





Research article

# Two new steppe leafrollers (Lepidoptera: Tortricidae) from Bulgaria with morphological notes

Boyan Zlatkov<sup>1</sup>, Ognyan Sivilov<sup>2</sup>

(1) Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd, 1000 Sofia, Bulgaria, [bzlatkov@gmail.com](mailto:bzlatkov@gmail.com) ; <https://orcid.org/0000-0002-5704-1634> 

(2) Faculty of Biology, Sofia University St. Kliment Ohridski, 8 Dragan Tzankov Blvd, 1164 Sofia, Bulgaria, [osivilov@gmail.com](mailto:osivilov@gmail.com) ; <https://orcid.org/0000-0003-3497-8237> 

**Abstract:** Two rare steppe species, *Ceratoxanthia rakosyella* Wieser & Huemer, 2000 and *Thiodia irinae* Budashkin, 1990, are reported for the first time from Bulgaria. They are found in endangered habitats in Northern Bulgaria. The species demonstrate peculiar genital morphology, which is discussed and illustrated. The moths, their habitats in Bulgaria and distribution are illustrated as well.

**Keywords:** faunistics, endangered habitats, genitalia, vesica

## Introduction

The steppe area of Bulgaria, originally occurring in the northern part of the country mainly along the Danube River, is largely destroyed by anthropogenic activity. Small patches are preserved mosaically mainly along steep slopes. Various types of steppe habitats in this area have been classified as relict and endangered (Biserkov et al., 2015), and some of them were regularly visited during entomological expeditions in 2020–2022. As a result a steppe moth species was found (Zlatkov & Sivilov, 2020). In the present paper we provide further records of two rare steppe species that have not been known from Bulgaria. The distributional ranges and the characteristics of the localities indicate that these species are limited to the steppes only. We also discuss the peculiar morphology of their genitalia and provide detailed illustrations.

## Methods

Two methods were used for moth collection: light trapping with mercury vapour light bulb and “blacklight” tube (for *C. rakosyella*) and netting at

daytime (for *T. irinae*). The moths were set in the field and later dissected in the laboratory under a stereomicroscope generally following Robinson (1976). A compound microscope was used for drawing and photography of the genitalia. The moths were photographed under a stereomicroscope (for a complete description of the equipment and techniques see Zlatkov & Sivilov, 2020). The map was created using Quantum GIS 3.28.1-Firenze, ESRI satellite imagery and spatial data provided by geoBoundaries (Runfola et al., 2020). The specimens were preserved in the collection of the Institute of Biodiversity and Ecosystem Research (IBER), Sofia, Bulgaria.

## Results and discussion

*Ceratoxanthia rakosyella* Wieser & Huemer, 2000

Material: 2 ♂♂, Dobrich region, Kapitan Dimitrovo, N 43.9531°, E 27.7053°, 150 m a.s.l., 19.vi.2022, leg. B. Zlatkov & O. Sivilov (IBER).

Morphological notes: Forewing length 8.7–8.8 mm (n = 2). The wing pattern is similar to other *Ceratoxanthia* spp., with a yellow background, rusty brown markings and a mosaic of pale refractive dots

