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## **DISTRIBUTION OF THE OLIVE BEE HAWK MOTH, *HEMARIS CROATICA* (ESPER, 1800) (LEPIDOPTERA, SPHINGIDAE) IN CROATIA**

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The Olive Bee Hawk moth, *Hemaris croatica* (Esper, 1800) is a day-flying moth described from Karlovac, Croatia, more than 200 years ago. From that time, only scattered data about its distribution in Croatia were known, without any systematic overview of its total distribution. To obtain a complete picture on the distribution of this species, literature and collection data from the two largest Croatian museums were examined. Also, recently collected data were added to create the first detailed distribution map that included 90 records in total, originating from 51 different localities. The majority of records cover the Mediterranean part of the country; regardless of this, the species has also been described from the continental region. We assume that records from the alpine and continental parts of the country can probably be assigned to the migratory activity of this species. It seems that its distribution is connected with the presence of one of its main larval host plants, of the genus *Cephalaria*, but further research is needed for confirmation.

### ***Hemaris croatica*, hawkmoths, Sphingidae, distribution**

T. KOREN, M. BJELIĆ, F. PEROVIĆ, M. ŠAŠIĆ, I. MIHOČ i M. KUČINIĆ: Rasprostranjenje hrvatske golupke *Hemaris croatica* (Esper, 1800) (Lepidoptera: Sphingidae) u Hrvatskoj. Entomol. Croat. Vol. 15. Num. 1-4: 255-264.

Hrvatska golupka je vrsta iz porodice noćnih leptira ljljaka, izrazite dnevne aktivnosti, opisana iz okolice Karlovca prije više od 200 godina. Od toga razdoblja pa sve do danas postoje tek sporadična publicirana opažanja ove vrste, bez sveobuhvatnog pregleda njezine rasprostranjenosti u Hrvatskoj. Radi distribucije hrvatske golupke prikupljena je i pregledana sva dostupna literatura te zbirke leptira dvaju najvećih hrvatskih prirodoslovnih muzeja. Podatci prikupljeni tijekom zadnjih godina pridodani su literaturnim i muzejskim, a radi

pregleda prve detaljne distribucije ove vrste na području Hrvatske. Temeljem navedenih izvora, hrvatska golupka u Hrvatskoj je zabilježena 90 puta na 51 lokaciji. Većina nalaza ove vrste prikupljena je u mediteranskom dijelu zemlje, iako je vrsta prvi put bila opisana iz kontinentalnoga dijela. Činjenica da su nalazi u alpskom i kontinentalnom dijelu Hrvatske tek malobrojni i pojedinačni može upućivati na to da su posljedica migratorne aktivnosti ove vrste. Čini se da je distribucija ove vrste u Hrvatskoj povezana sprisutnošću jedne od glavnih biljaka hraniteljica za gusjenice roda *Cephalaria*, no za pravu potvrdu takve povezanosti potrebna su daljnja istraživanja.

***Hemaris croatica*, ljljci, Sphingidae, distribucija**

## Introduction

The Olive Bee Hawkmoth, *Hemaris croatica* (Esper, 1800), with a wingspan ranging from 34-40 mm in males and 40-46 mm in females, is one of smallest species of the hawkmoth family (Sphingidae) occurring in Europe. It is easily distinguished from other western Palearctic hawkmoths by the intensive olive coloration of forewings, and fully scaled wings (Macek et al., 2007). *H. croatica* is a ponto-Mediterranean species (Macek et al., 2007) distributed from eastern Italy (Sala & Bettini, 2005), Switzerland, through the Balkans, Bulgaria, Turkey towards Lebanon, Israel, Crimea, Ukraine and Russia (Pittaway, 1993; Macek et al., 2007). Some records from the border area of its distribution can probably be attributed to the migratory activity of this species, which is very common behavioural pattern in the Sphingidae family (Macek et al., 2007).

*Hemaris croatica* was described from Karlovac (Karlstadt) Croatia. The morphology of this species varies little, so only two subspecies can be distinguished, the nominate subspecies *Hemaris croatica croatica* (Esper, 1800) distributed in the entire distribution area, and *Hemaris croatica fahira* de Freina, 2004 described from Luristan Province, western Iran (de Freina, 2004).

The Olive Bee hawk moth is active during sunny days, when it has been observed nectaring (Leraut, 2006) especially in the hottest part of the day from 9 till 15 (Macek et al., 2007). This species has two generations per year throughout most of its range, being found from the end of April till July, and again during August and September. *H. croatica* is a xerothermophilous species, inhabiting mainly lowland karst area and steppes (Macek et al., 2007). In Southern Russia, the habitats are the calcipetrite slopes of the steppe riverbanks with calciphyte vegetation where adults of this moth have been observed feeding on *Jurinea* spp. and

*Cephalaria* spp. (Poltavsky & Stradomsky, 2004). The females lay eggs singly on the underside of leaves of the host plants *Asperula*, *Cephalaria* and *Scabiosa* (Efetov & Budashkin, 1990; Leraut, 2006). The larvae of this species are highly variable, as in many other hawkmoth species. They are mostly bright green with speckled white spots (Pittaway, 1997-2011). The overwintering stage is a pupa that has a reddish brown coloration. There are no data from Croatia about the biology, ecology, oviposition or behaviour of this species.

