



**THE DISTRIBUTION OF WILLOWHERB HAWKMOTH  
*PROSERPINUS PROSERPINA* (PALLAS, 1772)  
(LEPIDOPTERA, SPHINGIDAE) IN CROATIA**

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**Abstract** - The Willowherb Hawkmoth (*Proserpinus proserpina*) is a rare and local moth species bound to thermophilous forest edges and wetland habitats. It is listed in the Annex IV of the Habitats Directive. So far, only several historical records existed for this species in Croatia, the last ones being more than 30 years old. Here an overview is presented of the known historical records, as well as five new records of *P. proserpina* from different regions of the country. The known distribution has been significantly expanded toward the south. The species has been confirmed in the Dalmatian mainland in Neretva river delta and for the first time recorded on two Adriatic islands, Murter and Dugi Otok. In order to assess its conservation status, a monitoring plan should be developed and implemented in Croatia.

**KEY WORDS:** Habitats directive, Annex IV, new records, Dalmatia, Adriatic islands

**Izvleček** – RAZŠIRJENOST VRBOVČEVEGA VEŠČECA *PROSERPINUS PROSERPINA* (PALLAS, 1772) (LEPIDOPTERA, SPHINGIDAE) NA HRVAŠKEM

Vrbovčev veščec (*Proserpinus proserpina*) je redka in lokalno prisotna vrsta, vezana na tople gozdne robove in mokrišča. Vrsta je navedena v Prilogi IV Direktive o habitatih. Na Hrvaškem je bilo do sedaj znanih le nekaj zgodovinskih zapisov, starejših od 30 let. V prispevku je predstavljen pregled zgodovinskih zapisov in pet novih najdb te vrste iz različnih regij države. Znana razširjenost te vrste se je močno razširila proti jugu Hrvaške. Zabeležena je na dalmatinski obali, v delti Neretve in prvič tudi na dveh jadranskih otokih, Murterju in Dugem otoku. Če želimo oceniti varstveni status vrste je potrebno razviti in izvajati načrt spremljanja te vrste na Hrvaškem.

**KLJUČNE BESEDE:** Habitatna direktiva, Annex IV, nove najdbe, Dalmacija, Jadranski otoki

## Introduction

In Croatia, about 20 Sphingidae species have been recorded so far (Mann 1857, 1869; Vukotinović 1879; Koča 1901; Grund 1918; Mladinov 1958; Kranjčev 1985). One of the rarest and infrequently seen species is the Willowherb Hawkmoth *Proserpinus proserpina* (Pallas, 1772). This is the only one out of six belonging to the genus *Proserpinus* occurring in the Palearctic region, and the only one inhabiting Croatia. This species is distributed from the Atlas Mountains in Northwest Africa, across central and southern Europe, east through Russia, Turkey and Lebanon, northern Iran and Iraq, southern Turkmenistan and Uzbekistan to Pamir mountains (Pittaway 1993). In Europe this species is present in most of the continent, except parts of Portugal, Spain, northern areas of France, Belgium, Germany and Denmark as well as northern parts of Europe (Pittaway 1993).

It inhabits different types of moist and warm habitats, like wetlands, stream banks, damp woodland clearings, well exposed forest edges, forested river valleys, often near watercourses characterized by rich riparian vegetation (Pittaway 1993, Zilli et al. 2006). In the neighbouring Slovenia, this species inhabits ruderal areas in the early stages of overgrowth with larval host plants of the genus *Oenothera* and various wetland habitats with larval host plants of the genus *Lythrum* (Lesar & Jež 2006). Aside from those, its caterpillars feed also on willowherbs (*Epilobium* spp.) (Pittaway, 1993; Leraut, 2006). All the mentioned hostplant genera are present in Croatia and occur across the country (Nikolić 2015).

The Willowherb Hawkmoth is a univoltine species that flies for short periods at dawn and dusk from late May to early June. In some areas of Europe partial second generation is sometimes possible (Romo et al. 2012). It pupates at shallow depth in the ground, overwintering in this stage (Collins & Wells 1987). The adults can live in captivity for two to three weeks (Harbich 1996).

This species is listed in the Annex IV of the Habitats Directive, meaning that a strict protection regime must be applied across its natural range, both inside and outside Natura 2000 ecological network. However, it is not mentioned in the list of Strictly protected species of Croatia (Anonymous 2016). According to the IUCN Red List it has a Data Deficient (DD) status due to the severely fragmented populations and the continuing decline of mature individuals (World Conservation Monitoring Centre 1996), while its status in Croatia is not assessed. With no recent records available, the species has not been included in any Natura 2000 sites in Croatia.

We present the current knowledge about the occurrence of *P. proserpina* in Croatia on which the future conservation of the species in the country can be based.

## Materials and methods

In order to gain an overview of the occurrence of *P. proserpina* in Croatia, all the available literature was checked, data from it extracted and the localities georeferenced.

