NAT. CROAT. | VOL. 33 | No 2 | 287-315 | ZAGREB | December 31, 2024

original scientific paper / izvorni znanstveni rad
DOI 10.20302/NC.2024.33.23

THE DIVERSITY OF MOTHS (LEPIDOPTERA: HETEROCERA) OF RISNJAK NATIONAL PARK, CROATIA

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Koren, T.: The diversity of moths (Lepidoptera: Heterocera) of Risnjak National Park, Croatia. Nat. Croat., Vol. 33, No. 2, 287–315, Zagreb, 2024.

The results of research into the moth fauna of Risnjak National Park (Primorje-Gorski Kotar County) are presented. The research was mainly conducted in two types of mountain habitats, beech forests and meadow-pastures. Prior to this three-year survey, only 70 moth species were known from the area. During the survey, 564 moth species were recorded at 15 sites, with many rare taxa found only for the second or third time in the country. Three new species were reported for the Croatian fauna: *Pharmacis carna, Lasionycta imbecilla* and *Horisme aemulata*. The survey provides valuable baseline data on the composition of moth species in the montane area of Risnjak National Park, which can be used for future research and conservation efforts. Succession is the main threat to habitats in this area, significantly affecting grassland areas in the park.

Key words: Noctuidae, Geometridae, Pyraloidea, Gorski Kotar, faunistic, montane area

Koren, T. Raznolikost faune noćnih leptira (Lepidoptera: Heterocera) Nacionalnog parka Risnjak. Nat. Croat., Vol. 33, No. 2, 287–315, Zagreb, 2024

Prikazani su rezultati istraživanja faune leptira Nacionalnog parka Risnjak (Primorsko-goranska županija). Istraživanje je provedeno uglavnom u dva tipa planinskih staništa, bukovim šumama i livadnim pašnjacima. Prije ovog trogodišnjeg istraživanja, za područje je bilo poznato svega 70 vrsta noćnih leptira. Tijekom istraživanja zabilježeno je 564 vrste leptira na 15 lokacija. Zabilježene su mnoge rijetke vrste, neke od kojih su pronađene samo po drugi ili treći put u zemlji. Tri nove vrste zabilježene su za faunu Hrvatske: *Pharmacis carna, Lasionycta imbecilla* i *Horisme aemulata*. Ovo istraživanje pruža važne osnovne podatke o bogatstvu vrsta i sastavu vrsta leptira u planinskom području Nacionalnog parka Risnjak, koji se mogu koristiti kao temelj za buduća istraživanja i očuvanja područja. Glavna prijetnja staništima u ovom području je sukcesija, koja značajno utječe na mnoga livadna područja u parku.

Ključne riječi: Noctuidae, Geometridae, Pyraloidea, Gorski Kotar, fauna, planinsko područje

INTRODUCTION

In Croatia, eight areas of high natural biodiversity have been declared national parks, including the Brijuni archipelago, Risnjak, Northern Velebit, the Plitvice Lakes, the Krka River, Paklenica, the Kornati Islands and the island of Mljet. However, the state of knowledge on the fauna in these areas varies greatly, especially for moths, which have not been extensively studied nationwide. As far as the moth fauna is concerned, a detailed historical survey only exists for the Brijuni Islands, and it dates back more than 110 years (Rebel, 1914, 1913). No comprehensive overview of moth diversi-

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ty has been published for other national parks, with only a few faunistic contributions available for Mljet (Kazimierczak, 2009) and Kornati (Koren & Bjelić, 2010).

The situation is somewhat better regarding the moth fauna of Risnjak National Park (Risnjak NP). While the published records are not detailed, several rare montane species have been reported from this area (Mladinov & Lorković, 1985). In addition, Lidija Mladinov, former curator of the Natural History Museum in Zagreb, visited the area for many years and collected moths during her butterfly surveys of the Kupa river valley. However, it remains unclear whether her observations included the meadows and pastures that are now part of the National Park or only the forest trails on Dimovec hill, since the information on the exact localities where the species were recorded is missing (Mladinov, 1983, 1980, 1978, 1977, 1976). In an overview of the Lepidoptera diversity of Gorski kotar area, Kučinić *et al*. (1994) listed 60 Macroheterocera for the area of Risnjak NP, but without referring to the specific localities. Recently, the montane species *Psodos quadrifaria* (Sulzer, 1776) has been reported from the area (Koren, 2012) as well as several Crambidae species (Koren, 2020). With these data, the total number of moth species comes to 70.

The aim of this paper is to present the results of a recent survey of moths in Risnjak NP, to overview some rare and interesting species observations and to provide notes on their habitats and threats.

MATERIALS AND METHODS

Study area

Risnjak National Park is situated in the mountainous region of Gorski Kotar, located in the Primorje–Gorski Kotar County. It was established as a national park in 1953, and its borders were extended in 1997 to encompass the Snježnik peak, most of the Krčevina stream basin, and the lower parts of the Kupa River, increasing the park's area to 6,400 hectares (Randić *et al*., 2003). Risnjak National Park's geology is primarily composed of sedimentary deposits with various lithological compositions. The park's oldest sediments, which are from the Palaeozoic era, include clay shales, sandstones, and quartz conglomerates. These sediments are primarily found near streams and rivers, such as the Krašićevica stream and the Kupa river valley (Randić *et al*., 2003). In the southern part of the National Park, around Vilja, Leska, and Bijele Vodice, there are Upper Triassic calcareous rocks that are slightly younger. However, the most extensive rocks in the area are the Jurassic calcareous rocks that make up the massifs of Risnjak, Snježnik, and Bijele stijene (Randić *et al*., 2003).

The topography of Risnjak National Park is characterized by varied relief, which can be categorized into three distinct geomorphological units. The first unit encompasses the western and north-western ridges of Snježnik and Risnjak, which are the highest points in the park. The second unit comprises the central and southeastern part of the park, which is a karst plateau. The third unit encompasses the valleys surrounding the source of the Kupa River, as well as the Krašićevica and Sušica streams. The climate in Risnjak NP is perhumid and moderately cold, based on data from the meteorological station in Lividraga (939 m). The coldest areas of the park are the mountain peaks, where the average annual temperature is less than 5.4 °C. As the altitude decreases, the average temperature reaches 8 °C in the beech-fir belt and 11 °C in the lowest par-

ts of the park (Randić *et al*., 2003). The average annual temperature is lowest in January (–2.0° C) and highest in July (14.2° C). Rainfall averages 3900 mm per year, with the highest amounts in November (488 mm) and the lowest in August (166 mm). Air humidity is high (94%).

The area of the National Park up to 1240 m is mainly covered by different types of forests, where beech and fir community (*Omphalodo-Fagetum*) dominates (Vukelić, 1985). Apart from that, the vegetation of Risnjak NP consists of about 30 plant communities, 14 of which belong to forest associations (Trinajstić, 1995). At an altitude of 1200–1400 m, the communities are replaced by pre-alpine beech forest (*Ranunculo platanifolii-Fagetum*). The upper limit of forest vegetation, starting at 1450 m, is a special Dinaric alliance of mountain pine forest (*Lonicero borbasianae-Pinetum mugi*). Growing n the colder and more humid valleys and at their edges, most often in the lower regions is the subalpine spruce forest (*Listero-Piceetum abietis*). On acidic soils up to 800 meters above sea level acidophilous fir forest grows (*Blechno-Abietetum*). Illyrian beech forests (*Lamio orvalae-Fagetum*) grow at altitudes between 450 and 700 m.

Much scarcer, but still present, are the grassland habitats. Mountain peaks are covered with mountain grasslands (*Seslerietalia tenuifoliae*). Larger grasslands are located at the western border of the Park, in the area of Lazac and Šegine and in the valley of Leska, where a mosaic of meadows with different grasslands (*Bromo-Plantaginetum*, *Festuco-Agrostietum, Nardetum*) is surrounded by old forests. Just as on other Dinaric mountains that stretch parallel to the coast, the flora and fauna of Risnjak are very rich. In the area of Risnjak NP, over 876 plant taxa (Šegulja *et al*., 1994) and 80 species of lichens have been recorded (Ozimec *et al*., 2010).

Lepidoptera collecting

This study was conducted between April 2019 and September 2021 using two primary methods of light trapping. The first method involved the use of light tent-pyramids, which consisted of a metal frame covered by white canvas, and two 15 W UV lamps connected to a 12 V battery. During each visit, six tent-pyramids were set up, spaced approximately ten meters apart. The second method involved the use of a 6 W 12 V Portable Heath Moth Trap, which was left on site overnight and collected the following morning. Four Portable Heath Moth Traps were used per location and night. Both methods were used at each locality, depending on the prevailing weather conditions. In addition, at some localities, moths were recorded during the day with an entomological net.

The Android application and digital platform Biologer were used to record field data during this research (Popović *et al*., 2020). The moths that could not be identified in the field were collected, prepared, and stored in the author's private collection (Koren Collection in Zagreb). Such specimens were dissected and identified according to their internal genital structures.

Moths were identified with many identification keys. For the Noctuidae family, books from the series Noctuidae Europeaea were used (Fibiger, 1997, 1993, 1990; Fibiger *et al*., 2010, 2009, 2007; Goater *et al*., 2003; Hacker *et al*., 2002; Ronkay & Ronkay, 1995, 1994; Ronkay *et al*., 2001; Witt & Ronkay, 2011; Zilli *et al*., 2005). For the Geometridae family, the book series The Geometrid Moths of Europe was used (Hausmann, 2001, 2004; Hausmann & Viidalepp, 2012; Mironov, 2003, 2003; Müller *et al*., 2019; Skou & Sihvonen, 2015). For other larger moths, different available keys were used (Leraut,

2012, 2009, 2006; Macek *et al*., 2012; Nowacki, 1998). For Microlepidoptera all the available literature was used, including the book series Microlepidoptera of Europe (Gaedike, 2019; Goater *et al*., 2005; Huemer & Karsholt, 2005, 1999), Pyraloidea of Europe (Slamka, 2019, 2013, 2008, 2006), Tortricidae of Europe (Razowski, 2003) and the Internet website Lepiforum.de (Lepiforum e.V., 2024). The taxonomy of the species follows the Fauna Europaea website (de Jong *et al*., 2014) with minor changes related to recent taxonomic changes. The moth families were listed in taxonomic order according to Kristensen *et al*. (2007).

A list of localities in the survey, with coordinates and altitudes, is given in Tab. 1 while a map is presented in Fig. 1.

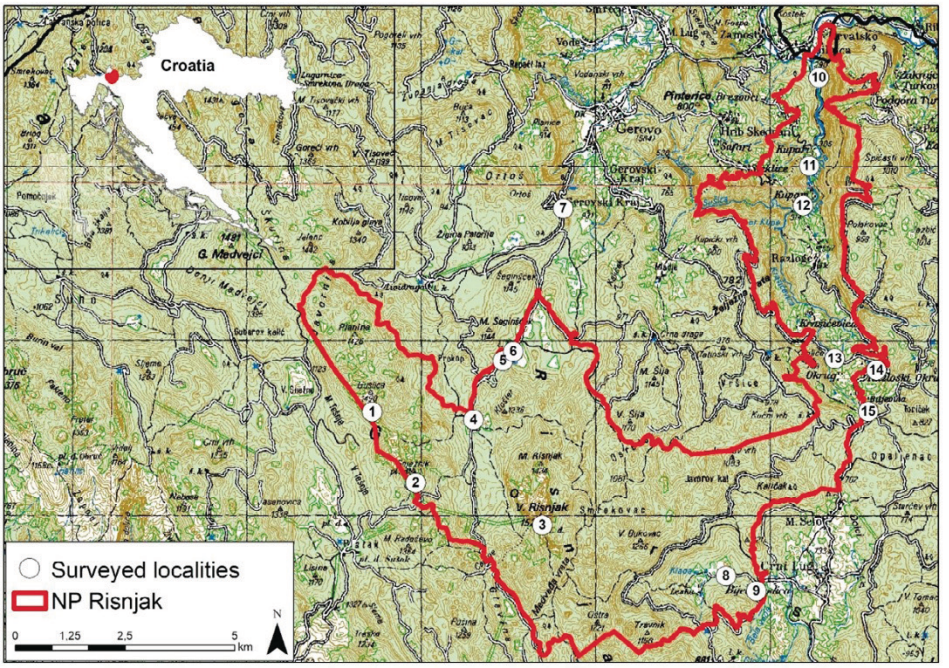

Fig. 1. Map of surveyed localities for moths on Risnjak National Park. Borders of NP Risnjak are shown in red colour. Locality numbers correspond to those in the List of localities.