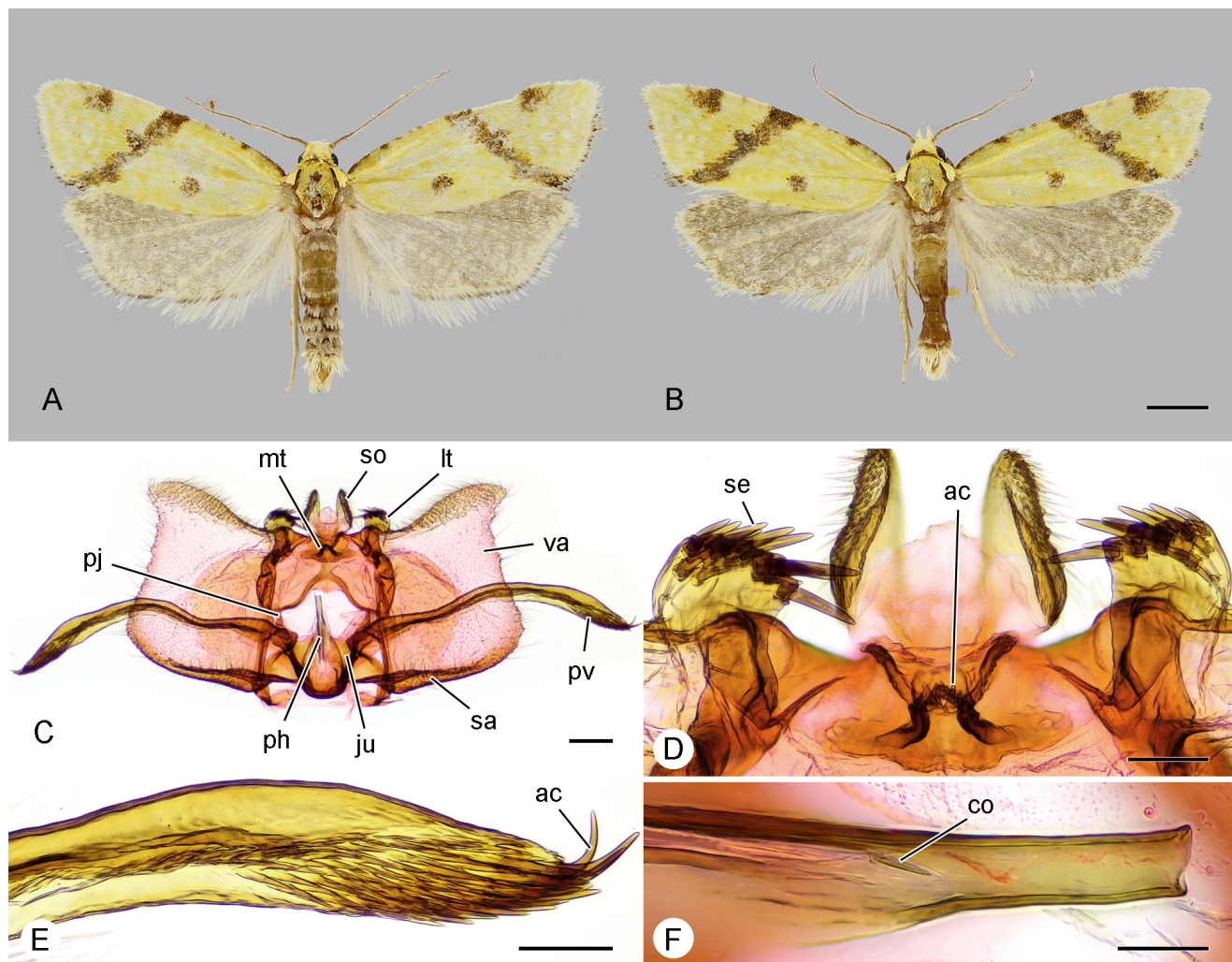


Fig. 1. *Ceratoxanthia rakosyella* males from Bulgaria – (A, B) habitus; (C) genitalia of (A); (D) details of transtilla; (E) detail of process of valva; (F) detail of phallus, apical part left oriented; (ac) acantha; (co) cornutus; (ju) juxta; (lt) lateral part of transtilla; (mt) median part of transtilla; (ph) phallus; (pj) process of juxta; (pv) process of valva; (sa) sacculus; (se) seta; (so) socius; (va) valva. Scale bars: (A, B) 2 mm; (C) 250 µm; (D, E) 100 µm; (F) 50 µm.

in the distal area (Fig. 1 A, B). The male genitalia are highly specialised similarly to other species of the genus (Fig. 1 C). The socii are elliptical pads (in Fig. 1 their flat surface is laterally oriented); the transtilla is trilobed, with a small median part adorned with small acanthae apically and very large lateral parts bearing stout setae medially (Fig. 1 D); the juxta bears flat triangular lateral processes pointed dorsally; the valva is modified with two long, rod-like lateral processes exceeding the length of the valva, with a longitudinal stripe and apex covered with acanthae (Fig. 1 E); the processes are basally connected with the processes of juxta and the juxta proper; the phallus is wide at the base, coalescent with the juxta, apically

narrow and tubular, the vesica bears a small stout non-deciduous cornutus (seta) (Fig. 1 F); the valvae are nearly rectangular, with sclerotised costa and strongly sclerotised protruded sacculus, the lateral margin is incised subapically.

**Habitat and biology:** The habitat is a Danubian loess steppe on a steep slope facing South (Fig. 5). It is endangered and listed in the Red Data Book of Bulgaria (Tzonev, 2015a). Apart from the flight period (second half of May–June), the biology of the species is basically unknown.

