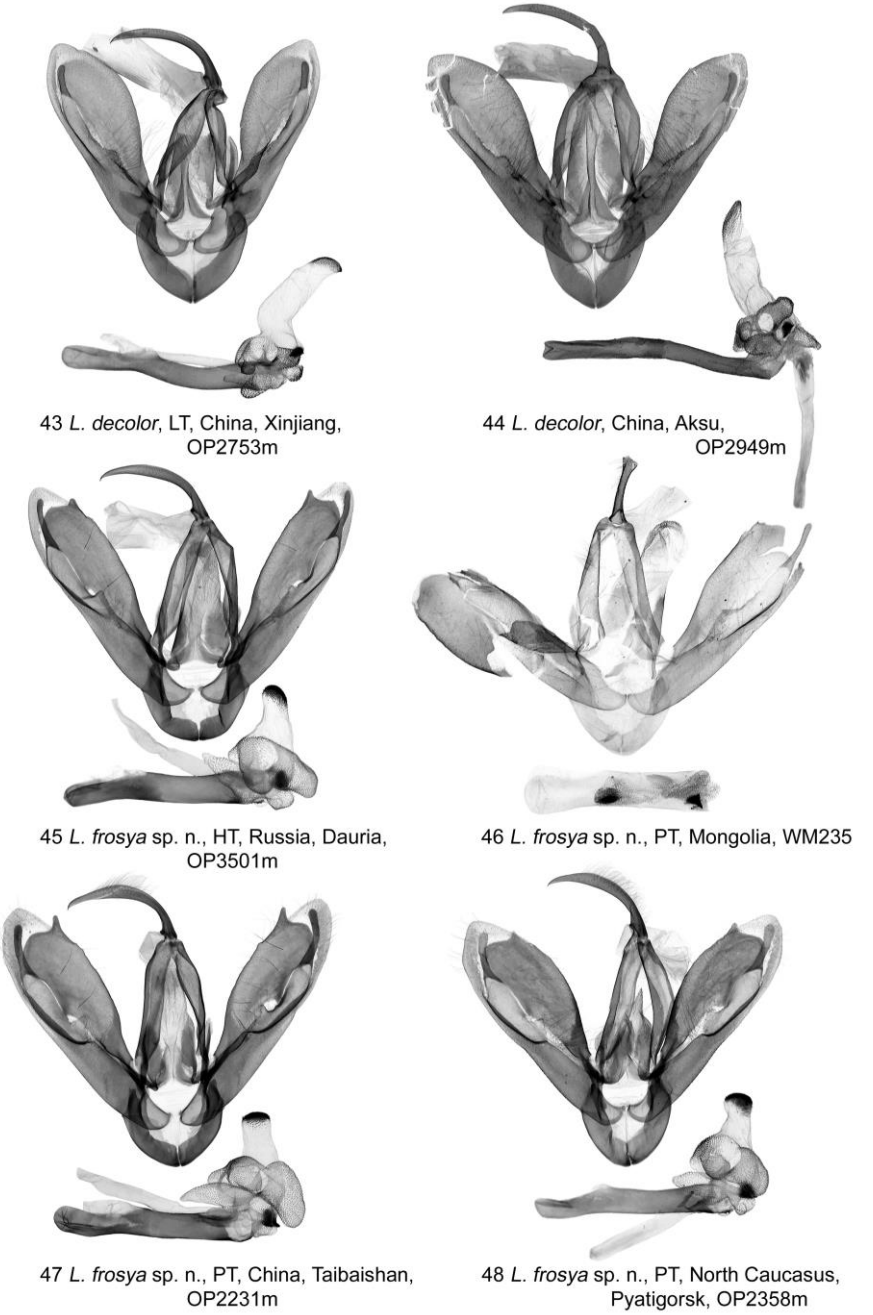
Type material. Holotype: Male (Fig. 37) Russia East, Dauria, valley of river Onon at Nizhnei Tsasuchei, No. 50, 10.VII.1989, leg. I. Kostyuk, slide OP3501m (coll. HNHM).

Paratypes. **Russia:** 1 ♂, Dauria, Onon river, at Nizhnei Tsasuchei, 18.VIII.1998, Kostyuk (coll. G. Ronkay); 1 ♂, North Caucasus, Pyatigorsk, Mt. Beshtau, 14–16.X.1998, leg. V. Tikhonov, slide OP2358m (coll. G. Behounek/ZSM); **Mongolia:** 1 ♂, Čojbalsan aimak, SW Ecke des Sees Bujr nur. 585 m, 11.VIII.1965, Exp. Dr. Z. Kaszab, 1965, Nr. 396, slide WM235 (coll. HNHM); **China:** 1 ♂, "Tapaishan im Tsinling, Sued-Shensi, Ca. 1000 m, 27.IX.1935, H. Höne", slide OP2231m (coll. ZFMK); 1 ♀, Inner Mongolia, Ulanhot loc., h-300 m, 29.VI.2008, leg. Floriani & Saldaitis, slide OP1562f (coll. O. Pekarsky).

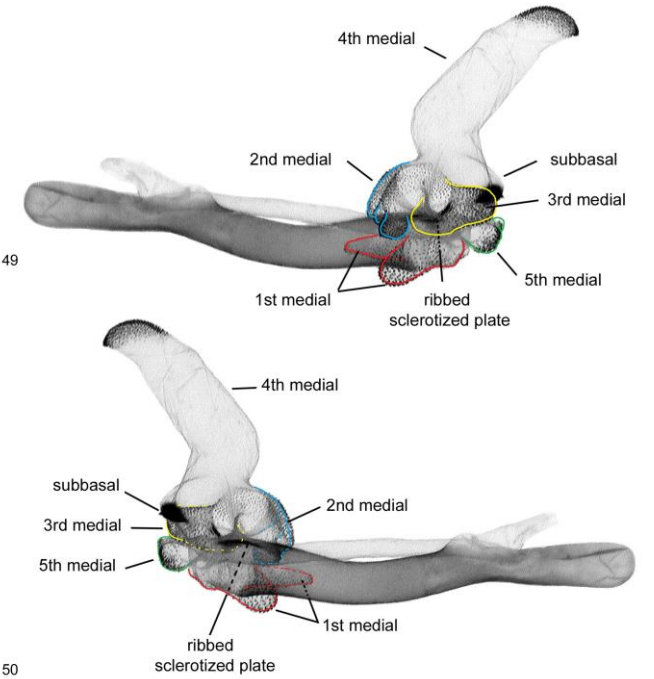
Diagnosis. The new species appears as more gracile comparing with *L. procax* and *L. nigricostata,* and even to *L. asiatica* and *L. decolor.* Distinguishable from the similar species by its delicate greyish-brown colouration of wings and the presence of numerous oblique light streaks on darkened costal edge. The genitalia are very distinctive in both sexes, the males differ from those of all related species by the shorter uncus, oval valva with very long ampulla and the very characteristic and autapomorphic pointed subapical costal process; the key features of the female are the well-sclerotized, tapering antrum and the subconical formation near ductus bursae.



