

## *Scythris buszkoi* sp. n., a new species of Scythrididae from Europe (Gelechioidea)

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**Abstract.** *Scythris buszkoi* sp. n. is described from material collected in south-western Ukraine. The species was found at two different localities: Kam'janec'-Podil's'kyj (Khmelnitsky oblast) and Tovste (Ternopil oblast). Almost half of the type material was reared from larvae mining the leaves of *Lycium barbarum* L. (Solanaceae). The imago, male and female genitalia, as well as pupa and last instar larva are described and illustrated. Notes on the life history are also given. Some larval characters of phylogenetic importance are discussed.

**Key words.** Lepidoptera, Scythrididae, *Scythris buszkoi*, new species, immature stages, morphology, Ukraine, Europe.

### Introduction

The family Scythrididae comprises small or medium sized, teardrop-shaped moths, frequently diurnal, dark-coloured, and cryptic in mode of life. The family is worldwide in distribution, and most members of Scythrididae live in various types of xerothermic habitats.

The Scythrididae fauna of Europe is at present fairly well investigated. The results from research carried out mainly by two lepidopterists: Bengt Å. Bengtsson (Sweden) and Pietro Passerin d'Entrèves (Italy). Apart from many descriptive and faunistic articles, two of their achievements are especially worth mentioning. One is the first comprehensive monograph dealing with scythridid moths of Europe and North Africa (Bengtsson 1997), while the other is a list and summary of the distribution of all European species of the family (Passerin d'Entrèves 1996). As yet, these publications are the most important contributions to our knowledge on Scythrididae of the continent. Nevertheless, the accumulated knowledge on scythridid preimaginal stages and larval life cycles is still rudimental, most likely because the immature stages are extremely difficult to find. This is a pity because there is no doubt that larvae, particularly, could provide many valuable features useful for solving some phylogenetic problems in the family. Although over the last decades Scythrididae were intensely investigated in Europe, some regions were explored less thoroughly; especially in eastern areas. Thus there is still a possibility of discovering new species belonging to this family in some parts of Europe.

In the present paper, a new scythridid species is described under the name of *Scythris buszkoi* sp. n., on the basis of material coming from south-western Ukraine. The rich material, collected by Professor J. Buszko, allows the description of adults and preimaginal stages. Furthermore, information on bionomics is also provided.



Fig. 1. *Scythris buszkoi* sp. n., holotype.

### Material and methods

The type material comprises 12 specimens: four moths were reared from larvae feeding on *Lycium barbarum*, two specimens emerged from the pupal stage, and 6 adults were caught with a net. The research on morphology of preimaginal stages was based on 3 caterpillars and 5 pupae. All study material was collected in Kam'janec'-Podil's'kyj (11.vii.2002) and Tovste (= Tolstoye) at the Seret River (12.vii.2002) in SW Ukraine.

The holotype is preserved in the Zoologische Staatssammlung, Munich, Germany (ZSM) while the paratypes are deposited in Zoologisk Museum, Copenhagen, Denmark (ZMUC), ZSM, as well as in the collections of the author (Poland) (TBA) and Bengt Å. Bengtsson (Sweden) (BAB).