**Faunistical notes:** The species was described from Romania, Dobrogea, Hagieni, after three males (Wieser & Huemer, 2000). Additional 5 male



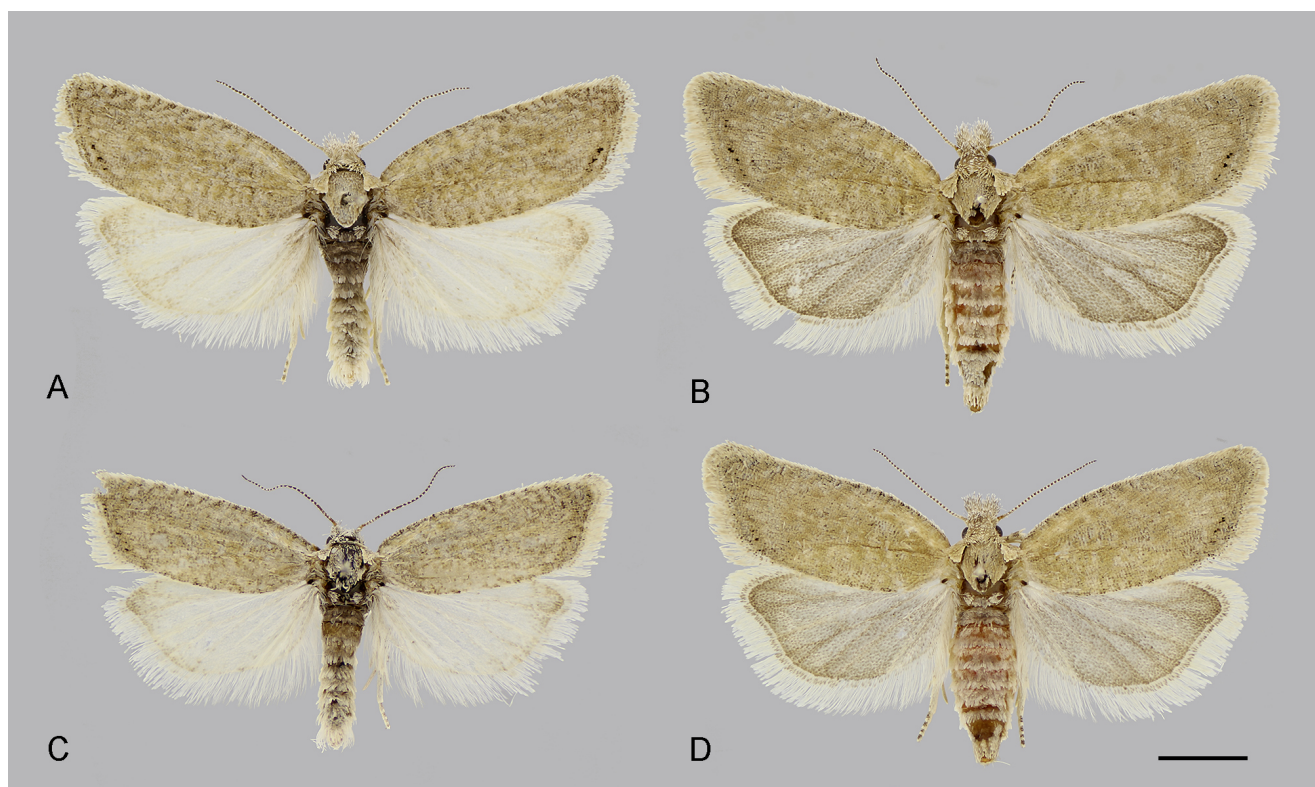


Fig. 2. *Thiodia irinae*, habitus – (A, C) males; (B, D) females; (A, B, D) Hadzhidimitrovo, 4.v.2022; (C) Kozar Belene, 5.v.2022. Scale bar 2 mm, all to scale.

specimens were collected from the same locality (Kovács & Kovács, 2006). Later Bidzilya et al. (2014) and Kavurka et al. (2021) recorded specimens from Ukraine, Lugansk region. The locality from Bulgaria is a new record for the country and the third for the species (Fig. 7). The females are unknown.

#### *Thiodia irinae* Budashkin, 1990

Material: 1 ♂, Veliko Tarnovo region, Hadzhidimitrovo, N 43.5370°, E 25.4828°, 90 m a.s.l., 6.v.2021, leg. B. Zlatkov; 1 ♀, ibid., 20.v.2021, leg. B. Zlatkov; 4 ♂♂, 9 ♀♀, ibid., 4.v.2022, leg. B. Zlatkov; 1 ♂, 2 ♀♀, Pleven region, Kozar Belene, N 43.4001°, E 25.1631°, 100 m a.s.l., 5.v.2022, leg. B. Zlatkov (all IBER).