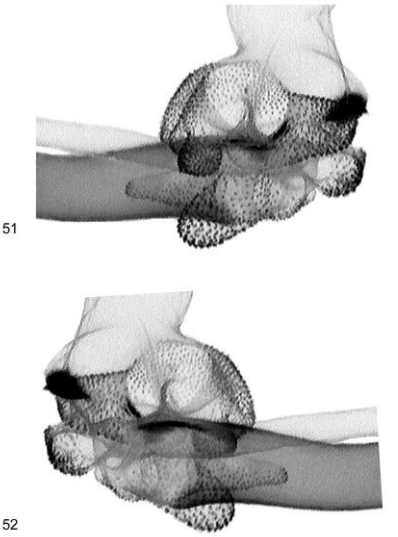
Figures 33–42. *Lygephila* spp., adults. 33, *L. decolor*, Lectotype, male, China, Yarkent (MNHU); 34, *L. decolor*, Paralectotype, female, China, Yarkent (MNHU); 35, *L. decolor*, male, China, Aksu (MNHU); 36, *L. decolor*, female, China, Xinjiang (OP); 37, *L. frosya*, Holotype, male, Russia, Dauria (HNHM); 38, *L. frosya*, male, Russia, Dauria (GR); 39, *L. frosya*, Paratype, male, China, Taibaishan (ZFMK); 40, *L. frosya*, Paratype, female, China, Inner Mongolia (OP); 41, *L. frosya*, Paratype, male, North Caucasus, Pyatigorsk (Behounek/ZSM); 42, *L. frosya,* Paratype, male, Mongolia, Čojbalsan (HNHM).



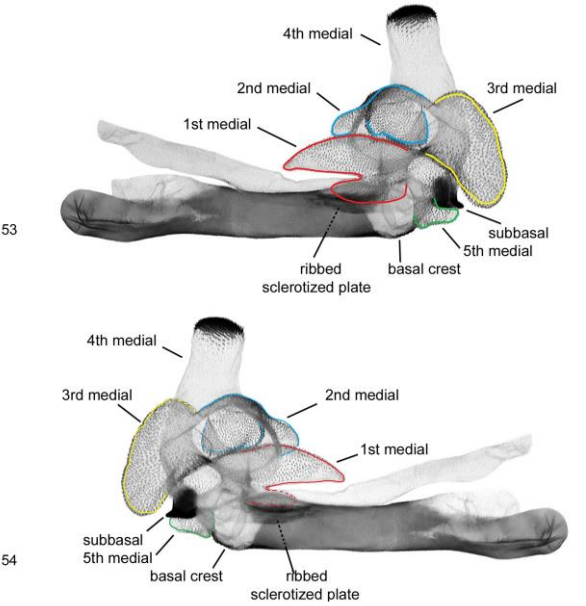
Figures 43–48. *Lygephila* spp. male genitalia. 43, *L. decolor*, Lectotype, China, Xinjiang (MNHU); 44, *L. decolor*, China, Aksu (MNHU); 45, *L. frosya*, Holotype, Russia, Dauria (HNHM); 46, *L. frosya*, Paratype, Mongolia, Čojbalsan, clasper apparatus damaged (uncus and apper part of valvae broken) (HNHM); 47, *L. frosya*, China, Taibaishan (ZFMK); 48, *L. frosya*, Paratype, North Caucasus, Pyatigorsk (Behounek/ZSM).



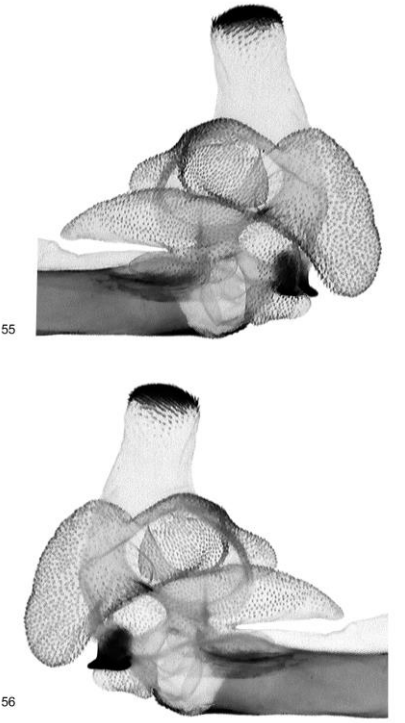
Figures 49, 50. Vesica structure. 49, 50 *Lygephila decolor*, Lectotype, China, Xinjiang, slide OP2753m; 49, lateral view; 50, lateral view opposite side.



Figures 51, 52. Vesica structure, larger magnification. 51, 52 *Lygephila decolor*, Lectotype, Xinjiang, slide OP2753m; 51, lateral view; 52, lateral view opposite side.



Figures 53, 54. Vesica structure. 53, 54 *Lygephila frosya*, Paratype, China, Taibaishan, slide OP2231m; 53, lateral view; 54, lateral view opposite side.



Figures 55, 56. Vesica structure, larger magnification. 55, 56 *Lygephila frosya*, Paratype, China, Taibaishan, slide OP2231m; 55, lateral view; 56, lateral view opposite side.

Description. Wingspan 28–30 mm (holotype 30 mm). Head and thorax grey, tegulae grey with sparse black scales, collar dark brown. Forewing long and narrow with pointed apex, greyish brown, irrorated with black scales, costal and subterminal areas darkened; inner part lighter, greyish, with indistinct borders with costal and subterminal areas; reniform stigma variable (small comma-like or triangular with conspicuous extension at inner corner); crosslines absent except pale postmedial line and very fine black terminal line; cilia as ground colour. Hindwing light grey-brown, outer part slightly darker; fringes as ground colour.

Male genitalia (Figs 45–48, 53–56). Almost symmetrical (right valva slightly narrower). Uncus long, narrow, evenly curved, valva oval-shaped, dorsal margin more roundish with tooth-like subapical costal extension; ampulla elongated, stick-like, located subapically; aedeagus cylindrical, short, straight with carinal crest; vesica membranous, multidiverticulate, subbasal diverticulum topped with sclerotized plate and claw-like cornutus, medial part has five diverticula various in shape and size (1st medial diverticulum bilobate, elongated, 2nd large, globular, 3rd reniform shaped, 4th large, subconical with dense scobination on top, 5th small, foot-like), terminal tube long (its end reaches bulbus ejaculatorius), membranous with ribbed sclerotized plate (Figs 48–51) at base.