During the last several years, field trips were done across Croatia in order to survey the moth fauna of the country, and this included many previously unvisited

areas and regions. Moths were surveyed using pyramidal UV light traps, with two to five traps used for four hours per locality. For each specimen, the exact locality, coordinates, date and additional notes are provided. The spatial processing and visualisation of data were done in the program ARC GIS desktop.

## Results and discussion

Up to now, this species has been recorded in Croatia only on a few occasions. The first records were imprecise, citing the whole region as a locality, for example Mann (1869) reports a record of *P. proserpina* from Dalmatia and Bohatsch (1892) from Slavonia. Afterwards, Koča (1901) recorded it at Vinkovci and Krivsko Ostrvo. Grund (1918) and Abafy-Aigner (1910) mention it from Rijeka, Lipik and Đakovo. The last known records of this species in Croatia have been published more than 30 years ago, when Kranjčev (1985) recorded it at Domaji and Koprivnica in Podravina region.

During this survey, the species had been recorded in five localities:

1. Neretva river Delta, Opuzen, Crepina, wet meadows near small streams, May 2010, N: 43.007307, E: 17.525403, 1 ex. found dead, obs. D. Kitonić.

2. Island Murter, Jezera, small moist meadow which floods seasonally, May 3<sup>rd</sup> 2013, N: 43.781817, E: 15.631033, 1 ex., obs. & coll. M. Črne.



**Fig. 1:** *Proserpinus proserpina* from the island Dugi Otok, Croatia.  
**Sl. 1:** *Proserpinus proserpina* z otoka Dugi otok, Hrvatska.

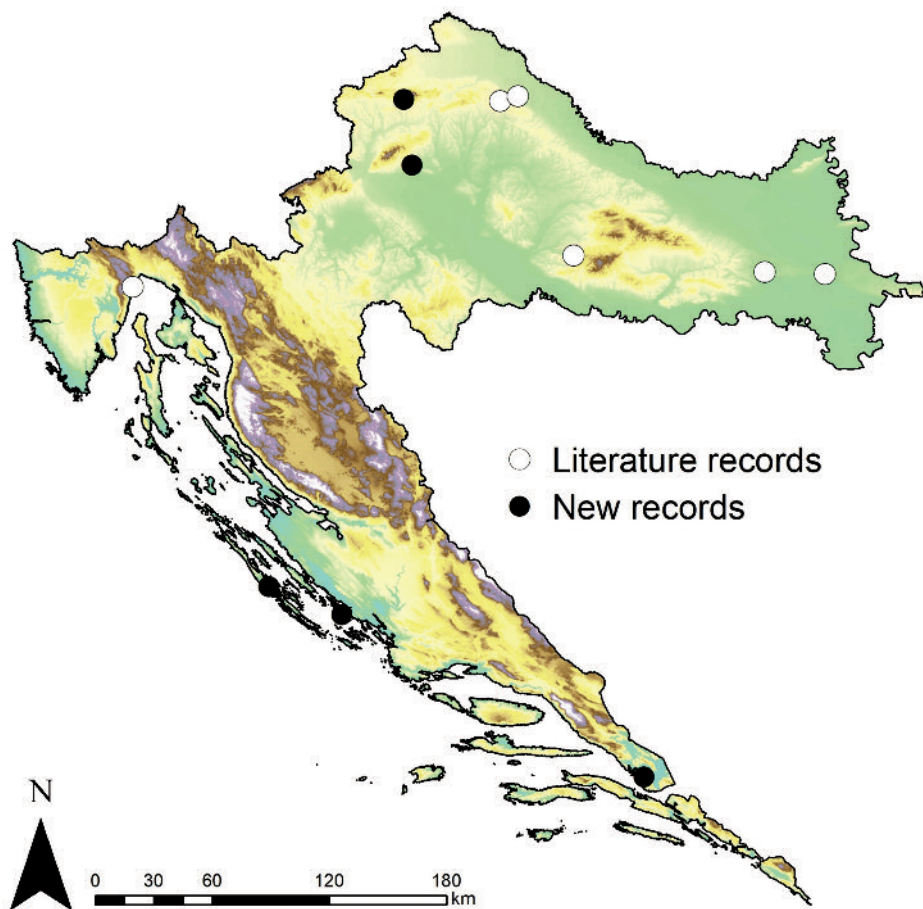
3. Hrvatsko Zagorje, Radoboj, Strahinščica, forest edge and groves, April 4<sup>th</sup> 2014, N: 46.15667400, E: 16.06890800, 1 ex., obs. T. Koren, S. Gomboc.
4. Grad Zagreb, Markovo Polje, Svinjarevo, wet meadows and forest edge, May 28<sup>th</sup> 2016, N: 45.852906, E: 16.118087, 3 ex., obs. M. Zadavec.
5. Island Dugi Otok, Kruševo polje, east of Sali settlement, edge of maquis April 28<sup>th</sup> 2018, N: 43.913767, E: 15.166964 1 ex., obs. & coll. T. Koren.