Morphological notes: Forewing length in males 5.5–6.2 mm ( $\bar{x}$  = 5.9,  $n$  = 6), in females 5.5–6.5 mm ( $\bar{x}$  = 5.9,  $n$  = 12). The head, including palps, is covered with long fluffy scales, giving a characteristic appearance of the moth (Fig. 3 B). The forewings are with ill-defined creamy costal strigulae continuous

with irregular transverse lines, alternating with pale grey-brown lines. The speculum is creamy, with a few black dots terminally. The hindwings in males are whitish, in females they are pale grey (Fig. 2). The male genitalia are with well-developed laterally flattened uncus, the sacculus is protruding in a triangular process distally, the cucullus is bordered proximally with long stout setae (Fig. 3 A). The phallus is subcylindrical, slightly bent ventrally. The vesica is ovoid, with a stout, straight non-deciduous cornutus (seta) attached apically; a semicylindrical endophallite is located along the distal ductus ejaculatorius simplex (Fig. 4). Notably, in some other *Thiodia* spp. the vesica is reduced and bears a bundle of deciduous, flat, sigmoid cornuti. The female genitalia are with a short oviscapt, the eighth segment is sclerotised, adorned with a belt of long, thick setae (Fig. 3 C). The only signum is an elliptical, concave sclerotised plate with minute acanthae (Fig. 3 D), unlike other species from the genus with two strongly invaginated, blade-like signa.

Habitat and biology: The habitat near Hadzhidimitrovo (Fig. 6 A) is a Danubian loess steppe on a

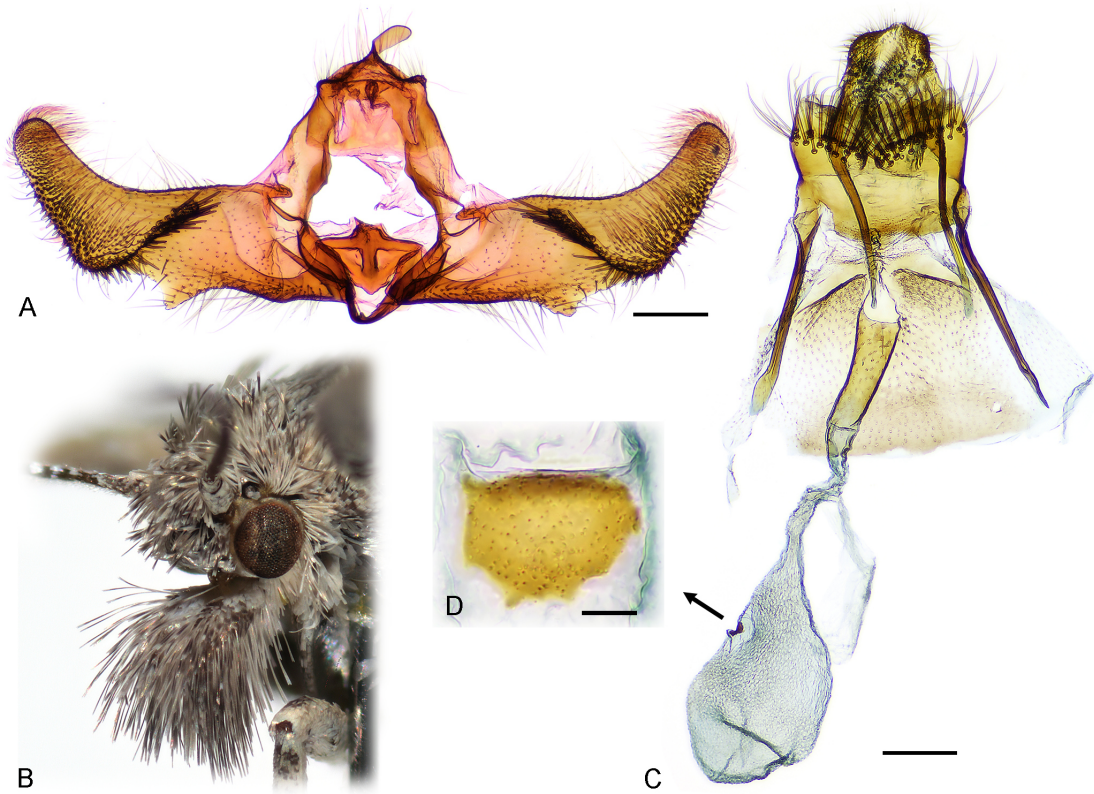


Fig. 3. Details of anatomy of *Thiodia irinae* – (A) male genitalia, fultura inferior cut transversally and phallus removed; (B) detail of head; (C) female genitalia; (D) details of signum. Scale bars: (A, C) 250 µm; (D) 20 µm.