Female genitalia (Fig. 93). Ovipositor relatively large, broad, papillae anales hairy with long setae on apical edges. Apophyses anteriores long, straight, apophyses posteriores thin, longer than apophyses anteriores. Antrum well sclerotized, tapering with almost parallel lateral edges, shallow concavity on posterior margin and roundish posterior ends, ostium bursae large, sclerotized, ductus bursae very small, corpus bursae ovoid, lower half membranous, upper half more consistent with heavily sclerotized subconical formation connecting ductus bursae, appendix bursae prominent, tapering.

Destribution. The known few specimens display a strongly disjunct pattern of distribution; the species is known from China (Inner Mongolia and Shaanxi: Taibaishan), Mongolia (Čojbalsan), Russia (Dauria) and from the Northern Caucasus (Pyatigorsk).

Etymology. The new species is named in loving memory of Barbary striped grass mouse, Frosya, who was the member of the family of the author for two and a half years and passed away in April 2012.

***Lygephila intermedia* sp. n.** Figs 57–64

Type material. Holotype: Male (Fig. 57), 1 ♂, Pakistan, Margalla Hills, 600 m, 20 km N Islamabad, Pir Sohawa, N33°50', E72°55', 29–31.VII.1994, leg. B. Herczig, Gy. M. László & G. Ronkay, slide OP1820m (coll. G. Ronkay).

Paratypes. **Pakistan:** 1 ♂, NW Kalam, 2200 m, N35˚21', E72˚36', No. 3, 25–26.V.1992, leg. M. Hreblay & G. Csorba, slide JB0222m, 1 ♀, Prov. NW-Frontier, Kaghan valley, 6 km NW of Balakot, 1200 m, 17.IV.1998, leg. B. Benedek & A. Szabó, slide JB223m (coll. HNHM); 4 ♂♂ & 3 ♀♀, Margalla Hills, 600 m, 20 km N Islamabad, Pir Sohawa, N33°50', E72°55', 8.VII.1994, leg. B. Herczig, Gy. M. László & G. Ronkay (coll. G. Ronkay); 1 ♀, Kashmir, Himalayas Mts, 30 km N Murree, near Nathia Ghali, Ayubia village, 2600 m, 23.V.1998, leg. Gy. M. László & G. Ronkay (coll. G. Ronkay); 1 ♂, Himalaya Mts, Kaghan valley, Tathabaya, 2200 m, N34°36', E73°26', 23.VI.1998, leg. Gy. Fábián & B. Herczig, 1 ♀, 28–29.VI.1998 (coll. G. Ronkay); 1 ♀, Kashmir, Himalaya Mts, 30 km N Murree, Ayubia, N34°01.75', E73°24.03', 2650 m, 5–6.VII.1998, leg. G. Csorba & G. Ronkay (coll. G. Ronkay); 1 ♀, Margalla Hills, Pir Sohawa, 1000 m, N33°49', E73°08', 4.VIII.1998, leg. Z. Varga & G. Ronkay (coll. G. Ronkay); 1 ♂, Himalaya, 1100 m, Indus valley, between Chilas and Dassu, Motel Barseen, 19.X.1998, leg. Gy. M. László & G. Ronkay (coll. G. Ronkay); 1 ♀, Kashmir Mts, 30 km N urree, near Nathia Ghali, Ayubia village, 2600 m, 20.VI.2000, leg. Z. Varga & G. Ronkay, slide OP1821f (coll. G. Ronkay); 2 ♂♂, 1770 m, Himalaya Mts., Kaghan, valley, n. Khanya village; 12–13.IX.1998, leg P. Gyulai & A. Garai (coll P. Gyulai); **Nepal:** 6 ♂♂ & 1 ♀, Annapurna Himal, valley of Kali Gandaki, 2000 m, near Ghasa, N28˚36', E83˚39.5', 21.VII.1995, leg. Gy. László & G. Ronkay (coll. G. Ronkay); 1 ♀, Annapurna Himal, valley of Kali Gandaki, Kokethanti village, 2650 m, 17.VI.1996, leg. Gy. M. László & G. Ronkay (coll. G. Ronkay); 3 ♂♂ & 3 ♀♀, Annapurna Himal, valley of Kali Gandaki, 2080 m, near Ghasa, N28°36', E83°39,5', 18–19.VI.1996, leg. Gy. M. László & G. Ronkay, slide OP1816m (coll. G. Ronkay); 1 ♀, Annapurna Himal, 1 km NW Chitre, 2300 m, N28°25,5', E83°41', 23.VII.1995, leg. Gy. M. László & G. Ronkay, slide OP1817f (coll. G. Ronkay); 1 ♂, Langtang, 2860 m, near Chandrabari, 85˚21'E, 28˚05'N, 25.IX.1994, leg. Csorba & Ronkay, slide JB242m, 1 ♂ & 1 ♀, Langtang, 1950 m, 1,5 km NE Dhunche, 85˚18'E, 28˚06'N, 24.IX.1994, leg. Csorba & Ronkay, slide JB0243f (coll. HNHM); 1 ♀, Ganesh Himal, Sheplu, 2100 m, 14–15.IX.1995, leg. P. Gyulai & A. Garai (coll P. Gyulai); 1 ♂, Ganesh Himal, 2 km NW of Nesim, 2300 m; 23–25.IX.1995, leg. P. Gyulai & A. Garai (coll P. Gyulai); 1 ♀, Annapurna region, Bagarchhap, N28°32', E84°20', 2200 m, 9.VI.1996, leg. M. Hreblay & Cs. Szabóky (coll P. Gyulai); 1 ♂, Annapurna region, 1 km E Cheme, N28°33', E84°15', 2600 m, 10.VI.1996, leg. M. Hreblay & Cs. Szabóky (coll P. Gyulai); **China:** 1 ♂, N Yunnan, Ningjing Shan, 2100 m, Mekong riv., Tse Kou, N28°01'59'', E98°54'17'', 5–9.VI.2011, leg. Major, slide OP1579m (coll. M. Dvořák); 1 ♀, China, Yunnan, Tse Kou, 2000 m, N28°02', E98°54', 5–10.VI.2011, leg. J. Klir, slide OP1580f (coll. M. Dvořák); **Iran:** 1 ♂ & 1 ♀, N. Iran, Alborz Mts, Chalush reg., 1800 m, 20–30.08.2009, leg. V. Gurko, slides OP1565m, OP1566f (coll. O. Pekarsky); 1 ♂, 2 ♀♀, Golestan prov., vicinity of Dasht village, 1000 m, N37°20'62'', E56°00'25'', 10.V.2009, leg. E. Gavristchuk (coll. M. Dvořák); 2 ♀♀, prov. Mazandaran, 15 km S of Azad Shar, 24–26.IV.2000, leg. K. Gaskó (coll P. Gyulai); 1 ♂, prov. Mazandaran, 15 km S of Azad Shar, 28–29.VI.2000, leg. K. Gaskó (coll P. Gyulai); 1 ♂, Prov. Khorasan, Golestan NP, 2000 m, Karabyl – Gharet, 25–26.VIII.2000, light trap, leg. P. Gyulai & A. Garai (coll P. Gyulai); **Tajikistan**: 1 ♂, Gissarsky ridge, Tigrovaya Balka, Danilevskiy, 27.IV.[1]996, slide

