

Contributions to the knowledge of the Geometridae Fauna of the Balkan Peninsula with some new species for Bulgaria, Serbia, Albania and Macedonia

(Lepidoptera, Geometridae)

by

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Abstract: *Biston achyra* WEHRLI, 1936, *Phigaliohybernia budashkini* (KOSTJUK, 2009) and *Dyscia conspersaria* ([DENIS & SCHIFFERMÜLLER], 1775) are reported for the first time for Bulgaria. *Phigaliohybernia budashkini* (KOSTJUK, 2009), *Dyscia raunaria* (FREYER, [1851]), *Nebula pirinica* (REISSER, 1936) and *Idaea metohiensis* REBEL, 1900 are new for Serbia. *Coenocalpe millierata* (STAUDINGER, 1901) is new for the Republic of Macedonia, *Gnophos dumetata* TREITSCHKE, 1827 and *Scopula orientalis* (ALPHÉRAKY, 1876) are new for Albania. *Aleucis orientalis* (STAUDINGER, 1892) is proved to occur in Bulgaria, Serbia and the Republic of Macedonia. Some of the new findings extend significantly the range of several species to the west and to the east. With some taxonomic notes and illustration of the species and its genitalia, including the everted vesica of the *Biston* and *Phigaliohybernia* species are discussed.

Introduction: The Geometrid moths of the Balkan Peninsula are relatively well studied, but there are still some gaps, especially amongst the late autumn and early spring species. 13 countries share territories on the Balkan Peninsula, but native lepidopterologists, both professional and amateurs, operating lamps overnight number less than half of that total; there are still whole countries where it is possible to find a dozen or more new species for the country in a week of collecting! The reasons for these gaps in knowledge include the absence of local purposeful research using modern collecting methods as well as contemporary examination of the available collections. Although the present author has collected intensively at lamps in the central and southern Balkans, geometrids remained a little bit neglected. Some previously undetermined and unpublished material from Bulgaria is presented here together with data from the previous two years from Serbia and the last year from Albania and Republic of Macedonia. Some geometrid material from Albania still remains undetermined and will be reported later, together with representatives of other Lepidopteran families. The problem with the identity of *Phigaliohybernia budashkini-aurantiaria* is not resolved; given the limited material available there is no sense in making any taxonomic changes here for the time being.

In the present paper, all Macedonian and Albanian material was collected in 2016 by S. BESHKOV & A. NAHIRNÍČ. Serbian material is also collected by S. BESHKOV & A. NAHIRNÍČ in 2015-2016. From Bulgaria, the sources are more varied. Since 2010, an 8 watt actinic (368 nm) and 8 watt "Blacklight" traps were used, both powered by 12 volt batteries, as well as Finnish "tent trap" with a 160 watt MV bulb at the top of the pole and a 20 watt (368 nm) black light over the catching pot below. An additional 20 watt (368 nm) lamp was also positioned about 70 metres from the tent trap. All traps ran throughout the night. Prior to 2010, a light tower with 160 W MVL powered by generator and 1-2 light traps with black and/or actinic light was used. Before 1995, several different types of lamps, plugged in buildings, were deployed.

Genitalia slides are prepared and photographed with Zeiss stereo microscope Stemi 2000-C with axioCam eRc 5s. Measurements of genitalia were taken with an ocular-micrometer after calibration with object-micrometer. All genitalia slides with numbers mentioned in the text are fixed on glass in Euparal, solitary everted vesicae were photographed in alcohol or in Euparal essence before mounting on glass. All genitalia are stained with Eosin Red with the exception of *S. orientalis* (ALPHÉRAKY). Insects are photographed with Sony DSCHX400v digital camera. Vesicae of *Phygalehybernia* were everted and illustrated by Dr BOYAN ZLATKOV. All trips outside Bulgaria were self-financed by the author. Within Bulgaria, the material was collected both, during different non-research projects or during trips, also self-financed by the author privately.

List of the species

Biston achyra WEHRLI, 1936 was described from Asia Minor and subsequently found in the Ukraine, the Levant, Russia and northern Greece (TÓTH, BABICS, & BENEDEK, 2013). Here it is reported for first time from Bulgaria. According to TÓTH, BABICS, & BENEDEK (2013) it can be distinguished from *B. strataria* (HUFNAGEL, 1767) by its considerably smaller size, more elongated forewing, and the presence of discal spot on the hindwing. Here some additional taxonomic features are mentioned and the ♂ genitalia, including the everted vesica are illustrated. In Bulgaria, *B. achyra* WEHRLI is known only from the south-west, where it is not rare, in the Struma River valley and the adjacent slopes of the Pirin Mts. as follows (from north to south), all ♂♂, genital preps (in the following GP) S. BESHKOV:

Kresna Gorge, Stara Kresna Railway Station, 200 m, N 41°48'15"; E 023°09'49", 25.III.1989, S. BESHKOV leg., GP 4./29.I.2017, vesica everted; Ibid, 13.III.1986, S. BESHKOV leg., GP 5./12.I.2017, vesica not everted.

S Pirin-Kresna Gorge, on the road to Stara Kresna Village, N 41°46'08"; E 023°10'32", 585 m, 20.III.2010, S. BESHKOV & D. VASSILEV leg., GP 5./29.I.2017, vesica not everted; Ibid, GP 5./09.I.2017, vesica everted.

Kresna Gorge, Shaytan Dere, 212 m, N 41°45'3"; E 023°09'20" 20.III.2010, S. BESHKOV & D. VASSILEV leg., GP 1./27.I.2017 and 2./27.I.2017, vesica everted.

Kresna Town, the Crossroad to Gorna Breznitza Village, 190 m, N41°43'4"; E 023°08'57", 25.II.2014, S. BESHKOV leg., GP 1./28.I.2017, vesica everted.

SW Pirin Mts., Gradeshka Banja above Gradeshnitsa Village, 340 m, N 41°42'28"; E 023°12'36", 20.III.2010, S. BESHKOV & D. VASSILEV leg., GP 2./21.I.2017, 9./09.I.2017, 5./27.I.2017, 1.-3./29.I.2017, vesica everted, 8./09.I.2017, vesica not everted; Ibid, 15.III.2014, S. BESHKOV leg., GP 1./21.I.2017, vesica everted.

Near Kamenitza Village, 200 m, N 41° 38'40"; E 023°10'10.", 4.IV.2003, S. BESHKOV, M. LANGOUROV, K. IVANOV & D. TCHOBANOV leg., GP 2./12.I.2017, vesica everted.

In addition to the differences given in TÓTH, BABICS, & BENEDEK (2013), *B. achyra* WEHRLI is always almost monochrome in appearance (figs. 1-5) with small exceptions (fig. 6). On the fore wings the postmedial line is less angled than in *B. strataria* (HUFN.). In *B. strataria* (HUFN.) the postmedial line is strongly pointed along veins M1-M2 and below Cu2 to the outer margin (figs. 7-9), usually it is colourful with creamy and rusty tint (figs. 7-8), but there are also not coloured specimens (figs. 9-12). In the hind wings, the postmedial line in *B. achyra* WEHRLI is curved inwards (fig. 4), whilst in *B. strataria* (HUFN.) it is almost straight and shadowed in outer side (figs. 7-11). The features above are also visible on the underside (figs. 13-14).

In general, the ♂ genital capsule is bigger in *B. strataria* (HUFN.), the valvae are longer (see tab. 1) and straight (figs. 15-21). In *B. achyra* WEHRLI valvae are shorter and a little bit curved, banana-like (figs. 22-28). Juxta in *B. strataria* (HUFN.) is more sclerotized with hooked bill-like tip (figs. 15, 16, 18, 19, 29). In *B. achyra* WEHRLI the juxta has a keeled fillet which sometime is not easily visible (figs. 22-24, 26-28, 30), but seldom is well pronounced (figs. 25, 31). The everted vesica in *B. achyra* WEHRLI (figs. 24-28, 32-34) is more simple, hammer-like, with the basal diverticulum pointed upward and slightly curved laterally. The central part of the vesica is bulbous, gradually elongated to the ductus ejaculatorius and curved slightly, laterally, and in an acute angle to the aedoeagus. In *B. strataria* (HUFN.), the basal diverticulum is more thumb-like, the central part of the vesica is bulbous and with another swelling laterally, elongated to the ductus ejaculatorius after constriction and curved slightly laterally and in almost right angle to the aedoeagus (figs. 17-21, 35-37).

A specimen from the Eastern Rhodopes, Rabovo Village, shares common features with both, *B. achyra* WEHRLI and *B. strataria* (HUFN.), in appearance (fig. 10) and the genitalia (fig. 17); the measurements of genitalia (GP1./22.I.2017) fall between the species, but are closer to *B. strataria* (HUFN.).

In Greece *B. achyra* WEHRLI was recently reported from Thraki/Thrace region, Lesitse Mts., 4 km SE of Kirki, 144 m (TÓTH, BABICS, & BENEDEK, 2013), which was the westernmost point of the range of the species known to date. The findings in SW Bulgaria extend the range of *B. achyra* WEHRLI approximately 220 km to the west.

Phigaliohybernia budashkini (KOSTJUK, 2009) was described as a new species, closely related to *Ph. aurantiaria* (HÜBNER, 1799) from the Ukraine (Crimea). The differences KOSTJUK (2009) found are in the ground colour, wing pattern and ♂ genitalia. In the ♂ genitalia differences are in the size and shape of the juxta, length of the aedoeagus and the shape and size of the apical cornutus. There are some unpublished data for the presence of *Ph. budashkini* (KOSTJUK) in Greece. Such a distribution suggested that *Ph. budashkini* (KOSTJUK) ought to occur in Bulgaria as well. The present author dissected and examined more than 30 ♂ specimens from different parts of Bulgaria and found that both phenotypes, as illustrated in KOSTJUK (2009), are present in Bulgaria. As indicated by the data in table 2, the measurements correspond to *Ph. budashkini* (KOSTJUK), but no single specimen shares exactly the measurements of *Ph. aurantiaria* (HBN.) as they are given in KOSTJUK (2009).