If we consider the historical and recent records, this species is in Croatia present in two biogeographical regions, the Mediterranean region and the Continental region. During this survey, we confirmed its occurrence in both regions. The records from Hrvatsko zagorje and Zagreb are located within the known historical range of the species, and only confirm that the species is still present in the area. On the other hand, the record on Neretva river is the first exact record from Dalmatia, and the confirmation of the record by Mann (Mann 1869). The records from the two Adriatic islands, Murter and Dugi Otok represent the first island records in Croatia. In general, the moth fauna of the Adriatic islands is far from complete, so these records do not come as a surprise. Interestingly, it was not recorded during a 30 years long survey of Krk island, the second largest Adriatic island (Habeler 2008[2003]).

During this survey, on both Adriatic islands *P. proserpina* was recorded on or in near vicinity of wetlands. On Dugi Otok, it was recorded in a karst field, distanced 10 km from the largest wetland area, Žmanska jezera, seasonally flooded freshwater lakes. On Murter, it was recorded in the only wetland area on the island, a seasonally flooded meadow near Jezera. The species host plants, *Oenothera* and *Epilobium hirsutum* have been recorded on Murter (Milović & Pandža 2010). On Murter island, Jezera represent the only wet meadow, and as such, can be regarded as extremely important for the persistence of the hygrophilous flora and fauna on the island. In the conversation with the residents, we found out that several decades ago, the wetland area was much larger, and the water was present in the meadows for a longer time. Nowadays only fragments of such habitats remain in the area.

While this survey gathers all the available records of *P. proserpina* in Croatia, it does not present the total distribution in the country. Further moth surveys will certainly find new populations across the country. Such new records will help the species to gain a conservation status in Croatia, as with such limited number of records and the lack of systematic moth surveys, a current assessment would not be relevant. As this species is listed in the Annex IV of the Habitats Directive, and its recent occurrence in Croatia has been confirmed, it should be added to the list of strictly protected species of Croatia (Anonymous 2016).

The conservation status of this species in the countries surrounding Croatia differs greatly. In Slovenia *P. proserpina* is listed as Endangered (Uradni list RS, 2002). In Italy its distribution is discontinuous across all the continental and peninsular regions, including Sicily (Zilli et al. 2006). Its conservation status has not been assessed but the species does not seem particularly threatened, the main risk factor is the alteration of forest edges which constitute its main habitat in the country (Zilli et al. 2006). It is without any conservation status also in Serbia, where it was recorded recently (Kerešić



**Fig. 2:** Literature (white circles) and recent records (black circles) of *Proserpinus proserpina* in Croatia.

**Sl. 2:** Literaturne (beli krogi) i nove najdbe (črni krogi) vrste *Proserpinus proserpina* na Hrvatskem.

& Almaši 2009) and Bosnia & Herzegovina from where only a single record exists (Rebel 1904).

In order to assess the status of this species in Croatia and the possible addition of this species to existing Natura 2000 areas, a systematic mapping and monitoring should be done. The recent observations presented in this work should be used as a starting point for such venture.

So far, no monitoring protocol for this species was developed across Europe, but a suggestion for monitoring exists for Italy (Zilli et al. 2006). The best method of monitoring of *P. proserpina* is the count of larvae in the adequate habitats where presence of the adults has been confirmed. This is done by a systematic mapping

using light traps across chosen areas of the country. As most of the specimens were recorded using light traps, this method should be used as a preferred method for noting the species presence, and possibly abundance in the area (Zilli et al. 2006). Regarding the larvae monitoring, it is advised to establish transects of 100 m in length and to check each hostplant (e.g. *Epilobium* spp.) in order to detect the presence of the larvae. The transects should be done in standardized way, in the same weather conditions and at the same time interval, in order to compare the results in different years. While the proposed method does not allow to obtain an exact estimation of the abundance of a population, it can be used to assess the population trends over time (Zilli et al. 2006).

### Acknowledgments

I am grateful to Mladen Zadavec, Stanislav Gomboc, Mitja Črne, and Davorka Kitonić for sharing their records and help during the field trips. Also, I would like to express my gratitude to Nature Park Telašćica and Public institution for the management of protected areas in Krapina-Zagorje county for financing parts of this work.

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Received / Prejeto: 14. 1. 2019





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Band/Volume: [27](#)

Autor(en)/Author(s): Koren Toni

Artikel/Article: [The distribution of Willowherb Hawkmoth \*Proserpinus Proserpina\* \(PALLAS, 1772\) \(Lepidoptera, Sphingidae\) in Croatia 51-57](#)