OP3332m (coll. ZISP); 1 ♀, Vahsshaya dolina, Molotovo badskij r-n, 6 poselok, peski, na svet, 23.IX.1952, leg. Y. Stsetkin (coll P. Gyulai); 1 ♀, Star. pristanj Dshilikulja, na r. Vahs, na svet, sovka, 6.IX.1948, leg. Y. Stshetkin (coll P. Gyulai); 1 ♀, SW, Kurgan Tjube region, Tigrovaja balka nat reserv., 3.VIII.2000, leg. V. Perepechaenko (coll P. Gyulai); **Kyrgyzstan:** 1 ♂, 3500 m, Alay-v., m. Sary-Tash, 18.7.1960, leg. Tschetkin, slide OP1857m (coll. P. Gyulai); **Turkmenistan:** 1 ♀, N slope Sjunt Mt., 20 km K-Kala, 25.VII.[19]52, V. Kuznetsov; 2 ♀♀, Turkomania, Kopet-Dagh Mts, valley Boboso, 18.VIII.1954, W. Potopolskij; 1 ♀, Turkomania, Kopet-Dhag Mts, valles Boboso, 22.VI.1956, W. Potopolskij (coll. ZISP); ***3*** ♀♀, Kopet-Dagh Mts, 10 km S of Ai-dere, 600–1000 m, N38°14', E56°46', No. L59, 27.VI.1992, leg. Gy. Fábián, B. Herczig, A. Podlussány and Z. Varga, slide OP1812f (coll. G. Ronkay), slide OP1811f (coll. O. Pekarsky); 1 ♂, Kopet-Dagh Mts, 1000 m Sayvana valley, cca 5 km SW of Sayvana, N38°17', E56°50', No. L60, 28.VI.1992, leg. Gy. Fábián, B. Herczig, A. Podlussány and Z. Varga (coll. G. Ronkay), 1 ♂, Kopet-Dagh Mts, 800-1600 m, valley of the rivers Ipay-Kala and Point-Kala, N38°13.15', E59°54.57', No. L63, 30.VI.–4.VII.1992, leg. Gy. Fábián, B. Herczig, A. Podlussány and Z. Varga (coll. G. Ronkay).

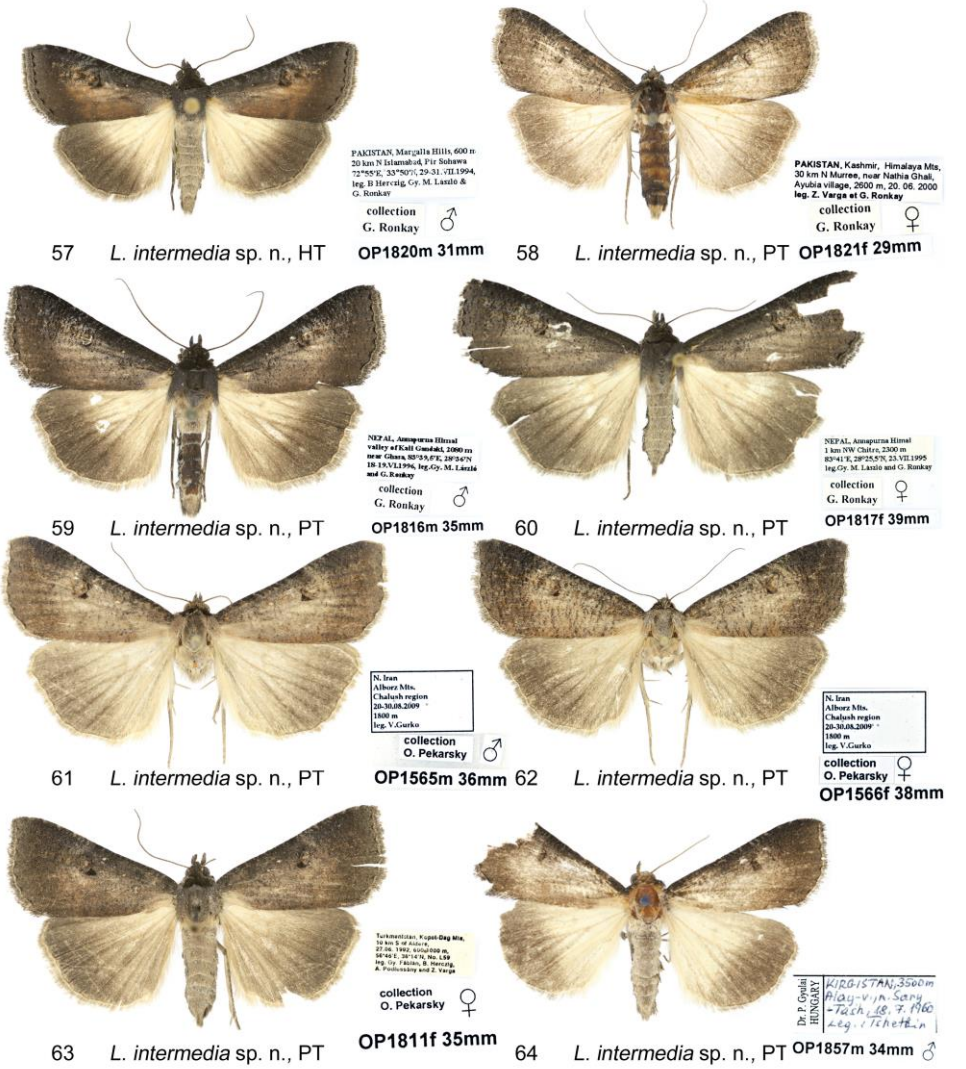
Taxonomy. The new species has a rather transitional position between *L. procax* and *L. nigricostata,* resembling externally the latter species but certain details of the genitalia show closer connections with *L. procax*.