In appearance and genitalia features are intermediate forms, so that a decision about specific identity is not always possible. There are yellow specimens, in appearance looking like *Ph. aurantiaria* (HBN.) (figs. 38-40) and some intermediate forms (fig. 41-42), but with the most important copulative feature (aedoeagus and its structures) being most similar to *Ph. budashkini* (KOSTJUK). In the dark ochre specimens, which in habitus correspond exactly to *Ph. budashkini* (KOSTJUK) (figs. 43-46), the shape and size of the apical cornutus is also variable.

In SW Bulgaria (Struma Valley) and the Eastern Rhodopes only specimens with the *budashkini* "crescent" type of apical cornutus (fig. 47-56) are present; these include yellow forms with the typical *budashkini* apical cornutus (fig. 63). In Central Bulgaria (Sofia, Gabrovo, Plovdiv Regions) both types are sympatric (figs. 57-62). A specimen closest to *Ph. aurantiaria* (HBN.) in appearance and in genitalia is that from N Bulgaria, at Pleven town (figs. 37, 64-65). Everted vesicas (figs. 66, 67) are also variable and not constant and even in a single locality there are considerable differences (fig. 67: E, F). It is easier to split specimens into two groups using colour, than by the genitalia features. Without examination using other methods, e.g. pre-imaginal stages, molecular methods, etc. and comparison to real *Ph. aurantiaria* (HBN.), it is not possible to split these species with certainty - at least within the Balkan population(s).

Localities with *Phigaliohybernia budashkini* (KOSTJUK, 2009) phenotype and genitalia type (Gen. preps S. BESHKOV): SW Bulgaria, Struma Valley: Marena Hill near General Todorov Village, 193 m, N 41°27'0"; E 023°18'49", 28.XI.2009, S. BESHKOV leg., GP 9./29.I.2017; The fish farm below Aramiyska Dupka Cave, near Levunovo Village, 110 m, N 41°29'31" E 023°16'05", 26.XI.2009, S. BESHKOV, R. HAVERINEN & K. NUPPONEN leg., GP 2./01.I.2017; Sveti Mina

Monastery near Strumyani Village, Sandanski District, 190 m, N 41°35'46"; E 023°13'58", 26.XI.2009, S. BESHKOV leg., Gen. preps 4./26.XII.2016 and 10./26.XII.2016; SW Pirin Mts., Gradeshka Banja above Gradeshnitsa Village near Kresna Town, 340 m, N41°42'28"; E 023°12'36", 29.XI.2008, S. BESHKOV & D. VASSILEV leg., GP 5./08.I.2017; Pirin- Kresna Gorge, Vlahi Village, 556 m, N 41°44'27"; E 023°13'46", 17.XI.2014, S. BESHKOV & S. ABADJIEV leg., GP 1./01.I.2017; Kresna Gorge, Stara Kresna Railway Station, 200 m, N 41°48'15" E023°09'49", 24.XI.1984, S. BESHKOV leg., Gen. preps 2./26.XII.2016, 5./29.XII.2016 and 3./01.I.2017.

S. Bulgaria, East Rhodopi Mts.: Odrintzi Village on Byala Reka river, Ivaylovgrad District, 200 m., 24.XI.1990, S. BESHKOV leg., GP 1./26.XII.2016; Below Egrek village, 600 m, Kroumovgrad district, 10.XII.2000, S. BESHKOV, M. LANGOUROV & B. PETROV leg., GP 1./08.I.2017; Studen Kladenetz Reservoir, Kroyatzi Hunting Chalet below Sveti Iliya Top, 200 m, 24.XII.1989, S. BESHKOV leg., GP 11./26.XII.2016.

Central Bulgaria: Upper Thracian Lowland: Plovdiv Town, 200 m, 8.XI.1954, N. VIHODCEVSKY leg., GP 7./26.XII.2016; Bessaparski Ridove Elevations, above Isparihovo Village, Pazardzhik Region, 320 m, 19.XII.1984, S. BESHKOV leg., GP 8./26.XII.2016; Predbalkan, Kmetovtzi Village between Gabrovo and Bozhentzite, 440 m, N42°53'54"; E 025°23'49", 11.XI.2010, S. BESHKOV leg., GP 2./29.XII.2016, and 2./08.I.2017.

W. Bulgaria: Golo Burdo Mts., Pernik Region, near the Chalet, 12.XI.1955, N. VIHODCEVSKY leg., GP 4./08.I.2017; Sofia City, 9.XI.1955, N. VIHODCEVSKY leg., GP 4./29.XII.2016.

Eastern Serbia: Bela Palanka Distr., Slivovicki Vis, above Slivovic Village, 925 m, N 43°08'29"; E 022°23'12", 6.XI.2016, S. BESHKOV & A. NAHIRNIC leg. in spider's net, GP 2./31.XII.2016.

Localities which share *Phigaliohybernia budashkini* (KOSTJUK, 2009) and *Ph. aurantiaria* (HÜBNER, 1799) phenotype and genitalia type: W. Bulgaria: Golo Burdo Mts., Pernik Region, near the Chalet, 12.XI.1955, N. VIHODCEVSKY leg. GP 8./08.I.2017; Vitosha Mts., Sofia Region, BAN Chalet, 1450 m, 20.XI.1959, N. VIHODCEVSKY leg., GP 7./08.I.2017; Lyulyaka Chalet near Beledie Han Village, Kostinbrod district, Sofia Region, 8.XI.1985, S. BESHKOV leg., GP 3./26.XII.2016; Vrachanska Planina-Iskar Gorge, "Pametnika" above Lakatnik Railway Station, 683 m, N 43°05'28"; E 023°23'07", 21.XI.2009, S. BESHKOV leg., GP 9./26.XII.2016.

SE Bulgaria, S Black Sea Coast, Primorsko Town, 14.XI.1963, N. VIHODCEVSKY leg., Gen. preps 1./29.XII.2016 and 9./08.I.2017.

Localities with close to *Phigaliohybernia aurantiaria* (HÜBNER, 1799) phenotype and genitalia type: W. Bulgaria: Sofia City, 550 m, 9.XI.1955, N. VIHODCEVSKY leg., GP 6./08.I.2017; Golo Burdo Mts., Pernik Region, near the Chalet, 12.XI.1955, N. VIHODCEVSKY leg., GP 3./08.I.2017. Central Bulgaria, Upper Thracian Lowland, Plovdiv Town, 200 m, 7.XI.1954, N. VIHODCEVSKY leg., GP 6./26.XII.2016; Predbalkan, Kmetovtzi Village between Gabrovo and Bozhentzite, 440 m, N42°53'54"; E 025°23'49", 11.XI.2010, S. BESHKOV leg., GP 3./29.XII.2016. N. Bulgaria, Pleven Town, "Kayluka" Park, near "Tzvetan Spasov" Chalet, 18.XI.1987, S. BESHKOV leg., GP 5./26.XII.2016.

Dyscia conspersaria ([DENIS & SCHIFFERMÜLLER], 1775): Bulgaria, Western Stara Planina Mts., Ponorite near the cross-road to Ponor village, above Beledie Han, 900 m, N42°54'43"; E 023°10'03", 6.VI.2009, 1 ♂ (fig. 68) and 2 ♀♀, S. BESHKOV leg. at light traps, GP 1./31.XII.2016, S. BESHKOV, ♂ genitalia (fig. 69). New species for Bulgaria. Habitat: EUNIS: E1.21 Helleno-Balkanica [Satureja montana] steppes. Limestone slopes with *Artemisia alba*, *Corothamnus procumbens*, etc. Other vegetation there contains *Syringa*, *Iris*, *Crataegus monogyna*, *Prunus spinosa*, *Euonymus verrucosus*, *Rubus*, *Teucrium chamaedrys*, *Chamaecytisus*, *Verbascum* and mixed *Quercus* forest around. This site is also the only confirmed locality for *Lignyopectera fumidaria* (HÜBNER, [1825]) on the Balkan Peninsula for several decades; it is isolated by several hundred kilometers from other localities.

Dyscia raunaria (FREYER, [1851]): E Serbia, Bela Palanka District, Slivovicki Vis Mnt, above Slivovic Village, 925 m, N 43°08'29"; E 022°23'12", 30.V.2016, S. BESHKOV & A. NAHIRNIC leg., 1 ♂ at light (fig. 70), genitalia checked, GP 1./21.II.2017, S. BESHKOV (fig. 71). New species for Serbia. Habitat: EUNIS: E1.21 Helleno-Balkanica [Satureja montana] steppes. Limestone slopes with *Artemisia alba*, *Corothamnus procumbens*, etc. (fig. 72).

Aleucis orientalis (STAUDINGER, 1892): BESHKOV & NAHIRNIC (2016) reported from Serbia, Trnava, 25.IV.2015, 1 ♂ specimen of *Aleucis distinctaria* (HERRICH-SCHÄFFER, 1839) and illustrated it there in fig. 10. In fact there were two specimens collected, both ♀♀ and the illustrated one is a ♀ and belongs to another species - *Aleucis orientalis* (STGR.), which was considered at that time as a subspecies of *A. distinctaria* (H.-S.). Genitalia of both specimens are checked, Gen. preps 2./09.I.2017 and 3./09.I.2017, S. BESHKOV (fig. 73). New localities of *A. orientalis* (STGR.) after examination of genitalia are: S. Serbia, Vranje Region, Starac Mt., Turski Grob near Pcinja River Valley, 799 m, N 42°20'39"; E 021°53'02", 24.IV.2015, S. BESHKOV & A. NAHIRNIC leg., 1 ♀, GP 4./09.I.2017, S. BESHKOV; Republic of Macedonia, Middle Vardar river, Demir Kapyia Gorge, 130 m, N 41°24'12.6"; E 022°17'19.2", 8.III.2013, S. BESHKOV & V. GASHTAROV leg., 1 ♂ (fig. 74), GP 1./09.I.2017, S. BESHKOV (fig. 75). According to SCOU & SIHVONEN (2015) both species are allopatric and in the Balkans only *A. orientalis* (STGR.) occurs, which is confirmed here. All previous reports of *A. distinctaria* (H.-S.) for the Balkans in fact probably refer to *A. orientalis* (STGR.), which is also reported and illustrated, together with ♂ genitalia, as *A. distinctaria orientalis* STAUDINGER) for Albania, Llogara (BESHKOV, MISJA & ABADJIEV, 1996).