List of localities

The list of localities contains the relevant toponyms, a short description of the habitat, altitude, coordinates, dates of the visits, and initials of observers. Localities are generally arranged in geographical order from west to east (Fig. 1).

1. Guslica peak (Fig. 2a), mountain grasslands, edges of beech forests; 45.45295° N, 14.5718° E, 1511 m a.s.l.; 19.7.2018, 17.7.2019, 18.7.2019, 19.7.2019, 29.7.2019, 14.8.2019, 15.8.2019, 8.7.2020, 9.7.2020, 21.7.2020, 22.7.2020, 27.7.2020.

2. Snježnik (Fig. 2b), grasslands and edges of beech forest around the peak; 45.438365° N, 14.584635° E, 1552 m a.s.l.; 21.6.2019, 19.7.2019.

3. Risnjak, grasslands around the peak; 45.429753° N, 14.621898° E, 1442 m a.s.l.; 19.6.2019.

4. Lazac, grasslands and beech forest edges; 45.451449° N, 14.601518° E, 1104 m a.s.l.; 11.6.2019, 19.6.2019, 21.6.2019, 17.7.2019, 18.7.2019, 12.8.2019, 22.10.2019, 23.10.2019, 12.5.2020, 21.5.2020, 10.6.2020, 12.6.2020, 20.6.2020, 10.7.2020, 12.7.2020, 13.7.2020, 17.7.2020, 23.7.2020, 24.7.2020, 9.8.2020, 10.8.2020, 9.9.2020, 12.9.2020, 14.9.2020, 12.7.2021, 5.9.2021.

5. Šegine: Japetova Šegina (Fig. 2c), southern part, road toward Lazac, forest edges and beech forest clearing, grasslands; 45.464613° N, 14.612445° E, 1079 m a.s.l.; 22.6.2019, 13.8.2019, 26.8.2019, 23.10.2019, 10.6.2020, 12.6.2020, 9.7.2020, 24.7.2020, 10.8.2020, 13.9.2020, 14.9.2020.

6. Šegine: Vinkova Šegina, northern part, meadows, dry meadows and beech forest edges; 45.465533° N, 14.613104° E, 960–1008 m a.s.l.; 17.6.2019, 18.6.2019, 21.6.2019, 22.6.2019, 18.7.2019, 19.7.2019, 20.7.2019, 12.8.2019, 13.8.2019, 25.8.2019, 26.8.2019, 22.10.2019, 23.10.2019, 9.6.2020, 10.6.2020, 11.6.2020, 20.6.2020, 5.7.2020, 9.7.2020, 10.7.2020, 23.7.2020, 24.7.2020, 9.8.2020, 10.8.2020, 12.8.2020, 20.8.2020, 13.9.2020, 14.9.2020, 5.9.2021, 13.9.2021.

7. Gerovski kraj, road toward Šegine meadows, beech forest clearings; 45.495056° N, 14.627624° E, 710 m a.s.l.; 22.6.2019, 18.7.2019, 11.6.2020, 26.5.2021.

8. Crni lug, Mrzla Vodica, Leska meadows, meadows, heath and forest edges; 45.419442° N, 14.675752° E, 726 m a.s.l.; 14.6.2019, 16.6.2019, 17.6.2019, 18.6.2019, 19.6.2019, 19.7.2019, 13.8.2019, 16.8.2019, 25.8.2019, 26.8.2019, 27.8.2019, 21.5.2020, 22.5.2020, 12.6.2020, 18.6.2020, 20.6.2020, 10.7.2020, 11.7.2020, 18.7.2020, 10.8.2020, 11.8.2020, 4.9.2021.

9. Crni lug, Mrzla vodica, meadows and forest edges around NP Risnjak administration building; 45.418469° N, 14.683973° E, 729 m a.s.l.; 25.5.2019, 17.6.2019, 18.6.2019, 19.6.2019, 20.6.2019, 17.7.2019, 19.7.2019, 21.7.2019, 13.8.2019, 14.8.2019, 27.8.2019, 13.9.2019, 24.10.2019, 19.5.2020, 20.5.2020, 21.5.2020, 23.5.2020, 12.6.2020, 18.6.2020, 19.6.2020, 20.7.2020, 23.7.2020, 24.7.2020, 25.7.2020, 12.8.2020, 13.8.2020, 13.9.2020, 15.9.2020, 4.9.2021.

10. Hrvatsko, meadows north of the village; 45.522275° N, 14.702419° E, 331 m a.s.l.; 22.5.2020.

11. Kupari, northern part of the village, forest edges along Kupa river; 45.504107° N, 14.699749° E, 379 m a.s.l.; 26.5.2019, 22.5.2020, 21.7.2020, 10.8.2020, 12.9.2020.

12. Kupari, southern meadows along Kupa river, closest to the spring (Fig. 2d); 45.495171° N, 14.696983° E, 404 m a.s.l.; 16.4.2019, 18.4.2019, 25.5.2019, 26.5.2019, 18.6.2019, 20.6.2019, 21.7.2019, 10.8.2019, 21.5.2020, 22.5.2020, 11.6.2020, 10.7.2020, 20.7.2020, 21.7.2020, 24.7.2020, 30.7.2020, 10.8.2020, 18.8.2020, 10.9.2020, 12.9.2020, 13.9.2020, 10.7.2021.

13. Krašićevica, macadam road between villages, forest clearings and forest edges, 45.4644° N, 14.707448° E, 595 m a.s.l.; 15.4.2019, 20.6.2019, 25.10.2019, 24.7.2020, 25.7.2020, 10.8.2020, 12.8.2020, 16.9.2020.

14. Razloški Okrug, forest edges along the road, 45.462047° N, 14.719636° E, 708 m a.s.l., 20.6.2019.

15. Biljevina, meadow near the road, 45.453477° N, 14.717263° E, 690 m a.s.l., 20.6.2019, 25.10.2019, 16.9.2020.

RESULTS

During the survey, a total of 2700 moth records were collected, which included 564 species (listed in alphabetical order within each family). However, a small percentage of the samples remained unidentified due to uncertain taxonomic status. The number of species recorded varied between three (for a locality explored only during daytime) to 222.

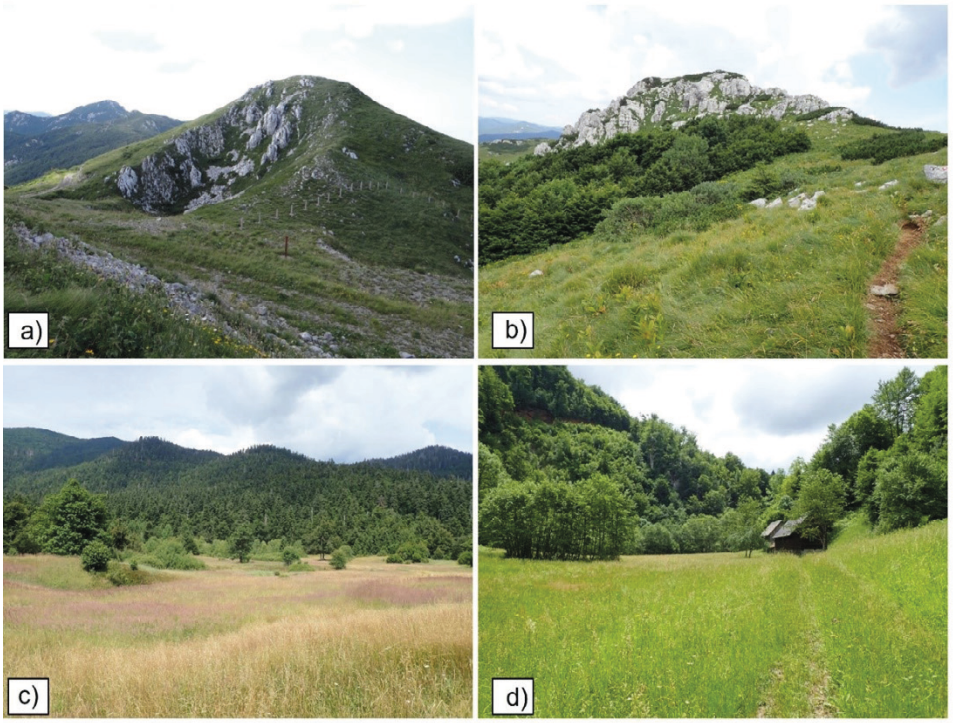

Fig. 2. Grassland habitats in Risnjak National Park. a) Guslica peak, b) Snježnik peak, c) Šegine, southern part, d) Kupa river valley, close to the spring.

The highest number of recorded species (above 200) were found in four localities: loc. 6 (222 species), loc. 9 (215 species), loc. 12 (214 species), and loc. 4 (209 species) (Tab. 1).

The most common species, recorded at ten or more localities, were *Herminia grisealis* (Denis & Schiffermüller, 1775), *Colocasia coryli* (Linnaeus, 1758), *Stauropus fagi* (Linnaeus, 1758), *Alcis repandata* (Linnaeus, 1758), *Cabera exanthemata* (Scopoli, 1763), *Colostygia olivata* (Denis & Schiffermüller, 1775), *Campaea margaritaria* (Linnaeus, 1761), *Cosmorhoe ocellata* (Linnaeus, 1758), *Thera variata* (Denis & Schiffermüller, 1775), *Fagivorina arenaria* (Hufnagel, 1767), *Xanthorhoe montanata* (Denis & Schiffermüller, 1775) and *Dendrolimus pini* (Linnaeus, 1758) (Tab. 2). 206 species were recorded only at a single locality (Tab. 1).

DISCUSSION

The recent survey of moths in Risnjak NP has provided a first baseline for moth diversity in the area. The recorded number of 564 species is a significant increase from the 70 species recorded previously (Kučinić *et al*., 1994). Consequently, the surveyed area can now be considered one of the better studied parts of Croatia and is the most extensively studied area in the whole Gorski Kotar region.

As there are no official Red lists or Red books for moths in Croatia currently, it is challenging to contextualize the collected data and evaluate the threats to various species. However, based on prior observation data and distribution patterns within the region, it is possible to provide an overview of rare or interesting species recorded

during this research. Although some species have not been recorded in Croatia for a century or more, this is not necessarily an indication of their rarity, but rather a reflection of the limited amount of surveys and the lack of published data on these species (Gumhalter, 2021; Gumhalter & Kučinić, 2020).

List of species recorded in Risnjak NP during moth surveys. Locality numbers correspond to those in Materials and methods and Fig 1.

