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NEW RECORDS OF THE BAT HAWKMOTH, *HYLES VESPERTILIO* (ESPER, 1780) (LEPIDOPTERA: SPHINGIDAE) IN CROATIA, BOSNIA AND HERZEGOVINA AND SERBIA

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Abstract

New records of *Hyles vespertilio* (Esper, 1780) are reported from Croatia, Bosnia and Herzegovina and Serbia. In Croatia, a single specimen was recorded on Mt. Biokovo, within the Biokovo Nature Park, southern Croatia. This is the first record in the country in 44 years. In Bosnia and Herzegovina, the species was recorded at 11 localities within or in the near surroundings of the Blidinje Nature Park. This species is new to the fauna of Bosnia and Herzegovina and is the 20th Sphingidae species recorded in the country. In Serbia, the species was recorded in Krajinoviće, Mt. Giljeva. This is the third known record and the first observation for this country in 32 years. The preferred host plant, *Epilobium dodonaei*, is present at all the studied localities in Croatia and Bosnia and Herzegovina, but the caterpillars were not surveyed during this work. These findings could be treated as resident populations of the bat hawkmoth, since the species is considered nonmigratory, and the host plant is present in the study areas.

KEY WORDS: Balkan Peninsula, Nature Park Blidinje, Nature Park Biokovo, distribution, moth fauna

Introduction

Hawkmoths (Lepidoptera: Sphingidae) are a widely distributed family of insects, present in every continent except Antarctica. They are medium-to-large sized moths, with robust hairy bodies and forewing sizes between 16 and 90 mm. They are fast and strong fliers, known to hover at the same altitudes for some time (e.g. when feeding using their long proboscises) with their wings narrow and tapering to enable such flight.

Many species of Sphingidae are powerful migrants, covering great distances between different continents (Pittaway, 1993; Leraut, 2006). The caterpillars of hawkmoths are usually easily recognizable due to their large size and the curved horn on the eighth abdominal segment (Leraut, 2006).

More than 1400 species and about 200 genera of Sphingidae have been described worldwide (Kitching & Cadiou, 2000). In Europe, about 40 species have been recorded so far (de Jong *et al.*, 2014). In Croatia, 22 species have been recorded to date (Koča, 1900, 1901; Grund, 1918; Kranjčev, 1985; Habeler, 2003; Koren, 2018). Recent publications about the distribution and status exist only for the rare *Hemaris croatica* (Esper, 1800) (Koren *et al*., 2011) and *Proserpinus proserpina* (Pallas, 1772) (Koren, 2019). In Bosnia and Herzegovina, 19 Sphingidae species are known to occur (Rebel, 1904; Georgijević, 1976; Anđus, 1986; Sijarić, 1991; Lelo, 2004), but recent data are lacking for most of them. In Serbia, 20 species are known so far (Vasić *et al*., 1978, Habiprot, 2022)

While many sphingids are migratory and may occur far from their habitats with preferred host plants, some species are more resident and are usually only recorded at the exact habitat. Thus, the records of such species are often scarce compared to their migratory relatives. One such species is the bat hawkmoth, *Hyles vespertilio* (Esper, 1780). It is easily recognizable, with almost uniform slate-grey forewings and reddish hindwings. Dark wing markings are indistinct, and this character could be used to distinguish it from other similar species of the genus *Hyles* (Pittaway, 2022). This species is endemic to the western Palaearctic region, distributed from France, across central and eastern Europe up to Georgia, Armenia and Azerbaijan (Pittaway, 2022). It is similar to *Hyles euphorbiae* (Linnaeus, 1758) in its feeding, mating, and activity behavior (Pittaway, 2022). During the day, adults usually rest on the ground, amongst rocks and pebbles. They tend to remain undisturbed and unnoticed as the wing and body coloration of the adults blends very well into the environment.

Herein we present new records of *Hyles vespertilio* in Croatia, Bosnia and Herzegovina, and Serbia and a tentative overview of the species' distribution on the Balkan Peninsula.

Materials and methods

Most of the data from Bosnia and Herzegovina was gathered during a survey conducted between 16th June and 4th July, 2021 on the territory of Blidinje Nature Park and its surroundings, in the high mountain area of northern Herzegovina. The study was part of a regional collaboration on biodiversity research and the development of Biologer, an open platform for collecting biodiversity data in southeastern Europe (Popović *et al.*, 2020). The record from Croatia was gathered during an entomological survey of Biokovo Nature Park. The record from Serbia was obtained from the administrators of the database Alciphron (HabiProt, 2014).