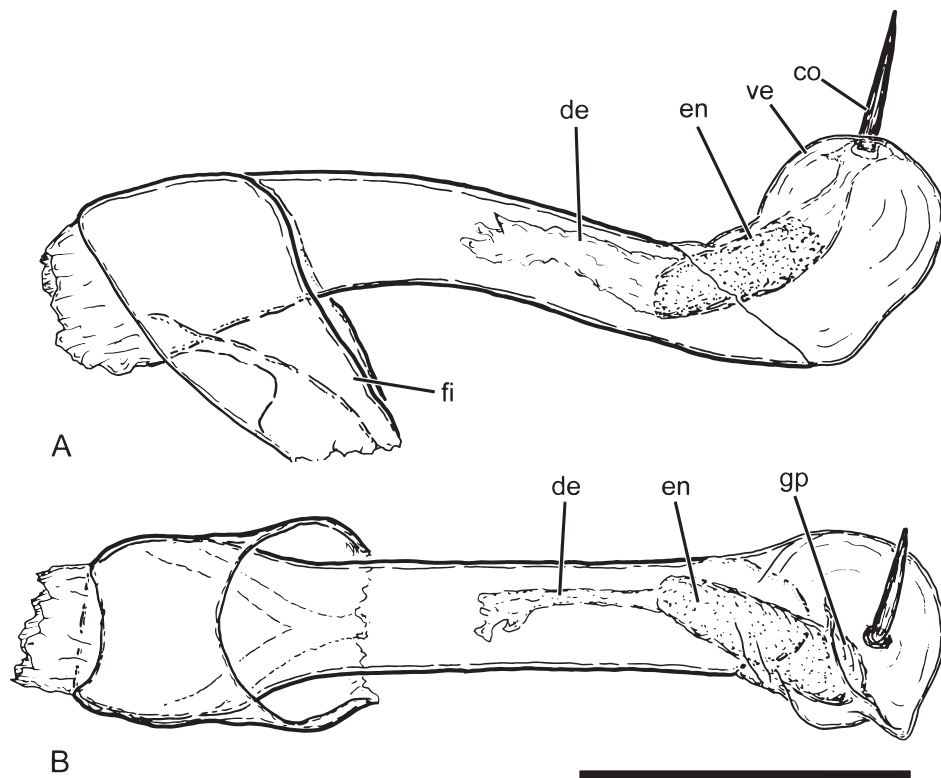


Fig. 4. *Thiodia irinae*, phallus of the specimen from fig. 3A – (A) left view; (B) dorsal view; (co) cornutus; (de) ductus ejaculatorius; (en) endophallite; (fi) fultura inferior; (gp) gonopore; (ve) vesica. Scale bar 250 µm.





Fig. 5. Loess steppe at Kapitan Dimitrovo, the habitat of *Ceratoxanthia rakosyella*, 19.vi.2022.

steep slope (Tzonev, 2015a). In areas with strong erosion calcareous (Aptian marl) outcrops are partially exposed, where the larval host plant (*Galatella villosa*, Asteraceae; Budashkin, 1990) forms large patches. The habitat at Kozar Belene (Fig. 6 B) is a continental petrophytic saline steppe on Aptian marl sediments (Tzonev, 2015b). At both localities the moths were swept out with an entomological net from the larval host plant where they rested (Fig. 6 C, D). In general they are not active flyers, their flight is only a couple of metres. The peak of activity is in the late afternoon. The flight period is May–June.

Faunistical notes: The species was described from the Crimean Peninsula, Karadag. Later it was found in several localities in Ukraine (Meganom Cape, St Iliya Cape, Kazantyp, Nanikove, Dvuyakornaya Bukhta, Chauda Cape); Zaporizhzhia region (Rozumivka, Pryvitne, Khortytsia Island); Dnipro region (Dnipro Airport); Russia: Astrakhan region (Bolshoe Bogdo Mts); Southern Ural (Orenburg region – Donskoje, Chelyabinsk region – Amurskii) (Budashkin, 1990, 2006, 2009; Bidzilya et al., 2003, 2013; Nedoshivina,

2007; Nupponen, 2012; Zhakov, 2012; GBIF, 2023). New species for Bulgaria (Fig. 7).

### Acknowledgements

We are grateful to Rossen Tzonev (Sofia, Bulgaria) for his advice and help with the identification of the habitats. The study was supported by the National Science Fund of Bulgaria, grant No. KP-06-N31/13, to which we express our gratitude.