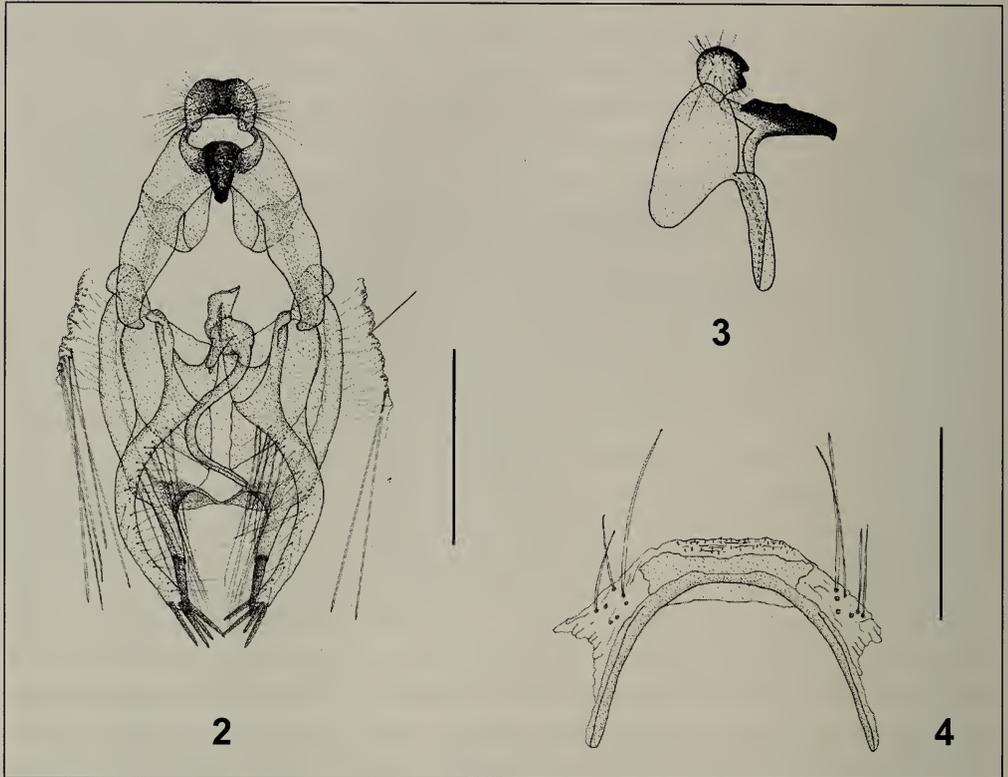
The terminology of the male and female genitalia follows Landry (1991), the one relating to larval morphology is according to Baran (1999, 2002), Hasenfuss (1980), Hinton (1946), and the terms of pupal structures follow Patočka (1997).

### *Scythris buszkoi* sp. n.

Material. Holotype (Fig. 1): ♂ Ukraine, Khmelnytsky oblast, Kam'janec'-Podil's'kyj, e.l. 29.vii.2002 (larva on *Lycium barbarum*), Buszko leg. (ZSM). – Paratypes: 4♂, 2♀ Ukraine, Khmelnytsky oblast, Kam'janec'-Podil's'kyj, 10.vii.2002, Buszko leg.; 2♂ Ukraine, Khmelnytsky oblast, Kam'janec'-Podil's'kyj, e.p. 15.vii.2002, Buszko leg.; 2♀ Ukraine, Khmelnytsky oblast, Kam'janec'-Podil's'kyj, e.l. 6.viii.2002 (larvae on *Lycium barbarum*), Buszko leg.; 1♀ Ukraine, Ternopil oblast, Tovste at the Seret River, e.l. 10.ix.2002 (larvae on *Lycium barbarum*), Buszko leg. (ZMUC, ZSM, TBA, BAB). Genitalia slides: T. Baran, prep. No: 102, 103, 104.

Description of imago (Fig. 1). Wingspan: 11.4–13.4 mm. Head dark olive brown mixed with ochreous brown and beige scales. Neck tuft ochreous brown. Haustellum base covered with whitish and beige scales. First segment of labial palpus white or white mixed with beige; basal half and dorsal surface of second and third segments covered with ochreous brown, beige or whitish scales, ventral surface of terminal parts dark brownish; sometimes third article dark brownish ventrally, and ochreous brown to beige dorsally. Antenna filiform, extended to about two-thirds of forewing length; scape, pedicel and segments of flagellum dark olive brown dorsally, ochreous brown to beige ventrally (occasionally, on ventral surface whitish scales also present); pecten of scape pale brown. Collar, tegula and dorsal part of thorax dark olive brown with some ochreous brown scales (sometimes tegula and collar almost entirely ochreous brown); ventral surface of thorax covered with whitish and beige scales. Legs olive brownish strongly mixed with ochreous scales on dorsal parts, and ochreous, beige and whitish scales on ventral ones; hind tibia also with long, whitish and ochreous hairlike scales. Forewing rather elongate-lanceolate. Forewing upper surface dark olive brown, somewhat glossy, densely covered with ochreous brown scales, and also mottled by dark brown or blackish brown scales forming more or less indistinct markings; dark pattern variable, most often consisting of irregular suffusions at dorsum (in basal half) and apical area, a few elongate spots just beneath fold (sometimes dark scales also scattered above), and near tornus; cilia dark olive brown. Forewing ventral surface entirely dark brown or dark brown with whitish or beige scales forming lines along some veins. Hindwing narrowly lanceolate, with both surfaces dark brown or ventral surface dark brown with whitish or beige scales at basal part and along costa; cilia coloured like those of forewing. Male abdomen dorsally brownish with grey tinge, ventral side covered with numerous whitish, beige and ochreous scales; anal tuft comparatively short and thick, ochreous. Female abdomen coloured as in male's, but dorsal side entirely brownish with grey tinge, i.e. without ochreous anal tuft; papillae anales somewhat protruding.