Diagnosis. The new species differs from *L. procax* by its characteristically darkened costa and lighter inner part of the wings and thereby being externally similar to *L. nigricostata,* distinguishable from it satisfactorily by the study of the genital structures only. In males, the ampulla of the new species is longer than in *L. procax* and somewhat thinner than in *L. nigricostata*, moreover, there is no sclerotized teeth row in the basal part of the vesica which is typical of *L. nigricostata* (see the Diagnosis of this latter species); in the females, it is much easier to separate the above mentioned species by the long but wide antrum with almost parallel lateral edges of *L. intermedia* and by shorter, rather triangular antrum with deeper cleft of *L. nigricostata*, whereas *L. procax* has narrower, belt-like antrum and *L. nigricostata* has shorter, more triangle antrum with deeper cleft on posterior margin.

Description. Wingspan 29–39 mm, on average 32–36 mm. Head, collar, tegulae and thorax black. Forewing elongated with pointed apex, blackish brown, irrorated with black scales, costal and subterminal area prominently dark, almost black; inner part lighter, greyish brown, border with costal and subterminal areas sharply marked; orbicular stigma as white dot; reniform stigma conspicuous, composed by small black dots and streaks; basal, subbasal and antemedial lines absent; terminal line well-marked a row of black streaks; cilia as ground colour. Hindwing ground colour matches with forewing, with strict border between light inner area and intensively darkened outer part; fringes as ground colour.

Male genitalia (Figs 74, 76, 78, 79–82). Slightly asymmetrical (right valva slightly narrower). Uncus long, narrow, evenly curved, valva with roundish dorsal and straight ventral margins; ampulla elongated, slightly clavate, located subapically. Aedeagus cylindrical, medium-long with developed carinal tooth. Vesica membranous, multidiverticulate; subbasal diverticulum topped with large

claw-like cornutus, medial part has six diverticula various in shape and size (1st large v-shaped, 2nd bilobate, 3rd reniform, 4th large, elongated, tube-like with scobination on top, 5th elongated, tapering and 6th medium size, globular) terminal diverticulum tapering, with five small pockets (Figs 79–82), terminal tube long, membranous, with ribbed sclerotized plate at base (Figs 79–82).



Figures 57–64. *Lygephila intermedia* sp. n., adults. 57, Holotype, male, Pakistan, Islamabad (GR); 58, Paratype, female, Pakistan, Kashmir (GR); 59, Paratype, male, Nepal, Annapurna Himal (GR); 60, Paratype, female, Nepal, Annapurna Himal (GR); 61, Paratype, male, Iran, Alborz Mts (OP); 62, Paratype, female, Iran, Alborz Mts (OP); 63, Paratype, female, Turkmenistan, Kopet-Dag Mts (OP); 64, Paratype, male, Kyrgyzstan, Sary-Tash (PGM).

Female genitalia (Figs 96–100). Ovipositor relatively large, broad, papillae anales hairy with long setae. Apophyses anteriores long, straight, apophyses posteriores thin, longer than apophyses anteriores. Antrum wide in posterior part, posterior margin with shallow concavity, ostium bursae large, sclerotized, ductus bursae very small, corpus bursae membranous, ovoid with sclerotized patches near appendix bursae.

Distribution. Iran, Turkmenistan, Kyrgyzstan, (supposedly Afghanistan), Pakistan, Nepal and China: North Yunnan.

Etymology. The name of the new species refers to the distributional range of the new species which is in between of two related taxa *L. procax* and *L. nigricostata*.

***Lygephila nigricostata* (Graeser, 1890) Stat rev.**

Toxocampa limosa var. *nigricostata* Graeser, 1890, Berliner entomologische Zeitschrift 35: 80. (TL: [Russia], Ussuri [Primorye territory]), Amur, Sidemi [Bezverkhovo])

Type material examined. *Toxocampa limosa* var. *nigricostata* Graeser, 1890 (Fig. 65) **Lectotype** (here designated) male, [Russian Far East], Amur, Sedemi [Bezverkhovo], 1888, Type, ex coll. Püngeler, slide OP1867m; **Paralectotype** (here designated) (Fig. 66), [Russian Far East], Amur, Askold [island], 1885, Cotype, ex coll. Püngeler, slide OP1868f (coll. MNHU).

Additional material examined. **Russia:** 1 ♂ & 1 ♀, [Russian Far East, Bezverkhovo], "Sidemi, Mantschourie, 1882, M. Jankowski, ex coll. K. Höfer", slides OP2071m, OP2072f (coll. NHMW); 1 ♂, label1: [Russia, Far East], Askold [island], Dör.[ries], [18]83; label2: Limosa var. Nigricostata Graes., ex coll. Staudinger, slide OP1941m (coll. MNHU); 1 ♀, [Russian Far East, Razdolnaya River] Suifun, [18]85. D. [F. Dörries] ex coll. Staudinger, slide OP1942f (coll. MNHU); 1 ♂, Ussuri, Kaymanovka, N43°38', E130°15', 1.VIII.2010, leg. V. Sablja, slide OP1585m (coll. M. Černila); 1 ♂, Primorye region, 80 km SE of Vladivostok, Kedrovaja pad, Barabash-Levada, 14.VII.1993, leg. Louda, slide OP1922m (coll. G. Ronkay); 1 ♂, Far East, Suchansky Rudnik, IX.1925–26, native collector, slide OP1808m (coll. G. Ronkay); 1 ♀, [RFE] Ussuria mer., Vladivostok circ., Peninsula Basargin, B. Astaurov, 4.VIII.1927, slide Matov0305f (coll. ZISP); 1 ♀, Far East, Primorye Area, Lasovsky Zapovednik, 10.VII.1990, leg. Klyuchko, slide OP1809f (coll. O. Pekarsky); **Japan:** 1 ♂, Asamayama, VIII.14, H. Höne, slide OP2233m (coll. ZFMK); 1 ♀, Takeura, Shiraoicho, Hokkaido, 4.VIII.1978, leg. Y. Kishida, slide OP2455f (coll. O. Pekarsky)

Taxonomy. Listed in KONONENKO et al. (1998), GOATER et al. (2003), KONONENKO (2005), KONONENKO & HAN (2007) and MATOV et al. (May 2008) as good species different from *L. procax*. Synonymised with *L. procax* by FIBIGER & KONONENKO (November 2008). Mentioned by KONONENKO (2010) as synonym of *L. procax*. BABICS (2014) revised its status. Latest in 2016 Kononenko again listed *L. nigricostata* as synonym of *L. procax*. Present research confirms that *L. nigricostata* is a good species, distinct from *L. procax*.