### References

- Bidzilya A.V., Bidychak R.M., Budashkin Y.I., Demyanenko S.A., Zhakov A.V. 2014 New and interesting records of Microlepidoptera (Lepidoptera) from Ukraine. Contribution 3. Optimisation and protection of ecosystems 11: 3–17. (In Russian)



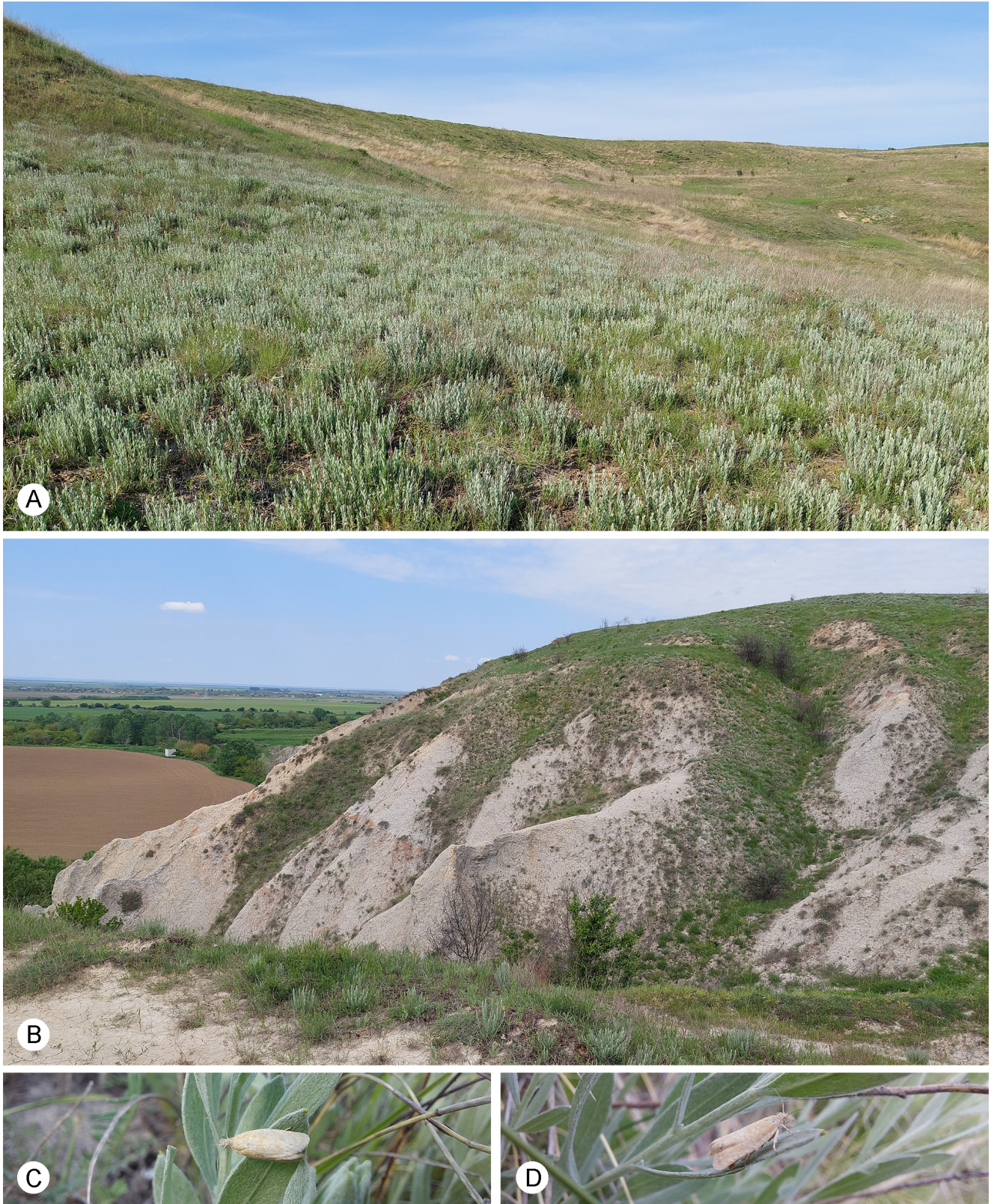


Fig. 6. Habitat of *Thiodia irinae* – (A) loess steppe near Hadzhidimitrovo with *Galatella villosa* in the foreground, the larval host plant of the moth, 4.v.2022; (B) continental petrophytic saline steppe at Kozar Belene, 5.v.2022; (C, D) moths resting on leaves of *G. villosa*.