Gnophos dumetata TREITSCHKE, 1827: Albania, Korca Region, above Zvezda Village on the road to Prespa Lake, 1088 m, N 40°43'59"; E 020°52'49", 23.IX.2016, S. BESHKOV, A. VASO & A. NAHIRNIĆ leg., 3 ♂♂ (fig. 76). The habitat is limestone rocky area with *Buxus* and *Carpinus*. New species for Albania.

Nebula pirinica (REISSER, 1936): W Serbia, Prijepolje municipality, Cetanica Mts., near Karaula Village, 1369 m, N 43°19'10"; E 019°49'54", 4.VIII.2015, S. BESHKOV & A. NAHIRNIĆ leg. at lamps and light traps, 1 ♂ (fig. 77) and 1 ♀; ♂ genitalia checked (fig. 78). Balkan endemic species reported here as new for Serbia.

Coenocalpe millierata (STAUDINGER, 1901): Republic of Macedonia, Vardar River Valley, Demir Kapija Gorge, on the road to Klisura village, 155 m, N 41°23'21"; E 022°17'41", 20.X.2016, S. BESHKOV & A. NAHIRNIĆ leg., 1 ♀ (fig. 79) and 2 ♂♂, Gen. preps 3./22.II.2017 (fig. 80) and 1./23.II.2017, S. BESHKOV, ♂ genitalia and 8th sternite, GP1./23.II.2017, S. BESHKOV (fig. 81) examined. Habitat: Maquis with *Quercus pubescens*, *Quercus coccifera*, *Juniperus excelsa*, *Juniperus oxycedrus*, *Paliurus spina-christi*, *Platanus orientalis*. New genus and a new species for the Republic of Macedonia. Its closely related species *Coenocalpe lapidata* (HÜBNER, 1809) is reported from Bulgaria, Zemen Gorge, Skakavitza [Railway Station], 26.IX.1984, 1 ♂, coll. KRUSCHOVSKI (GANEV, 1985). Unfortunately, the collection of KRUSCHOVSKI was stolen after his death; the collection of GANEV is not in Bulgaria, it was sold to the Museo Civico di Zoologia (Roma) and for the present author it is not possible to check the correct identification. So far as the present author remembers, as a student he has seen one specimen in the collection of GANEV and it was with very distinct line-pattern like real *C. lapidata* (HBN.), but he cannot remember whether this specimen was the Bulgarian one. The flight period (end of September) also suggests that the Bulgarian specimen should indeed be *C. lapidata* (HBN.). The flight period of *C. millierata* (STGR.) starts in the middle of October (HAUSMANN & VIIDALEPP, 2012). However, until more material is collected and carefully examined, the question about the specific identity of Bulgarian the *Coenocalpe* species remains open.

Idaea metohiensis REBEL, 1900: W Serbia, Prijepolje municipality, Cetanica Mts., near Karaula Village, 1369 m, N 43°19'10"; E 019°49'54", 4.VIII.2015, S. BESHKOV & A. NAHIRNIĆ leg. at lamps and light traps, 2 ♀♀ (fig. 82), GP 1./16.IV.2016, S. BESHKOV, ♀ genitalia (fig. 83). In the habitat there is meadow with *Juniperus* and coniferous forest around on limestone area. New species for Serbia, not previously reported from its present political borders.

Scopula orientalis (ALPHÉRAKY, 1876): Albania, Korca Region, Devollil Gorge, near Strelca Village, Maliq district, 755 m, N40°43'18"; E 020°31'35", 5.VI.2016, S. BESHKOV & A. NAHIRNIĆ leg., 1 ♂ (fig. 84), wingspan 30 mm, GP 2./22.II.2017, S. BESHKOV, ♂ genitalia with 8th sternit (fig. 85). This seems to be westernmost point of the range of the species known to date. New species for Albania. The habitat is Serpentine river valley with steep stony slopes with *Quercus trojana*, *Cotinus coggygria*, *Colutaea*, *Carpinus*, *Fraxinus ornus*, *Astaragallus*, etc. The distribution of *S. orientalis* (ALPH.) on the Balkan Peninsula is restricted to Republic of Macedonia only. Data for Bulgaria that appeared in HAUSMANN (2004) are without clear origin and unknown to the present author, so the report for this country in its present political borders is considered as doubtful.

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Table 1: *Biston achyra-strataria* sorted ascending by size of the genital capsule (saccus-valval tip) in mm.

Gen. prep. No.	species	juxta	valva	saccus-uncus	saccus-valval tip
Gen. prep.2./27.I.2017 SB	B. achyra	1.80	2.55	2.15	2.60
Gen. prep.1./29.I.2017 SB	B. achyra	1.70	2.85	2.15	2.70
Gen. prep.3./29.I.2017 SB	B. achyra	1.75	2.60	2.20	2.70
Gen. prep.5./12.I.2017 SB	B. achyra	1.75	2.60	2.25	2.75
Gen. prep.8./09.I.2017 SB	B. achyra	1.75	2.60	2.25	2.75
Gen. prep.9./09.I.2017 SB	B. achyra	1.75	2.70	2.25	2.75
Gen. prep.2./21.I.2017 SB	B. achyra	1.80	2.75	2.25	2.80
Gen. prep.4./29.I.2017 SB	B. achyra	1.85	2.70	2.25	2.80
Gen. prep.5./27.I.2017 SB	B. achyra	1.80	2.75	2.40	2.85
Gen. prep.1./22.I.2017 SB	B. strataria	1.70	2.75	2.40	2.85
Gen. prep.2./12.I.2017 SB	B. achyra	1.85	2.75	2.25	2.90
Gen. prep.5./09.I.2017 SB	B. achyra	1.75	2.80	2.30	2.90
Gen. prep.1./21.I.2017 SB	B. achyra	1.85	2.80	2.30	2.90
Gen. prep.1./28.I.2017 SB	B. achyra	1.90	2.80	2.35	2.95
Gen. prep.1./27.I.2017 SB	B. achyra	1.70	2.75	2.30	2.95
Gen. prep.5./29.I.2017 SB	B. achyra	1.95	2.80	2.30	2.95
Gen. prep.4./22.I.2017 SB	B. strataria	1.75	2.80	2.30	2.95
Gen. prep.6./29.I.2017 SB	B. strataria	1.85	2.75	2.35	3.00
Gen. prep.3./21.I.2017 SB	B. strataria	1.80	3.10	2.40	3.25
Gen. prep.3./12.I.2017 SB	B. strataria	1.85	2.95	2.50	3.20
Gen. prep.2./22.I.2017 SB	B. strataria	1.90	3.00	2.50	3.20
Gen. prep.4./12.I.2017 SB	B. strataria	1.85	3.00	2.50	3.25
Gen. prep.4./21.I.2017 SB	B. strataria	2.05	3.25	2.50	3.50
Gen. prep.7./09.I.2017 SB	B. strataria	1.85	2.85	2.55	3.05
Gen. prep.3./27.I.2017 SB	B. strataria	1.85	3.10	2.55	3.10
Gen. prep.4./27.I.2017 SB	B. strataria	1.85	3.00	2.55	3.20
Gen. prep.3./22.I.2017 SB	B. strataria	1.95	3.05	2.55	3.25
Gen. prep.6./09.I.2017 SB	B. strataria	2.00	3.20	2.55	3.35
Gen. prep.8./29.I.2017 SB	B. strataria	2.00	3.10	2.65	3.25
Gen. prep.7./29.I.2017 SB	B. strataria	1.95	3.10	2.65	3.35

Table 2: *Phigaliohybernia budashkini-aurantiaria*, measurements (in mm) and features.

Gen. prep. No.	aedeagus	juxta	incisura	apical cornut	wingspan	color/pattern	locality
Gen. prep. 1./26.XII.2016	2.10	0.70	0.20	crescent	33	ochre/yes	BG, Eastern Rhodopi, Odrintzi
Gen. prep. 2./26.XII.2016	2.35	0.77	0.20	crescent	39	ochre/yes	SW BG, Kresna Gorge, Stara Kresna
Gen. prep. 3./26.XII.2016	2.25	0.75	0.30	wide base, slightly curved	36	ochre/no	BG, Lyulyaka Chalet, Sofia Region
Gen. prep. 4./26.XII.2016	2.15	0.70	0.15	crescent	35	ochre/yes	SW Bulgaria, near Strumyani Village
Gen. prep. 5./26.XII.2016	2.25	0.75	0.25	crescent	38	yellow/yes	N BG, Pleven Town, Kayluka park
Gen. prep. 6./26.XII.2016	2.25	0.75	0.15	slightly crescent	39	yellow/yes	BG, Plovdiv Town
Gen. prep. 7./26.XII.2016	2.35	0.75	0.15	crescent	35	yellow/yes	BG, Plovdiv Town
Gen. prep. 8./26.XII.2016	2.10	0.75	0.20	slightly crescent	34	ochre/yes	BG, Ispirihovo Village, Pazardzhik Region
Gen. prep. 9./26.XII.2016	2.20	0.75	0.25	crescent	34	pale ochre/yes	BG, Iskar Gorge, Lakatnik Railway Station
Gen. prep. 10./26.XII.2016	2.20	0.75	0.20	crescent	35	ochre/yes	SW BG, near Strumyani Village
Gen. prep. 11./26.XII.2016	2.10	0.77	0.25	slightly crescent	33	ochre/no	BG, E Rhodopi, Kroyatzi Hunting Chalet
Gen. prep. 1./29.XII.2016	2.20	0.75	0.25	slightly crescent	35	ochre/yes	BG, S Black Sea Coast, Primorsko
Gen. prep. 2./29.XII.2016	2.10	0.75	0.20	crescent	35	ochre/no	BG, Kmetovtzi village, Gabrovo Region
Gen. prep. 3./29.XII.2016	2.15	0.75	0.25	short, horn like	35	pale ochre/yes	BG, Kmetovtzi village, Gabrovo Region
Gen. prep. 4./29.XII.2016	2.10	0.75	0.25	crescent	37	yellow/yes	BG, Sofia Town
Gen. prep. 5./29.XII.2016	2.25	0.70	0.20	crescent	38	pale ochre/yes	SW BG, Kresna Gorge, Stara Kresna station
Gen. prep. 2./31.XII.2016	2.10	0.65	0.15	slightly crescent	35	ochre/yes	E Serbia, Slivoviski Vis, Bela Palanka district
Gen. prep. 1./01.I.2017	2.25	0.75	0.25	crescent	35	yellow/yes	SW BG, Kresna Gorge-S. Pirin Mts, Vlaha Village
Gen. prep. 2./01.I.2017	2.20	0.75	0.25	slightly crescent	35	ochre/yes	SW BG, near Levunovo