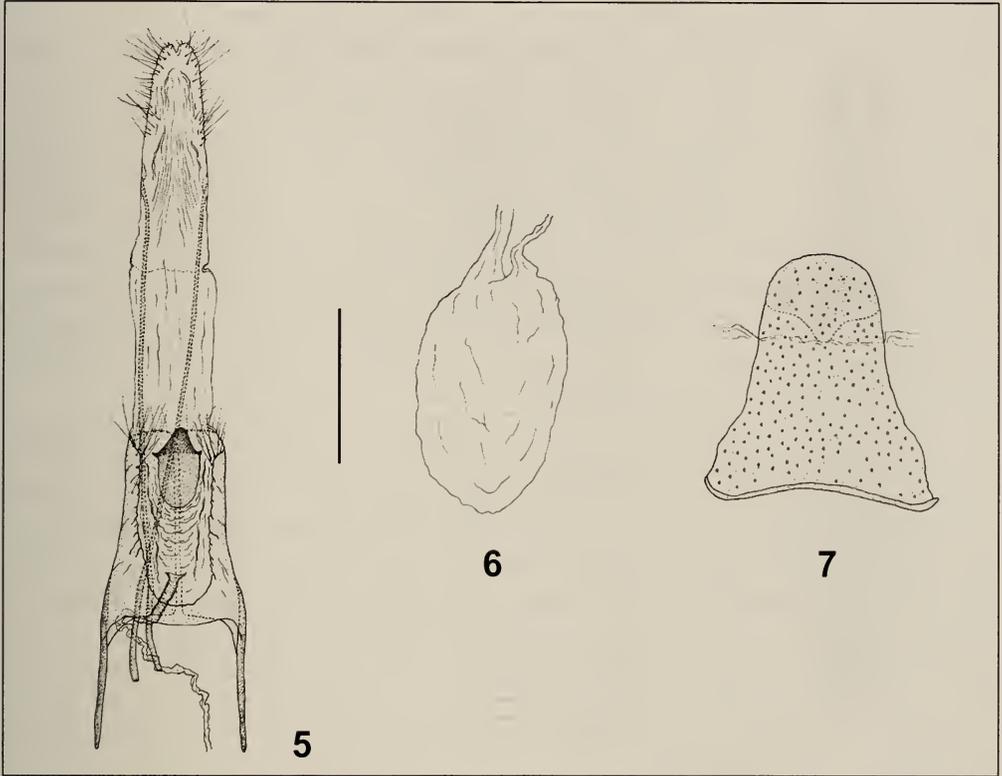
Male genitalia (Figs. 2–4). Tegumen in ventral aspect conical, rounded distally, with two long and wide lateral arms fused to ventral part at about half of tegumen length; in dorsal aspect, anterior margin with deep and narrow V-shaped emargination. Uncus well developed, hood-like, in ventral aspect more or less rectangular in outline, with rounded and setose lateral parts, shallow median depression at apex, and wide basal concavity; central part darkly melanized; in lateral aspect a distinct incision on ventral edge. Base of gnathos a semicircular band; distal arm rather long, very darkly sclerotized; the arm in ventral aspect tapered, truncated at tip; in lateral aspect hooked apically, with small protrusion on dorsal side. Vinculum more or less a U-shaped plate extended caudally beneath basal part of valvae; median part with longitudinal incision. Valva broadened at about basal one-third; the remaining part narrow, slightly tapered, and strongly curved inwardly; inner wall setose; apex rounded with a few long and stout spines. Aedeagus distinctly shorter than valvae, strongly sigmoid; swollen near base, bulb-shaped, the remaining portion narrow,



