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Lomaspilis bithynica Wehrli, 1954 stat. rev., a distinct species new for Europe (Geometridae)

Jörg Gelbrecht [1], Adam Malkiewicz [2] & Radosław Stelmaszczyk [3]

[1] G.-Hauptmann-Str. 28, D-15711 Königs Wusterhausen; e-mail: c.aureum@t-online.de

[2] Zoological Institute, University of Wrocław; Przybyszewskiego 63/77, 51-148 Wrocław, Poland; e-mail: amalki@biol.uni.wroc.pl

[3] Museum of Natural History, University of Wrocław, Sienkiewicza 21, 50-335 Wrocław, Poland; e-mail: stelma@biol.uni.wroc.pl

Abstract. *Lomaspilis bithynica* Wehrli, 1954 formerly treated as a subspecies of *L. opis* (Butler, 1878) is recognized as a distinct species after an examination of the holotype and additional material. A differential diagnosis is given to distinguish the species from the other two Palaearctic members of genus *Lomaspilis* Hübner, [1825]. The external and genital features of the three species are figured. *L. bithynica* has been recorded from the Turkish provinces of Bolu, Trabzon, Çankiri, Erzurum, Erzincan, Artvin, Rize, and Kars. It is recorded here for the first time from Europe based on specimens collected recently in central Greece. Data on bionomics are also given.

Zusammenfassung. *Lomaspilis bithynica* Wehrli, 1954 stat. rev., die früher als Unterart von *L. opis* (Butler, 1878) galt, wird nach Untersuchung des Holotypus und weiteren Materials in den Artstatus erhoben. Eine detaillierte Diagnose gestattet es, die Art von den beiden anderen palaearktischen Arten der Gattung *Lomaspilis* Hübner, [1825] zu unterscheiden. Ihre äußeren Unterscheidungsmerkmale sowie die der Genitalapparaturen werden abgebildet. Nach unserer Kenntnis wurde *L. bithynica* in den türkischen Provinzen Bolu, Trabzon, Cankiri, Erzurum, Erzincan, Artvin, Rize und Kars gefunden. Die Art wurde neuerdings auch in Zentral-Griechenland nachgewiesen, was einen Erstnachweis für Europa darstellt. Erstmalig werden auch Daten zur Lebensweise von *L. bithynica* publiziert.

Key words. Lepidoptera, Geometridae, *Lomaspilis*, *bithynica*, Turkey, Greece, Europe, species status, morphology, distribution, host plant.

Introduction

Scoble (1999) lists only two species in the genus *Lomaspilis* Hübner, [1825]: *L. marginata* (Linnaeus, 1758) and *L. opis* (Butler, 1878), the latter represented by four subspecies: the nominotypical *L. o. opis* from Japan, *L. o. amurensis* (Hedemann, 1881) from the Amur region, *L. o. nigrita* Heydemann, 1938 from Finland, and *L. o. bithynica* Riemis, 1992 from north-eastern Turkey (Prov. Erzurum). Viidalepp (1996) lists *L. amurensis* (Hedemann, 1881) as a subspecies of *marginata*.

L. opis bithynica Riemis, 1992 had been described as form "*bithynica*" of *Lomaspilis marginata* by Wehrli (in Seitz 1954). According to article 10.2 of the International Code of Zoological Nomenclature (1999), a form name is available if validly published before 1961. Because Wehrli's (1954) publication is valid, he correctly made *Lomaspilis opis bithynica* (cf. ICZN article 45.6) an available name in writing: "...Eine merkwürdige Form, vielleicht zu subsp. *opis* Btlr. ... gehörig, oder besondere Art oder Rasse, – form. *bithynica n.* (22 e) erhielt ich von Boli, Kleinasien (E. Pfeiffer) leider nur in einem ♀ Exemplar...". Riemis (1992) was not justified to redescribe this taxon as a new subspecies. Thus, *L. opis bithynica* Riemis, 1992 must be listed as a junior primary homonym of *L. opis bithynica* Wehrli, 1954.