Gen. prep. No.	aedeagus	juxta	incisura	apical cornut	wingspan	color/pattern	locality
Gen. prep. 1./26.XII.2016	2.10	0.70	0.20	crescent	33	ochre/yes	BG, Eastern Rhodopi, Odrintzi
Gen. prep. 2./26.XII.2016	2.35	0.77	0.20	crescent	39	ochre/yes	SW BG, Kresna Gorge, Stara Kresna
Gen. prep. 3./26.XII.2016	2.25	0.75	0.30	wide base, slightly curved	36	ochre/no	BG, Lyulyaka Chalet, Sofia Region
Gen. prep. 4./26.XII.2016	2.15	0.70	0.15	crescent	35	ochre/yes	SW Bulgaria, near Strumyani Village
Gen. prep. 5./26.XII.2016	2.25	0.75	0.25	crescent	38	yellow/yes	N BG, Pleven Town, Kayluka park
Gen. prep. 6./26.XII.2016	2.25	0.75	0.15	slightly crescent	39	yellow/yes	BG, Plovdiv Town
Gen. prep. 7./26.XII.2016	2.35	0.75	0.15	crescent	35	yellow/yes	BG, Plovdiv Town
Gen. prep. 8./26.XII.2016	2.10	0.75	0.20	slightly crescent	34	ochre/yes	BG, Isperihovo Village, Pazardzhik Region
Gen. prep. 9./26.XII.2016	2.20	0.75	0.25	crescent	34	pale ochre/yes	BG, Iskar Gorge, Lakatnik Railway Station
Gen. prep. 10./26.XII.2016	2.20	0.75	0.20	crescent	35	ochre/yes	SW BG, near Strumyani Village
Gen. prep. 11./26.XII.2016	2.10	0.77	0.25	slightly crescent	33	ochre/no	BG, E Rhodopi, Kroyatzi Hunting Chalet
Gen. prep. 1./29.XII.2016	2.20	0.75	0.25	slightly crescent	35	ochre/yes	BG, S Black Sea Coast, Primorsko
Gen. prep. 2./29.XII.2016	2.10	0.75	0.20	crescent	35	ochre/no	BG, Kmetovtzi village, Gabrovo Region
Gen. prep. 3./29.XII.2016	2.15	0.75	0.25	short, horn like	35	pale ochre/yes	BG, Kmetovtzi village, Gabrovo Region
Gen. prep. 4./29.XII.2016	2.10	0.75	0.25	crescent	37	yellow/yes	BG, Sofia Town
Gen. prep. 5./29.XII.2016	2.25	0.70	0.20	crescent	38	pale ochre/yes	SW BG, Kresna Gorge, Stara Kresna station
Gen. prep. 2./31.XII.2016	2.10	0.65	0.15	slightly crescent	35	ochre/yes	E Serbia, Slivoviski Vis, Bela Palanka district
Gen. prep. 1./01.I.2017	2.25	0.75	0.25	crescent	35	yellow/yes	SW BG, Kresna Gorge-S. Pirin Mts, Vlahi Village
Gen. prep. 2./01.I.2017	2.20	0.75	0.25	slightly crescent	35	ochre/yes	SW BG, near Levunovo

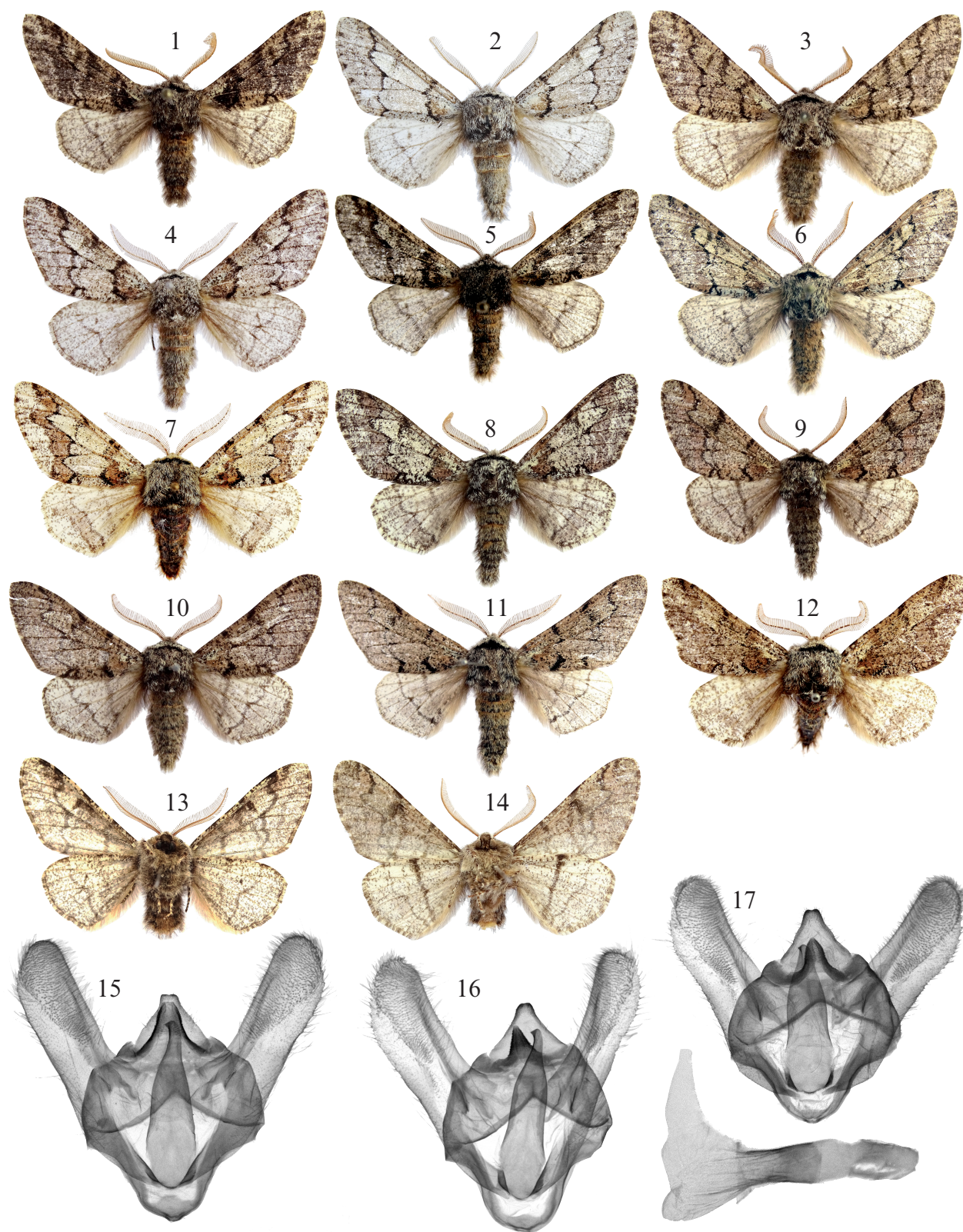


Fig. 1-6: *Biston achyra* WEHRLE, 1936, ♂

Fig. 1: SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 3./29.I.2017.

Fig. 2: SW Bulgaria, Kresna Gorge, Stara Kresna Railway Station, 25.III.1989, GP 4./29.I.2017.

Fig. 3: SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 5./09.I.2017.

Fig. 4, 13 (under side): SW Bulgaria, Kresna Town, 25.II.2014, GP 1./28.I.2017.

Fig. 5: SW Bulgaria, Kresna Gorge, Stara Kresna Railway Station, 13.III.1986, GP 5./12.I.2017.

Fig. 6: SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 5./22.I.2017.

Fig. 7-12, 14-17: *Biston strataria* (HUFNAGEL, 1767), ♂

Fig. 7: SW Bulgaria, Kresna Gorge, Stara Kresna Railway Station, 13.III.1986, GP 6./09.I.2017.

Fig. 8: SW Bulgaria, Kresna Town, 25.III.2014, GP 8./29.I.2017.

Fig. 9, 14 (under side): SW Bulgaria, Belassitza Mts., 26.III.2010, GP 3./27.I.2017.

Fig. 10: E Bulgaria, E Rhodopi Mts., near Rabovo Village, 29.III.2012, GP 1./22.I.2017.

Fig. 11: SW Bulgaria, S Pirin Mts., near Kalimantzi village, 26.III.2011, GP 4./27.I.2017.

Fig. 12: SW Bulgaria, Kresna Gorge, Stara Kresna Railway Station, 14.III.1985, GP 3./12.I.2017.