Figs. 2–4. Male genitalia of *Scythris buszkoi* sp. n., paratype. 2. Complex of tegumen-uncus-gnathos-vinculum-valvae-aedeagus-sternum 8, ventral view (scale bar 0.5 mm). 3. Complex of tegumen-uncus-gnathos, lateral view. 4. Tergum 8, ventral view (scale bar 0.5 mm).

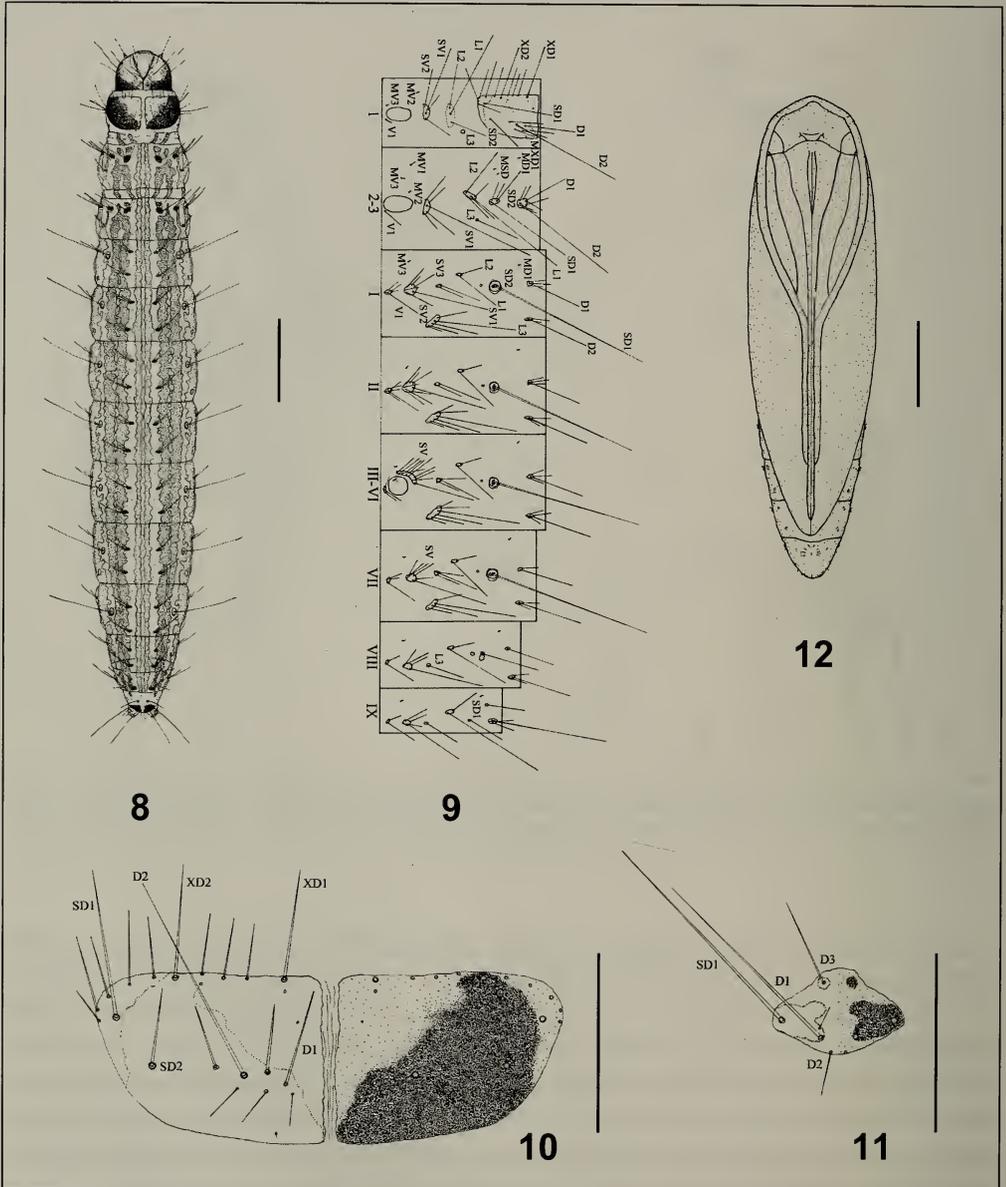
tubular, somewhat tapered. Tergum 8 a slender, arched sclerite. Sternum 8 subquadrate, anteriorly with wide V-shaped emargination, posteriorly with two lateral projections, each equipped with big, terminal spine.