	List of recorded species	Locality numbers
	Hepialidae	
1.	*Pharmacis carna* (Denis & Schiffermüller, 1775)	1
2.	*Phymatopus hecta* (Linnaeus, 1758)	4, 7, 9, 14
3.	*Triodia sylvina* (Linnaeus, 1761)	4, 6, 8, 9, 13, 15
	Adelidae	
4.	*Cauchas leucocerella* (Scopoli, 1763)	4
	Yponomeutidae	
5.	*Yponomeuta evonymella* (Linnaeus, 1758)	4, 12, 13
	Ypsolophidae	
6.	*Ypsolopha dentella* (Fabricius, 1775)	13
	Gelechiidae	
7.	*Helcystogramma triannulella* (Herrich-Schäffer, 1854)	6
	Elachistidae	
8.	*Agonopterix kaekeritziana* (Linnaeus, 1767)	6
9.	*Anchinia daphnella* (Denis & Schiffermüller, 1775)	4, 6
	Limacodidae	
10.	*Apoda limacodes* (Hufnagel, 1766)	7, 8, 11, 12, 13
	Zygaenidae	
11.	*Adscita mannii* (Lederer, 1853)*	8
12.	*Adscita statices* (Linnaeus, 1758)*	8
13.	*Jordanita globulariae* (Hübner, 1793)*	4, 6, 8, 12
14.	*Zygaena filipendulae* (Linnaeus, 1758)	4, 6, 8, 12
15.	*Zygaena lonicerae* (Scheven, 1777)*	4, 6
16.	*Zygaena loti* (Denis & Schiffermüller, 1775)	4, 6
17.	*Zygaena purpuralis* (Brünnich, 1763)*	6, 8, 9
18.	*Zygaena viciae* (Denis & Schiffermüller, 1775)	8
	Cossidae	
19.	*Cossus cossus* (Linnaeus, 1758)	12
	Tortricidae	
20.	*Acleris cristana* (Denis & Schiffermüller, 1775)*	12
21.	*Acleris forsskaleana* (Linnaeus, 1758)*	4
22.	*Acleris laterana* (Fabricius, 1794)*	6
23.	*Acleris variegana* (Denis & Schiffermüller, 1775)	12, 15
24.	*Agapeta hamana* (Linnaeus, 1758)	11
25.	*Agapeta zoegana* (Linnaeus, 1767)	8, 9, 12
26.	*Archips betulana* (Hübner, 1787)	13
27.	*Archips podana* (Scopoli, 1763)	6
28.	*Dichelia histrionana* (Frölich, 1828)	4, 13
29.	*Eana argentana* (Clerck, 1759)	2, 4
30.	*Epiblema cirsiana* (Zeller, 1843)*	6
31.	*Epiblema foenella* (Linnaeus, 1758)*	4
32.	*Epiblema grandaevana* (Lienig & Zeller, 1846)*	4, 8, 13
33.	*Epiblema scutulana* (Denis & Schiffermüller, 1775)*	3, 8
34.	*Eucosma cana* (Haworth, 1811)	4
35.	*Notocelia uddmanniana* (Linnaeus, 1758)	12
36.	*Pammene aurita* Razowski, 1991*	13
37.	*Pandemis corylana* (Fabricius, 1794)	4, 6

Continued

	List of recorded species	Locality numbers
	Crambidae	**1**
38.	*Agriphila inquinatella* (Denis & Schiffermüller, 1775)*	4, 6, 9
39.	*Agriphila straminella* (Denis & Schiffermüller, 1775)*	4, 12, 13
40.	*Agriphila tristella* (Denis & Schiffermüller, 1775)*	6, 8, 9
41.	*Agrotera nemoralis* (Scopoli, 1763)	13
42.	*Anania crocealis* (Hübner, 1796)	1, 6, 7, 8, 9, 11
43.	*Anania fuscalis* (Denis & Schiffermüller, 1775)	4, 6
44.	*Anania hortulata* (Linnaeus, 1758)	12
45.	*Anania lancealis* (Denis & Schiffermüller, 1775)	4, 5, 8, 9, 11, 12, 13, 14
46.	*Anania stachydalis* (Germar, 1821)	8, 11, 12
47.	*Anania terrealis* (Treitschke, 1829)	6
48.	*Anania verbascalis* (Denis & Schiffermüller, 1775)	11, 12, 13
49.	*Catoptria combinella* (Denis & Schiffermüller, 1775)*	1, 2
50.	*Catoptria falsella* (Denis & Schiffermüller, 1775)	8, 13
51.	*Catoptria myella* (Hübner, 1796)*	1, 4, 8, 12
52.	*Catoptria pauperellus* (Treitschke, 1832)*	4
53.	*Catoptria pyramidellus* (Treitschke, 1832)*	1, 4, 5, 13
54.	*Catoptria speculalis* Hübner, 1831*	1
55.	*Catoptria verellus* (Zincken, 1817)	1, 13
56.	*Crambus ericella* (Hübner, 1813)*	1, 2
57.	*Crambus lathoniellus* (Zincken, 1817)*	4, 6, 12
58.	*Crambus pascuella* (Linnaeus, 1758)*	4, 6, 8
59.	*Cydalima perspectalis* (Walker, 1859)	12
60.	*Diasemia reticularis* (Linnaeus, 1761)	8, 9, 12
61.	*Diasemiopsis ramburialis* (Duponchel, 1834)	9, 12
62.	*Evergestis forficalis* (Linnaeus, 1758)	13
63.	*Evergestis limbata* (Linnaeus, 1767)	1
64.	*Evergestis pallidata* (Hufnagel, 1767)	7, 8, 9, 11, 12, 13
65.	*Evergestis politalis* (Denis & Schiffermüller, 1775)	9
66.	*Metasia ophialis* (Treitschke, 1829)	7, 11, 12, 13
67.	*Nomophila noctuella* (Denis & Schiffermüller, 1775)	8
68.	*Ostrinia nubilalis* (Hübner, 1796)	6, 7, 8, 11, 13
69.	*Paratalanta hyalinalis* (Hübner, 1796)	12
70.	*Pediasia contaminella* (Hübner, 1796)*	4
71.	*Pleuroptya ruralis* (Scopoli, 1763)	8, 9, 11, 12, 13
72.	*Pyrausta aurata* (Scopoli, 1763)	5, 6, 9, 12, 13
73.	*Pyrausta castalis* Treitschke, 1829	4
74.	*Pyrausta falcatalis* Guenée, 1854	13
75.	*Pyrausta nigrata* (Scopoli, 1763)	6, 9
76.	*Pyrausta purpuralis* (Linnaeus, 1758)	9
77.	*Sitochroa verticalis* (Linnaeus, 1758)	4
78.	*Udea alpinalis* (Denis & Schiffermüller, 1775)	1, 2, 6
79.	*Udea cyanalis* (La Harpe, 1855)*	1, 12
80.	*Udea ferrugalis* (Hübner, 1796)	1, 5, 9, 12, 13
81.	*Udea nebulalis* (Hübner, 1796)	1
82.	*Udea olivalis* (Denis & Schiffermüller, 1775)	1, 4, 5, 7, 8
	Pyralidae	
83.	*Acrobasis tumidana* (Denis & Schiffermüller, 1775)	4
84.	*Assara terebrella* (Zincken, 1818)	4
85.	*Catastia marginea* (Denis & Schiffermüller, 1775)	5
86.	*Dioryctria abietella* (Denis & Schiffermüller, 1775)*	1, 4
87.	*Dioryctria simplicella* Heinemann, 1863*	1, 4, 6, 8

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	List of recorded species	Locality numbers
88.	*Dioryctria sylvestrella* (Ratzeburg, 1840)*	12, 13
89.	*Endotricha flammealis* (Denis & Schiffermüller, 1775)	5, 7, 11, 12, 13
90.	*Hypsopygia glaucinalis* (Linnaeus, 1758)	12
91.	*Oncocera semirubella* (Scopoli, 1763)	5, 11, 13
92.	*Phycita meliella* (Mann, 1864)*	12
93.	*Phycitodes binaevella* (Hübner, 1813)	1
94.	*Stemmatophora honestalis* (Treitschke, 1829)	4
	Lasiocampidae	
95.	*Cosmotriche lobulina* (Denis & Schiffermüller, 1775)	4, 5, 6, 8
96.	*Dendrolimus pini* (Linnaeus, 1758)	4, 5, 6, 7, 8, 9, 12, 13, 14, 15
97.	*Lasiocampa quercus* (Linnaeus, 1758)	9, 13
98.	*Lasiocampa trifolii* (Denis & Schiffermüller, 1775)	8, 9
99.	*Macrothylacia rubi* (Linnaeus, 1758)	8
100.	*Malacosoma castrensis* (Linnaeus, 1758)	8, 9
101.	*Malacosoma neustria* (Linnaeus, 1758)	8, 9, 12
102.	*Odonestis pruni* (Linnaeus, 1758)	1, 5, 6, 8, 9, 11, 12, 13
103.	*Phyllodesma tremulifolia* (Hübner, 1810)	12
104.	*Poecilocampa populi* (Linnaeus, 1758)	4, 5, 9, 13, 15
105.	*Trichiura crataegi* (Linnaeus, 1758)	4, 9, 12, 13, 15
	Brahmaeidae	
106.	*Lemonia taraxaci* (Denis & Schiffermüller, 1775)	6
	Saturniidae	
107.	*Aglia tau* (Linnaeus, 1758)	7, 12
108.	*Antheraea yamamai* (Guérin-Méneville, 1861)	6, 11, 13
	Sphingidae	
109.	*Agrius convolvuli* (Linnaeus, 1758)	1, 4, 5, 9
110.	*Deilephila elpenor* (Linnaeus, 1758)	5, 6, 10, 12
111.	*Deilephila porcellus* (Linnaeus, 1758)	4, 5, 6, 8, 9, 12
112.	*Hemaris fuciformis* (Linnaeus, 1758)	4, 5, 6
113.	*Hemaris tityus* (Linnaeus, 1758)	4
114.	*Laothoe populi* (Linnaeus, 1758)	1, 5, 6, 7, 8, 9, 11, 13
115.	*Macroglossum stellatarum* (Linnaeus, 1758)	1, 2
116.	*Mimas tiliae* (Linnaeus, 1758)	12
117.	*Smerinthus ocellata* (Linnaeus, 1758)	8
118.	*Sphinx ligustri* Linnaeus, 1758	12
119.	*Sphinx pinastri* Linnaeus, 1758	1, 6, 8, 9, 12
	Drepanidae	**1**
120.	*Drepana curvatula* (Borkhausen, 1790)	12, 13
121.	*Drepana falcataria* (Linnaeus, 1758)	11, 13
122.	*Falcaria lacertinaria* (Linnaeus, 1758)	9
123.	*Habrosyne pyritoides* (Hufnagel, 1766)	4, 5, 6, 8, 9, 11, 12, 13
124.	*Ochropacha duplaris* (Linnaeus, 1761)	13
125.	*Sabra harpagula* (Esper, 1786)	11, 12, 13
126.	*Tethea or* (Denis & Schiffermüller, 1775)	7, 8, 9, 12, 13
127.	*Tetheella fluctuosa* (Hübner, 1803)	12, 13
128.	*Thyatira batis* (Linnaeus, 1758)	5, 6, 7, 8, 9, 11, 12, 13, 14
129.	*Watsonalla binaria* (Hufnagel, 1767)	1, 4, 5, 6, 8, 9, 13
130.	*Watsonalla cultraria* (Fabricius, 1775)	1, 4, 5, 9
	Geometridae	**1**
131.	*Acasis viretata* (Hübner, 1799)	1, 13
132.	*Aethalura punctulata* (Denis & Schiffermüller, 1775)	9
133.	*Agriopis bajaria* (Denis & Schiffermüller, 1775)	5