This species is interesting to Croatian entomologists for two reasons; it is the symbol of the Croatian Entomological Society, and it is the only species of hawk moths described from Croatia, and named after the country. Accordingly, and because of the very limited knowledge about the distribution of *H. croatica* in Croatia, we wanted to contribute to the knowledge about its distribution in our country. As well as the literature data, data from the museum specimens and newly collected data have been considered. We also wanted to see if the distribution of this species in Croatia follows the distributions of its main larva food plants of the genera *Asperula*, *Cephalaria* and *Scabiosa*, and if so, if it is limited to the areas in which those food plants are present. Its presence in different regions of Croatia is also discussed.

## Materials and Methods

### Literature data:

In a total of 21 papers, records of *H. croatica* in Croatia were found, out of 300 mentioning lepidopteran diversity in the country. These are:

Esper, 1800 (1); Germar, 1817 (2); Mann, 1857 (3); Mann, 1869 (4); Werner, 1895 (5); Abafy-Aigner et al, 1896 (6); Nicholl, 1899 (7); Abafy-Aigner, 1910 (8); Rebel 1913 (9); Grund, 1918 (10); Zerny, 1920 (11); Schawerda, 1921 (12); Stauder, 1923 (13); Schwingenschuss & Wagner, 1925-1927 (14); Seyer, 1938 (15); Bartol et al, 1964 (16); Burgermeister, 1964 (17); Mladinov, 1965 (18); Habeler, 1976 (19); Hafner, 1994 (20); Habeler, 2003 (21).

### Data from museum collections:

To obtain data about the distribution of this species we overviewed the entomological collections of two natural history museums in Croatia: the Croatian Natural History Museum (CHNM) in Zagreb (Central Collection of Lepidoptera

and the Lorković Collection) and the Košćec Collection from the Entomological Department of the Varaždin City Museum. The collections of CHNM keep several specimens of *H. croatica*, while the museum in Varaždin had none.

#### Field data

During field trips in different parts of Croatia during the last decade, the authors collected several new data. The data were collected sporadically.

### Results

To simplify the presentation, results have been discussed in terms of three biogeographical zones: Mediterranean, Alpine and continental, and each zone has been divided into regions (e.g. Istria, Rijeka and Kvarner, Gorski Kotar, Lika, Kordun, Slavonia and Dalmatia). For each record, the following data have been provided: locality, date, number of specimens, observer or legator.

#### Mediterranean

##### Istria:

- Lovran (9); Coastal part of Istria and Kvarner (12).
- Records from CHNM: Mošćenička Draga, 3.VI.1967, leg. Lorković.
- New records: Plomin, 28.VI.2007, 2 ex, leg. Kučinić.

##### Rijeka and Kvarner:

- Jablanac (10); Krk Island, Buka (21); Krk Island: Čižići (21); Krk Island, Hrustina (Hrusta) (21); Krk Island, Konobe (21); Krk Island, Krk (16); Krk Island, Punat (16, 21); Krk Island, Punat cemetery (21), Krk Island, Stara Baška (21); Krk Island, Treskavac (Malmašuta) (21); Krk Island, Veli Vrh (21); Novi Vinodolski (Novi) (8); Pag Island, Caska (18); Pag Island, Senj (Zenng) (8, 10); Šilo Island (15); Zaglav (18); Rijeka (Fiume) (3, 8, 13).
- Records from CHNM: Jablanac, X.1908; leg. Grund; Jablanac, 29.VII.1916, leg. Gušić; Krk Island, Kornić, 31.VII.1916, leg. Gušić; Novi Vinodolski, 15.VI.1975, leg. Lorković; Pag Island, Caska, 24.VI.1960, 26.VI.1960; 27.VI.1960, 28.VI.1960, 8.VIII.1960, 27.VI.1962, leg. Mladinov (CHNM); Pag Island, Pag, 10.VII.1930, leg. Lorković; Pag Island, Zaglav, 26.VI.1956, leg. Mladinov; Ričine stream, Novi Vinodolski, 2.VI.1973, obs. Lorković.

- New records: Pag Island, Novalja, leg. Perović.

