

New records and updated distribution of the rare and threatened European hoverfly *Psarus abdominalis* (Fabricius, 1794) in NW Balkans

(Diptera, Syrphidae)

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New data and a historical overview of the distribution of the endemic European hoverfly *Psarus abdominalis* (Fabricius, 1794) in Bosnia and Herzegovina, Croatia, and Serbia are presented. *Psarus abdominalis* is the hoverfly with the highest priority for protection in Europe. The species is reported for the first time in Bosnia and Herzegovina, while records from Croatia and Serbia represent the second location for these countries. New records were collected in the field (Serbia) or they were found in museum collections (Bosnia and Herzegovina and Croatia). The species status and distribution in the NW Balkans are briefly discussed.

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Introduction

Hoverflies (Syrphidae) are a large family of flies (Diptera) with more than 6200 described species worldwide and more than 950 in Europe (Young et al. 2016, Speight 2020a). The Balkan Peninsula with its great diversity of habitats and climates represents a hoverfly hotspot (Vujić et al. 2001, Grković et al. 2021), but the diversity and the distribution of many species in this region are still insufficiently known. Vujić et al. (2001) reported more than 450 species for the Balkan Peninsula but the number is far from final as afterward, many additional species have been recorded in the peninsula and numerous new species have been described as well (e.g. Nedeljković et al. 2018, Grković et al. 2019, 2021). Except for Serbia, which has a long tradition of syrphidological studies

(e.g. Nedeljković et al. 2009, Radenković et al. 2013, Tot et al. 2018, Vujić et al. 2018, etc.), in NW Balkans, in the countries of former Yugoslavia, the knowledge of this group is scarce and largely based on very old records (e.g. Strobl 1898, 1900, 1902, Langhoffer 1919). In recent years cooperation within the Biologer and Alciphron database projects (Popović et al. 2020, Vujić 2023) resulted in the publication of many new biodiversity data from the western Balkan, including several Syrphidae species new to Croatia, Bosnia and Herzegovina, and Serbia (Vujić et al. 2021, 2022).

The genus *Psarus* Latreille, 1804 is a distinctive monotypic genus containing a single species, *Psarus abdominalis* (Fabricius, 1794) that is endemic to Europe (Speight 2020a). It is regarded as threatened at the European level (Speight 2020a). *Psarus abdominalis* is an almost hairless hoverfly of 8.5–10 mm long,

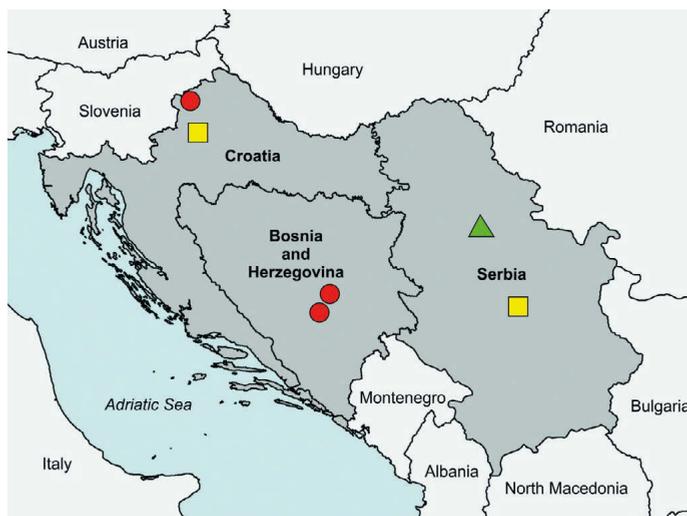


Fig. 1. New records and the currently known distribution of *Psarus abdominalis* in Bosnia and Herzegovina, Croatia and Serbia (■, literature records; ●, museum records; ▲, new data).

with abdominal tergites extensively orange and elongate antennae, with the arista inserted on the apical half of the third segment (Speight & Sarthou 2012, Speight 2020b). Adults mimic solitary parasitic bees of the genus *Sphecodes* Latreille, 1804 and appear in the same habitat as these bees (Mengual & Ssymank 2015).