Fig. 15: Genitalia. E Bulgaria, E Rhodopi Mts., Studen Kladenetz Village, 19.III.1990, GP 4./12.I.2017.

Fig. 16: Genitalia. SW Bulgaria, Kresna Town, 25.II.2014, GP 8./29.I.2017.

Fig. 17: Genitalia with everted vesica. E Bulgaria, E Rhodopi Mts., Rabovo Village, 29.III.2012, GP 1./22.I.2017.

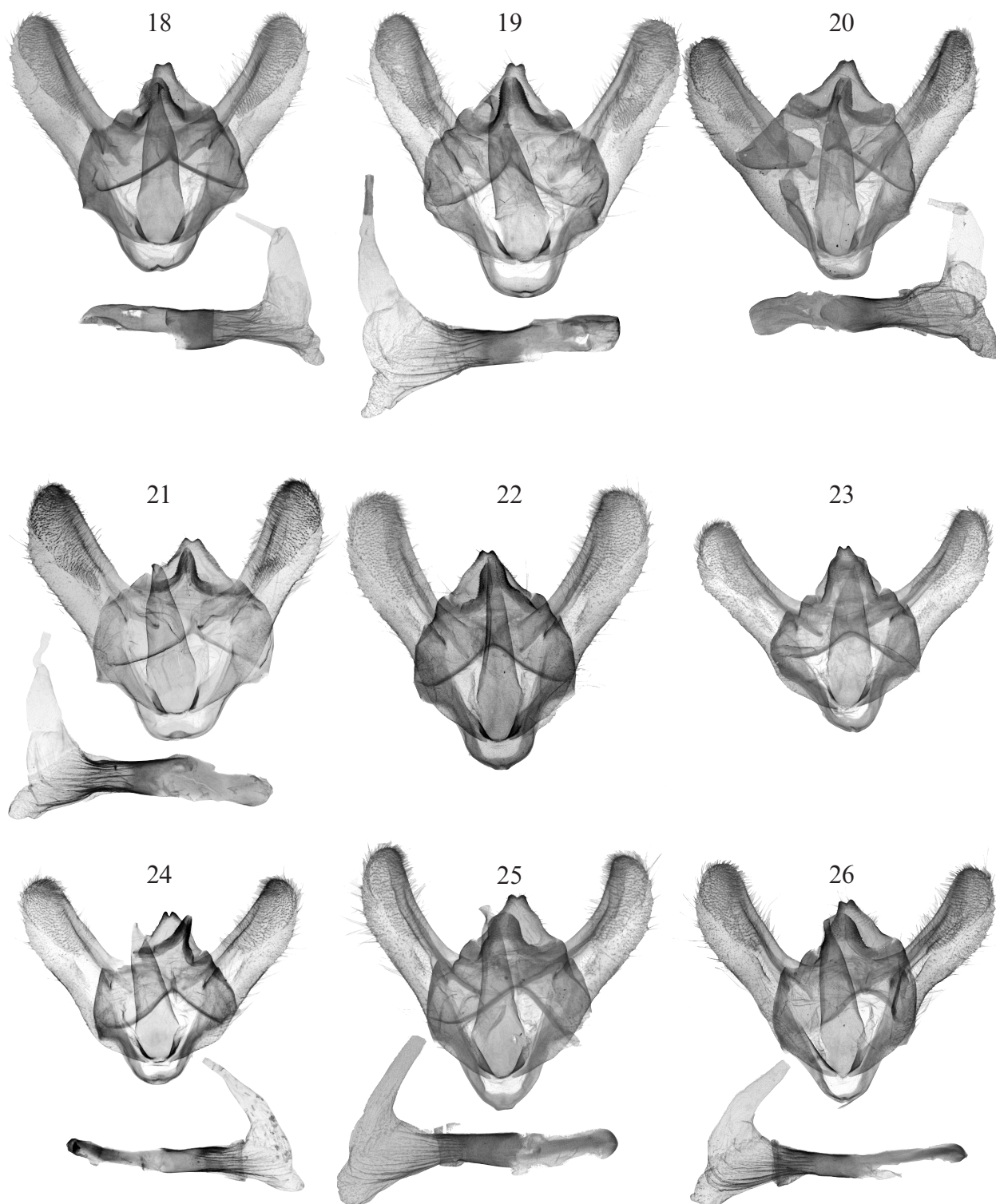


Fig. 18-21: *Biston strataria* (HUFNAGEL, 1767), ♂

Fig. 18: Genitalia with everted vesica. SW Bulgaria, Kresna Gorge, Stara Kresna Railway Station, 14.III.1985, GP 2./22.I.2017.

Fig. 19: Genitalia with everted vesica. SW Bulgaria, S Pirin Mts., Kalimantzi Village, 26.III.2011, GP 4./27.I.2017.

Fig. 20: Genitalia with everted vesica. SW Bulgaria, Kresna Gorge, Stara Kresna Railway Station, 14.III.1985, GP 7./09.I.2017.

Fig. 21: Genitalia with everted vesica. SW Bulgaria, Kresna Gorge, Stara Kresna Railway station, 14.III.1985, GP 3./21.I.2017.

Fig. 22-26: *Biston achyra* WEHRLE, 1936, ♂

Fig. 22: Genitalia. SW Bulgaria, Kamenitza Village, 04.IV.2003, GP 2./12.I.2017.

Fig. 23: Genitalia. SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 8./09.I.2017.

Fig. 24: Genitalia with everted vesica. SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 2./21.I.2017.

Fig. 25: Genitalia with everted vesica. SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 3./29.I.2017.

Fig. 26: Genitalia with everted vesica. SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 1./29.I.2017.

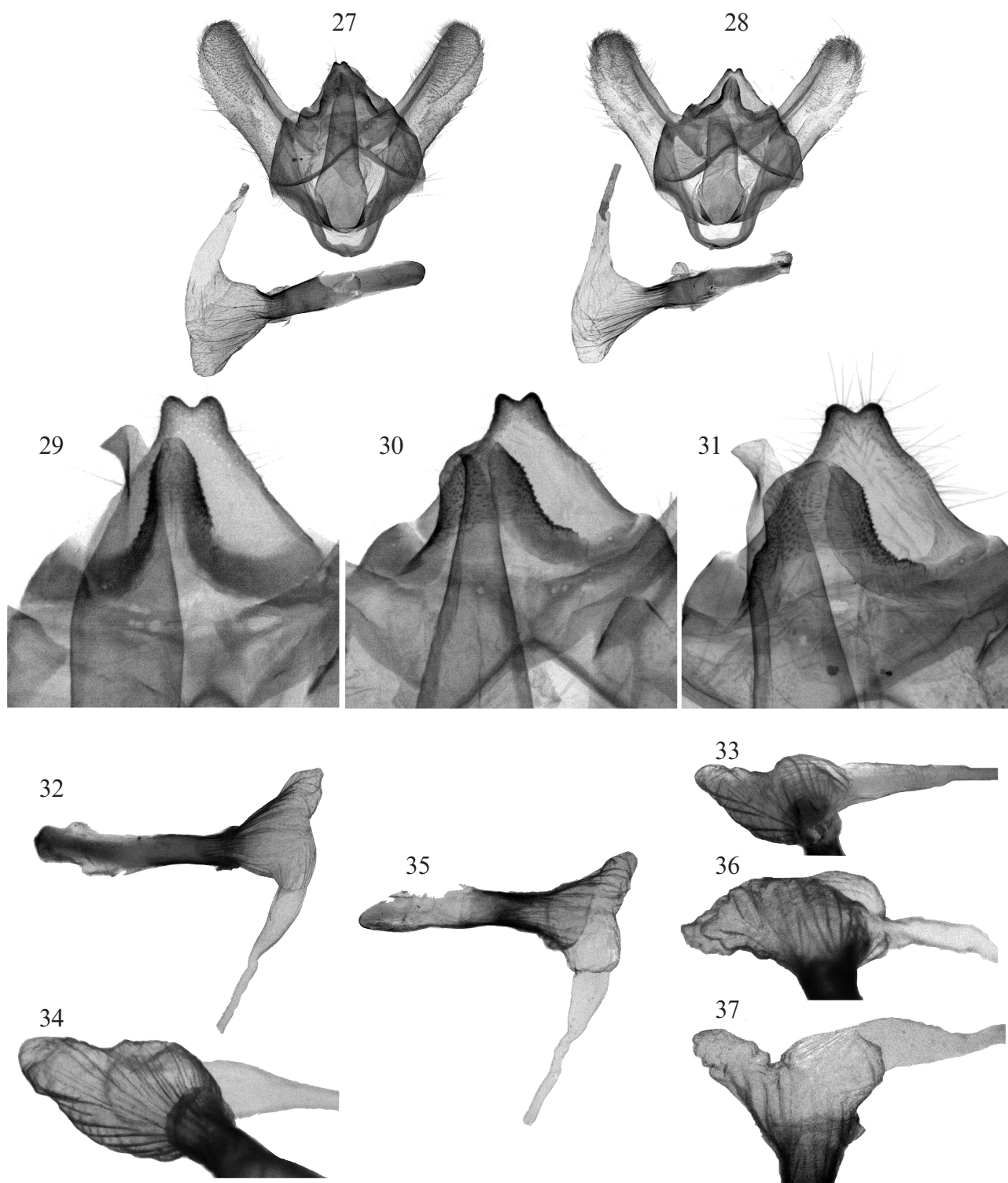


Fig. 27, 28, 30-34: *Biston achyra* WEHRLI, 1936, ♂

Fig. 27: Genitalia with everted vesica. SW Bulgaria, Kresna Gorge, Stara Kresna Railway station, 25.III.1989, GP 4./29.I.2017.

Fig. 28: Genitalia with everted vesica. SW Bulgaria, Kresna Gorge, on the road to Stara Kresna, GP 5./09.I.2017.

