

Addition to the knowledge on the moth fauna (Insecta: Lepidoptera) of Bosnia and Herzegovina and Croatia

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Abstract. Additions to the moth fauna of Bosnia and Herzegovina and Croatia are given. We report on first observations of five species and on reconfirmation of one species after eight decades. In Croatia, we recorded the species *Eublemma cochylioides* (Guenée, 1852) for the first time, while *Eublemma himmighoffeni* (Millière, 1867) has been confirmed in the country after 85 years. We report on the first observation of five moth species for Bosnia and Herzegovina: *Triodia adriaticus* (Osthelder, 1931), *Eumera regina* Staudinger, 1892, *Dryobotodes monochroma* (Esper, 1790), *Lithophane lapidea* (Hübner, [1808]) and *Nycteola columbana* (Turner, 1925). Even though these records could be expected due to species general distributions, they fill the knowledge of moth diversity of both countries and the wider region.

Key words: Hepialidae, Geometridae, Erebidae, Nolidae, Noctuidae, distribution, diversity

Izvleček. Prispevek k favni nočnih metuljev (Insecta: Lepidoptera) Bosne in Hercegovine in Hrvaške – V prispevku podajamo nove podatke o nočnih metuljih v Bosni in Hercegovini ter na Hrvaškem, s prvimi opažanji petih vrst in ponovno potrditvijo ene vrste po več kot osem desetletjih. Na Hrvaškem smo prvič zabeležili vrsto *Eublemma cochylioides* (Guenée, 1852), medtem ko je bila *Eublemma himmighoffeni* (Millière, 1867) ponovno najdena po 85 letih. V Bosni in Hercegovini smo našli pet novih vrst za državo: *Triodia adriaticus* (Osthelder, 1931), *Eumera regina* Staudinger, 1892, *Dryobotodes monochroma* (Esper, 1790), *Lithophane lapidea* (Hübner, [1808]) in *Nycteola columbana* (Turner, 1925). Čeprav je bilo te vrste mogoče pričakovati glede na njihovo splošno razširjenost, naši podatki dopolnjujejo poznavanje raznolikosti nočnih metuljev v obeh državah in v regiji.

Cljučne besede: Hepialidae, Geometridae, Erebidae, Nolidae, Noctuidae, razširjenost, raznovrstnost

Introduction

In the beginning of the 20th century, an impressive work was published that covered the previously unknown moth fauna of Bosnia and Herzegovina (Rebel 1904a) and which today serves as a landmark for all who research the butterfly and moth fauna of the country. Afterwards, only a few papers dealing with the moths of Bosnia and Herzegovina were published



(Schawerda 1918; Stauder 1925, 1926, 1929, 1930, 1933), most of which have been consolidated in the revision of the list (Lelo 2004). Still, in comparison with the neighbouring countries, the moth diversity of Bosnia and Herzegovina is far from sufficient (Plant & Jakšić 2018) and records of additional species of almost all moth families are expected.

In Croatia the moth fauna, especially Macroheterocera, has been studied in greater detail, and for the larger families published and unpublished checklists exist (Kučinić 1997; Koren 2012; Mihoci 2012; Gumhalter 2019) rendering it easier to put any records in the comparative perspective.

During the recent years, several new and/or interesting moth species have been recorded in Bosnia and Herzegovina (Hanjalić & Lelo 2015; Koren & Kulijer 2020; Koren & Martinović 2020; Beshkov & Nahirnić-Beshkova 2021; Koren et al. 2021, 2022a), as well as in Croatia (Mrnjavčić Vojvoda et al. 2014; Koren & Gomboc 2015; Koren & Kulijer 2020).

In this work the records of additional six species are presented, five new to Bosnia and Herzegovina and one new to the fauna of Croatia, with one reconfirmation of the species after over eight decades.

Materials and methods

This report covers our observations from the 2020–2022 period in Bosnia and Herzegovina and Croatia (Tab. 1).