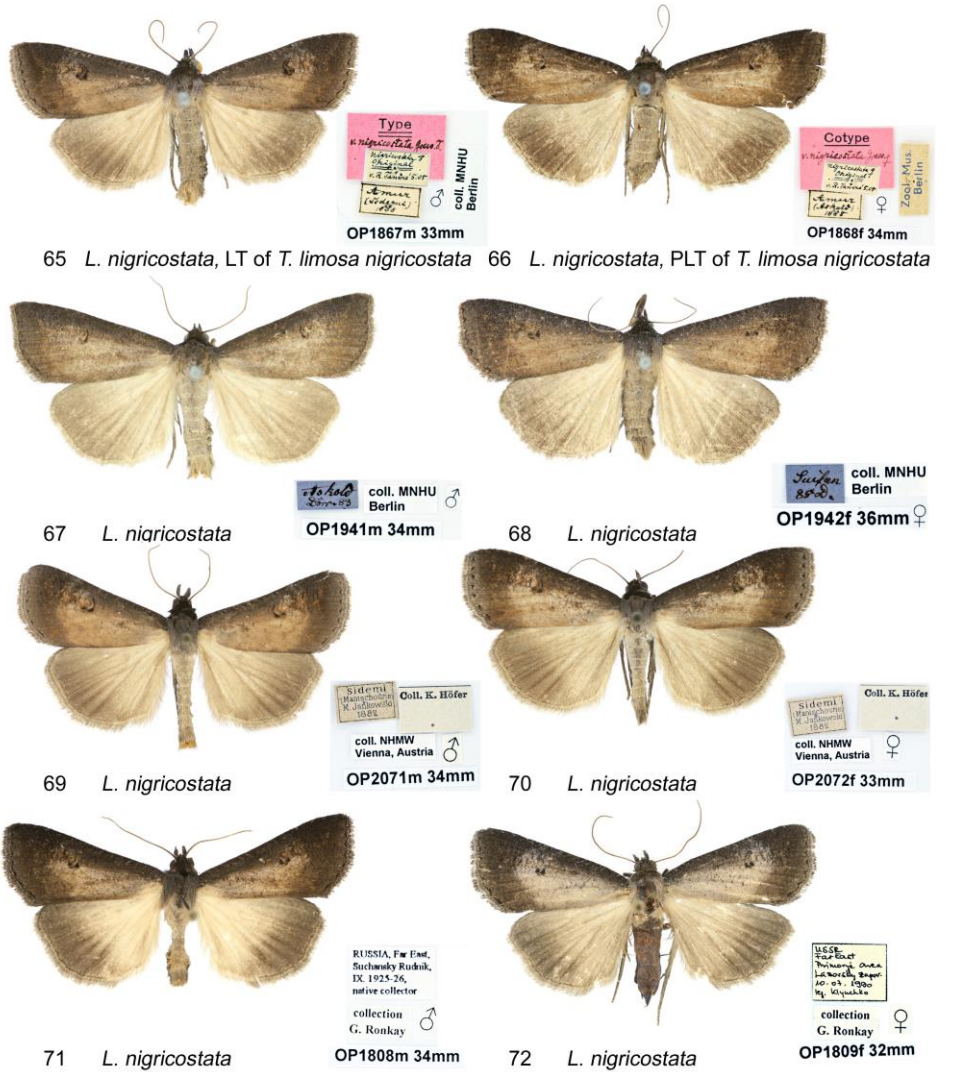
Diagnosis. Externally different from *L. procax* by markedly darkened costal and subterminal areas of forewings and outer part of hindwings, from *L. intermedia* it is separable by the genitalia structures only. In males, the ampulla is longer than in *L. procax*, and somewhat thicker than in *L. intermedia*. The most conspicuous autapomorphy of *L. nigricostata* is the row of sclerotized teeth in basal part of the vesica which is absent in all other species of the group; in the females, the antrum is smaller, more triangular, the cleft on the posterior margin is deeper than in the related species, and the posterior end is angular.

Description. Wingspan 29–36 mm, on average 32–36 mm. Head, collar, tegulae and thorax black. Forewing elongated with pointed apex, blackish brown, irrorated with black scales, costal and subterminal area intensively dark, almost black; inner part lighter, greyish brown, border with costal and subterminal areas sharply defined; orbicular stigma as white dot; reniform stigma conspicuous, composed by small black dots and streaks; basal, subbasal and antemedial lines absent; terminal line a row of black streaks, well-marked; cilia as ground colour. Hindwing as ground colour of forewing, with marked border between light inner area and intensively darkened outer part; fringes as ground colour.

Male genitalia (Figs 73, 75, 77, 83–86). Slightly asymmetrical (right valva slightly narrower). Uncus long, narrow, evenly curved, valva with roundish dorsal and straight ventral margins; ampulla elongated, slightly clavate, located subapically. Aedeagus cylindrical, medium-long, with developed carinal tooth. Vesica membranous, multidiverticulate; basal part bears a row of sclerotized teeth (autapomorphy of the species), subbasal diverticulum topped with large claw-like cornutus, medial part has six diverticula various in shape and size (1st large v-shaped, 2nd bilobate, 3rd reniform, 4th large, elongated, tube-like with scobination on top, 5th elongated, tapering and 6th medium size, globular) terminal diverticulum tapering with five small pockets (Figs 83–86), terminal tube long, membranous with ribbed sclerotized plate at base (Figs 83–86).

Female genitalia (Figs 101–104). Ovipositor relatively large, broad, papillae anales hairy with long setae. Apophyses anteriores long, straight, apophyses posteriores thinner and longer than apophyses anteriores. Antrum tapering, distal part rather triangular with prominent cleft on posterior margin; ostium bursae large, sclerotized, ductus bursae very small, corpus bursae membranous, ovoid with sclerotized patch near appendix bursae.

Distribution. Russian Far East, Japan, Korea and China.