Fig. 30: Uncus with tip of the juxta. SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 8./09.I.2017.

Fig. 31: Uncus with tip of the juxta. SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 3./29.I.2017.

Fig. 32: Everted vesica. SW Bulgaria, Kresna Town, 25.II.2014, GP 1./28.I.2017.

Fig. 33: Everted vesica. SW Bulgaria, Kresna Town, 25.II.2014, GP 1./28.I.2017.

Fig. 34: Everted vesica. SW Bulgaria, Kresna Gorge, Shaytan Dere, GP 1./27.I.2017.

Fig. 29, 35-37: *Biston strataria* (HUFNAGEL, 1767), ♂

Fig. 29: Uncus with tip of the juxta. E Bulgaria, E Rhodopi Mts., Haskovski Mineralni Bani, 28.III.2012, GP 6./29.I.2017.

Fig. 35: Everted vesica. SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 4./22.I.2017.

Fig. 36: Everted vesica. SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 4./22.I.2017.

Fig. 37: Everted vesica. SW Bulgaria, Gradeshka Banja near Kresna Town, 20.III.2010, GP 4./22.I.2017.

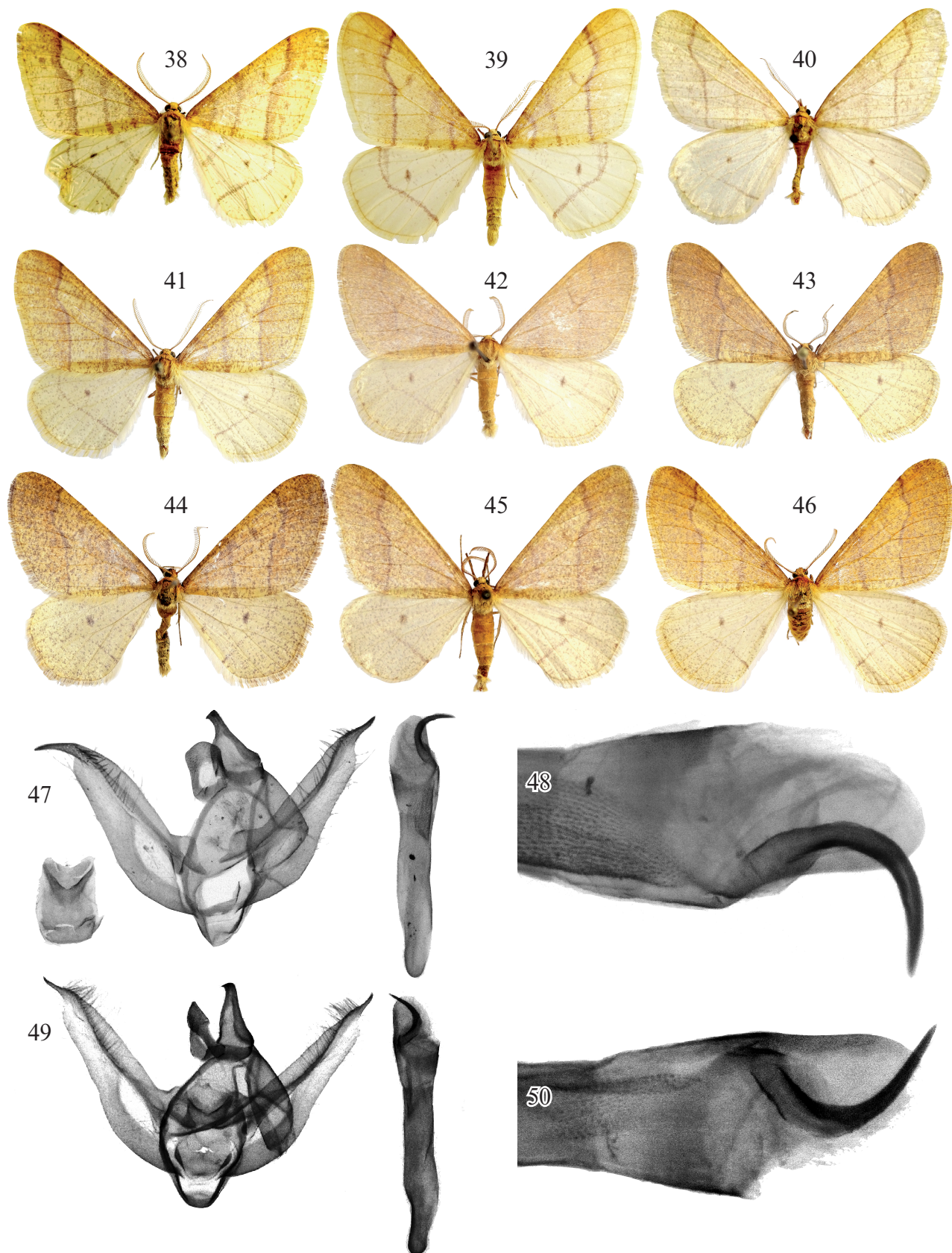


Fig. 38, 40: *Phigaliohybernia aurantiaria* (HÜBNER, 1799), ♂
 Fig. 38: N. Bulgaria, Pleven Town "Kayluka" Park, 18.XI.1987, GP 5./26.XII.2016.
 Fig. 40: Bulgaria, Plovdiv Town, 7.XI.1954, N. Vihodcevsy leg., GP 6./26.XII.2016.

Fig. 39, 41-50: *Phigaliohybernia budashkini* (KOSTJUK, 2009), ♂
 Fig. 39: SW Bulgaria, S Pirin Mts., Vlahi Village, 17.XI.2014, GP 1./01.I.2017.
 Fig. 41: SW Bulgaria, Marena Hill near General Todorov Village, 28.XI.2009, GP 9./29.I.2017.
 Fig. 42: Bulgaria, Lyulyaka Chalet near Beledie Han Village, Sofia Region, 8.XI.1985, GP 3./26.XII.2016.
 Fig. 43: E Bulgaria, E Rhodopi Mts., Odrintzi Village, 24.XI.1990, GP 1./26.XII.2016.
 Fig. 44: E Serbia, Bela Palanka Distr., Slivovicki Vis, 6.XI.2016, GP 2./31.XII.2016.
 Fig. 45: SW Bulgaria, near Strumyani Village, 26.XI.2009, GP 10./26.XII.2016.
 Fig. 46: SW Bulgaria, Kresna Gorge, Stara Kresna Railway Station, 24.XI.1984, GP 3./01.I.2017.
 Fig. 47, 48: Genitalia. E Bulgaria, E Rhodopi Mts., Odrintzi Village, 24.XI.1990, GP 1./26.XII.2016.
 Fig. 49, 50: Genitalia. E Serbia, Bela Palanka Distr., Slivovicki Vis, 6.XI.2016, GP 2./31.XII.2016.

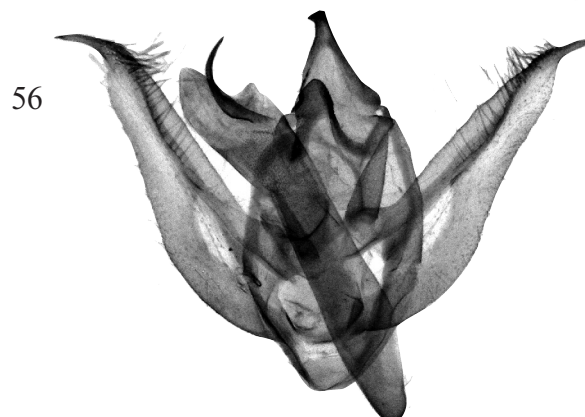
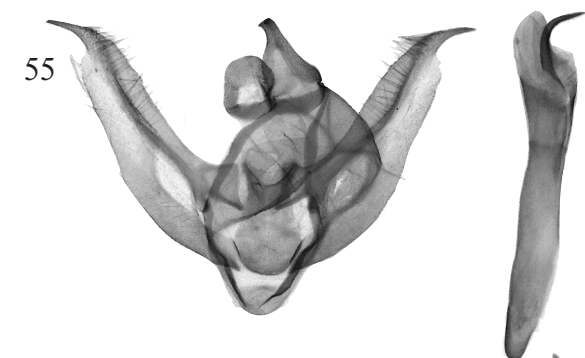
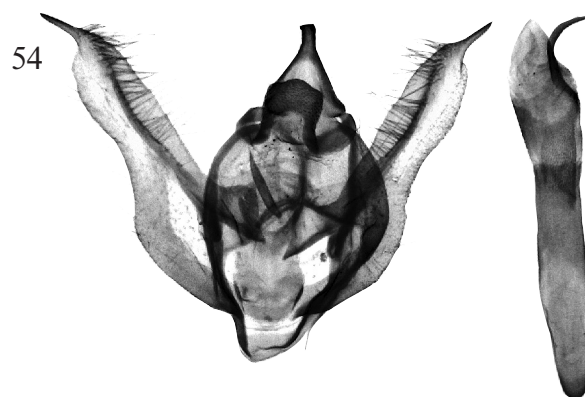
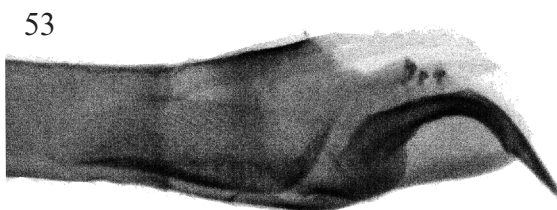
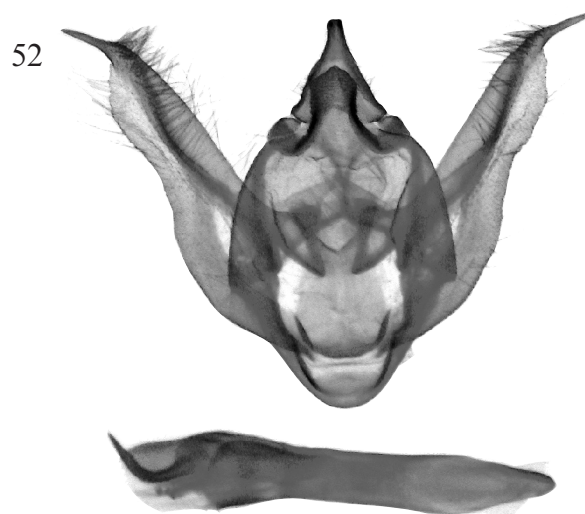
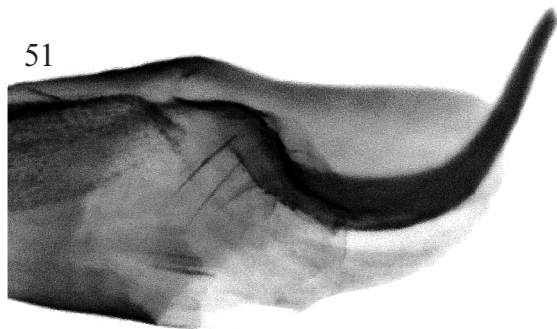


Fig. 51-57: *Phigaliohybernia budashkini* (KOSTJUK, 2009), ♂

Fig. 51: Apical cornutus. SW Bulgaria, near Strumyani Village, 26.XI.2009, GP 10./26.XII.2016.