The natural range of *P. abdominalis* extends from southern Sweden, through the Netherlands and Belgium to central France, and from Brittany in the west, through central Europe to the European parts of Russia, Ukraine, and Turkey in the east. In the south it is known from Italy, countries of the former Yugoslavia and Greece (Mengual & Ssymank 2015, Speight 2020a). Although the species has been reported from many countries, most of the records are older than 1950, and it is believed to be extinct in Sweden, the Netherlands, and Belgium (Mengual & Ssymank 2015, Speight 2020a). Verlinden & Decler (1987) state that *P. abdominalis* disappeared from northwest Europe. In Austria, the occurrence is considered doubtful (Mengual & Ssymank 2015).

The preferred habitats of the species are well-drained thermophilous oak forests with mature trees and diverse herb vegetation (Speight 2020a). Dry oak forests with well-developed shrub vegetation and sunny, sheltered forest edges on calcareous soil were also reported by Stuke (2000), while Dussaix (2013) reported *P. abdominalis* from a flower-rich margin of *Pinus pinaster* Aiton forest with *Quercus* sp.

The biology of the species is insufficiently known. Mengual & Ssymank (2015) argue that the larvae might be associated somehow with *Geranium*

sanguineum L., but the species was found also in the habitats where this plant is not present (Hadrava 2022). The adult flies visit flowers and inflorescences of various plants, including *Anthemis* sp., *G. sanguineum*, *Veronica* sp. and yellow crucifers (Speight 2020a). Stuke (2000) mentions that adults visit only *G. sanguineum* in Central Europe. Popov (2009) mentioned *P. abdominalis* feeding on flowering bushes of *Cotinus coggygria* Scop., and mentions literature records from flowers of several herbaceous plants, including also *Geranium* sp. Glumac (1968) recorded the species in a variety of habitats and feeding plants in North Macedonia.

According to Speight (2020a), the species is monovoltine, flying from April to the beginning of July, but also longer flight period extending to the beginning of September was reported, particularly from North Macedonia (Glumac 1968, Mengual & Ssymank 2015).

This paper presents new records and the distribution of the threatened European hoverfly species *Psarus abdominalis* in the western part of the Balkan Peninsula.

Material and methods

The presented data consists of newly gathered records from Serbia stored in Mihailo Vujić private collection, Belgrade (coll. M.V.), specimens from the entomological collection of the National Museum of Bosnia and Herzegovina (NMBiH) in Sarajevo and the entomological collection of Andrija Hensch kept by the Croatian Ento-

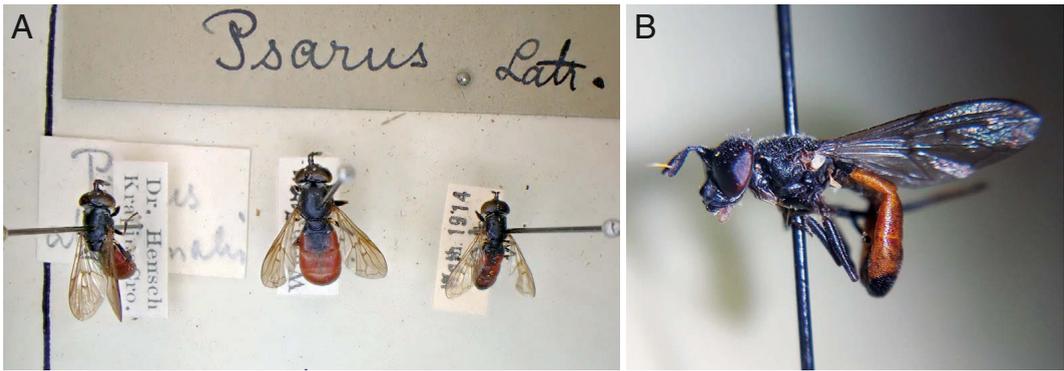


Fig. 2. The specimens of *Psarus abdominalis* in the entomological collection of Viktor Apfelbeck in the National Museum of Bosnia and Herzegovina (A) (photo: D. Kuljier) and the male specimen of *Psarus abdominalis* from Vrčin, Serbia (B) (photo: M. Vujić).

mological Society at the Faculty of Forestry in Zagreb (coll. Hensch). The specimen collected in the field was caught by an entomological net and prepared by standard procedure.

As the locality data for specimens from the museum collections are not precise, the position of the toponym mentioned on the labels is given on the map.

The species identification was done using the keys from Speight & Sarthou (2012), Bot & van de Meutter (2019) and Speight (2020b).

Results

Published records: **Croatia:** Langhoffer (1919), Glumac (1972); **Serbia:** Radenković (2008).