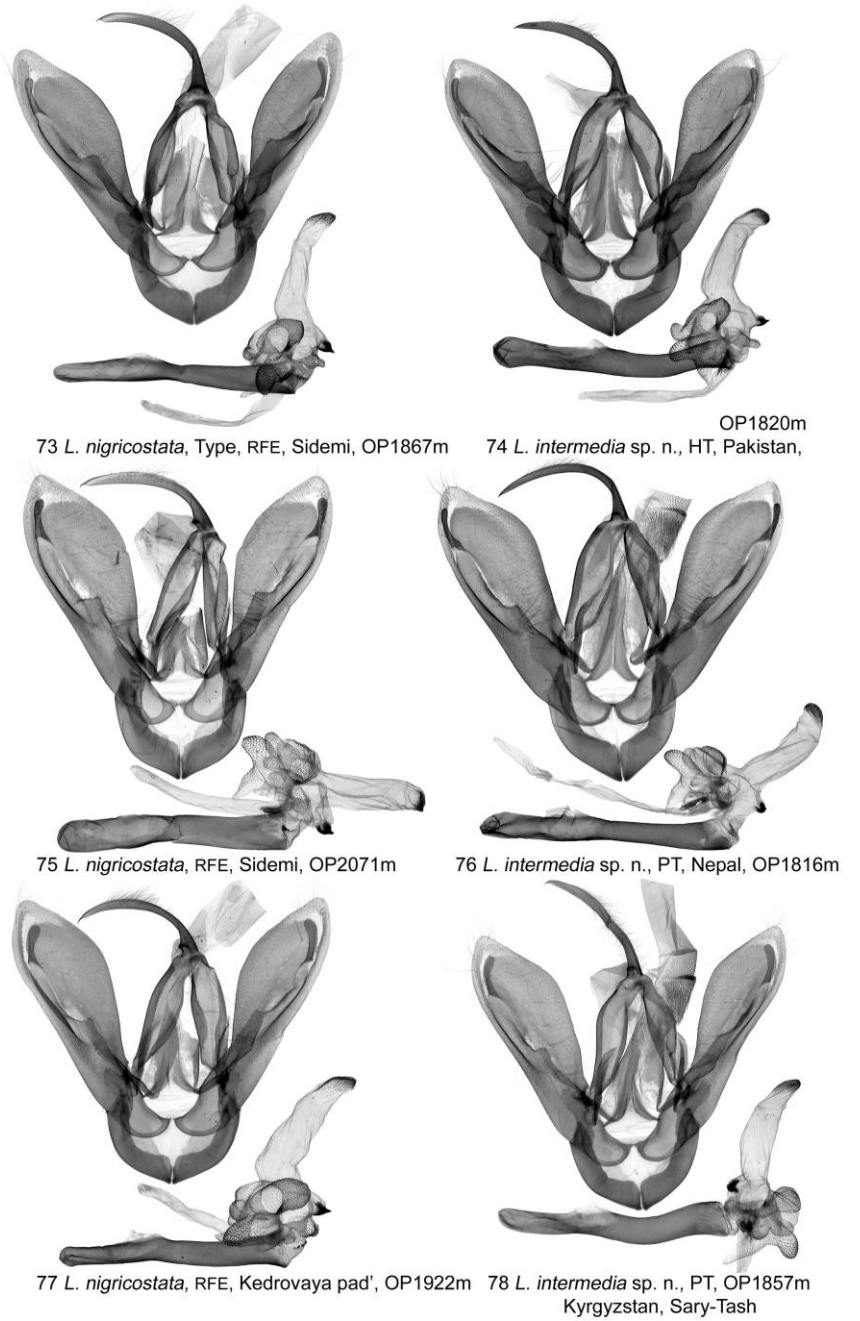
65 *L. nigricostata*, LT of *T. limosa nigricostata* 66 *L. nigricostata*, PLT of *T. limosa nigricostata*

67 *L. nigricostata* 68 *L. nigricostata*

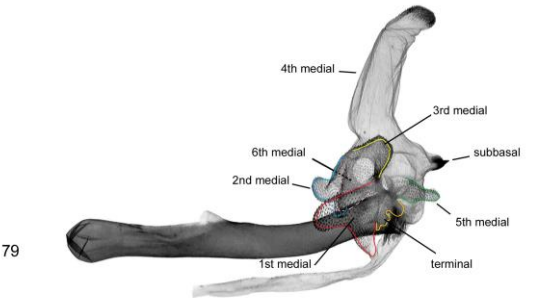
69 *L. nigricostata* 70 *L. nigricostata*

71 *L. nigricostata* 72 *L. nigricostata*

Figures 65–72. *Lygephila nigricostata*, adults. 65, Lectotype of *Toxocampa limosa nigricostata*, male, RFE, Bezverkhovo (MNHU); 66, Paralectotype of *Toxocampa limosa nigricostata*, female, RFE, Askold (MNHU); 67, male, RFE, Askold, (MNHU); 68, female, RFE, Razdolnaya River (MNHU); 69, male, RFE, Bezverkhovo (NHMW); 70, female, RFE, Bezverkhovo (NHMW); 71, male, RFE, Suchansky Rudnik (GR); 72, female, RFE, Lazovsky State Reserve (GR).



Figures 73–78. *Lygephila* spp. male genitalia. 73, *L. nigricostata*, Lectotype of *Toxocampa limosa nigricostata*, RFE (MNHU); 74, *L. intermedia*, Holotype, Pakistan (GR); 75, *L. nigricostata*, RFE (NHMW); 76, *L. intermedia*, Paratype, Nepal (GR); 77, *L. nigricostata*, RFE (GR); 78, *L. intermedia*, Paratype, Kyrgyzstan (PGM).



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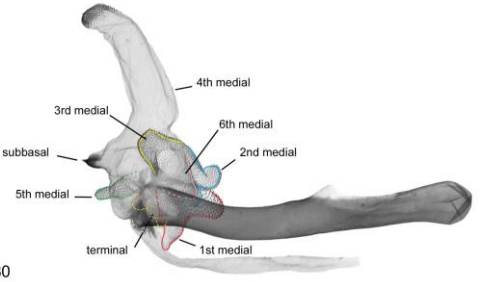

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Figures 79, 80. Vesica structure. 79, 80 *Lygephila intermedia*, Holotype, Pakistan, slide OP1820m; 79 lateral view; 80, lateral view opposite side.

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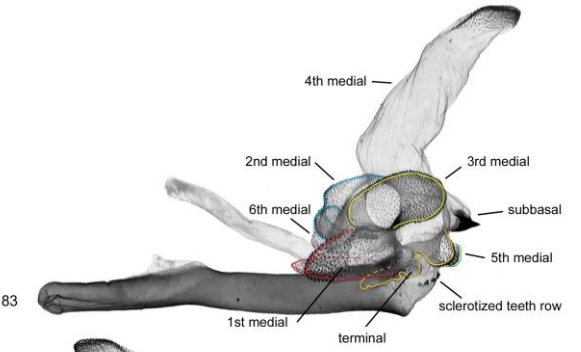
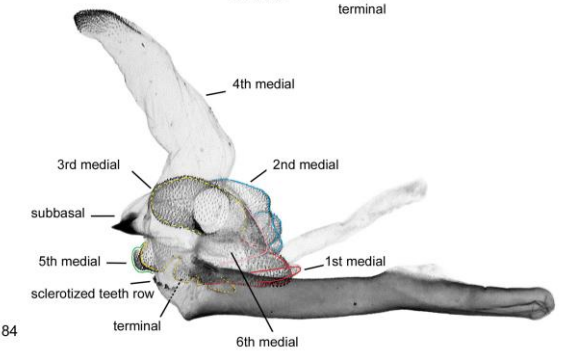
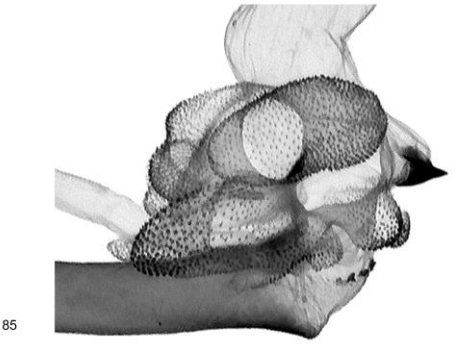
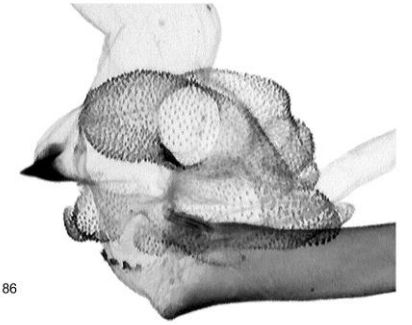
Figures 81, 82. Vesica structure, larger magnification. 81, 82 *Lygephila intermedia*, Holotype, Pakistan, slide OP1820m; 81, lateral view; 82, lateral view opposite side.