The study in Bosnia and Herzegovina was mainly conducted on the Klek peninsula and the nearby mainland, while the study in Croatia was conducted within the Klek settlement and the mainland south of the border with Bosnia and Herzegovina. Two main light-trapping methods were used. The main method applied was the pyramid-shaped collecting tent comprising a metal frame and two 15W UV lamps (604 nm) connected to a 12 V battery and covered with a white canvas. Six traps were used, distanced about ten meters apart. The second method implied the usage of two 6W 12V portable heath moth traps with actinic UV-A lamps (350–400 nm) which were set in the dusk and left on site and collected the following morning. Three portable heath moth traps were used per locality and night. In addition, in Klek settlement, Croatia, a 100W mercury light bulb put on a terrace was used to attract moths.

The android application and digital platform Biologer were used to record field data during this research (Popović et al. 2020). The specimens were identified and are stored in the collection of T. Koren. For each record, the exact locality, coordinates, altitude, and dates are provided.

Table 1. The list of localities with methods used and new records of moth species in Bosnia and Herzegovina and Croatia. Abbreviations: DK – Dejan Kuljer, TK – Toni Koren. Coordinates are in WGS84 decimal degrees.

Tabela 1. Seznam lokalitet z uporabljenimi metodami in novimi podatki za nočne metulje Bosne in Hercegovine in Hrvatske. Okrajšave: DK – Dejan Kuljer, TK – Toni Koren. Koordinate so v WGS84 decimalnih stopinjah.

No.	Location	Method	Date (Observer)	Species
1	House at Opuće settlement, Neum, BIH; 42.927186° N, 17.572877° E, 40 m a.s.l.	portable heath moth traps	1.10.2021 (DK)	<i>Triodia adriaticus</i>
2	Opuće settlement, northern part, Neum, BIH; 42.928529° N, 17.572879° E, 35 m a.s.l.	portable heath moth traps	16.10.2021 (DK) 19.10.2021 (DK)	<i>Dryobotodes monochroma</i> <i>Lithophane lapidea</i>
3	Konštar locality, Neum city, BIH; 42.930888° N, 17.658310° E, 175 m a.s.l.	portable heath moth traps	14.9.2020 (DK)	<i>Eumera regina</i> <i>Nycteola columbana</i>
4	Gradina locality, Neum city, BIH; 42.932013° N, 17.684761° E, 200 m a.s.l.	portable heath moth traps	16.9.2020 (DK)	<i>Eumera regina</i>
5	Klek settlement, CRO; 42.946881° N, 17.56341° E, 81 m a.s.l.	mercury light bulb	9.10.2022 (DK)	<i>Eublemma cochylioides</i>
6	Slopes on the eastern side of the bay, grasslands, and overgrown agricultural land, Zaton, Dubrovnik, CRO; 42.696625° N, 18.048319° E, 55 m a.s.l.	pyramid-shaped tents	27.5.2021 (TK)	<i>Eublemma himmighoffeni</i>

Results and discussion

In total, the records of seven moth species are presented, five being recorded for the first time in Bosnia and Herzegovina, one in Croatia and one rediscovered in Croatia after 85 years. The species were registered at six different localities (Fig. 1).

The species *Triodia adriaticus* (Osthelder, 1931) (fam. Hepialidae) was found for the first time in Bosnia and Herzegovina, Opuće settlement (Loc. 1; Tab. 1, Fig. 1). This species inhabits parts of south-eastern Europe, from Istria in Croatia, across the Adriatic coastline to Macedonia, Albania (Beshkov 1994), Ionian Sea coast, Korfu and Peloponnesus in Greece (de Freina and Witt 1990). This species is usually numerous in favourable habitats and can be attracted to light sources in high numbers. No previous records of this species exist for Bosnia and Herzegovina, but its occurrence was expected due to the probably continuous distribution along the Adriatic coastline (Koren 2020).