Continued

List of recorded species	Locality numbers
134. *Alcis repandata* (Linnaeus, 1758)	1, 4, 5, 6, 7, 8, 9, 11, 12, 13
135. *Angerona prunaria* (Linnaeus, 1758)	12, 13, 14, 15
136. *Anticlea derivata* (Denis & Schiffermüller, 1775)	12
137. *Anticollix sparsata* (Treitschke, 1828)	12
138. *Aplocera efformata* (Guenée, 1858)*	4, 7
139. *Aplocera plagiata* (Linnaeus, 1758)*	4
140. *Aplocera praeformata* (Hübner, 1826)*	1, 4, 6
141. *Artiora evonymaria* (Denis & Schiffermüller, 1775)	6
142. *Ascotis selenaria* (Denis & Schiffermüller, 1775)	9
143. *Asthena albulata* (Hufnagel, 1767)	11, 12, 13
144. *Biston betularia* (Linnaeus, 1758)	1, 4, 5, 6, 7, 8, 9, 12, 13
145. *Bupalus piniaria* (Linnaeus, 1758)	12
146. *Cabera exanthemata* (Scopoli, 1763)	1, 3, 4, 5, 7, 8, 9, 11, 12, 13
147. *Cabera pusaria* (Linnaeus, 1758)	11
148. *Campaea margaritaria* (Linnaeus, 1761)	1, 4, 5, 6, 7, 8, 9, 11, 12, 13, 15
149. *Camptogramma bilineata* (Linnaeus, 1758)	7, 9, 11, 12, 13
150. *Camptogramma scripturata* (Hübner, 1799)	1, 5, 9, 13
151. *Catarhoe cuculata* (Hufnagel, 1767)	1, 4, 5
152. *Catarhoe rubidata* (Denis & Schiffermüller, 1775)	11, 12, 13
153. *Chiasmia clathrata* (Linnaeus, 1758)	1, 3, 4, 6, 8, 9, 12
154. *Chlorissa cloraria* (Hübner, 1813)	9
155. *Chlorissa viridata* (Linnaeus, 1758)	6, 8, 9
156. *Cidaria fulvata* (Forster, 1771)	1, 4, 5
157. *Cleora cinctaria* (Denis & Schiffermüller, 1775)	6
158. *Coenotephria ablutaria* (Boisduval, 1840)	1, 4, 6
159. *Coenotephria tophaceata* (Denis & Schiffermüller, 1775)*	1, 6, 12
160. *Colostygia aqueata* (Hübner, 1813)*	1
161. *Colostygia kollariaria* (Herrich-Schäffer, 1848)*	1, 4
162. *Colostygia olivata* (Denis & Schiffermüller, 1775)	1, 4, 5, 6, 8, 9, 11, 12, 13, 15
163. *Colostygia pectinataria* (Knoch, 1781)	4, 5, 6, 8, 9, 11, 12
164. *Colostygia turbata* (Hübner, 1799)*	6
165. *Colotois pennaria* (Linnaeus, 1761)	13
166. *Cosmorhoe ocellata* (Linnaeus, 1758)	1, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14
167. *Crocallis elinguaria* (Linnaeus, 1758)	4
168. *Cyclophora albiocellaria* (Hübner, 1789)	1
169. *Cyclophora annularia* (Fabricius, 1775)	4, 6, 8, 9, 11, 12, 13
170. *Cyclophora linearia* (Hübner, 1799)	4, 5, 6, 8, 9, 11, 12, 13, 15
171. *Cyclophora pendularia* (Clerck, 1759)	8
172. *Cyclophora punctaria* (Linnaeus, 1758)	9
173. *Cyclophora quercimontaria* (Bastelberger, 1897)	11
174. *Deileptenia ribeata* (Clerck, 1759)	4, 6, 8, 9, 12, 13
175. *Dysstroma citrata* (Linnaeus, 1761)*	4, 13
176. *Dysstroma truncata* (Hufnagel, 1767)*	4, 15
177. *Ecliptopera capitata* (Herrich-Schäffer, 1839)	4, 5, 8, 9, 12
178. *Ecliptopera silaceata* (Denis & Schiffermüller, 1775)	6, 11
179. *Ectropis crepuscularia* (Denis & Schiffermüller, 1775)	8, 9, 11, 12
180. *Electrophaes corylata* (Thunberg, 1792)	1, 4
181. *Elophos dilucidaria* (Denis & Schiffermüller, 1775)*	1
182. *Elophos serotinaria* (Denis & Schiffermüller, 1775)*	1
183. *Ematurga atomaria* (Linnaeus, 1758)	8, 9, 12
184. *Ennomos autumnaria* (Werneburg, 1859)	12
185. *Ennomos erosaria* (Denis & Schiffermüller, 1775)	11

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List of recorded species	Locality numbers
186. *Ennomos fuscantaria* (Haworth, 1809)	8, 9, 13, 15
187. *Ennomos quercinaria* (Hufnagel, 1767)	1, 4, 6, 8, 9, 12, 13
188. *Epione repandaria* (Hufnagel, 1767)	4, 7, 8, 9, 11, 12
189. *Epione vespertaria* (Linnaeus, 1767)	8, 9
190. *Epirrhoe alternata* (Muller, 1764)	4, 6, 8, 11, 12, 13
191. *Epirrhoe galiata* (Denis & Schiffermüller, 1775)	1, 4, 9
192. *Epirrhoe hastulata* (Hübner, 1790)	4
193. *Epirrhoe molluginata* (Hübner, 1813)	1, 4, 5, 6, 8
194. *Epirrhoe rivata* (Hübner, 1813)	7, 12
195. *Epirrhoe tristata* (Linnaeus, 1758)	4, 6
196. *Epirrita dilutata* (Denis & Schiffermüller, 1775)	6
197. *Erannis defoliaria* (Clerck, 1759)	4, 6
198. *Euchoeca nebulata* (Scopoli, 1763)	11, 12, 13
199. *Eulithis populata* (Linnaeus, 1758)	4, 6
200. *Eulithis prunata* (Linnaeus, 1758)	1
201. *Euphyia biangulata* (Haworth, 1809)	4
202. *Euphyia unangulata* (Haworth, 1809)	4, 6, 8, 9, 12, 13
203. *Eupithecia abietaria* (Goeze, 1781)*	4
204. *Eupithecia absinthiata* (Clerck, 1759)*	4, 6
205. *Eupithecia impurata* (Hübner, 1813)*	12
206. *Eupithecia orphnata* W. Petersen, 1909*	6
207. *Eupithecia plumbeolata* (Haworth, 1809)*	6
208. *Eupithecia pusillata* (Denis & Schiffermüller, 1775)*	4, 6, 8
209. *Eupithecia satyrata* (Hübner, 1813)*	4, 6, 8
210. *Eupithecia selinata* Herrich-Schäffer, 1861*	13
211. *Eupithecia subfuscata* (Haworth, 1809)*	4, 6, 8
212. *Eupithecia subumbrata* (Denis & Schiffermüller, 1775)*	4, 6, 8
213. *Eupithecia tenuiata* (Hübner, 1813)*	6
214. *Eupithecia venosata* (Fabricius, 1787)*	6
215. *Eupithecia virgaureata* Doubleday, 1861*	12, 13
216. *Eustroma reticulata* (Denis & Schiffermüller, 1775)	4
217. *Fagivorina arenaria* (Hufnagel, 1767)	1, 2, 4, 5, 6, 7, 8, 9, 11, 13
218. *Gandaritis pyraliata* (Denis & Schiffermüller, 1775)	4, 5, 6, 8, 9, 12, 13
219. *Geometra papilionaria* (Linnaeus, 1758)	8, 9, 11, 12, 13
220. *Gnophos dumetata* Treitschke, 1827*	4, 6, 8, 9
221. *Gnophos furvata* (Denis & Schiffermüller, 1775)	7
222. *Gymnoscelis rufifasciata* (Haworth, 1809)	4, 6, 9, 13
223. *Heliomata glarearia* (Denis & Schiffermüller, 1775)	8
224. *Hemistola chrysoprasaria* (Esper, 1795)	9
225. *Hemithea aestivaria* (Hübner, 1789)	12
226. *Horisme aemulata* (Hübner, 1813)*	1
227. *Horisme calligraphata* (Herrich-Schäffer, 1838)*	1
228. *Horisme radicaria* (de La Harpe, 1855)*	14
229. *Horisme tersata* (Denis & Schiffermüller, 1775)*	7
230. *Hydrelia flammeolaria* (Hufnagel, 1767)	4, 13
231. *Hydria undulata* (Linnaeus, 1758)	1
232. *Hydriomena furcata* (Thunberg, 1784)	9
233. *Hydriomena impluviata* (Denis & Schiffermüller, 1775)	6, 7, 8, 9, 12, 13, 14, 15
234. *Hylaea fasciaria* (Linnaeus, 1758)	9
235. *Hypomecis punctinalis* (Scopoli, 1763)	4, 8, 9, 11, 12, 13, 14
236. *Hypomecis roboraria* (Denis & Schiffermüller, 1775)	4, 5, 6, 8, 9, 12, 13, 14
237. *Hypoxystis pluviaria* (Fabricius, 1787)	12

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List of recorded species	Locality numbers
238. *Idaea aversata* (Linnaeus, 1758)	4, 5, 6, 8, 9, 11, 12, 13
239. *Idaea biselata* (Hufnagel, 1767)	4, 9, 13
240. *Idaea degeneraria* (Hübner, 1799)	6
241. *Idaea distinctaria* (Boisduval, 1840)*	9
242. *Idaea pallidata* (Denis & Schiffermüller, 1775)*	6
243. *Jodis lactearia* (Linnaeus, 1758)	6, 9, 11, 13
244. *Lampropteryx suffumata* (Denis & Schiffermüller, 1775)	7, 9, 12
245. *Ligdia adustata* (Denis & Schiffermüller, 1775)	6, 9, 11, 12
246. *Lomaspilis marginata* (Linnaeus, 1758)	1, 4, 6, 8, 9, 12, 13
247. *Lomographa bimaculata* (Fabricius, 1775)	8, 11, 12
248. *Lomographa temerata* (Denis & Schiffermüller, 1775)	1, 11
249. *Macaria alternata* (Denis & Schiffermüller, 1775)	6, 11, 12, 13
250. *Macaria liturata* (Clerck, 1759)	1, 4, 6, 8, 9
251. *Macaria notata* (Linnaeus, 1758)	13
252. *Macaria signaria* (Hübner, 1809)	6, 9, 13
253. *Melanthia procellata* (Denis & Schiffermüller, 1775)	8, 9, 11, 12, 13, 15
254. *Mesoleuca albicillata* (Linnaeus, 1758)	4, 7, 9, 11, 12, 13, 14
255. *Mesotype verberata* (Scopoli, 1763)	2
256. *Nebula nebulata* (Treitschke, 1828)	1
257. *Nothocasis sertata* (Hübner, 1817)	6, 12
258. *Nycterosea obstipata* (Fabricius, 1794)	12
259. *Odontopera bidentata* (Clerck, 1759)	4, 8, 9, 11, 12
260. *Opisthograptis luteolata* (Linnaeus, 1758)	4, 5
261. *Ourapteryx sambucaria* (Linnaeus, 1758)	13
262. *Paradarisa consonaria* (Hübner, 1799)	11, 12
263. *Parectropis similaria* (Hufnagel, 1767)	4, 6, 8, 9, 12, 13, 14, 15
264. *Pareulype berberata* (Denis & Schiffermüller, 1775)	12
265. *Pasiphila debiliata* (Hübner, 1817)	4, 12
266. *Pasiphila rectangulata* (Linnaeus, 1758)	12
267. *Peribatodes rhomboidaria* (Denis & Schiffermüller, 1775)	5, 6, 7, 9, 11, 12, 13, 14
268. *Peribatodes secundaria* (Denis & Schiffermüller, 1775)	4, 9, 13
269. *Perizoma affinitata* (Stephens, 1831)	4, 6, 9
270. *Perizoma albulata* (Denis & Schiffermüller, 1775)	4, 6, 8
271. *Perizoma alchemillata* (Linnaeus, 1758)	1, 4, 5, 9, 11, 12, 13
272. *Perizoma blandiata* (Denis & Schiffermüller, 1775)	9
273. *Perizoma hydrata* (Treitschke, 1829)	6
274. *Perizoma minorata* (Treitschke, 1828)	1
275. *Perizoma obsoletata* (Herrich-Schäffer, 1838)	1, 4, 6
276. *Petrophora chlorosata* (Scopoli, 1763)	9, 11, 12
277. *Philereme vetulata* (Denis & Schiffermüller, 1775)	8
278. *Plagodis dolabraria* (Linnaeus, 1767)	4, 8, 11, 13
279. *Plagodis pulveraria* (Linnaeus, 1758)	4, 6, 8, 9, 11, 12, 13
280. *Pseudopanthera macularia* (Linnaeus, 1758)	6, 9, 12
281. *Psodos quadrifaria* (Sulzer, 1776)	2, 3
282. *Pungeleria capreolaria* (Denis & Schiffermüller, 1775)	4, 5, 6, 7, 8, 9, 11, 12, 15
283. *Rhodometra sacraria* (Linnaeus, 1767)	5, 6
284. *Rhodostrophia vibicaria* (Clerck, 1759)	4
285. *Scopula immorata* (Linnaeus, 1758)	8, 9, 11, 12
286. *Scopula immutata* (Linnaeus, 1758)*	12
287. *Scopula incanata* (Linnaeus, 1758)*	1
288. *Scopula ornata* (Scopoli, 1763)	5, 6, 9
289. *Scopula ternata* Schrank, 1802*	1