During several trips to north and north-eastern Turkey, the senior author found several specimens of *L. bithynica* looking identical to those figured by Wehrli (1954) and

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Riemis (1992). The first attempt to breed specimens of this *L. bithynica* population ex ovo on *Betula* spp., which are the only known host plants of *opis* (Skou 1984), was not successful. No larva fed on this plant and all died. In another experiment, *Salix* sp. and *Populus tremula* were additionally offered because *Salix* and *Populus* species are known to be the typical host plants of *L. marginata*, while *Quercus, Fagus, Betula*, and *Corylus* are also mentioned in the literature as occasional host plants (Bergmann 1955; Ebert et al. 2003). It was found that larvae of *L. bithynica* feed only on *Populus tremula*. These results were confirmed by other entomologists (T. Drechsel, B. Müller). *P. tremula* was common at all sites where *L. bithynica* was found. Consequently, we hypothesized that *L. bithynica* would not be a subspecies of *L. opis* Butler.

Comparative studies were done to answer this hypothesis. After detailed analysis of both male and female genitalia, we found that *L. opis bithynica* was not conspecific with *L. opis* or *L. marginata.* Consequently, we consider *L. bithynica* as a good species: *Lomaspilis bithynica* Wehrli, 1954 stat. rev. The key to solve this taxonomic problem was to apply the method of vesica eversion as improved by Sihvonen (2001). We also compared our material with the holotype of *L. bithynica* (Figs. 7–8) described and figured by Wehrli (1954) and the holotype of *L. opis bithynica* of Riemis (1992). East Palaearctic subspecies or forms of *L. opis* and *L. marginata* were not included in our studies.

Abbreviations

ZFMK Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn
ZMA Zoological Museum Amsterdam
ZSM Zoologische Staatssammlung, Munich

Material. *L. bithynica* Wehrli, 1954: Holotype ♀ with labels: 'Asia min.[or] s. | Bithynia | Boli <sic> 11.–20.vi.[19]34 | 800 m | E. Pfeiffer - München leg.' (on white paper printed in black); '*bithynica* Wehrli *Lomaspilis* Hb. | Holo ♀ Type (on red paper handwritten and printed in black), ZFMK. – *L. opis bithynica* Riemis, 1992: Holotype ♂ with labels: 'TURKIYE St.1703 <?> | Erzurum Rd.[Road] Erzu- | rum-Ispir, 10 km SW | Ovacik, 2300 m | 2.vii.1991 | W.De Prins, D. v. d. | Poorten, A.Riemis' (on white paper printed in black); 'HOLOTYPE | Lomaspilis | opis bithynica | det. A. Riemis, 1992' (on red paper printed in black), ZMA. – **Turkey**: 2♂, Prov. Erzurum, Kaçkar Dağı, Yaylalar, alt. ca. 1900 m., 4./5.vii.1983, M.-C. et F. Aulombard et J. Plante leg., ZSM; 22♂, 8♀, Dog. Karadeniz Dağlari: Korga Dağı, Umg. Köprüköy bei Ispir, 1600–2000 m, 3.–8.vi.2000, Gelbrecht, Drechsel, Busse & Schwabe leg., (7♂, 8♀, ex ovo cult., emerged: 20.iv.2001–12.v.2001 and 7.x.2001 and iv.2002), coll. Gelbrecht et coll. Malkiewicz; 2♂, 1♀, same locality, 1600 m, 23.vii.2001, leg. et coll. Löbel; 1♂, same locality, 1600 m, 22.vi.2002, Gelbrecht & Schwabe leg., coll. Gelbrecht; 2 ex., same locality, 1600 m, 06., 24.vi.2003, leg. et coll. Müller; 1 ex., 9 km S Ispir im Tal des Çoruh, 1840 m, 23.vi.2001, leg. et coll. Ochse; 1♂, Kuzgun-Brj., Stausee, 2280 m, 22.vi.2003, leg. et coll. Müller. 1♂, Prov. Kars, Arastal, 15 km E Karakurt, 1400 m, 23.vii.1992, leg. et coll. Petersen; 1♂, Sarikames, 2000 m, 4.vi.2000, leg. et coll. Petersen. 1 ex., Prov. Artvin, Kaçkar Dağı, ca. 1800 m, Yaylalar Umg., 17.vii.1995, leg. & coll. Noack; 2 ex., Kaçkar Dağı / Bilek Dağı, 7 km N Aksu, 1600 m, 16.vii.2001 leg. et coll. Ochse. Prov. Rize: 1♂, 1♀, Umg. Çamlik, 1500 m, 8.vi.2003, leg. et coll. Müller. 2♂, Prov. Trabzon, Ovit Dağı, 5 km N Hotel Genesis b. Dereköy, 1200–1300 m, 29.v.2000, leg. Gelbrecht, Drechsel, Busse & Schwabe, coll. Gelbrecht. 1♀, Prov. Çankiri, Ilgaz Umgebung, 1400 m, 10.vi.–14.vi.1991, leg. et coll. Löbel; 1♀, Ilgaz Umgebung, 960 m, 16.vi.1992, leg. et coll. Petersen. **Greece**: 2♀, Aliakmon River, Ag.[ios] Georgios Grevena 600 m, 6.vi.1992, Müller et Kotitsa leg., ZSM.