Two light-trapping methods powered by 12 V batteries were used during our field surveys. The first method used 6W heath moth traps that were left at the locality throughout the night and collected in the morning. The second method used light tents consisting of a white sheet and a 230-W UV lamp. Depending on the researcher, 2-4 heath traps or 8 light tents were used per locality. Voucher specimens are deposited in the Lepidopterological Collection Koren in Zagreb.

In addition to recent field observations, the distribution of *H. vespertilio* was complemented from the available literature and the Alciphron database (HabiProt, 2014) and used to create distribution maps covering the Balkan Peninsula. The following references were used: Croatia (Koča, 1901; Abafi-Aigner, 1902; Grund, 1918; Mladinov, 1958; Kovačević & Franjević-Oštrc, 1978; Vukotinović, 1879), Serbia (Vasić *et al*., 1978; Jakšić, 1986), and the record from Krajinoviće is only the second record for the country and the first one in 44 years, Montenegro (Vasić *et al*., 1990), Slovenia (Carnelutti, 1992; Fajčík, 2003), Hungary (Sáfián &

Hadarics, 2005), Northern Macedonia (Krpač *et al*., 2019), Albania (Rebel, 1913; Rebel & Zerny, 1934; Beshkov & Nahirnić, 2019), Bulgaria (Ganev, 1984) and Greece (Weidlich, 2012).

Results and discussion

During this survey, *H. vespertilio* (Fig. 1) was recorded at 11 localities in Bosnia and Herzegovina, one in Croatia and one in Serbia (Fig. 2).

Figure 1. *Hyles vespertilio* (Esper, 1780) from Bosnia and Herzegovina, Masna Luka, Jasle, 28.vi.2021. Photo by T. Koren

Examined material

Bosnia and Herzegovina: Loc. 1. Trebiševo, Dugi brig, 43.707476 N, 17.488639 E, 1339 m a.s.l., 30.06.2021, leg. T. Koren; Loc. 2. Blidinje Nature Park, Vran Mt., Kedžara, Balinski dolac, 43.701894 N, 17.529927 E, 1527 m a.s.l., 30.06.2021, leg. T. Koren; Loc. 3. Blidinje Nature Park, Vran Mt., Kedžara, Vrtlaci, 43.694134 N, 17.538405E, 1471 m a.s.l., 30.06.2021, leg. T. Koren; Loc. 4. Blidinje Nature Park, Sovićka vrata, Kamen, 43.688395 N, 17.598874 E, 1246 m a.s.l., 30.06.2021, leg. M. Martinović; Loc. 5. Doljanka River valley, Sovići, Kraje, 43.701130 N, 17.620888 E, 733 m a.s.l., 04.07.2021, leg. M. Martinović; Loc. 6. Blidinje Nature Park, Dugo polje, Podborje, 43.641461 N, 17.510565 E, 1242 m a.s.l., 03.07.2021, leg. M. Martinović; Loc. 7.

Blidinje Nature Park, Masna luka, Jasle, 43.632109 N, 17.546347 E, 1232 m a.s.l., 28.06.2021, leg. T. Koren; Loc. 8. Blidinje Nature Park, Blidinje Lake, south side, 43.600013 N, 17.502538 E, 1189 m a.s.l., 02.07.2021, leg. D. Kulijer; Loc. 9. Blidinje Nature Park, Vitrinjača, SW of Blidinje Lake, on the road Blidinje - Rakitno, 43.581865 N, 17.46744 E, 1380 m a.s.l., 29.06.2021, leg. T. Koren; Loc. 10. Čabulja Mt., Rosne poljane, 43.532622 N, 17.508142 E, 1388 m a.s.l., 02.07.2021, leg. T. Koren; Loc. 11. Neretva River canyon, Drežnica, Čitluk, 43.520641 N, 17.739037 E, 467 m a.s.l., 29.08.2021, leg. D. Kulijer.

Croatia: Nature Park Biokovo, below the peak Sv. Jure, 43.339164 N, 17.053701 E, 1583 m a.s.l., 10.06.2021, obs. B. Lauš.

Serbia: Giljeva Mt., Krajinoviće, north of the settlement, 43.190277 N, 19.894725 E, 1417 m a.s.l., 30.07.2018, photographed by V. Vučković (available at: https://alciphron.habiprot.org.rs/listing-443813-hyles-vespertilio).