The species *Eumera regina* Staudinger, 1892 (fam. Geometridae) was found for the first time for Bosnia and Herzegovina, at two different localities, Konštar (Loc. 3; Tab. 1, Fig. 1) and Gradina (Loc. 4; Tab. 1, Fig. 1). This is a unique and striking Geometridae moth that cannot be confused with any other species due to the forewing terminal area being yellowish pink with two white dots (Fig. 2a) (Skou & Sihvonen 2015). Within Europe, the distribution of this species is restricted to the Balkan Peninsula and ranges from Dalmatia (Croatia) to Greece (Skou & Sihvonen 2015). No previous records of this species exist for Bosnia and Herzegovina, but its

occurrence was expected due to recent records of *E. regina* in the Neretva River Delta (Koren, unpubl.), just several kilometres west of the localities where the species was found in Bosnia and Herzegovina. It was recorded in a habitat typical of this species in the region, karst grasslands surrounded by maquis (Fig. 2b).

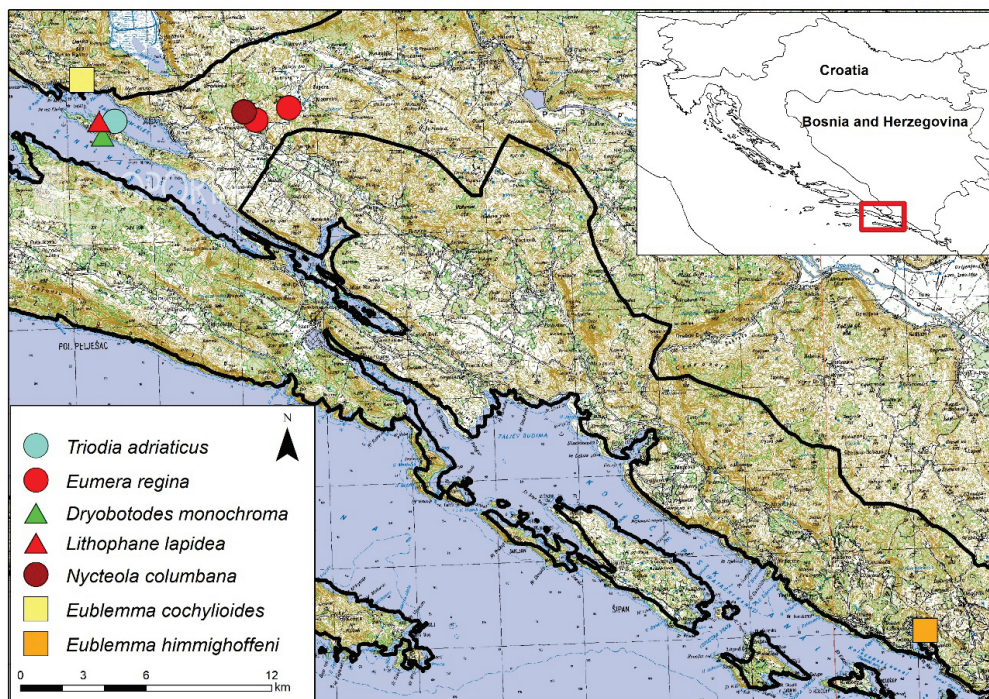


Figure 1. Distribution of the newly recorded moth species in Bosnia and Herzegovina & Croatia.

Slika 1. Razširjenost novo zabeleženih vrst nočnih metuljev v Bosni in Hercegovini in na Hrvaškem.

The species *Dryobotodes monochroma* (Esper, 1790) (fam. Noctuidae) was found for the first time in Bosnia and Herzegovina (Rebel 1904a; Lelo 2004), recorded on two different dates at Opuće settlement (Loc. 2; Tab. 1, Fig. 1). This is a Holo-Ponto-Mediterranean species with its northern distribution limit in Central Europe (Ronkay et al. 2001). The map presented in the Noctuidae Europaeae series (Ronkay et al. 2001) is misleading, as it includes the whole Balkan Peninsula and its countries. For Croatia and Bosnia and Herzegovina, this does not hold true. In Croatia, this species is, according to the newly gathered data (Koren, unpubl.) and historical records (Rebel 1912; Schwingenschuss & Wagner 1926; Stauder 1926), present only on the Mediterranean coastline, while in Bosnia and Herzegovina there have been no records of this species so far (Rebel 1904a; Lelo 2004). Thus, the presence of this species in the Mediterranean part of Bosnia and Herzegovina was expected. The identification was confirmed by the examination of male genital structures in order to distinguish it from the very similar *Dryobotodes servadeii* Parenzan, 1982 (Ronkay et al. 2001).