Unpublished museum records: **Bosnia and Herzegovina:** Visoko, 1914, 1 ♀, leg. Wgth.; Ivan, 1911, 1 ♀, leg. Wgth.; **Croatia:** Krapina, 1 ♀, leg. Dr. Hensch (coll. NMBiH); Krapina, 25.v.1915, 1 adult; 22.iv.1922, 1 adult; 16.vii.1922, 1 ♂; 08.viii.1909, 1 ♀; 26.vii.1910, 1 adult; 28.iv.1910, 1 ♀; 30.viii.1909, 1 adult; 3.vi.1923, 1 ♀; ix.1921, 1 ♂; 26.v.1910, 1 adult; 07.v.1924, 1 ♂ (coll. Hensch).

New field record: **Serbia:** Vrčin, 44.669569° N, 20.617382° E, 31.iii.2021, 1 ♂, leg. M. Vujić (coll. M.V.).

In total, 24 specimens of *Psarus abdominalis* (Fabricius, 1794) from four locations in Bosnia and Herzegovina, Croatia and Serbia were studied (Fig. 1.). Three specimens were found in the entomological collection of Viktor Apfelbeck in the National Museum of Bosnia and Herzegovina (Fig. 2). Two originate from different localities in the central part of Bosnia and Herzegovina, while the third was collected in Krapina, NW Croatia. In Hensch entomological collection in Zagreb, 20 specimens are stored. Of them, 11 originate from Krapina, while for nine

specimens locality data are missing, but there is a high possibility that they originate from the same location. At the bottom of some labels, he wrote “Cornus”, “Pastinaca” and “Tokay”, which are probably the plants on which the specimens were captured (*Cornus* and *Pastinaca* are plant genera, while Tokay is the name, often misused, for many grape vine (*Vitis vinifera* L.) varieties. The mark on the label most likely indicates that the specimen was caught on the grape vine, although this cannot be determined with certainty).

New record from Vrčin (Belgrade surroundings, Peripannonian region, Central Serbia) includes one male specimen (Fig. 2) that was observed sitting on the bark of Turkey oak, *Quercus cerris* L. It was found in young oak forest, severely fragmented due to forest cuts and with an abundance of invasive trees *Robinia pseudoacacia* L. and *Ailanthus altissima* (Mill.) Swingle.

The records from Bosnia and Herzegovina represent the first finding of the species in the country while the records from Croatia and Serbia are the second ones for those countries.

Discussion

The new records on the occurrence of *P. abdominalis* in the NW Balkan are significant since the species is very rare and highly threatened in Europe, and data from the Balkans are scarce. Nevertheless, new records are not unexpected as the species was already known from the region (Mengual & Ssymank 2015, Speight 2020a) and suitable habitat still exists. The small number of known records from this region could indicate that *P. abdominalis* is a rare, local, and possibly threatened species in this area, but due to the

poor knowledge on the hoverfly fauna, particularly in Bosnia and Herzegovina and Croatia, additional research is needed to confirm this claim.

For Bosnia and Herzegovina and Croatia, only old museum specimens with general localities (e.g. Krapina) are available, without precise locality information, and the habitat details are not available. According to Šilić (1988) in the countries of former Yugoslavia *G. sanguineum*, with which *P. abdominalis* is most often associated (Stuke 2000, Mengual & Ssymank 2015), inhabits light/open xerothermic oak and Austrian pine (*Pinus nigra* J. F. Arnold) forests and their degradational stages, as well as dry meadows, from lowlands to the hilly and mountain region. It is a characteristic species of the thermophilous oak forests of the order *Quercetalia pubescentis* Br.-Bl. and also common in *Erico-Pinetalia* H-at forests. Such habitats are still common in the surroundings of Krapina in Croatia, where Hensch collected all the specimens more than a hundred years ago. It is also the same region of the country where the species was previously found (Langhoffer 1919). In Bosnia and Herzegovina thermophilous oak forests are the most characteristic vegetation of the southern, dry karstic area that is under influence of the Mediterranean. These forests are not typical vegetation in two regions of the country where the species was found, although they can appear locally. Visoko is a small town in central Bosnia, in the upper part of the Bosna River valley. It is a hilly area along the Bosna River, with altitudes ranging from 400 to app. 850 m a.s.l. The second, Ivan locality, is a mountainous area that represents a geographical border of the northern, Bosnia region and the southern, Herzegovina region, with altitude ranging from 800 up to 1530 m a.s.l.