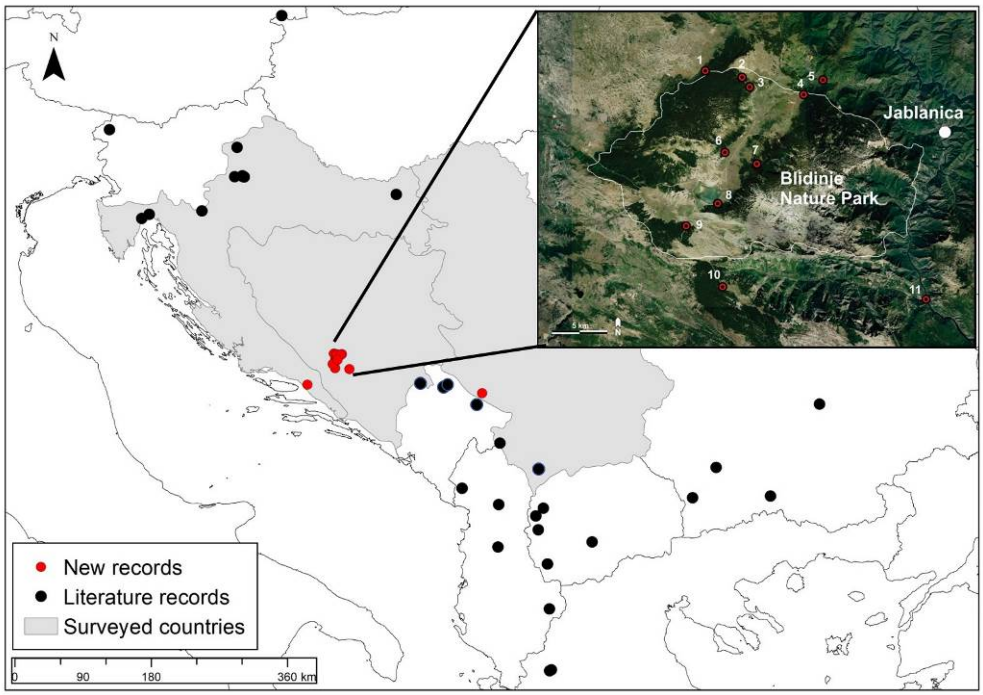

Figure 2. New records of *Hyles vespertilio* (Esper, 1780) in Croatia, Bosnia and Herzegovina and Serbia with the available literature records for the region.

For Bosnia and Herzegovina, no previous records of bat hawkmoth exist (Rebel, 1904; Georgijević, 1976; Anđus, 1985; Lelo, 2004; Sijarić, 1991; Hanjalić & Lelo, 2015). According to these literature sources, this is the 20th Sphingidae species recorded in the country. As it was very common during our survey across Blidinje, it is to be expected that the species will be recorded on other mountains in the country with similar habitats and altitude range.

In Croatia, the occurrence of this species is known, but most of the records are based on historical data (Koča, 1901; Abafi-Aigner, 1902; Grund, 1918; Mladinov, 1958; Vukotinović, 1879), with the most recent one from 44 years ago (Kovačević & Franjević-Oštrc, 1978).

While published work regarding recent moth diversity in Croatia is rather scarce (Habeler, 2003; Koren *et al*., 2015; Koren, 2018; Veljković, 2019; Vignjević *et al*., 2010), extensive field surveys are being conducted across the country, collecting data for future publication. The record from Mt. Biokovo is the first of *H. vespertilio* according to the authors' knowledge. Accordingly, statements found in the available literature about *H. vespertilio* being common in Croatia (Sáfián & Hadarics, 2005) are far from correct. Even in areas around Zagreb where the species was historically recorded several times (Grund, 1918; Vukotinović, 1879), it was not recorded during the recent survey (Koren, 2020). Indeed, we can conclude that *H. vespertilio* belongs to one of the rarest resident species in the country.

The locality on which it was recorded, Mt. Biokovo, has been surveyed for some time (Mladinov & Kučinić, 1993; Gumhalter & Kučinić, 2020), including by the authors in the last several years at the exact locality, but this species was not recorded prior to the current survey.

In Serbia, this species is historically known from the area of Prokletije (Vasić *et al*., 1978) and Prizrenska Bistrica (Jakšić, 1986). The record from Krajinoviće is only the third record for the country and the first in 32 years.

The distribution and status of this species on the Balkan Peninsula is not well known, and literature on the distribution of Sphingidae in the area do not exist. Accordingly, we tried to create a distribution map with known occurrences on the Peninsula. The map is probably not complete, but it can be a good starting point for future surveys. In general, not many records of *H. vespertilio* are known for the wider area of the Balkan Peninsula (Fig. 2).