L. opis nigrita: 3♂, 5♀, **Poland**, Mikaszówka, P.[uszcza] Augustowska, 1.–10.vii.1997, Malkiewicz leg.; 2♂, Gruszki, Puszcza Augustowska, 13.vi.1992, Kokot leg.; 1♂, Rygol, Puszcza Augustowska, 16.vi.1992, Kokot leg.; 1♂, Grudki, Puszcza Białowieska, 6.vi.2000, Kokot leg.; 2♂, 2♀, Puszcza Borecka, 1.–13.06.1994, Buszko leg.; 3♂, 2♀, Mostki, gm.[ina] Staszów, 6.vi.1990, Pałka leg.; all specimens in coll. Malkiewicz.

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L. marginata: 3♂, 3♀, **Poland**, Szklarska Poręba G.[órna], 10.v.1990, 15.vi.1991, 20.vii.1991; 2♂, 2♀, Karpacz-Stanica, 22.vi.1990, 5.vi.1993; 1♂, Wrocław 14.vi.[19]84; 1♀, Czarny Dunajec, 15.vii.1993; all specimens leg. et coll. Malkiewicz; 1♂ Polska, Toruń, 10.v.1994, J. Buszko leg.; 1♂ Polska, DV25, Tatra Mts., 1100 m., Dolina Jaworzynka, 7.vii.2001, J. Buszko leg.; 1♀ Polska, Bory Stobrawskie, Dobrodzień, 11.v.1991, leg. A. Guziak; 1♀ Polska, distr. Żary, Pietrzyków, 11.v.1998, A. Kokot leg.

Lomaspilis bithynica Wehrli, 1954

Diagnosis. External features. Forewing length: male 14.0–15.0 mm (average 14.5), female 11.5–13.0 mm (average 12.3) (most females were bred). Forewing of *L. opis nigrita* males approximately 2 mm shorter (12.5 mm), whereas *L. marginata* males about 1.2 mm shorter (13.3 mm). Females of all three species similar in forewing length. Pattern of fore- and hindwings generally as in other two *Lomaspilis* species; differences expressed in shades and shapes of spots. Basal and median spots black with bluish suffusion. Terminal band pure black. Ground colour white, apart from costa (in bred females sometimes yellowish). Basal spot trapezoid, slightly concave between Cu and An veins, not oval as in *L. opis* and not as elongate as in *L. marginata.* Black medial band distal at M2 and CuA2 with two deep constrictions; at CuA2 often interrupted (Figs. 13–15). In *L. opis*, the medial band is broader, the concave constrictions are not so deeply, but mostly it is interrupted at CuA2. Terminal black band medial concavity deepest and more angled on both fore- and hindwing. Shape and continuity of medial band of both wings and width of medial concavity in terminal black band variable. *L. opis* wing pattern with similar variability, but medial band rarely continuous. Most important variation found in *L. marginata,* for which medial band can be reduced to one costal spot on forewings and nothing on hindwings.