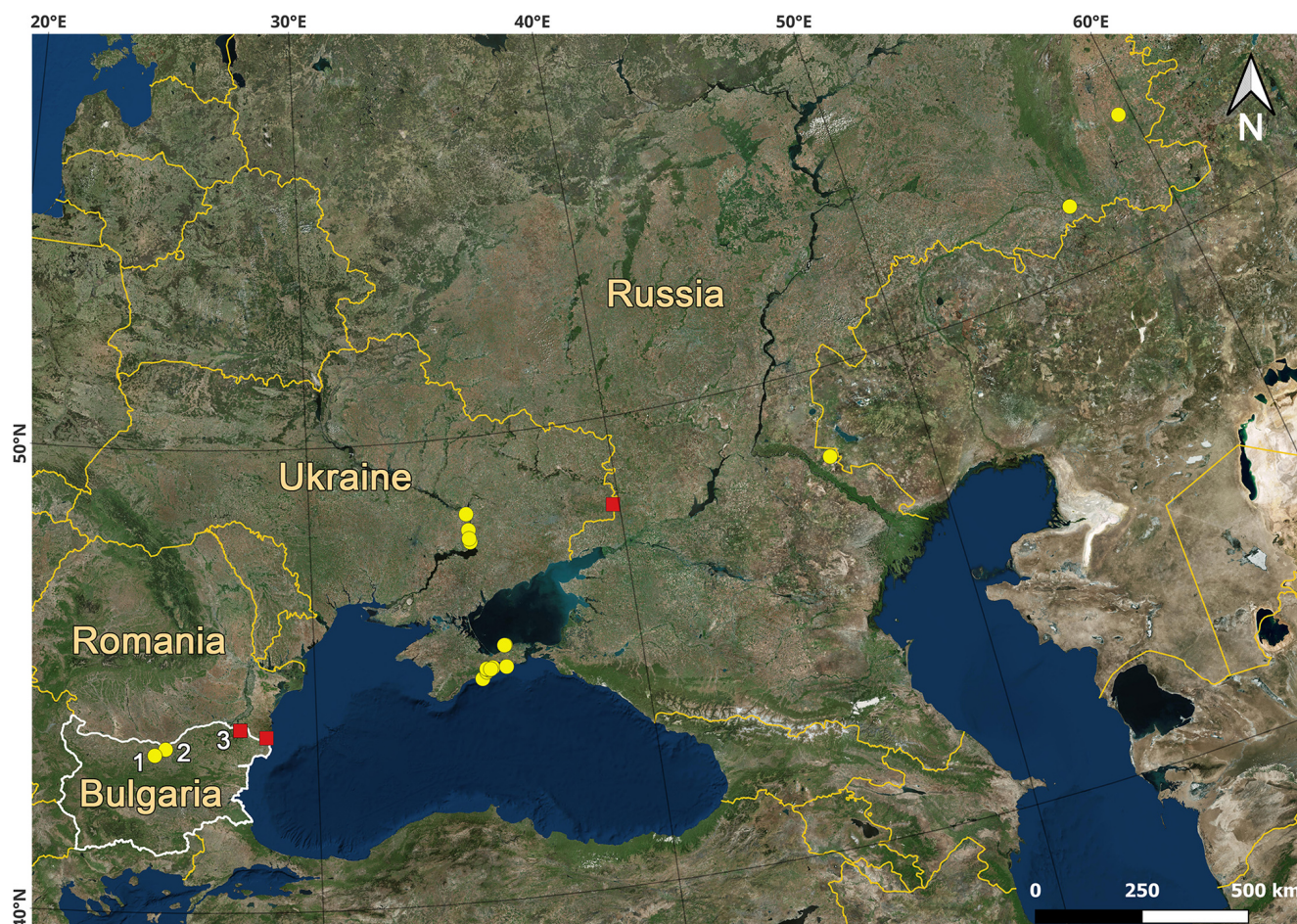


Fig. 7. Distribution of *Ceratoxanthia rakosyella* (red squares) and *Thiodia irinae* (yellow circles). The numbers indicate the localities in Bulgaria – (1) Kozar Belene; (2) Hadzhidimitrovo; (3) Kapitan Dimitrovo.

Bidzilya A.V., Budashkin Y.I., Goloborod'ko K.K., Demyanenko S.A., Zhakov A.V. 2013 New and interesting records of Microlepidoptera (Lepidoptera) from Ukraine. Contribution 2. Eversmannia 33: 23–30 + pl. 2. (In Russian)

Bidzilya A.V., Budashkin Y.I., Zhakov A.V. 2003 New records of butterflies (Insecta: Lepidoptera) from Ukraine. The Kharkov Entomological Society Gazette 10 (1–2): 59–73. (In Russian)

Biserkov V. et al. (eds) 2015 Red Data Book of the Republic of Bulgaria. Volume 3. Natural habitats. BAS and MoEW, Sofia, 422 pp.