In Slovenia, this species is seemingly scarce, though present (Carnelutti, 1992; Fajčík, 2003). In Hungary, the presence of this species was noted only recently (Sáfián & Hadarics, 2005). In Northern Macedonia, several historical as well more recent records exist (Krpač *et al*., 2019). In Montenegro, the only available records are from the Durmitor area (Tara, Budečevica, Taren Canyon, Đurđevića Tara, Bistrica, Šćepan Polje) (Vasić *et al*., 1990). In Albania, this species has been recorded from several localities (Rebel, 1913; Rebel & Zerny, 1934; Beshkov & Nahirnić, 2019). Only a few records were available for Bulgaria (Ganev, 1984) and Greece (Weidlich, 2012), while the occurrence of *H. vespertilio* in Romania is uncertain and no exact records exist (Chimi, 2010).

The habitat of the species is described as well-drained, open, sunny, south-facing, gravel/scree slopes in warm, dry valleys and hot shingle riverbanks (Pittaway, 2022). The habitat on Mt. Biokovo (Fig. 3A) can be described as steep grassland with large rocks and boulders near a beech forest. In Bosnia and Herzegovina, it was recorded in several different habitats including rocky pastures, montane grasslands with large rocks and forest edges in montane valleys (Fig. 3B). These habitats correspond to the needs of the host plants of its larvae. The caterpillars of *H. vespertilio* feed on the genus *Epilobium*, especially *E. dodonaei* Vill. (syn. *E. rosmarinifolium* Haenke and *Chamaenerion angustissimum* (Weber) D. Sosn.). It can also be found on *Oenothera* spp. and, occasionally, *Galium* spp. (Pittaway, 2022).

Epilobium dodonaei is an herbaceous perennial plant species belonging to the vegetation class of mountain screes (*Thlaspietea rotundifolii*) (Raven, 2001; Kalníková *et al*., 2021). It is considered as pioneer vegetation of montane and submontane open gravel bar habitats, developing in extreme ecological conditions at places with the constant movement of the geological substrate. It is also common in anthropogenically altered habitats whose properties are closely related to the original habitats, like railway embankments, quarries, sandpits, gravel-pits or mine dumps (Smejkal, 1997; Milanović *et al*., 2015; Ranđelović *et al*., 2016; Kalníková *et al*., 2021).