Male genitalia (Figs. 1–3). (*L. bithynica*: n=5; *L. opis nigrita*: n=10; *L. marginata*: n=6). Valva of *L. bithynica* distally slightly narrower than in *L. opis*, but almost uniform in shape in the three species. Basal process of costa hook-shaped, more sinuate and longer than that of *L. opis* and *L. marginata.* Medial part of costa curved abruptly, curved regularly in other two species. Saccus triangular without distinct pair of wrinkles in middle, but present in the two other species (Figs. 1c, 3c). Width of tip of costa variable in all species. Vesica pear-shaped: anteriorly narrow, medially becoming wider, posteriorly twice anterior width; anterior part covered with minute spines at one side; posterior end with one row of cornuti, attached opposite to ductus ejaculatorius; at base of ductus ejaculatorius, vesica forming a small globular diverticulum. The latter is absent in the other species in which the vesica is more simply built: elongate, cylindrical in *L. marginata* (Fig. 3) and kidney-shaped in *L. opis* (Fig. 1). Number, shape, and distribution of cornuti variable and not diagnostic (8–12 for *L. bithynica*, 12–15 for *L. opis*, 8–14 for *L. marginata*).

Female genitalia (Figs. 4–6). (*L. bithynica*: n=6 from Greece and Turkey; *L. opis nigrita*: n=9; *L. marginata*: n=6). Antrum cup-shaped, more strongly sclerotized posteriorly. Ostium comparatively wider than in *L. opis.* Colliculum large, strongly sclerotized; it is narrower in *L. opis* and only weakly developed in *L. marginata.*

Bursa copulatrix pear-shaped in *L. opis* and *L. marginata*, but in *L. marginata* more spherical anteriorly. In *L. bithynica* bag-shaped, highly dependent on maturation stage.