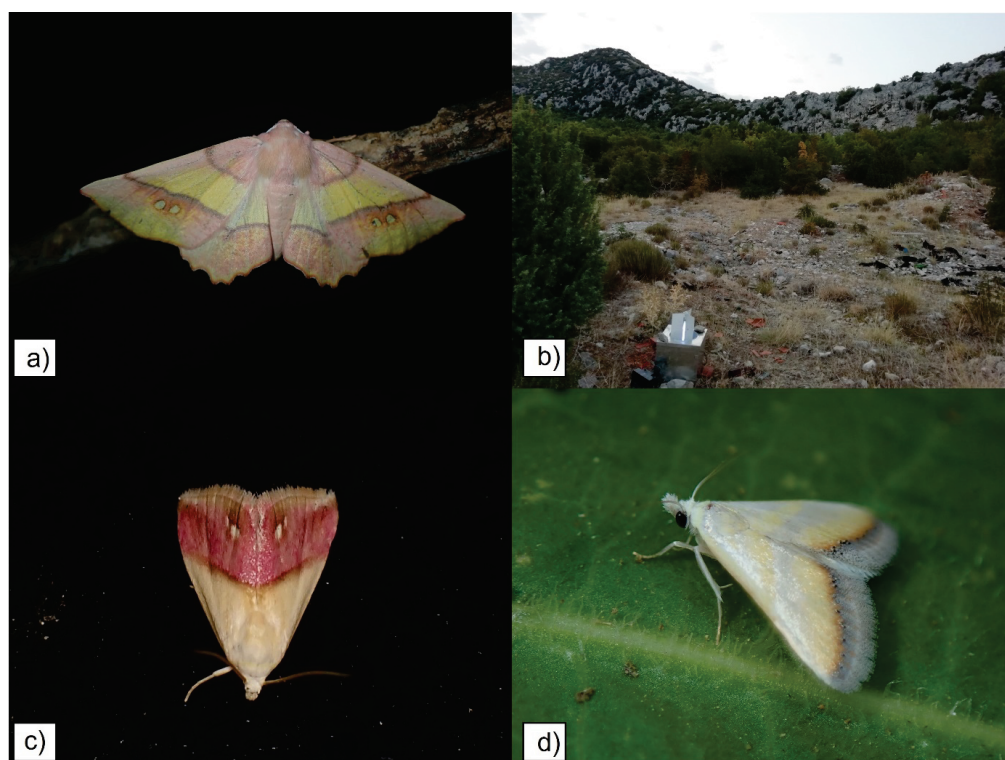


Figure 2. Photos of three moth species, found in Bosnia and Herzegovina and Croatia: a) *Eumera regina* from Gradina, b) habitat of *E. regina* at Gradina, c) *Eublemma cochylioides* from Klek settlement, d) *Eublemma himmighoffeni* from Zaton. For the localities, see Tab. 1. Photo: T. Koren (a, d), D. Kulijer (b, c).

Slika 2. Fotografije trih vrst noćnih metuljev, najdenih v Bosni in Hercegovini in na Hrvaškem: a) *Eumera regina* z lokalitete Gradina, b) habitat vrste *E. regina* na lokaliteti Gradina, c) *Eublemma cochylioides* iz naselja Klek, d) *Eublemma himmighoffeni* z lokacije Zaton. Za lokalitete glej Tab. 1. Foto: T. Koren (a, d), D. Kulijer (b, c).

The second species of the family Noctuidae, *Lithophane lapidea* (Hübner, [1808]), was recorded at the second locality near Opuće settlement (Loc. 2; Tab. 1, Fig. 1), which is the first observation for Bosnia and Herzegovina. This is a Ponto-Mediterranean species in Europe occurring in France, northern and central Italy and across the Balkan Peninsula (Ronkay et al. 2001). In neighbouring Croatia, it is a fairly common species along the Adriatic coastline from Istria in the north (Koren 2022) down to the southern part of the country. Thus, the presence in the Mediterranean part of Bosnia and Herzegovina was expected.