Fig. 52, 53: Genitalia. SW Bulgaria, Marena Hill near General Todorov Village, 28.XI.2009, GP 9./29.I.2017.

Fig. 54 (GP 3./01.I.2017), 55 (GP 2./26.XII.2016): Genitalia. SW Bulgaria, Kresna Gorge, Stara Kresna Railway Station, 24.XI.1984.

Fig. 56: Genitalia. SW Bulgaria, Gradeshka Banja near Kresna Town, 29.XI.2008, GP 5./08.I.2017.

Fig. 57: Apical cornutus. Bulgaria, Predbalkan, Kmetovtzi Village between Gabrovo and Bozhentzite, 11.XI.2010, GP 2./29.XII.2016.

Fig. 58. *Phigaliohybernia aurantiaria* (HÜBNER, 1799), ♂ genitalia. Bulgaria, Predbalkan, Kmetovtzi Village between Gabrovo and Bozhentzite, 11.XI.2010, GP 3./29.XII.2016.

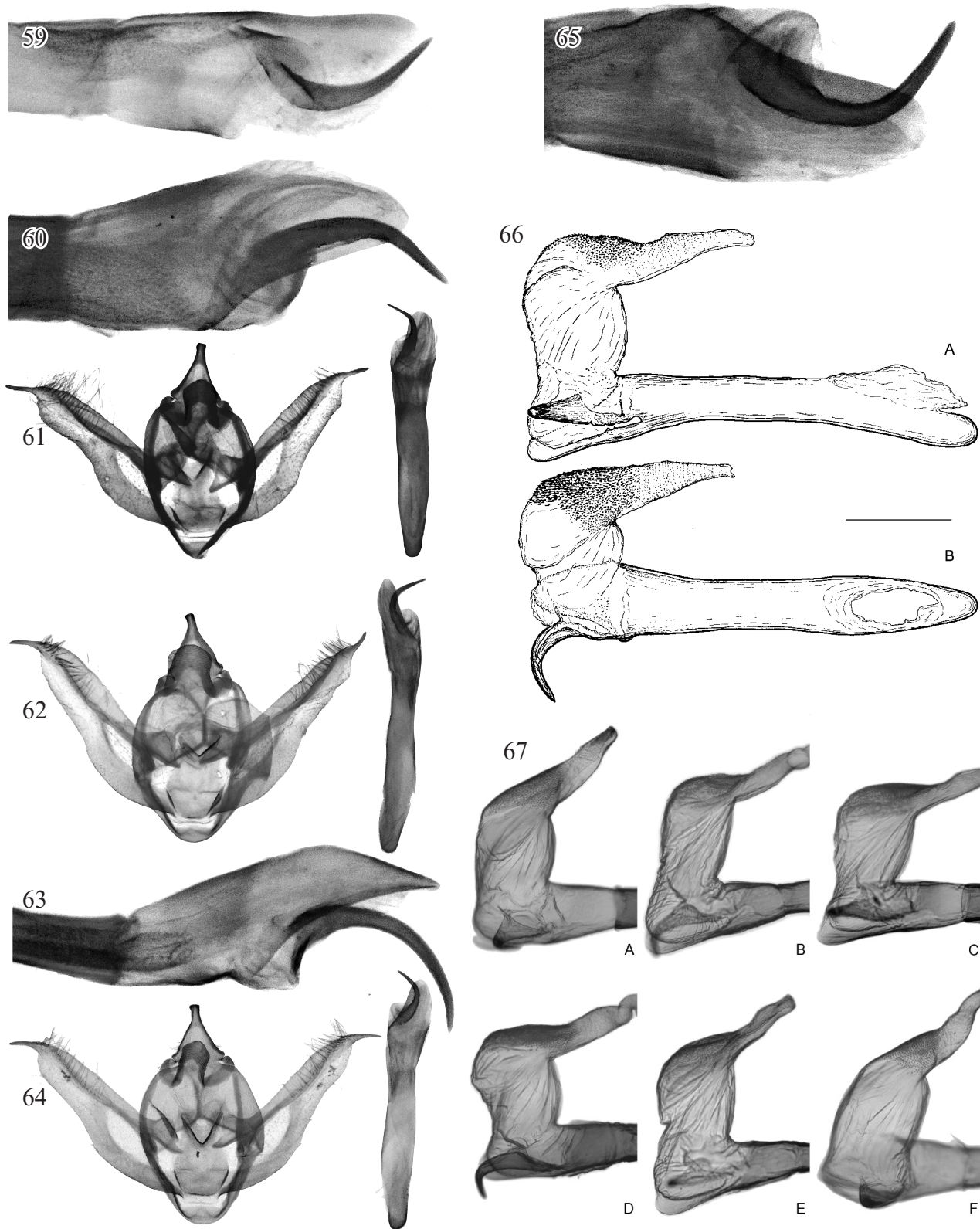


Fig. 59-61: *Phigaliohybernia aurantiaria* (HÜBNER, 1799) ?, ♂

Fig. 59: Apical cornutus. Bulgaria, Predbalkan, Kmetovtzi Village between Gabrovo and Bozhentzite, 11.XI.2010, GP 3./29.XII.2016.

Fig. 60: Apical cornutus. Bulgaria, Golo Burdo Mts., Pernik Region, near the Chalet, 12.XI.1955, N. Vihodcevsy leg., GP 3./08.I.2017.

Fig. 61: Genitalia. Bulgaria, Vitosha Mts., Sofia Region, BAN Chalet, 1450 m, 20.XI.1959, N. Vihodcevsy leg., GP 7./08.I.2017.

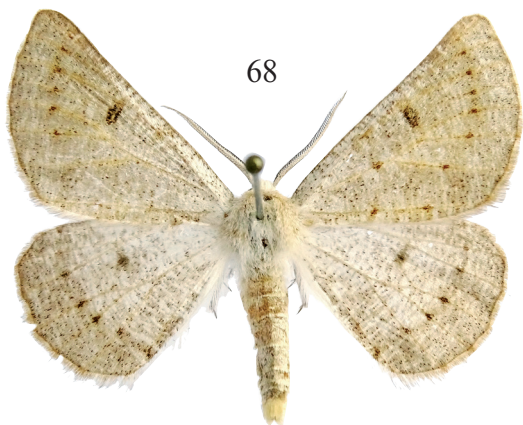
Fig. 62: *Phigaliohybernia budashkini* (KOSTJUK, 2009) ?, ♂, genitalia. Bulgaria, Upper Thracian Lowland, Plovdiv City, 200 m, 8.XI.1954, N. Vihodcevsy leg., GP 7./26.XII.2016

Fig. 63: *Ph. budashkini* (KOSTJUK, 2009) ?, ♂, apical cornutus. SW Bulgaria, S Pirin Mts., Vlahi Village, 17.XI.2014, GP 1./01.I.2017.

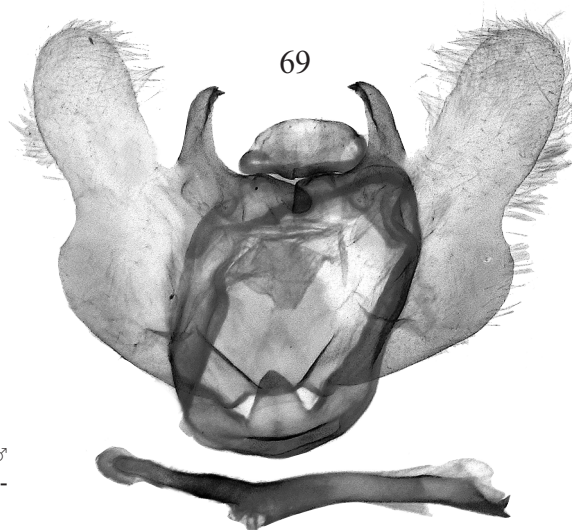
Fig. 64. 65: *Phigaliohybernia aurantiaria* (HÜBNER, 1799), ♂, genitalia and apical cornutus. N. Bulgaria, Pleven Town "Kayluka" Park, 18.XI.1987, GP 5./26.XII.2016

Fig. 66. Aedeagus with vesica everted of *Ph. aurantiaria-budashkini*, Bulgaria, Kresna Gorge, Vlahi Village, 16.XI.2014, GP 11./07.III.2017 BZ. A. Dorsolateral view, a natural position of the aedeagus when lying on a slide. B. Dorsal view. Scale bar = 0.5 mm.