Female genitalia (Figs. 5–7). Sterigma undeveloped. Ostium bursae funnel shaped, situated medially in anterior half of segment VIII. Ductus bursae membranous; the most posterior, short (about half length of anterior apophyses) portion with thickened and transversely wrinkled walls, strongly broadened just before ostium bursae; inception at posterior end of more or less ovoid corpus bursae. Segment VIII well sclerotized, except for narrow, longitudinal area on tergal side, and U-shaped, depressed, strongly wrinkled region on sternal side; posterior margin setose. Sternum 8 with median plate in posterior half of segment VIII; distal part of the plate (a fragment projected out of posterior margin of the segment) conical, proximal part (a fragment placed on the segment) rectangular with rounded anterior margin. Anterior apophyses almost straight, shorter than sclerotized part of segment VIII. Posterior apophyses thin and long (about 4 × length of anterior ones). Papillae anales tapered. Sternum 7 trapezoid with more or less rounded posterior margin; distal part (about one third of the sternum length) protruding from posterior margin of segment VII.



Figs. 5–7. Female genitalia of *Scythris buszkoi* sp. n., paratype: 5. General aspect without corpus bursae. 6. Corpus bursae. 7. Sternum VII (scale bar 0.5 mm).

Last instar larva (Fig. 8). Body length: 7–8.5 mm, head capsule width: 0.76–0.84 mm. Head capsule dirty yellow orange with extensive, postero-lateral, dark brown or blackish brown spots; narrow areas next to adfrontals whitish; ocellar regions black. Prothoracic shield dirty yellow orange with narrow, white dorsal line and big, postero-lateral blackish brown spots (at posterior margin of the shield, spots reach dorsal line). Anal shield weakly sclerotized, as blackish brown spots (sometimes, spots only around pinacula of setae). Body cocoa brown, but areas between subdorsal and lateral lines, as well as lateral and supraspiracular ones darker. Lines creamy white; dorsal and ventral lines extended from thoracic segment I to abdominal segment IX, the remaining ones extended from thoracic segment II to abdominal segment IX; on 9th abdominal segment lines less distinct. Dorsal and subdorsal lines almost unbroken, with somewhat irregular edges, lateral ones rather indistinct, as irregular spots, supraspiracular ones distinct, with very irregular edges, subspiracular ones wide, with almost smooth edges, ventral line very broad. Pinacula blackish brown. Thoracic legs dark brown in outer parts, whitish in inner ones. Chaetotaxy (Figs. 9–11); thorax, segment I: XD1, XD2 vertically located; SD1 somewhat posterior to XD2; anterior and lateral parts, as well as posterior half of prothoracic plate



**Figs. 8–12.** Features of preimaginal stages of *Scythris buszkoi* sp. n. **8.** Mature larva, habitus, dorsal view (scale bar = 1 mm). **9.** Larval chaetotaxy, last instar, thoracic segments I–III, abdominal segments I–IX. **10.** Larval prothoracic plate. **11.** Larval anal plate (scale bar 0.5 mm). **12.** Pupa, ventral view (scale bar 1 mm).

with secondary setae. L1, L2, L3 almost in vertical line; pinaculum of L group weakly sclerotized. SV group (SV1-2) with 1–2 secondary setae on pinaculum. Seta V1 minute. Segments II–III: pinacula of D, SD, SV groups, and pinaculum of L1 and L2 with secondary setae (L3 on separate pinaculum). V1 distinctly longer than the one of previous segment. Abdomen, segment I: Pinacula of D1, D2, L3, V1, and SV group