#### Dalmatia:

- Benkovac (13); Dalmatia (2, 4); Drniš (13); Dubrovnik (17); Kaštel Sućurac (13); Knin (13, 20); Ombla (Val d'Ombla) (7); Omiš (13); Pelješac, Kučište (5); Perković (13); Raljevac, near Knin (20); Siverić (13); Slivno (15); Split (Spalato) (7, 11, 13); Tjjesno (19); Vodice (19); Zadar (Zara) (13, 14).
- Records from CHNM: Kaštel Stari, 29.V.1937, leg. Lorković; Kaštelsko prigorje, 27.IV.1935, leg. Lorković; Starigrad, 1.VIII.1922, leg. Gušić; Zadar (Zara), leg. Kozulić.
- New records: Crveno Jezero, Imotski, 18.VII.2009, 1 ex, leg. Žganec; Dobarnica, Zrmanja tributary, 2.VII.2010, 1 ex, leg. Koren; Golubići, Krupa, obs. Perović; Knin, 23.VI.1998, 1 ex, leg. Kučinić; Knin, 1.VII.2003, 10 ex, obs. Kučinić; Neretva, estuary, 15.VI.2009, 1 ex, obs. Koren; Obrovac, 2.VII.2010, 1 ex, leg. Koren.

#### Alpine

##### Gorski Kotar:

- CHNM collection: Fužine, 1913, leg. Taborski.

##### Lika:

- New records: Plitvice Lakes, Bijela Rijeka spring, 30.VII.1997, 1 ex, leg. Kučinić; Northern Velebit, Dundovića Podi, 23.V.2009, 2 ex, leg. Mihoci.

#### Continental

- Kordun:
  - Karlovac (1, 6, 10).
- Slavonia:
  - Lipik (10).

#### Discussion

From a compilation of all the literature data and new records, it can be seen that *H. croatica* was recorded 90 times in Croatia at 51 localities (Fig. 1). Some records are the result of multiple citations of the same source, but this cannot be

completely ruled out, especially in older literature. A number of records represents the accidental work of many entomologists who researched into the moths of Croatia during the last 210 years. In most cases *H. croatica* was observed individually, with only one observation of approximately 20 individuals in the surroundings of Knin (2003, obs. Kučinić).



Figure 1. Distribution of *Hemaris croatica* in the different biogeographical regions of Croatia.

The majority of the literature records cover the Mediterranean region. The Adriatic coast and islands have always been tempting destinations for European entomologists, and most papers dealing with butterflies and moths of Croatia were done in the coastal part of the country. *Hemaris croatica* is known from two Adriatic islands: Krk and Pag. On the island of Krk Habeler (2003) collected more than 30 specimens at 10 locations as a result of continuous surveys done in the last 30 years. Eight specimens from tPag Island are held in the CHNM, six collected were collected by Mladinov, one by Lorković and one by Magerle.

Very interesting are the records from the continental region. *H. croatica* was recorded at only two locations, Karlovac and Lipik (Esper, 1800; Grund, 1918).

Karlovac is the type locality, which is interesting as this species is rare in continental Croatia, but as that part was not explored thoroughly, new records from it can be expected.

The records from Plomin (Kučinić) and Mošćenička Draga (Lorković) are the most western distribution records in Croatia. However, records from eastern Italy (Sala & Bettini, 2005) suggest that this species could be more widespread in Istria, although this species was not recorded during a survey of central Istria (Koren, unpublished data) or during research into the western coast of Istria (Daniel, 1971; Witt, 1987).

Regarding the Alpine part of the country, there are areas in which moth fauna was thoroughly surveyed without any reports of this species being made (Mladinov, 1976, 1978, 1983; Kranjčev, 1985). The record Fužine (Taborski, CHNM) is the first record from the Alpine part of Croatia.



Figure 2. Provisional distribution of the genus *Cephalaria* in Croatia with marked records of *Hemaris croatica*

While our new records show that the species is present in the Mediterranean region, there are no recent records from the continental part. In a recent study of lepidopteran diversity near the type locality Karlovac this species was not observed (Španić, personal communication). Due to there being only a few historical records originating from two localities, and no recent ones, it is possible that the records of *H. croatica* in that region can be assigned to the migratory activity rather than the presence of resident populations.

To explain the distribution of *H. croatica* in Croatia, we compared the known distribution of the moth with that of its major larval host plants: *Scabiosa*, *Asperula* and *Cephalaria*. The distributions of genera were assessed from Flora Croatica Database (Nikolić, 2011). Species from the genus *Asperula* and *Scabiosa* are distributed through the country, but that from *Cephalaria* only in the Mediterranean region, with a few isolated populations in the continental part (Fig 2). *H. croatica* and species from the genus *Cephalaria* have overlapping distributions but without observed ovipositioning on the plants from the genus, it is not possible to draw any certain conclusions.

In this paper we presented all new data on the distribution of the species in Croatia, but to determine the current and complete picture about the rarity and status of this species, more systematic and long-term surveys are needed.

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