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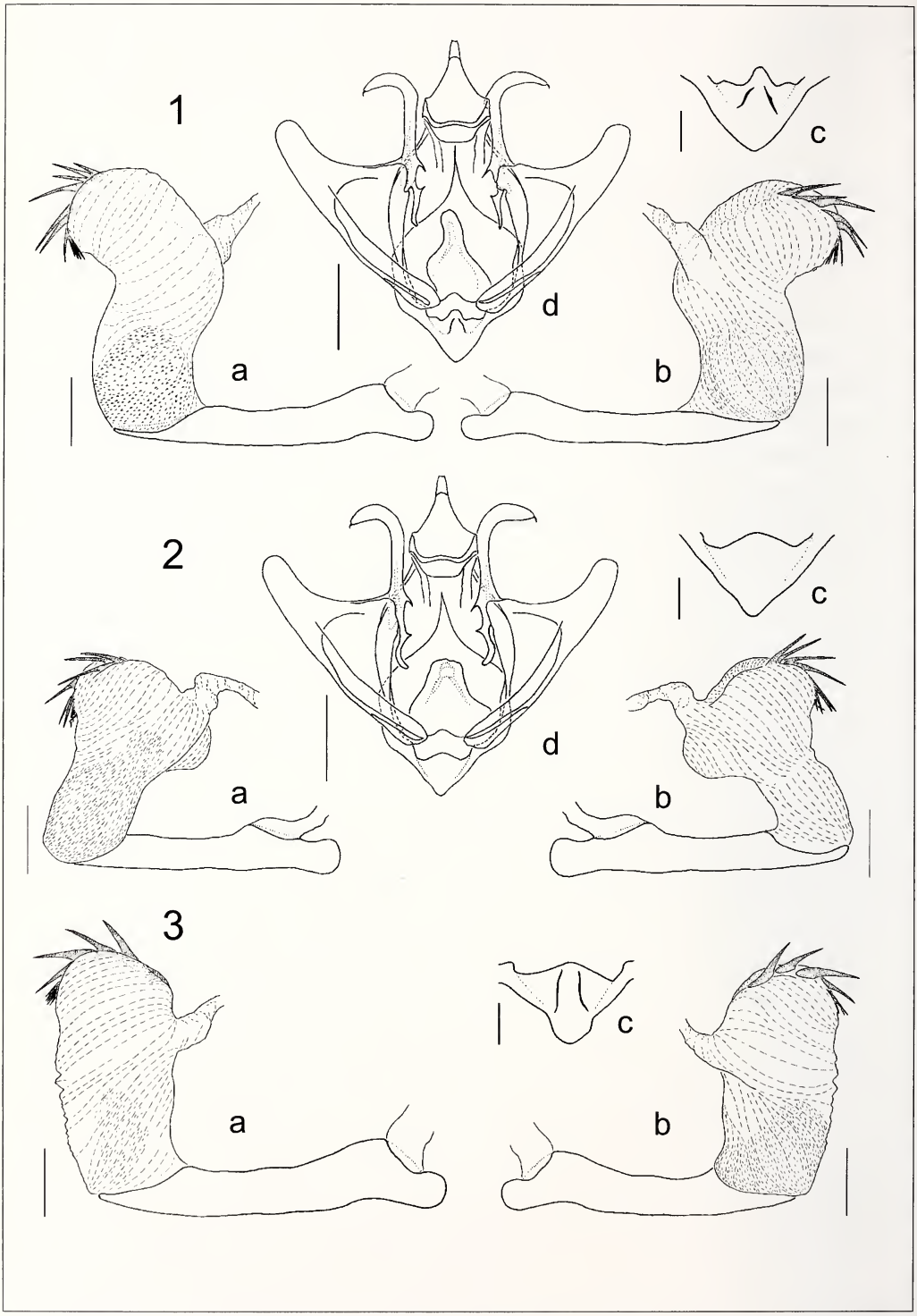

Figs. 1–3. Male genitalia of *Lomaspilis* spp. **1.** *L. opis nigrita* from Poland. **2.** *L. bithynica* stat. rev. from Turkey. **3.** *L. marginata* from Poland. **a, b.** Aedeagus with everted vesica (viewed from both sides). **c.** Saccus enlarged. **d.** General view with aedeagus removed (scale bar 0.5 mm).

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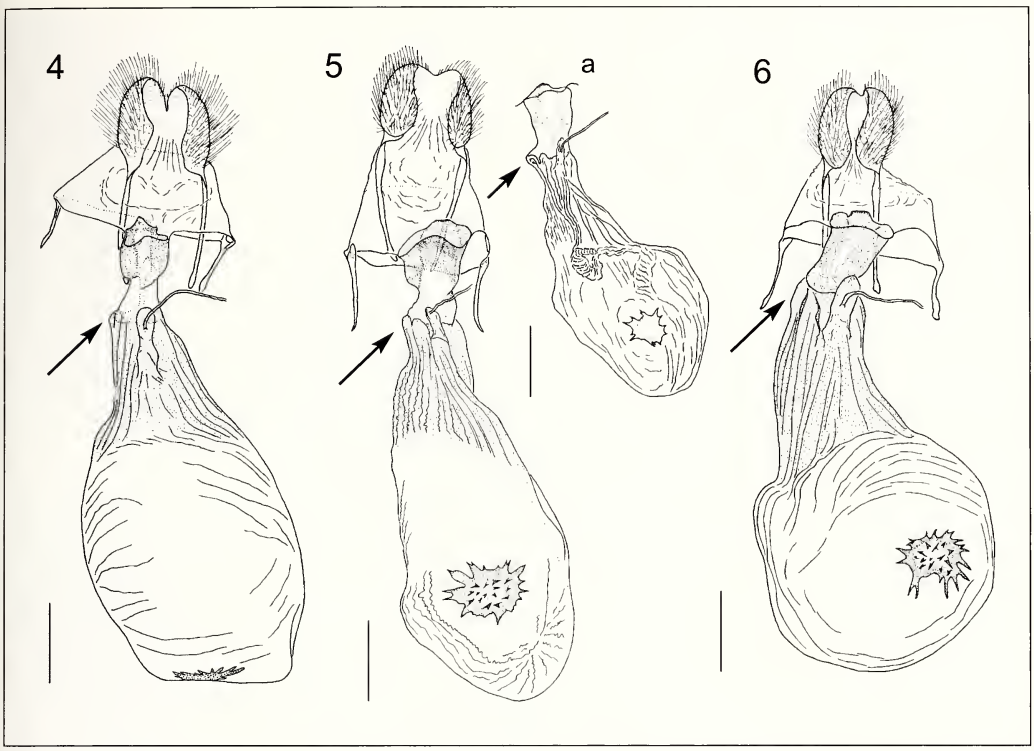