The species *Nycteola columbana* (Turner, 1925) (fam. Nolidae) was found at Konštar locality (Loc. 3; Tab. 1, Fig. 1) for the first time in Bosnia and Herzegovina (Rebel 1904b; Lelo 2004). This is an Eurasian species, distributed in southern parts of Europe, northern Africa and the Middle East (Fibiger et al. 2009). It is very similar to other members of the genus *Nycteola* and the correct identification was confirmed by examining the genital structures (Fibiger et al. 2009).

The species *Eublemma cochylioides* (Guenée, 1852) (fam. Erebidae) (Fig. 2c) was found for the first time in Croatia at Klek settlement (Loc. 5; Tab. 1, Fig. 1). This is a variable species with the forewing colour ranging from yellow to pink. Especially notable are the specimens with the half of the forewing coloured yellow and half pink as is the case with the specimen from Klek (Fig. 2c). This individual was observed and photographed only when reaching a mercury bulb positioned at the external side of the house. Due to the unique appearance, its identification was possible even without catching the individual.

The species *E. cochylioides* is a tropical species with disjunct distribution in Europe, Africa, Middle East to SE Asia, all to Australia (Fibiger et al. 2010). Recently, the spreading of this species has been noted in northern Europe and recorded up to Great Britain (Hatton et al. 2022). This species inhabits open, steppe-like habitats. Adults fly from September to November. Larvae feed on different Asteraceae species (Fibiger et al. 2010). This is not only the first record in Croatia, but also the northernmost record along the Adriatic coast. While the migrating behaviour is known in this species (Hatton et al. 2022), it is possible that it was just overlooked during previous surveys and is indeed native to the area.

The second species of the Erebidae family, *Eublemma himmighoffeni* (Millière, 1867) (Fig. 2d), was found at Zaton in Croatia (Loc. 6; Tab. 1, Fig. 1). This is a small and easily recognizable member of the genus *Eublemma* due to its forewing colouration. For this species, only one reliable record exists in the literature for Croatia, Gruž (Gravosa) in Dubrovnik city (Schwingenschuss & Wagner 1926). Stauder (1927) mentioned the presence of this species in Dalmatia, but without exact locations. The second record of the species, also from Gruž, is available on the web portal lepiforum.de with the following data: Dalmatia, Gravosa - Zaton, 1.–8.10.1936 H. Fabigan (Lepiforum e.V. 2021). While the new record from Croatia reported herewith is not far from the previously known area of this species around Dubrovnik, it represents the first confirmed record of the species in the country after 85 years.

The known flight period of this species is from the end of June till the end of August (Fibiger et al. 2010) and up to mid-September (Beshkov 1994), but our record from Croatia shows that this species is active even earlier, at the end of May. It inhabits dry grassland habitats near the coast (Fibiger et al. 2010), which concurs with our observations (Tab. 1).

Conclusions

Many species are being recorded in the Mediterranean part of the Bosnia and Herzegovina region, mostly the Neum and Klek peninsula areas. Here, the political border of Croatia is discontinued, with part of the coastline and the sea belonging to Bosnia and Herzegovina. Thus, it is the hotspot for recording Mediterranean species in the country, such as the ones presented in this work, that have not been recorded in the country so far. It is most likely that many of these species are present also within the mainland Herzegovina, as is the case with Mediterranean butterfly species (Lelo 2008; Koren et al. 2019; Koren et al. 2022b), but this should be investigated with additional surveys.

The Klek Peninsula and the small territory around Neum are the only parts of Bosnia and Herzegovina with characteristic Eumediterranean and maritime habitats and therefore highly valuable for the overall biodiversity of the country. For several true Mediterranean plant species and habitat types, this is the sole area where they occur on the territory of Bosnia and Herzegovina (Kutleša & Lakušić 1964; Maslo & Milanović 2022). Due to the restricted range in the country, tourism development and related urbanization and construction of infrastructure, Mediterranean habitats and the species that inhabit them are under significant and growing threat.

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