Budashkin Y.I. 1990 New and little known taxa of tortricid moths (Lepidoptera, Tortricidae) from Eastern Crimea. Entomologicheskoe Obozrenie 69 (2): 413–418. (In Russian)

Budashkin Y.I. 2006 The materials on Lepidopterofauna of the Kazantip nature reserve. Trudy Nikitskogo botanicheskogo sada –

Nacional'nogo nauchnogo centra 126: 263–291. (In Russian)

Budashkin Y.I. 2009 Revision of tortricid fauna (Lepidoptera) of the Crimean peninsula. In: Gaevskaya A.V., Morozova A.L. (eds) Karadag 2009, Collection of scientific papers dedicated to the 95th anniversary of the Karadag Scientific Station and the 30th anniversary of the Karadag Nature Reserve of the National Academy of Sciences of Ukraine. ECOSI-Hydrophysics, Sevastopol, 158–207. (In Russian)

GBIF [Global Biodiversity Information Facility] 2023 *Thiodia irinae* Budashkin, 1990. GBIF Occurrence Download.

<https://doi.org/10.15468/dl.p4vh6p> (accessed 30 October 2023)

Kavurka V.V., Demyanenko S.O., Budashkin Y.I. 2021 Checklist of tortricid moths (Lepidoptera: Tortricidae) of Luhansk region of Ukraine. The



- Kharkov Entomological Society Gazette 29 (2): 10–30.  
<https://doi.org/10.36016/KhESG-2021-29-2-2>
- Kovács Z., Kovács S. 2006 Tribul Cochylini (Lepidoptera, Tortricidae) în România. Partea III. (*Agapeta*, *Ceratoxanthia*, *Fulvoclysis*, *Eugnosta*, *Commophila*, *Prochlidonia*, *Eupoecilia*). Buletin de Informare Entomologică 17: 5–56.
- Nedoshivina S.V. 2007 To the fauna of Leafrollers (Lepidoptera, Tortricidae) of the Astrakhan Province. Entomological and Parasitological investigations in Volga Region 6: 127–128. (In Russian)
- Nupponen K. 2012 Redescription of *Pelochrista maculiferana* (Kennel, 1900), bona sp., with notes on eight poorly known species of leafrollers from the Volgo-Ural region (Lepidoptera: Tortricidae). Nota lepidopterologica 35 (2): 115–124.
- Robinson G.S. 1976 The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera. Entomologist's Gazette 27: 127–132.
- Runfola D., Anderson A., Baier H., Crittenden M., Dowker E., Fuhrig S., Goodman S., Grimsley G., Layko R., Melville G., Mulder M., Oberman R., Panganiban J., Peck A., Seitz L., Shea S., Slevin H., Youngerman R., Hobbs L. 2020 geoBoundaries: A global database of political administrative boundaries. PLoS ONE 15 (4): e0231866.  
<https://doi.org/10.1371/journal.pone.0231866>
- Tzonev R. 2015a 07E1 Danubian loess steppes. In: Biserkov V. et al. (eds) Red Data Book of the Republic of Bulgaria. Volume 3. Natural habitats. BAS and MoEW, Sofia, 145–147.
- Tzonev R. 2015b 32E6 Continental petrophytic saline steppes. In: Biserkov V. et al. (eds) Red Data Book of the Republic of Bulgaria. Volume 3. Natural habitats. BAS and MoEW, Sofia, 207–208.
- Wieser C., Huemer P. 2000 *Ceratoxanthia rakosyella* sp. n., eine bemerkenswerte neue Schmetterlingsart aus Rumänien (Lepidoptera, Tortricidae). Entomologica romanica 4: 5–9.
- Zhakov A. 2012 *Thiodia irinae* Budashkin, 1990, Lebendfotos. In: Lepiforum e.V. (ed.) LepiWiki. [https://lepiforum.org/wiki/page/Thiodia\\_irinae#Lebendfotos](https://lepiforum.org/wiki/page/Thiodia_irinae#Lebendfotos) (accessed 4 November 2023)
- Zlatkov B., Sivilov O. 2020 An addition of two Tortricidae species to the Bulgarian fauna with notes on genital morphology (Lepidoptera). Historia naturalis bulgarica 41 (13): 103–108.  
<https://doi.org/10.48027/hnb.41.13001>