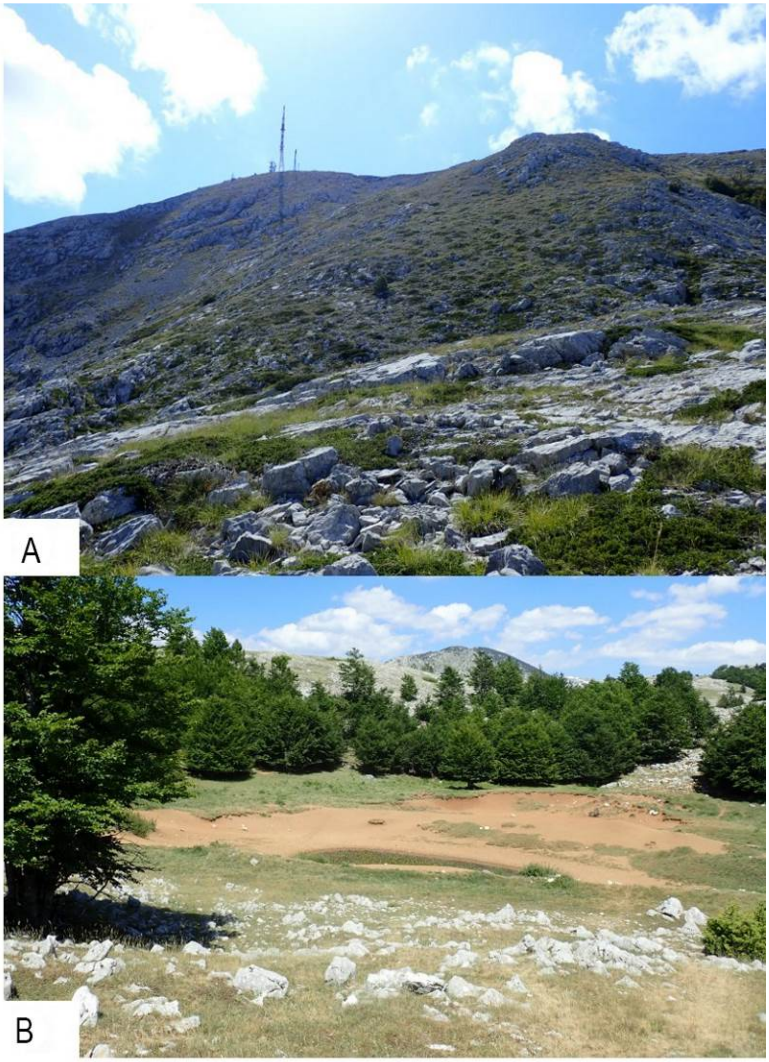

Figure 3. Habitats of *Hyles vespertilio* (Esper, 1780): A – Habitat on Mt. Biokovo below the peak Sv. Jure, B – Habitat at Blidinje Nature Park, Vitrinjača, SW of Blidinje Lake.

According to Milanović *et al.* (2015), in Bosnia and Herzegovina, *E. dodonaei* is characteristic species of pioneer vegetation on gravel shores around fast and cold mountain streams. This vegetation type is classified in Natura 2000 habitat type: 3220 Alpine rivers and the herbaceous vegetation along their banks. In the study area, the vegetation of the screes is rich, diverse and present on the entire vertical profile of this high mountain region, including the communities with *E. dodonaei* (Redžić *et al*., 2011). In the Neretva River canyon, this species has also been reported as very abundant along railway tracks (Riter-Studnička, 1956). *Epilobium dodonaei* in Croatia is ecologically connected to sandy and rocky places but also to dry ruderal sites of the western part of the country and the coastal regions, including Mt. Biokovo (Nikolić, 2015-2022; Strgulc Krajšek *et al*., 2009).

Over most of its range, the bat hawkmoth is usually bivoltine, with the first generation flying in May/June and the second, partial-to-full, in August/September (Pittaway, 2022). The records from Croatia and most records from Bosnia and Herzegovina thus correspond to the first, while the record from Serbia and one record from Bosnia and Herzegovina (Neretva River canyon, Drežnica, Čitluk) correspond to the second generation of this species. With the presence of its host plant, as well as the nonmigratory character of this species (Pittaway, 2022), it is most likely that the recorded populations in Croatia and Bosnia and Herzegovina, and probably Serbia as well, are resident to the respected areas. During this study, we did not search for caterpillars, but this is a good method for surveying the presence of the species and should be done in future. Caterpillars can be found from June to July and again in September on the host plant (Sáfián & Hadarics, 2005).

As the imago is active during the night, light trapping is a good method to record this species. During our survey, all but two specimens were collected using heath moth traps. The only exceptions were the single specimen recorded at Masna Luka, Blidinje and the specimen from the Neretva River canyon (Loc. 11). The specimen from Masna Luka arrived rather late to the light trap, around 12 pm. The specimen from the Neretva River canyon was found during the day inside a restaurant. On all other localities, specimens were recorded in the morning while emptying heath moth traps. At most localities in Bosnia and Herzegovina, several specimens were present in each trap. All the observed specimens were probably fresh, but some were damaged in the traps, as quite a large number of moths were recorded at each locality. Accordingly, the use of heath traps that are active during the whole night seems to be a good way of recording this species and should be used in the future.

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НОВИ НАЛАЗИ ЉИЉКА *HYLES VESPERTILIO* (ESPER, 1780) (LEPIDOPTERA: SPHINGIDAE) У ХРВАТСКОЈ, БОСНИ И ХЕРЦЕГОВИНИ И СРБИЈИ

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Извод

Нови налази љиљка *Hyles vespertilio* (Esper, 1780) су пријављени из Хрватске, Босне и Херцеговине и Србије. У Хрватској, једна јединка је забележена на Биокову, у оквиру Парка природе Биоково на југу државе. Ово је први податак за Хрватску након 44 године. У Босни и Херцеговини, врста је забележена на 11 локалитета у оквиру или у близини Парка природе Блидиње. Врста је новозабележена за фауну Босне и Херцеговине, и то је 20. врста љиљка (Sphingidae) забележена у држави. У Србији је врста забележена у Крајиновићу, на планини Гиљева, а представљени податак је трећи за државу и први након 32 године. Преферирана биљка хранитељка ове врсте је *Epilobium dodonaei* и присутна је на свим истраживаним локалитетима у Хрватској и Босни и Херцеговини, иако гусенице нису забележене током теренских истраживања. С обзиром на чињеницу да врста није миграторна, те да је на истраживаним локалитетима присутна и биљка хранитељка, највероватније је да су забележене популације ове врсте сталне.

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