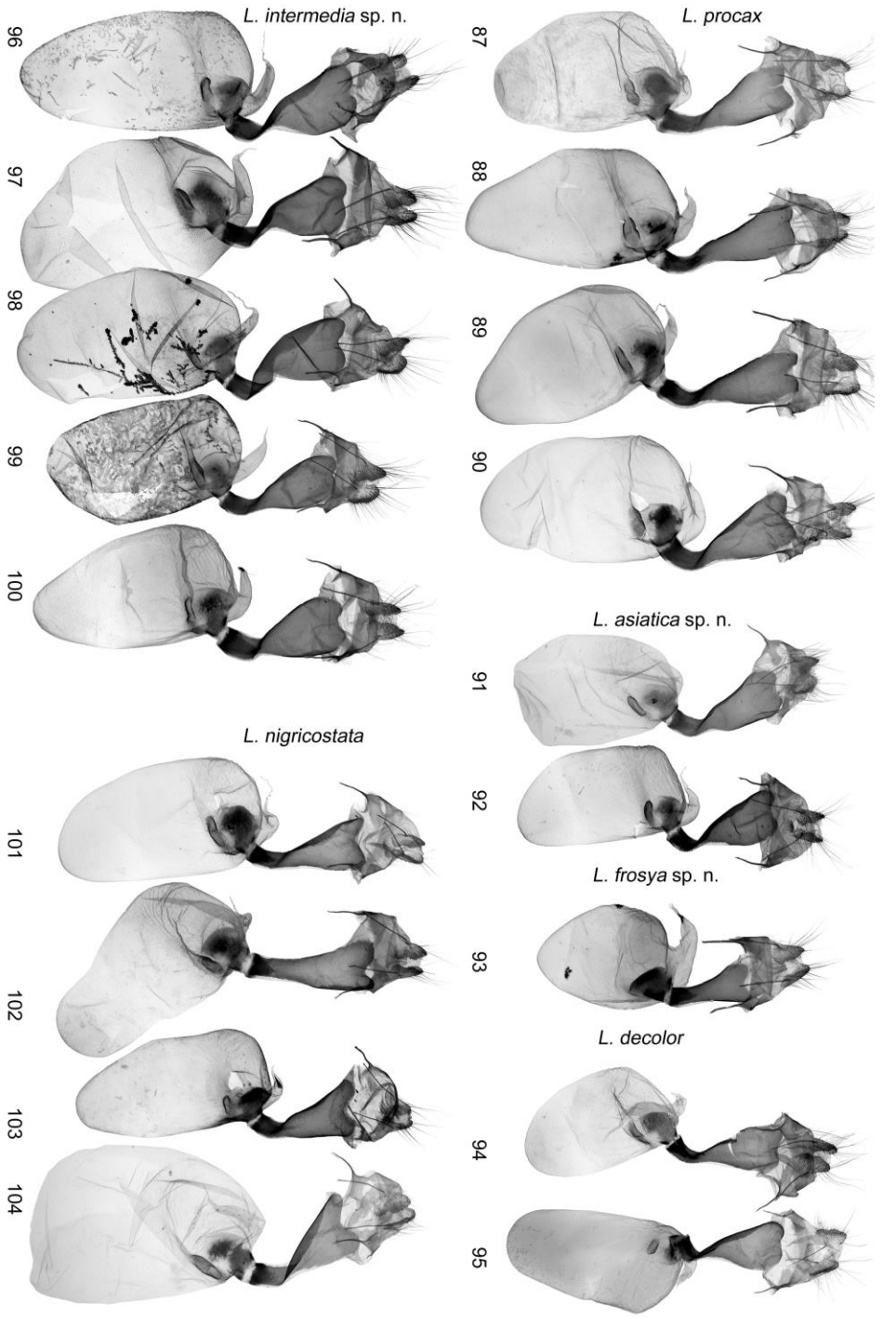


Figures 83, 84. Vesica structure. 83, 84 *Lygephila nigricostata*, RFE, slide OP1922m; 83, lateral view; 84, lateral view opposite side.





Figures 85, 86. Vesica structure, larger magnification. 85, 86 *Lygephila nigricostata*, RFE, slide OP1922m; 85, lateral view; 86, lateral view opposite side.



Caption to the **Figures 87-104** is on the next page.

Figures 87–104. *Lygephila* spp. female genitalia. 87, *L. procax*, Spain, Granada, OP1934f (MNHU); 88, *L. procax*, Hungary, Villány, OP1561f (OP); 89, *L. procax*, Slovenia, Podgorje, OP1564f (OP); 90, *L. procax*, Greece, Thessaly, OP1810f (GR); 91, *L. asiatica*, Paratype, Kazakhstan, Zaisan, OP3163f (OP); 92, *L. asiatica*, Paratype, Kazakhstan, Almaty, OP1815f (GR); 93, *L. frosya*, Paratype, China, Inner Mongolia, OP1562f (OP); 94, *L. decolor*, Paralectotype, China, Yarkent, OP2754f (MNHU); 95, *L. decolor*, China, Xinjiang, OP2272f (OP); 96, *L. intermedia*, Paratype, Turkmenistan, Kopet-Dag Mts, OP1811f (OP); 97, *L. intermedia*, Paratype, Turkmenistan, Kopet-Dag Mts, OP1812f (GR); 98, *L. intermedia*, Nepal, Annapurna Himal, OP1817f (GR); 99, *L. intermedia*, Paratype, Pakistan, Kashmir Mts, OP1821f (GR); 100, *L. intermedia*, Paratype, Iran, Alborz Mts, OP1566f (OP); 101, *L. nigricostata,* Paralectotype of *Toxocampa limosa nigricostata,* RFE, Askold, OP1868f (MNHU); 102, *L. nigricostata*, RFE, OP1942f (MNHU); 103, *L. nigricostata*, RFE, OP1809f (OP); 104, *L. nigricostata*, Japan, OP2455f (OP).

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