Figs. 4–6. Female genitalia of *Lomaspilis* spp., ventral view. **4.** *L. opis nigrita* from Poland. **5.** *L. bithynica* stat. rev. from Greece, Aliakmon River; **5a**. Bursa copulatrix of virgin female, not expanded from Turkey, Korga Dağı, above Köprüköy near Ispir. **6**. *L. marginata* from Poland, Karkonosze Mts. (scale bars 0.5 mm).

Shape of asteroid signum strongly variable in all species; localized on ventral side of bursa in *L. bithynica* and *L. marginata*, but at bottom of bursa in *L. opis*.

Distribution. *L. bithynica* is known from many sites in northern and north-eastern Turkey and from one locality in Greece (Prov. Nomos Grevenon). This is the first record of this species for Europe. According to Ebert (pers. comm.) no specimens of the genus *Lomaspilis* are known from Iran. The distribution of *L. bithynica* is strongly isolated from that of *L. opis* which ranges from eastern Poland, eastern Slovakia and Finland through Russia and the East Palaearctic region (Malkiewicz & Sosiński 2000, Müller 1996, Skou 1984, Viidalepp 1996). *L. marginata* is a common species throughout most regions of Europe and its range extends to eastern Asia, southward to northern Turkey and the Caucasus.

Life history. Habitats of *L. bithynica* are deciduous forests with *Populus tremula*, the only known host plant, in mountains at an altitude of 600 m above sea-level in Greece and between 800–2,300 m a.s.l. in Turkey. This univoltine species flies from the end of May until the end of July. Under breeding conditions a few specimens of a second generation emerged in September and at the beginning of October. Adults were collected at light but also sometimes during the day like other *Lomaspilis* species.

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Figs. 7–8. Holotype of *Lomaspilis bithynica*, female (ZFMK).**7.** Specimen. **8.** Labels.

Discussion. Most authors of previous studies on the morphology and taxonomy of the genus *Lomaspilis* emphasized the poor or non-existent value of the male and female genitalia for determination at the species level (Wehrli 1954; Buszko & Bengtsson 1991; Riemis 1992). However, Heydemann (1936) recognized about 10 diagnostic characters in both sexes. According to our analysis only three of these are more or less useful: the shape of the saccus (and arrangement of wrinkles) in males, the shape of the bursa, and width of the ostium bursae in females. The other features listed by Heydemann are not suitable, particularly regarding the male's uncus, shape of the valva, the number and shape of the cornuti, and the shape of the signum in females. The last especially, repeated and illustrated by Riemis (1992), can be misleading because of wide intraspecific variability. The only reliable male character we could find is the form of the vesica. Another doubtful character regarded as diagnostic is the black colour of the dots and bands on the wings as well as on the head, thorax, and abdomen. In *L. bithynica* the black markings are not more black than those of *L. opis nigrita*, and both species are not always distinctive from *L. marginata* by the intensity of its black markings. There are some examples of *L. marginata* specimens that are more black than brown in collections and in the literature (Buszko & Bengtsson 1991). On the contrary, the pure white ground colour of the wings in *L. bithynica* seems to be diagnostic, at least for males.