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	List of recorded species	Locality numbers
290.	*Scopula tessellaria* (Boisduval, 1840)	8
291.	*Scotopteryx bipunctaria* (Denis & Schiffermüller, 1775)	1, 6, 8
292.	*Scotopteryx chenopodiata* (Linnaeus, 1758)	4, 5, 6, 7, 8, 9
293.	*Scotopteryx luridata* (Hufnagel, 1767)	1, 2, 6
294.	*Scotopteryx moeniata* (Scopoli, 1763)	1, 6
295.	*Selenia dentaria* (Fabricius, 1775)	11, 13
296.	*Selenia lunularia* (Hübner, 1788)	12, 13
297.	*Selenia tetralunaria* (Hufnagel, 1767)	8, 9, 11, 12, 13
298.	*Siona lineata* (Scopoli, 1763)	1, 4, 6, 8, 9, 12
299.	*Stegania cararia* (Hübner, 1790)	12
300.	*Thera britannica* (Turner, 1925)	4
301.	*Thera cognata* (Thunberg, 1792)	1, 4, 8
302.	*Thera variata* (Denis & Schiffermüller, 1775)	1, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 15
303.	*Thera vetustata* (Denis & Schiffermüller, 1775)	4, 5, 6, 8, 9, 12
304.	*Timandra comae* Schmidt, 1931	5
305.	*Triphosa dubitata* (Linnaeus, 1758)	1, 4, 5
306.	*Xanthorhoe biriviata* (Borkhausen, 1794)	7, 11, 12, 13
307.	*Xanthorhoe designata* (Hufnagel, 1767)	1, 4, 6
308.	*Xanthorhoe ferrugata* (Clerck, 1759)	4, 8, 11, 12, 13
309.	*Xanthorhoe fluctuata* (Linnaeus, 1758)	1, 4, 5, 6, 12, 13
310.	*Xanthorhoe montanata* (Denis & Schiffermüller, 1775)	1, 4, 5, 6, 7, 8, 9, 12, 13, 15
311.	*Xanthorhoe quadrifasiata* (Clerck, 1759)	1, 11, 13
312.	*Xanthorhoe spadicearia* (Denis & Schiffermüller, 1775)	4, 5, 8, 9, 13
	Erebidae	**1**
313.	*Arctia aulica* (Linnaeus, 1758)	8
314.	*Arctia plantaginis* (Linnaeus, 1758)	1, 2, 8
315.	*Arctornis l-nigrum* (Muller, 1764)	1, 4, 5, 6, 8, 9, 13
316.	*Atolmis rubricollis* (Linnaeus, 1758)	4, 12, 13
317.	*Callimorpha dominula* (Linnaeus, 1758)	4, 6, 7, 8, 9, 12, 13
318.	*Calliteara pudibunda* (Linnaeus, 1758)	5, 6, 7, 9, 11, 12, 14, 15
319.	*Calyptra thalictri* (Borkhausen, 1790)	5
320.	*Catocala electa* (Vieweg, 1790)	9, 12
321.	*Catocala elocata* (Esper, 1787)	8
322.	*Catocala fraxini* (Linnaeus, 1758)	9, 12
323.	*Catocala nupta* (Linnaeus, 1767)	12
324.	*Cybosia mesomella* (Linnaeus, 1758)	1, 4, 5
325.	*Diacrisia sannio* (Linnaeus, 1758)	8, 9
326.	*Diaphora mendica* (Clerck, 1759)	6
327.	*Dysauxes ancilla* (Linnaeus, 1767)	9, 12, 13
328.	*Dysgonia algira* (Linnaeus, 1767)	5
329.	*Eilema caniola* (Hübner, 1808)	1, 5, 6, 8, 9, 11, 12, 13
330.	*Eilema complana* (Linnaeus, 1758)	5, 6, 9
331.	*Eilema depressa* (Esper, 1787)	4, 6, 8, 9, 11, 12, 13
332.	*Eilema griseola* (Hübner, 1803)	9, 13
333.	*Eilema lurideola* (Zincken, 1817)	5, 6
334.	*Eilema lutarella* (Linnaeus, 1758)	1
335.	*Eilema sororcula* (Hufnagel, 1766)	1, 6, 8, 9, 13
336.	*Eublemma ostrina* (Hübner, 1808)	5
337.	*Eublemma parva* (Hübner, 1808)	6, 9
338.	*Eublemma purpurina* (Denis & Schiffermüller, 1775)	4
339.	*Euclidia glyphica* (Linnaeus, 1758)	1, 2, 3, 4, 8, 9, 10, 12
340.	*Euclidia mi* (Clerck, 1759)	2, 3, 8

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	List of recorded species	Locality numbers
341.	*Euplagia quadripunctaria* (Poda, 1761)	11, 12, 13
342.	*Euproctis similis* (Fuessly, 1775)	13
343.	*Herminia grisealis* (Denis & Schiffermüller, 1775)	4, 6, 7, 8, 9, 11, 12, 13, 14, 15
344.	*Herminia tarsicrinalis* (Knoch, 1782)	4, 6, 7, 8, 9, 11, 12, 13, 15
345.	*Herminia tarsipennalis* (Treitschke, 1835)	6, 9, 15
346.	*Hypena crassalis* (Fabricius, 1787)	4, 8
347.	*Hypena proboscidalis* (Linnaeus, 1758)	5, 9, 11, 12, 13, 15
348.	*Idia calvaria* (Denis & Schiffermüller, 1775)	5, 6, 8
349.	*Laspeyria flexula* (Denis & Schiffermüller, 1775)	4, 5, 7, 9, 11, 12, 13
350.	*Lithosia quadra* (Linnaeus, 1758)	4, 5, 8, 9, 11, 12, 13
351.	*Lygephila craccae* (Denis & Schiffermüller, 1775)	5, 6, 13, 15
352.	*Lygephila pastinum* (Treitschke, 1826)	5, 6, 9
353.	*Lymantria monacha* (Linnaeus, 1758)	4, 5, 6, 8, 9, 11, 12, 13
354.	*Miltochrista miniata* (Forster, 1771)	7, 8, 9, 11, 12, 13
355.	*Orectis proboscidata* (Herrich-Schäffer, 1851)	11, 12
356.	*Paracolax tristalis* (Fabricius, 1794)	4, 6, 9, 12, 13
357.	*Parascotia fuliginaria* (Linnaeus, 1761)	4, 5, 6, 7, 9
358.	*Parasemia plantaginis* (Linnaeus, 1758)	1, 2, 5, 6, 8, 9
359.	*Pechipogo strigilata* (Linnaeus, 1758)	4, 8, 12
360.	*Phragmatobia fuliginosa* (Linnaeus, 1758)	4, 6, 9, 11, 12
361.	*Phytometra viridaria* (Clerck, 1759)	4, 6, 8, 9, 12
362.	*Polypogon gryphalis* (Herrich-Schäffer, 1851)	12
363.	*Polypogon tentacularia* (Linnaeus, 1758)	4
364.	*Rhyparia purpurata* (Linnaeus, 1758)	8
365.	*Rivula sericealis* (Scopoli, 1763)	6, 8, 9, 10, 12
366.	*Schrankia costaestrigalis* (Stephens, 1834)	12, 13
367.	*Schrankia taenialis* (Hübner, 1809)	11
368.	*Scoliopteryx libatrix* (Linnaeus, 1758)	5, 6
369.	*Spilosoma lubricipeda* (Linnaeus, 1758)	8, 9, 12
370.	*Spilosoma lutea* (Hufnagel, 1766)	6, 7, 8, 9, 11, 12, 14, 15
371.	*Trisateles emortualis* (Denis & Schiffermüller, 1775)	1, 4, 6, 9, 11, 12, 13
	Noctuidae	
372.	*Abrostola asclepiadis* (Denis & Schiffermüller, 1775)*	6
373.	*Abrostola triplasia* (Linnaeus, 1758)*	6, 8, 12
374.	*Acontia trabealis* (Scopoli, 1763)	12
375.	*Acronicta aceris* (Linnaeus, 1758)	1, 12, 13
376.	*Acronicta alni* (Linnaeus, 1767)	1, 4
377.	*Acronicta euphorbiae* (Denis & Schiffermüller, 1775)	9
378.	*Acronicta leporina* (Linnaeus, 1758)	9
379.	*Acronicta psi* (Linnaeus, 1758)*	1, 4, 6, 9, 12, 13
380.	*Acronicta rumicis* (Linnaeus, 1758)	6
381.	*Acronicta strigosa* (Denis & Schiffermüller, 1775)	11, 12, 13
382.	*Actinotia polyodon* (Clerck, 1759)	5, 6, 9
383.	*Actinotia radiosa* (Esper, 1804)	4, 6
384.	*Aedia leucomelas* (Linnaeus, 1758)	6
385.	*Agrochola macilenta* (Hübner, 1809)	5
386.	*Agrotis exclamationis* (Linnaeus, 1758)	1, 8, 9, 11
387.	*Agrotis ipsilon* (Hufnagel, 1766)	9, 11, 12, 13
388.	*Agrotis segetum* (Denis & Schiffermüller, 1775)	9
389.	*Allophyes oxyacanthae* (Linnaeus, 1758)	13
390.	*Ammoconia caecimacula* (Denis & Schiffermüller, 1775)	5
391.	*Amphipoea fucosa* (Freyer, 1830)*	6