(SV1-3) with secondary setae. L2 dorsal to L1, on common pinaculum. Anterior and slightly dorsal to L3 there is one separate group of secondary setae; the group consists of 2 setae. SD2 (minute seta) adjacent to dorsal part of the basal ring of SD1; apodeme directed ventrally; SD group surrounded by extra ring. L2 relatively long. Segment II: arrangement of setae similar to abdominal segment I, except for: SD2 adjacent to anterior part of the basal ring of SD1, extra ring somewhat smaller, apodeme directed more or less posteriorly; SV group and L3 usually with more numerous secondary setae on pinacula. Segments III–VI: arrangement of D, SD, and L groups as on abdominal segment II. Pinaculum of the separate group with 1–3 secondary setae. Pinaculum of SV group sickle-shaped, with numerous secondary setae. V1 shorter than in previous abdominal segments, with 1–2 secondary setae. Segment VII: D1 with 1 secondary seta, D2 with 1–2 secondary setae on pinaculum. SD group as on 1st abdominal segment. Pinaculum of L3 with less numerous secondary setae than the pinaculum of previous abdominal segments. The separate group of secondary setae consists of 1–3 setae. SV1 and SV3 with 3–4 secondary setae on common pinaculum. V1 with maximum of 2 secondary setae. Segment VIII: only pinacula of D2, SV group, and V1 with secondary setae. SD2 adjacent more or less to dorsal part of small basal ring of SD1; extra ring as elongated posterior sclerite; SD1 shorter and thinner than on previous abdominal segments. L1 longer and L3 distinctly shorter than on abdominal segments I–VII. Segment IX: D2 dorsal to D1; D2 distinctly longer than D1. SD1 hair-like. SV3 and V1 with secondary setae. D2, L1, L2 distinctly longer than on abdominal segment VIII. Segment X: anal shield with D1, D2, D3, SD1 and 1 secondary seta on each side of the shield; the secondary seta anterior to D1. The long setae on the body pointed or bifurcated apically. The other positions of setae as in Figs. 9–11. Crochets of ventral prolegs triordinal and partially biordinal (in outer part). Crochets of anal prolegs triordinal medially, biordinal laterally.

Pupa (Fig. 12). Length: 4.0–5.5 mm; width: 1.2–1.6 mm. Fronto-clypeal suture distinct, curved medially. Labrum without clear incision. Maxillary palpus very small, more or less tetragonal. Basal part of labial palpus weakly indicated. Proboscis ending somewhat before or at forewing apex. Foreleg extending somewhat behind half of proboscis length; midleg ending slightly before foreleg. Antenna running beyond half of proboscis length but not reaching proboscis apex; a distance between apex of antenna and forewing similar to length of labial palpus. Forewing extending to posterior margin of 7th abdominal segment or somewhat before. 10th abdominal segment rounded.

Life history. Caterpillars of *S. buszkoi* sp. n. feed on *Lycium barbarum* (Solanaceae). They live in silken galleries extending along branches and leaf-stalks. From these 'shelters' larvae mine the leaves of the food-plant making blotch-like mines which may sometimes occupy almost an entire leaf-blade. The larvae are 'external' miners because they stay in mines only during feeding. If not feeding or disturbed, they reside in a web. Mature larvae were found in the first half of July, when adults were on the wing. Pupation takes place on the plant, in a dense, white cocoon. The moths were observed flying around their food-plant during the day. Although

moths were caught only in July (reared in July–September), *S. buszkoi* sp. n. has likely more than one brood per year. This assumption is supported by the fact that most European Scythrididae produce their first generation in May–June. Thus, the moths occurring in the period of July to September belong most probably to a second generation. *S. buszkoi* sp. n. inhabits sunny slopes overgrown with *Lycium barbarum*.

**Distribution.** The species is known only from two localities situated in Podil'ska Vysočyna, in the south-western part of the Ukraine.