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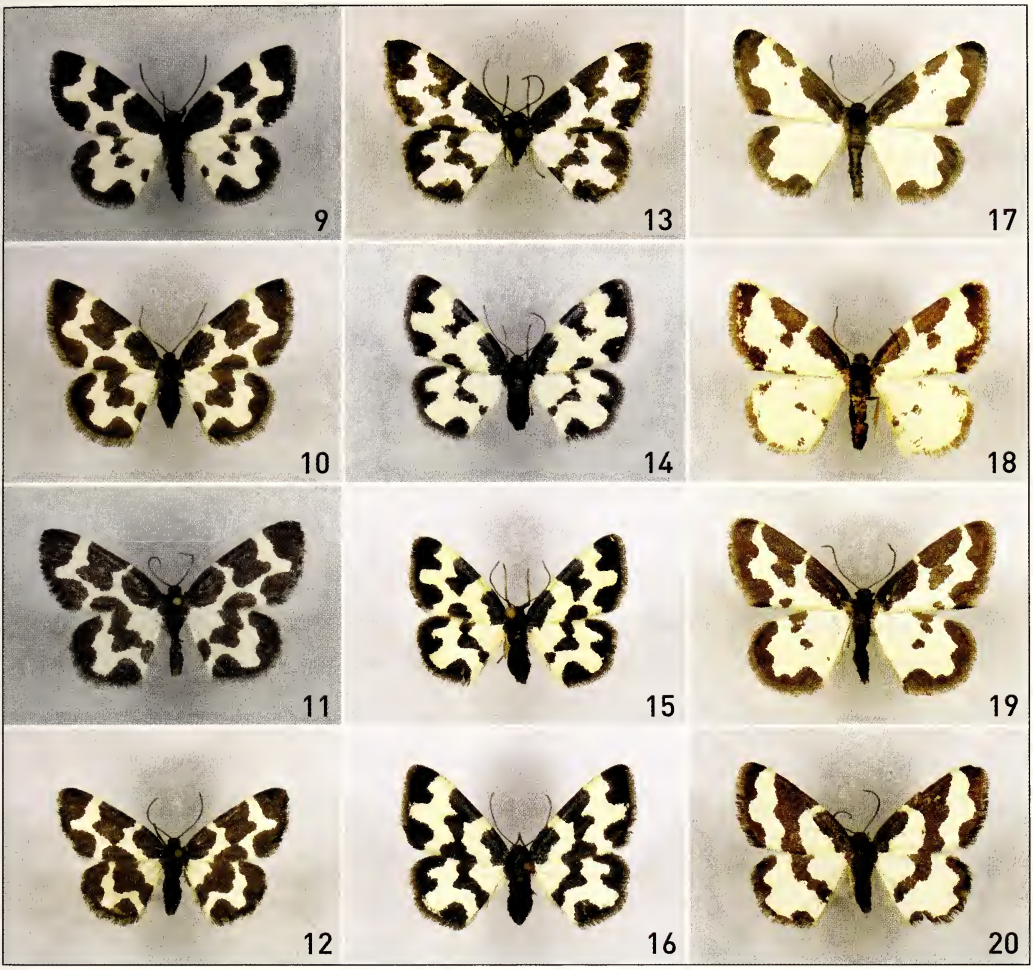

Figs. 9–20. Variability of wing pattern elements of *Lomaspilis* spp. **9–12.** *L. opis nigrita* from Poland: **9.** Male, Puszcza Borecka; **10–12.** Females, Mikaszówka, Płaska, Puszcza Augustowska. **13–16.** *L. bithynica* stat. rev. from Turkey: **13.** Male, **14–16.** Females, Korga Dağı, above Köprüköy near Ispir. **17–20.** *L. marginata* from Poland: **17.** Male, Toruń; **18.** Female, Dobrodzień; **19.** male, Tatra Mts., Dolina Jaworzynka; **20.** Female, Pietrzyków.

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