Continued

List of recorded species	Locality numbers
392. *Amphipoea oculea* (Linnaeus, 1761)*	4, 6, 9
393. *Amphipyra berbera* Rungs, 1949*	9, 13
394. *Amphipyra perflua* (Fabricius, 1787)	13
395. *Amphipyra pyramidea* (Linnaeus, 1758)*	1, 6, 7, 9, 11, 12, 13, 15
396. *Amphipyra tragopoginis* (Clerck, 1759)	4, 5, 9
397. *Anaplectoides prasina* (Denis & Schiffermüller, 1775)	1, 4, 5, 6, 8, 9, 13
398. *Anarta trifolii* (Hufnagel, 1766)	1
399. *Apamea crenata* (Hufnagel, 1766)	9
400. *Apamea epomidion* (Haworth, 1809)	1, 6, 8, 12
401. *Apamea furva* (Denis & Schiffermüller, 1775)	1
402. *Apamea illyria* Freyer, 1846	1, 6
403. *Apamea lateritia* (Hufnagel, 1766)	1, 4, 6
404. *Apamea lithoxylaea* (Denis & Schiffermüller, 1775)	6, 12
405. *Apamea monoglypha* (Hufnagel, 1766)	1, 4, 6, 8, 9, 12, 13
406. *Apamea oblonga* (Haworth, 1809)	1, 6
407. *Apamea platinea* (Treitschke, 1825)	1
408. *Apamea remissa* (Hübner, 1809)	1, 6, 8
409. *Apamea rubrirena* (Treitschke, 1825)	1, 4, 6
410. *Apamea scolopacina* (Esper, 1788)	5, 6
411. *Apamea sicula* (Turati, 1909)	1, 4, 6
412. *Apamea sordens* (Hufnagel, 1766)	4, 6
413. *Apamea sublustris* (Esper, 1788)	5, 6
414. *Asteroscopus sphinx* (Hufnagel, 1766)	13
415. *Atethmia centrago* (Haworth, 1809)	11
416. *Athetis lepigone* (Möschler, 1860)	4, 13
417. *Atypha pulmonaris* (Esper, 1790)	1, 4, 5, 6, 7, 8, 9, 12
418. *Auchmis detersa* (Esper, 1787)	5, 6, 11, 12
419. *Autographa bractea* (Denis & Schiffermüller, 1775)	4
420. *Autographa gamma* (Linnaeus, 1758)	1, 4, 5, 7, 8, 9, 11, 12
421. *Autographa jota* (Linnaeus, 1758)	1, 4, 5, 6, 8, 9, 12, 15
422. *Autographa pulchrina* (Haworth, 1809)	1, 5, 6, 8, 9
423. *Axylia putris* (Linnaeus, 1761)	7, 9, 11, 12
424. *Calliergis ramosa* (Esper, 1786)	4, 6
425. *Callopistria juventina* (Stoll, 1782)	12, 13
426. *Callopistria latreillei* (Duponchel, 1827)	11
427. *Caradrina aspersa* Rambur, 1834*	4
428. *Caradrina gilva* (Donzel, 1837)*	1
429. *Caradrina morpheus* (Hufnagel, 1766)*	6, 9
430. *Ceramica pisi* (Linnaeus, 1758)	1, 4, 5, 6, 8, 9
431. *Charanyca ferruginea* (Esper, 1785)	1, 5, 6, 7, 8, 9, 11, 12
432. *Charanyca trigrammica* (Hufnagel, 1766)	4, 5, 6, 7, 8, 9, 11, 12, 15
433. *Chersotis cuprea* (Denis & Schiffermüller, 1775)	1, 4, 6
434. *Chersotis multangula* (Hübner, 1803)	1
435. *Cleoceris scoriacea* (Esper, 1789)	5, 6
436. *Colocasia coryli* (Linnaeus, 1758)	1, 5, 6, 8, 9, 11, 12, 13, 14, 15
437. *Conistra rubiginea* (Denis & Schiffermüller, 1775)	4, 13
438. *Conistra vaccinii* (Linnaeus, 1761)	6, 11, 13
439. *Cosmia pyralina* (Denis & Schiffermüller, 1775)	13
440. *Cosmia trapezina* (Linnaeus, 1758)	1, 4, 5, 9, 13, 15
441. *Craniophora ligustri* (Denis & Schiffermüller, 1775)	9, 11, 12, 13
442. *Cryphia algae* (Fabricius, 1775)*	5, 13
443. *Cucullia lucifuga* (Denis & Schiffermüller, 1775)	9

Continued

List of recorded species	Locality numbers
444. *Deltote pygarga* (Hufnagel, 1766)	4, 5, 6, 7, 8, 9, 11, 12, 13
445. *Diachrysia chrysitis* (Linnaeus, 1758)	6, 8, 9, 12
446. *Diachrysia chryson* (Esper, 1789)	8, 9, 15
447. *Diachrysia stenochrysis* (Warren, 1913)	6
448. *Diarsia brunnea* (Denis & Schiffermüller, 1775)*	1, 4, 5, 6, 7, 8, 9, 12, 13
449. *Dypterygia scabriuscula* (Linnaeus, 1758)	11
450. *Eucarta amethystina* (Hübner, 1803)	11, 12
451. *Eucarta virgo* (Treitschke, 1835)	12
452. *Euchalcia modestoides* Poole, 1989	1
453. *Euchalcia variabilis* (Piller, 1783)	1, 4, 6
454. *Eugnorisma depuncta* (Linnaeus, 1761)	4, 5, 6, 8, 9, 13
455. *Euplexia lucipara* (Linnaeus, 1758)	4, 6, 8, 9, 11, 12, 13
456. *Eupsilia transversa* (Hufnagel, 1766)	4, 13
457. *Euxoa decora* (Denis & Schiffermüller, 1775)	1, 6
458. *Euxoa nigricans* (Linnaeus, 1761)	4
459. *Gortyna flavago* (Denis & Schiffermüller, 1775)	4, 9, 15
460. *Hadena caesia* (Denis & Schiffermüller, 1775)	1
461. *Hadena capscincola/bicruris*	6
462. *Hadena compta* (Denis & Schiffermüller, 1775)	1
463. *Hadena confusa* (Hufnagel, 1766)	1, 4, 5, 6, 8, 9, 11
464. *Hadena filograna* (Esper, 1788)	1
465. *Helicoverpa armigera* (Hübner, 1808)	6, 9, 12
466. *Hoplodrina blanda* (Denis & Schiffermüller, 1775)*	5
467. *Hoplodrina respersa* (Denis & Schiffermüller, 1775)*	6
468. *Hydraecia micacea* (Esper, 1789)*	6
469. *Hydraecia petasitis* Doubleday, 1847	9, 12
470. *Hyppa rectilinea* (Esper, 1788)	4, 6
471. *Ipimorpha retusa* (Linnaeus, 1761)	12
472. *Lacanobia contigua* (Denis & Schiffermüller, 1775)*	4
473. *Lacanobia suasa* (Denis & Schiffermüller, 1775)*	1, 4, 6
474. *Lacanobia thalassina* (Hufnagel, 1766)*	8
475. *Lacanobia w-latinum* (Hufnagel, 1766)*	9
476. *Lasionycta imbecilla* (Fabricius, 1794)	4, 6, 7, 8, 9
477. *Leucania comma* (Linnaeus, 1761)	1, 4, 5, 6, 8, 9
478. *Lithophane consocia* (Borkhausen, 1792)	4
479. *Lithophane ornitopus* (Hufnagel, 1766)	6
480. *Lithophane semibrunnea* (Haworth, 1809)*	6, 9
481. *Lycophotia porphyrea* (Denis & Schiffermüller, 1775)	1, 4, 7, 8
482. *Macdunnoughia confusa* (Stephens, 1850)	13
483. *Mamestra brassicae* (Linnaeus, 1758)	12
484. *Melanchra persicariae* (Linnaeus, 1761)	4, 6, 13
485. *Mesapamea secalis* (Linnaeus, 1758)*	1, 9
486. *Mesoligia furuncula* (Denis & Schiffermüller, 1775)	4
487. *Mniotype satura* (Denis & Schiffermüller, 1775)	5, 6, 9, 12, 13, 15
488. *Moma alpium* (Osbeck, 1778)	6, 12, 14
489. *Mormo maura* (Linnaeus, 1758)	12
490. *Mythimna albipuncta* (Denis & Schiffermüller, 1775)	1, 4, 6, 8, 9, 12
491. *Mythimna conigera* (Denis & Schiffermüller, 1775)	1, 4, 5, 6, 7, 8, 9, 12
492. *Mythimna ferrago* (Fabricius, 1787)	1, 5, 6, 9, 11, 12, 13
493. *Mythimna impura* (Hübner, 1808)	4, 5, 8, 9
494. *Mythimna l-album* (Linnaeus, 1767)	12
495. *Mythimna pallens* (Linnaeus, 1758)	8

Continued

	List of recorded species	Locality numbers
496.	*Mythimna turca* (Linnaeus, 1761)	6, 11, 12
497.	*Mythimna unipuncta* (Haworth, 1809)	9, 12
498.	*Mythimna vitellina* (Hübner, 1808)	5, 9, 12
499.	*Noctua comes* Hübner, 1813	1, 4, 5, 6, 9
500.	*Noctua fimbriata* (Schreber, 1759)	1, 4, 6, 7, 8, 9, 11, 12, 13
501.	*Noctua janthe* (Borkhausen, 1792)*	1
502.	*Noctua janthina* Denis & Schiffermüller, 1775*	5, 11
503.	*Noctua pronuba* (Linnaeus, 1758)	1, 4, 6, 9, 11, 12
504.	*Noctua tirrenica* Biebinger, Speidel & Hanigk, 1983*	1
505.	*Ochropleura plecta* (Linnaeus, 1761)	4, 5, 6, 8, 9, 11, 12
506.	*Oligia latruncula* (Denis & Schiffermüller, 1775)*	1, 4
507.	*Oligia strigilis* (Linnaeus, 1758)*	4
508.	*Oligia versicolor* (Borkhausen, 1792)*	1, 12
509.	*Panchrysia v-argenteum* (Esper, 1798)	1, 8
510.	*Panemeria tenebrata* (Scopoli, 1763)	5, 8
511.	*Panthea coenobita* (Esper, 1785)	1, 4, 6, 12, 13
512.	*Parastichtis suspecta* (Hübner, 1817)	1
513.	*Phlogophora meticulosa* (Linnaeus, 1758)	5, 9
514.	*Phlogophora scita* (Hübner, 1790)	4
515.	*Photedes morrisii* (Dale, 1837)	8
516.	*Polia nebulosa* (Hufnagel, 1766)	8, 9, 12, 13
517.	*Polychrysia moneta* (Fabricius, 1787)	4, 5, 6
518.	*Polyphaenis sericata* (Esper, 1787)	5, 9
519.	*Pseudeustrotia candidula* (Denis & Schiffermüller, 1775)	13
520.	*Pyrrhia umbra* (Hufnagel, 1766)	5
521.	*Rhyacia simulans* (Hufnagel, 1766)	1
522.	*Sideridis reticulata* (Goeze, 1781)	8
523.	*Sideridis rivularis* (Fabricius, 1775)	9
524.	*Subacronicta megacephala* (Denis & Schiffermüller, 1775)	9, 12
525.	*Thalpophila matura* (Hufnagel, 1766)	5, 6, 9
526.	*Tholera cespitis* (Denis & Schiffermüller, 1775)	4, 8, 9
527.	*Tholera decimalis* (Poda, 1761)	4, 6, 9, 11
528.	*Tiliacea aurago* (Denis & Schiffermüller, 1775)	6
529.	*Trachea atriplicis* (Linnaeus, 1758)	13
530.	*Xanthia togata* (Esper, 1788)	5, 6, 13
531.	*Xestia ashworthii* (Doubleday, 1855)	1
532.	*Xestia baja* (Denis & Schiffermüller, 1775)	5, 6, 8, 9, 11
533.	*Xestia castanea* (Esper, 1798)	6, 12
534.	*Xestia c-nigrum* (Linnaeus, 1758)	1, 5, 6, 8, 9, 12, 13
535.	*Xestia ditrapezium* (Denis & Schiffermüller, 1775)	9
536.	*Xestia stigmatica* (Hübner, 1813)	1, 12
537.	*Xestia triangulum* (Hufnagel, 1766)	9
538.	*Xestia xanthographa* (Denis & Schiffermüller, 1775)	4, 6, 9, 11, 12
	Nolidae	
539.	*Nola aerugula* (Hübner, 1793)	12
540.	*Pseudoips prasinana* (Linnaeus, 1758)	1, 4, 8, 9, 11, 12, 13
	Notodontidae	
541.	*Cerura vinula* (Linnaeus, 1758)	11
542.	*Clostera anachoreta* (Denis & Schiffermüller, 1775)	5, 9
543.	*Clostera curtula* (Linnaeus, 1758)	8, 9
544.	*Clostera pigra* (Hufnagel, 1766)	1, 4, 6, 8, 9, 12
545.	*Drymonia dodonaea* (Denis & Schiffermüller, 1775)	1, 4, 6, 8, 9, 11, 12