Fig. 67. Variations in everted vesicae of *Ph. aurantiaria-budashkini* specimens from different localities in Bulgaria. (A) Iskar Gorge, 21.XI.2009, GP 9./26.XII.2016, SB. (B) Bessaparski Ridove Elevations, 19.XII.1984, GP 8./26.XII.2016, SB. (C) Sakar Mountains, 9.11.1987, GP 7./07.III.2017, BZ. (D) Eastern Rodopi Mts., Strandzevo village, 8.-9.XII.2000, GP 8./07.III.2017, BZ. (E) Black Sea Coast, Primorsko, 14.XI.1963, GP 9./08.I.2017, SB. (F) Ibid. GP 9./07.III.2017, BZ. Note the considerable difference between E and F, both originating from the same locality.

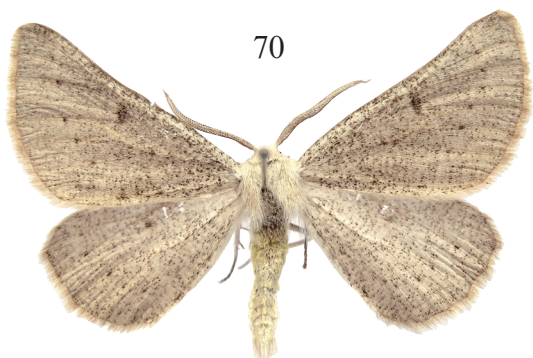


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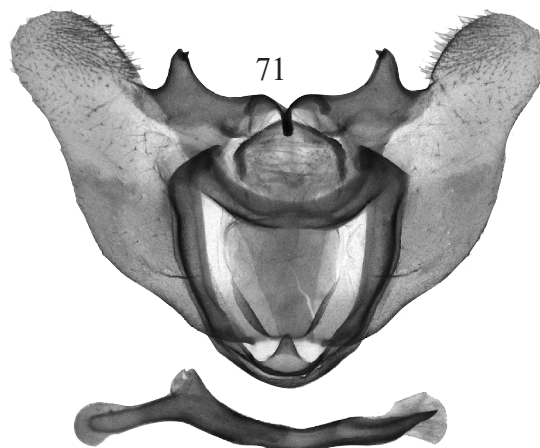


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Fig. 68, 69: *Dyscia conspersaria* ([DENIS & SCHIFFERMÜLLER], 1775), ♂ with genitalia. Bulgaria, Western Stara Planina Mts., above Beledie Han Village, Sofia Region, 6.VI.2009, GP 1./31.XII.2016.



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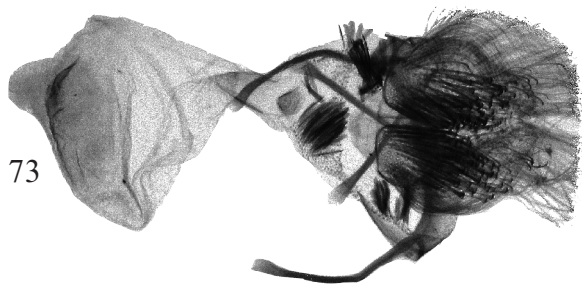
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Fig. 70, 71: *Dyscia raunaria* (FREYER, [1851]), ♂ with genitalia. E Serbia, Bela Palanka District, Slivovicki Vis, 30.V.2016, GP 1./21.II.2017.



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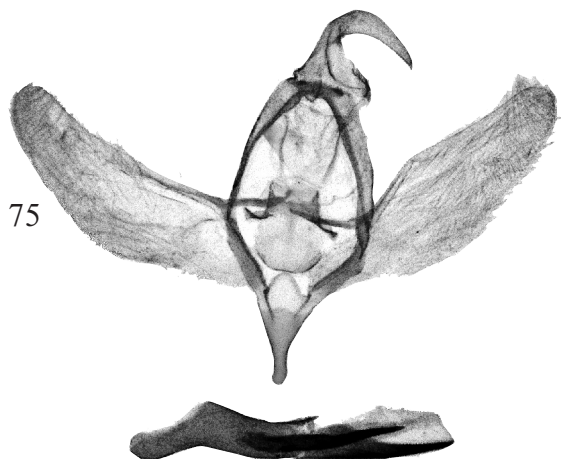
Fig. 72: Slivovishki Vis, 30.V.2016, collecting locality of *Dyscia raunaria* (FREYER, [1851]).



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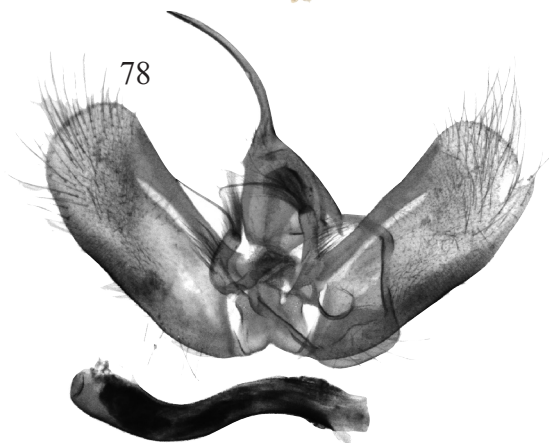
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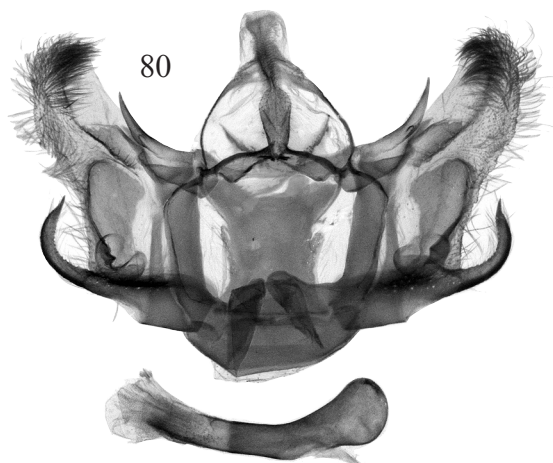
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Fig. 73: *Aleucis orientalis* (STAUDINGER, 1892), ♀ genitalia. S. Serbia, Preshevo district, above Trnava Village, 25.IV.2015, GP 3./09.I.2017.

Fig. 74: *Aleucis orientalis* (STAUDINGER, 1892), ♂. Republic of Macedonia, Demir Kapiya, 8.III.2013, GP 1./09.I.2017.

Fig. 75: *Aleucis orientalis* (STAUDINGER, 1892), ♂ genitalia, Republic of Macedonia, near Demir Kapiya, 8.III.2013, GP 1./09.I.2017.

Fig. 76: *Gnophos dumetata* TREITSCHKE, 1827, ♂. Albania, Korca Region, above Zvezda Village, 23.IX.2016.

Fig. 77: *Nebula pirinica* (Reisser, 1936), ♂. W Serbia, Cetanica, 4.VIII.2016, GP 2./16.IV.2016.

Fig. 78: *Nebula pirinica* (Reisser, 1936), ♂ genitalia. W Serbia, Cetanica, 4.VIII.2016, GP 2./16.IV.2016.

Fig. 79: *Coenocalpe millierata* (STAUDINGER, 1901), ♀. Republic of Macedonia, Demir Kapija Gorge, 20.X.2016.

Fig. 80: *Coenocalpe millierata* (STAUDINGER, 1901), ♂ genitalia. Republic of Macedonia, Demir Kapija Gorge, 20.X.2016, GP 3./22. II.2017.

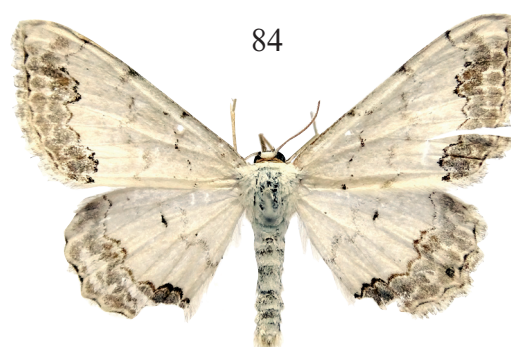
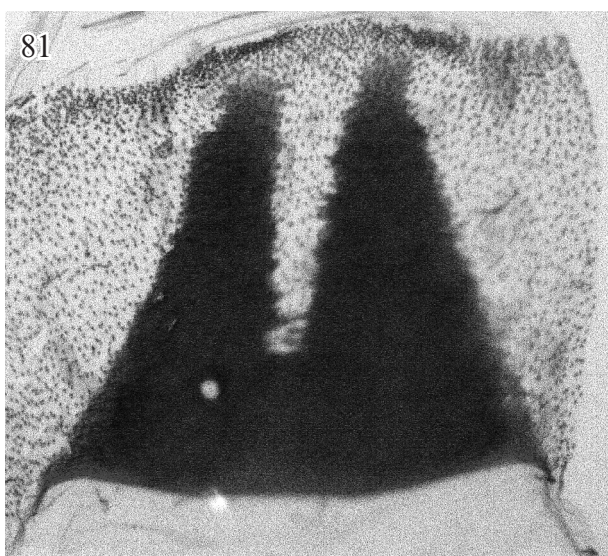


Fig. 81: *Coenocalpe millierata* (STAUDINGER, 1901), ♂ 8th sternite, Republic of Macedonia, Demir Kapija Gorge, 20.X.2016, GP 1./23. II.2017.

Fig. 82: *Idaea metohiensis* REBEL, 1900, ♀. W Serbia, Cetanica, 4.VIII.2015.

Fig. 83: *Idaea metohiensis* REBEL, 1900, ♀ genitalia. Serbia, Cetanica, 4.VIII.2015, GP 1./16.IV.2016.

Fig. 84: *Scopula orientalis* (ALPHÉRAKY, 1876), ♂. Albania, Devollil Gorge, near Strelca Village, 5.VI.2016, GP 2./22.II.2017

Fig. 85: *Scopula orientalis* (ALPHÉRAKY, 1876), ♂ genitalia with 8 sternit. Albania, Devollil Gorge, near Strelca Village, 5.VI.2016, GP 2./22.II.2017.

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