**Derivatio nominis.** This new species is dedicated to Professor Jarosław Buszko, in honour of his achievements in lepidopterology.

## Discussion

Moths of *Scythris buszkoi* sp. n. externally resemble other scythridids with olive brown forewings mixed with pale scales. However, the presence of dark spots on the wings (especially in fresh specimens), as well as numerous whitish scales on the ventral side of the abdomen may be helpful for determination. The genitalia of both male and female are very characteristic and they can not be confused with those of any other species of Scythrididae. In the male the shapes of the aedeagus, valvae, and sternum VIII are diagnostic, while in the female the form of the sternal plate and that of the sclerotization of segment VIII easily separate this species from others. Moreover, an interesting feature of the male genitalia is the presence of relatively long and sharp spines on the apices of the valvae and on two processes of sternum 8. Such spines on these parts of the genitalia appear seldom in the family and may have some significance in phylogeny. This combination of genitalic features, however, does not coincide with any known European species-group established by Bengtsson (1997). Thus, *Scythris buszkoi* sp. n. forms, in all probability, its own group.

As regards preimaginal stages, caterpillars of the new species are coloured as in most Scythrididae, i.e. they are dark with paler longitudinal lines. The mature larvae are somewhat similar to those of *Scythris bifissella* (Hofmann, 1889) (Baran 2002) and *Scythris knochella* (Fabricius, 1794) (Baran, in prep.), but they can be distinguished from these species mostly by the characteristic pattern of the head and prothoracic shield, as well as by the arrangement and shapes of body lines. The research on larval chaetotaxy shows that the species possesses a feature which may be an important synapomorphy for the family Scythrididae (Baran, in prep.) – abdominal segments I–VII have an additional, separate group of secondary setae situated anterodorsally to L3. This character has also been found in a few other examined larvae of Scythrididae (Baran 1999, 2002, 2003 in press., MacKay 1972). The feature has not been discovered in other families so far, and thus appears to be unique within Lepidoptera. Moreover, two other characters of *Scythris buszkoi* sp. n. should be mentioned: 1. On abdominal segments I–VII, seta L3 always has secondary setae on a common pinaculum; 2. On abdominal segments I and VII, microscopic seta SD2 is placed on the dorsal part of the basal ring of SD1, whereas the seta of abdominal segments II–VI is situated anteriorly. Although our knowledge of scythridid larvae is scanty, it seems probable that both characters will prove to be autapomorphic for the

family in future comprehensive, phylogenetic research. Nevertheless, especially the second feature needs further investigation, because it shows some variability – a modification of this state has been observed in mining larvae of *Scythris siccella* (Zeller, 1839) (Baran 2003 in press.). The results in the present paper reveal also that the SD group of abdominal segments I–VII is equipped with a sclerotized, complete ring. Such pinacula are widespread within Scythrididae and in the past they were used as a generic character (Benander 1965); nevertheless, some cases of their reduction have been discovered too (Powell 1976, Baran 2003 in press.). It should be stressed, however, that according to the author's research (Baran, in prep.) and to Hasenfuss (1993) the presence of extra rings in Scythrididae is a case of retention of a plesiomorphic state, and therefore this feature should be treated only as a diagnostic one.

As for the pupa, the species may be differentiated from other known European scythridids (Patočka 1997, Baran 2002, 2003 in press.) only by a combination of the following features: basal part of labial palpi indistinct, midlegs shorter than forelegs, and antennae somewhat shorter than proboscis.

In conclusion, it is worth noting that *Scythris buszko* sp. n. is the only known scythridid in Europe whose larvae feed on *Lycium barbarum*. However, in Asia there are two described species of the family feeding on the related *Lycium ruthenicum*, namely *Scythris deresella* Falkovich, 1969 and *Scythris lyci* Falkovich, 1969 (Falkovich 1969). The morphology of the male genitalia, however, does not indicate a close affinity between these taxa and *Scythris buszko* sp. n. Furthermore, *S. buszko* sp. n. is the second known species of Scythrididae in Europe with leafmining habits in the larval stage. Hitherto, mining caterpillars had been discovered only in *S. siccella* (Baran 2003 in press.).

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