Continued

List of recorded species	Locality numbers
546. *Drymonia melagona* (Borkhausen, 1790)	11, 12, 13, 14
547. *Drymonia querna* (Denis & Schiffermüller, 1775)	12
548. *Furcula bifida* (Brahm, 1787)	4, 6, 8
549. *Furcula furcula* (Clerck, 1759)	1, 4
550. *Gluphisia crenata* (Esper, 1785)	12
551. *Harpyia milhauseri* (Fabricius, 1775)	1, 5
552. *Leucodonta bicoloria* (Denis & Schiffermüller, 1775)	9
553. *Notodonta dromedarius* (Linnaeus, 1767)	12, 13
554. *Notodonta tritophus* (Denis & Schiffermüller, 1775)	8, 9
555. *Notodonta ziczac* (Linnaeus, 1758)	8, 9, 12
556. *Phalera bucephala* (Linnaeus, 1758)	1, 2, 4, 6, 8, 9, 12, 14
557. *Phalera bucephaloides* (Ochsenheimer, 1810)	1, 6, 13, 15
558. *Pheosia tremula* (Clerck, 1759)	9, 13
559. *Pterostoma palpina* (Clerck, 1759)	9, 12
560. *Ptilodon capucina* (Linnaeus, 1758)	1, 4, 6, 8, 9, 11, 12, 14
561. *Ptilodon cucullina* (Denis & Schiffermüller, 1775)	1, 6, 12, 13
562. *Ptilophora plumigera* (Denis & Schiffermüller, 1775)	4, 6, 12, 13, 15
563. *Spatalia argentina* (Denis & Schiffermüller, 1775)	4, 6
564. *Stauropus fagi* (Linnaeus, 1758)	1, 4, 6, 8, 9, 11, 12, 13, 14, 15

*Species identification was also based on the examination of male or female genital structures.

Hepialidae

Pharmacis carna (Denis & Schiffermüller, 1775) (Fig. 3a)

The distribution of this species ranges from the Alpine arc in Europe to the Far North of Russia (Leraut, 2006). It is typically found at higher elevations, above 1000 meters, and is associated with alpine meadows and rocky terrains. The closest recorded locations to Croatia are in Crna Prst and Mojstrovka in Slovenia, and Mt Bjelašnica in Bosnia and Herzegovina (Stauder, 1933). The species has not been found in Croatia previously, making this an addition to the country's fauna (Gumhalter *et al*., 2023).

Phymatopus hecta (Linnaeus, 1758) (Fig. 3b)

The distribution of this species ranges from Europe to Siberia and Japan. In Europe, it is present from Ireland and Scotland to Scandinavia and Finland, Italy and northern Balkans (Leraut, 2006). So far there are only a few records from Croatia, mostly from the inland region including Krapina (Abafi-Aigner, 1910) and Koprivnica (Kranjčev, 1985) as well in the mountains near Ogulin (Koča, 1901). The closest record to Risnjak NP is from Kupa river, but it remains unclear if the record originates from Croatia or Slovenia (Mladinov, 1976).

Crambidae

Pyrausta falcatalis Guenée, 1854 (Fig. 3c)

The distribution of this species is relatively restricted, ranging from France to Ukraine but excluding the northern and southern parts of Europe. It is typically found in montane areas, including forests and valleys at elevations of up to 2000 meters above sea level (Slamka, 2013). Only a few historical records of this species exist in Croatia from Rijeka, Kraljevica and Josipdol (Abafy-Aigner *et al*., 1896; Koča, 1925; Mann, 1867). This is the first record of the species in Croatia for almost a century.

Geometridae

Macaria signaria (Hübner, 1809)

This holarctic species is present across Europe and Asia and throughout temperate North America (Skou & Sihvonen, 2015). While being a rather common species, living in small populations in Europe, in Croatia it is rather local and rare with only a handful of records from Zagreb (Mihoci, 2012; Vukotinović, 1879), Josipdol (Mann, 1867) and Papuk (Kočа, 1901). The last record from Croatia originates from 1922 (Mihoci, 2012), making this the first record in the last 100 years.

Eustroma reticulata (Denis & Schiffermüller, 1775) (Fig. 3d)

Eustroma reticulata is an Euroasiatic species that is present in temperate areas of Europe, ranging from central France and southern Fennoscandia to the Urals (Hausmann & Viidalepp, 2012). Although the distribution map in the Geometridae of Europe series does not include Croatia, this species is indeed present in the country, as it has been recorded in Rijeka (Kovačević & Franjević-Oštrc, 1978), and in several localities in the Podravina region (Kranjčev, 1985). The record from Risnjak is the only recent observation of this species and expands its known distribution in the country. *Eustroma reticulata* is considered endangered, with populations declining throughout Europe, and it is already extinct in many localities of its former occurrence (Hausmann & Viidalepp, 2012).

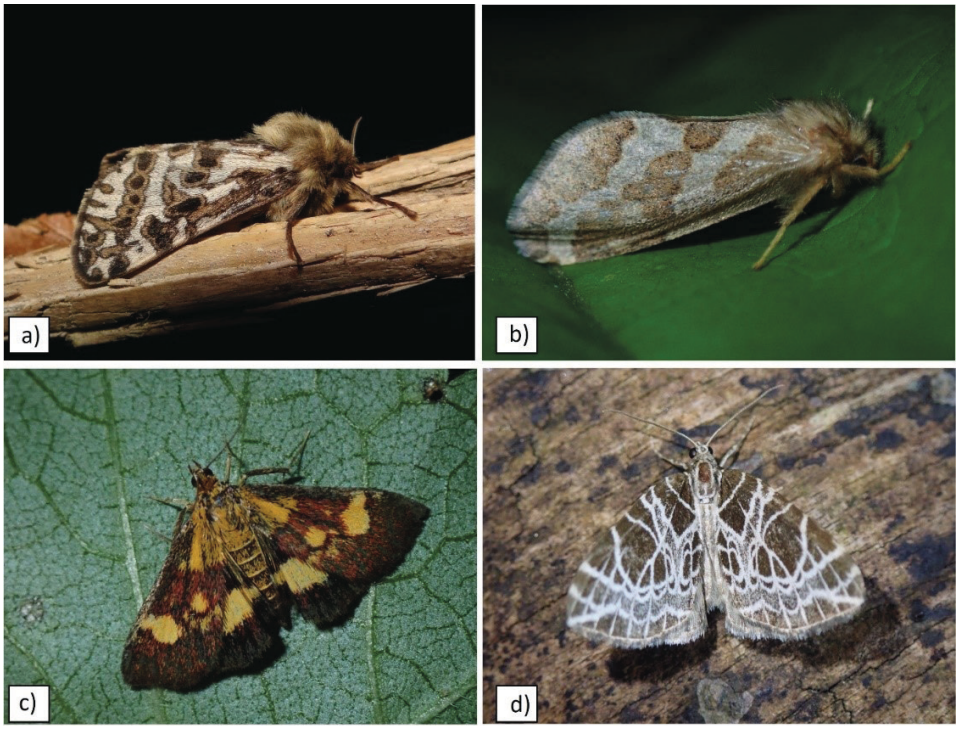

Fig. 3. Some interesting species recorded during moth surveys. a) *Pharmacis carna*, b) *Phymatopus hecta*, c) *Pyrausta falcatalis*, d) *Eustroma reticulata*.

Horisme aemulata (Hübner, 1813) (Fig. 4a)

This is a Euroasiatic species that is typically found in boreo-montane areas. Its distribution within Europe is limited to the Pyrenees, Alps, Carpathians, and the mountains of the northern Balkan peninsula (Hausmann & Viidalepp, 2012). The discovery of *Horisme aemulata* on Mt Risnjak is noteworthy, as it has not been recorded for Croatia (Mihoci, 2012), and is also absent from the distribution map in the series "The Geometrid Moths of Europe" (Hausmann & Viidalepp, 2012). This further emphasizes the alpine character of Risnjak NP and its unique position in the country.

Erebidae

Arctia aulica (Linnaeus, 1758) (Fig. 4b)

This is a Eurasian species present from France across central, northern and eastern Europe, across Asia to Japan (Witt & Ronkay, 2011). The distribution map in the series "Noctuidae Europeaea" does not include Croatia (Witt & Ronkay, 2011), but several historical records do exist (Jurinac, 1884; Mann, 1867, 1857; Rebel, 1910; Stauder, 1930). The last record originates from the Žumberak area, from the 1st of June 1924 (Mladinov, 1958). Accordingly, this is the first record of *A. aulica* in Croatia in the last 90 years.

Noctuidae

Amphipyra perflua (Fabricius, 1787) (Fig. 4c)

This species is distributed across Europe, throughout Siberia to the Pacific Ocean, as well as in Turkey, Transcaucasia, and the Caucasus (Fibiger *et al*., 2007). It is typically found in warm, moist forests, particularly in oak woodlands with a good population of hazel, which is the main food source for the larvae. The moths are active from mid-July to September and are attracted to light and sugar. This species is generally rare and local. Its populations are known to fluctuate greatly, and it may disappear from an area for longer period of time before being recorded again (Fibiger *et al*., 2007). So far this species has been recorded only in Zagreb for Croatia (Mladinov, 1958; Vukotinović, 1879). The last record is from the 6th of September 1932 (Mladinov, 1958), making this the only record in the country in the last 90 years.

Apamea platinea (Treitschke, 1825) (Fig. 4d)

Apamea platinea belongs to the grey Noctuidae whose colour depends on the colour of the rocky substrate in its habitat (Zilli *et al*., 2005). It is present in southern Europe, the Mediterranean region, and the Near East, including Iran (Zilli *et al*., 2005). This species is a typical of xeric biotopes, mostly found in rocky habitats, dry mountain slopes, prairies, and steppes (Zilli *et al*., 2005). In southern parts of its range, it can be found at middle or high elevations, always in the most xeric areas of the mountains. In Croatia, prior to this survey it was known only from two mountain chains, Mt Učka (Mladinov & Lorković, 1985) and the mountains of Velebit (Stauder, 1925).

Apamea rubrirena (Treitschke, 1825) (Fig. 5a)

The distribution of this species extends from western Europe to northern Eurasia, including the Russian Far East and North East, Korea, and Japan, making it a Eurasiatic species (Zilli *et al*., 2005). It is typically found in temperate to cold forests, particularly in the montane forest belt, and can thrive in coniferous, broad-leaved, or mixed

Fig. 4. Some interesting species recorded during moth surveys. a) *Horisme aemulata*, b) *Arctia aulica*, c) *Amphipyra perflua*, d) *Apamea platinea*.

woodland habitats. Although the distribution map in the Noctuidae Europaea series (Zilli *et al*., 2005) suggests it has a wide distribution in Croatia, this is not the case. In fact, only a single literature record exists for the country, specifically from Mt Velebit (Mladinov, 1985). Accordingly, this is the second record of the species in Croatia, and it fills a distribution gap between the populations in Slovenia (Carnelutti, 1992) and Bosnia and Herzegovina (Rebel, 1904).

Hydraecia petasitis Doubleday, 1847 (Fig. 5b)

This hygrophilous species is Euro-Siberian in distribution and probably covers the range in whichits foodplants, such as *Petasites* spp., grow. Its main habitats include stream and brook valleys, lake shores, cool and humid areas, dark rock walls covered by forests, and the edges of marshy and swampy forests. The flight period is from July to September, and, while the moths are good flyers, they are rarely observed far from their hostplants. During the day, they rest on the stems or deep in the dense stands of the foodplants, and start flying at dusk (Zilli *et al*., 2005). However, records are scarce, and it occurs in the northern and central parts of Europe, avoiding the far Nordic and southernmost parts of the continent (Zilli *et al*., 2005). In Croatia, this species was recorded on Lička Plješevica and in Podravina region (Kučinić, 1992; Mladinov & Lorković, 1985). The record from Risnjak significantly expands its known range toward the west.

Lithophane consocia (Borkhausen, 1792) (Fig. 5c)

This Euro-Siberian species is distributed in the northern and central parts of Eurasia, appearing locally and rarely in southern Europe while being more common in the forest-steppe belt of Siberia (Ronkay *et al*., 2001). It was recorded in Croatia only 20 years ago, and the record from the island Krk was the only one for the country (Habeler, 2003). A single specimen was collected in Risnjak NP during this survey, indicating the rarity of the species in the surveyed area. On the other hand, this species flies from the beginning of September to the end of December and, after hibernating, from March to May (Ronkay *et al*., 2001). This is a very cold period in Risnjak, and the moth trapping is usually difficult due to the small number of recorded moths in the traps and/or the light tents. So, it is possible that the species is more common in the area but needs additional targeted surveys during autumn and spring.

Lasionycta imbecilla (Fabricius, 1794) (Fig. 5d)

This is a Siberian-Mongolian species. In Central and S. Europe, it typically inhabits isolated, high-altitude regions in the upper montane and subalpine zones. In Southeast Europe, the species is limited to the northern boundary of the grass steppe belt (Hacker et al., 2002). Although this species was common within Risnjak and frequently found in groups near the light traps, the observations represent the first recorded sightings of the species in Croatia. The closest records to Risnjak are from Slovenia (Carnelutti, 1992) and Bosnia and Herzegovina (Stauder, 1926).

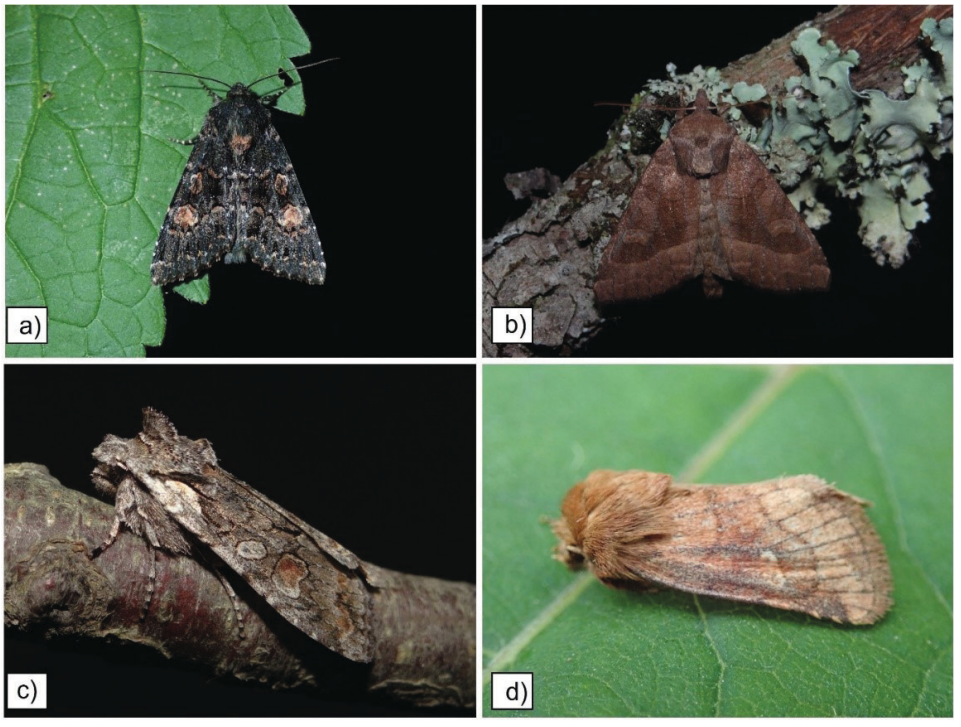

Fig. 5. Some interesting species recorded during moth surveys. a) *Apamea rubrirena*, b) *Hydraecia petasitis*, c) *Lithophane consocia*, d) *Lasionycta imbecilla*.

Polychrysia moneta (Fabricius, 1787) (Fig. 6a)

This species inhabits the Western Palaearctic, with its occurrence ranging across central and northern regions of Europe, some parts of Asia Minor, Turkey, Armenia, Azerbaijan, the main chain of the Caucasus, and western Iran (Goater *et al*., 2003). Only a single published record exists for Croatia, from Brušane, Mt Velebit (Abafi-Aigner, 1910). The record from Risnjak NP represents the second observation of this species in Croatia and the first one in more than 100 years.

Panchrysia v-argenteum (Esper, 1798) (Fig. 6b)

This European-Alpine species occurs sporadically in the Alps, and mountains in the Balkans and Greece (Goater *et al*., 2003). It inhabits dense grasslands on calcareous ground, as well as rocky walls and gorges, and steep subalpine slopes with stands of *Thymus* spp. (Goater *et al*., 2003). This is a rather rare species in Croatia, only known from Rijeka (Abafy-Aigner *et al*., 1896) and Istria (Mladinov & Lorković, 1985).

Caradrina gilva (Donzel, 1837) (Fig. 6c)

This Ponto-Mediterranean species is distributed in the south of Europe, southern parts of central Europe and the Near East (Fibiger *et al*., 2007). It is a xeromontane species usually found at higher elevations, although it is also present on limestone grasslands at lower altitudes in the northern part of the range (Fibiger *et al*., 2007). This concurs with two previous records from Croatia, both originating from the lowland areas, one from Krk island (Habeler, 2003) and one from sandy areas in Podravina (Kranjčev, 1985). The record of this species in Risnjak NP indicates that montane populations of this species also exist in Croatia.

Xestia ashworthii (Doubleday, 1855)

This Euroasiatic species is distributed across the mountain chains of Europe with several described subspecies (Fibiger, 1993). It inhabits open rocky areas in the subalpine zone of the mountains (Fibiger, 1993). In Croatia, this species has been known only from Mt Biokovo (Mladinov & Kučinić, 1993). Accordingly, Risnjak is a new locality for this species in Croatia. Within Risnjak NP it was recorded only on Guslica peak, where it was numerous and common.

Notodontidae

Leucodonta bicoloria (Denis & Schiffermüller, 1775) (Fig. 6d)

This prominent species is distributed from Ireland to the south of Scandinavia and from Russia to Japan, but missing from the southern parts of Europe (Leraut, 2006). Its only record in Croatia originates from the Podravina region (Kranjčev, 1985). During this survey only a single specimen was recorded in Risnjak NP, possibly indicating its rarity in the area.

Fig. 6. Some interesting species recorded during moth surveys. a) *Polychrysia moneta*, b) *Panchrysia v-argenteum*, c) *Caradrina gilva*, d) *Leucodonta bicoloria*.

CONCLUSIONS

The Risnjak National Park is a predominantly forested area, with forests covering over 96% of its surface (Gašparac *et al*., 2017). The forest are in a good conservation state, represent the typical potential vegetation of the area and are generally not managed (Gašparac *et al*., 2017).

The grasslands and meadows of Risnjak NP are of greater concern for the long-term survival of Lepidoptera. Although the Park features mountain meadows, these occupy only a small fraction of the total area. True mountain meadows are found at the peaks of Guslica, Risnjak, and Snježnik. During the winter months, heavy winds often blow away the snow from the peaks, exposing plants to extreme climatic conditions, including low temperatures and physiological drought resulting from permanently frozen substrates. As a result, the area primarily features low perennial plants, and annual species are notably absent since the vegetation season is too short for their full development (Gašparac *et al*., 2017).

The issue of meadow succession is particularly pronounced at lower altitudes, presenting a challenge in the whole region of Gorski Kotar. The area's poor demographic picture compounds this problem, as more and more former hayfields and pastures are being overtaken by forests. Although this may benefit residents by providing a source of heating during the long winter months, it is contributing to a decline in the biological diversity of meadow species, including Lepidoptera. The decline is already apparent from the studies on the butterflies of Risnjak, where species diversity is generally very low compared to other mountainous areas of Croatia (Koren *et al*., 2021).

The diversity of moth species remains poorly understood, particularly in mountain habitats lacking recent surveys of moth fauna. To ensure the long-term conservation of Lepidoptera diversity, it is crucial to protect existing meadow complexes and, where feasible, expand grassland areas by clearing marginal portions of the forests. The meadow complexes of Leska and Šegina are especially critical, as their peripheral parts exhibit visible signs of late-stage succession. Fortunately, meadows are regularly maintained and mowed, with park staff actively removing trees and shrubs encroaching on the grasslands. While this is currently the only method for conserving the meadows, the long-term restoration of extensive grazing to at least some of Risnjak's meadow habitats is necessary.

The condition of meadows in the Kupa river valley is equally concerning, as these small grasslands are now entirely enclosed by forests from all sides. Lepidoptera migrations are limited to a narrow corridor along the Kupa River, but this pathway is also restricted, lacking open areas between the meadows near the Kupa spring and Hrvatsko at the valley's entrance. The situation is particularly alarming when the earliest available aerial images of the valley from 1968 (accessible at: https://ispu.mgipu.hr) are compared with the current state. The images clearly demonstrate that at least half of the former grasslands have been lost by forest expansion; many intermediary grasslands, which once connected meadows by the Kupa River valley to the grasslands in the northern part of the area, are entirely absent. The abandonment of the closest village to the spring, Kupari, has contributed to this loss.

While this research did not cover all groups of moths, such as many families of Microlepidoptera, it still represents a valuable contribution to our understanding of the moths inhabiting Risnjak National Park. It serves as a solid foundation for future research and monitoring efforts aimed at deepening our knowledge of moth species of this area. Moreover, this study is one of the few recent research projects carried in the mountainous regions of Croatia, aside from those conducted on Mt Biokovo (Gumhalter & Kučinić, 2021; Mladinov & Kučinić, 1993). The results provide valuable baseline data on moth species richness and composition in the area, which can be used for further studies and conservation efforts.

In recent times, mountainous areas in Croatia have been relatively well studied in terms of butterfly populations, with several published studies (Koren *et al*., 2020; Koren & Lauš, 2013; Mihoci *et al*., 2007; Tvrtković *et al*., 2015). However, knowledge of moth species remains limited in much of the country. As climate change becomes increasingly prevalent, manifesting itself primarily in shorter and milder winters in mountainous regions (Gašparac *et al*., 2017), mountain Lepidoptera will become even more vulnerable. This has been proven for butterflies, which are shifting their distribution toward the summits (Rödder *et al*., 2021), but on low altitude mountains like the ones in this study, local extinction events are more likely (Franco *et al*., 2006).

ACKNOWLEDGMENTS

A part of this survey was done during the Interreg V–A Slovenia-Croatia 2014–2020 project "Veze prirode" supported by the European Union and co-financed by the European Regional Development Fund. The author is thankful to Stjepan Grevinger, Risnjak National Park, for logistic support.

Received January 18, 2024

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