The new record from Vrčin (Serbia) consists of a single male specimen (Fig. 2) observed sitting on the bark of Turkey oak. Speight (2020a) reported that *P. abdominalis* males can be observed sitting in the sun on the oak leaves or at the end of dead branches of trackside trees at two or more meters above the ground. At this site, the oak forest was young and highly fragmented, primarily due to intensive logging and the spread of the invasive or pioneer tree species. In a wider area, the oak forest consists almost exclusively of *Q. cerris* and *Q. frainetto* (Ten. 1813) and other oak species can be found only as singular trees (e.g. *Q. robur* L. near streams). Almost all forests in a wider area are privately owned and under intensive logging, what are the most pronounced threatening factors for the survival of this population. Additionally, the spread of invasive trees, such as black locust, *R. pseudoacacia* and tree of heaven, *A. altissima*, especially after a logging, is an equally important threatening factor. The oak

forest fragment where *P. abdominalis* was found does not have well-developed floor of herbaceous plants. It mainly consists of plants non-specific for forest habitats, *Galium aparine* L., *Torilis arvensis* (Huds.) Link, *Lamium purpureum* L., *Ficaria verna* Huds. and *Urtica dioica* L. At this site, as well as in whole area of Vrčin, *G. sanguineum* was never found. Some other *Geranium* species can be found in surroundings of mentioned forest (e.g. *Geranium robertianum* L. and *Geranium dissectum* L.).

In the Balkan Peninsula, only from North Macedonia the species was reported as common, but this is mainly based on one study from Glumac (1968), who reported records from five locations between 1958 and 1960. It is questionable whether the species could be regarded as common in the country based only on these records. In most other countries where it has been recorded, mainly scarce old records exist (Mengual & Ssymank 2015). For Croatia *P. abdominalis* was reported by Langhoffer (1919) from Zagreb. Glumac (1972) probably cited the same record, as well as Dirickx (1994) (Mengual & Ssymank 2015). For Slovenia, it is known only based on an old record published by Strobl (1909) (De Groot & Govedič 2008). From other Balkan countries, only a few recent findings from Bulgaria and Greece have been reported (Mengual & Ssymank 2015), and most recently this species has been found for the first time in Serbia (Radenković 2008).

Based on recorded dates, in the study area the species flies from April to September, which is consistent with the data from the literature (Glumac 1968, Mengual & Ssymank 2015, Speight 2020a).

According to Speight (2020a), *Psarus abdominalis* is threatened at the European level and it is a syrphid of the highest priority for protection in Europe. However, Vujić et al. (2001) do not consider this species to be threatened in the Balkan Peninsula, while Mengual & Ssymank (2015) who reviewed the distribution data for this species across the whole range, argue that more data from the Balkans are needed to access the species regional status. Due to insufficient field research in the past, as well as in recent times, and the scarcity of available data, our opinion is that the species status in the study area should be regarded as data deficient until systematic target surveys are conducted. As similar data are available for all the countries, including Serbia which is the only country within the study area that has been significantly investigated in terms of hoverfly fauna (Mengual & Ssymank 2015, Vujić et al. 2018), we can assume that the species is probably rare and local within the region, but additional surveys are needed in all Balkan countries. Considering that *P. abdominalis* is a rare and threatened species in Europe, the target research at historic and potentially

suitable habitats should be in the focus of future research with the aim of determination of species status and conservation measures.

Although reasons for the decline and disappearance in western Europe are not clear yet, it is pointed out that the main causes could be forest management and forest clearance (Speight 2020a), while in southern Sweden the decrease in broad-leaved habitats with forest grazing is indicated as the main cause (Bartsch 2009). According to Popov (2009), another possible reason could be a critical relationship with certain endangered plant associations and/or plant species. Although often associated with *G. sanguineum*, the distribution of this plant species is much wider than the actual distribution of *P. abdominalis*, so Mengual & Ssymank (2015) suggest that a distinct mosaic of microhabitats in a warm dry climate is necessary for the survival of *P. abdominalis* populations. Although further research on *P. abdominalis* biology is needed, we believe that it does not (at least obligatory) require *G. sanguineum* for larval development and/or adult feeding resource. This is also confirmed at our newly recorded locality in Serbia where *G. sanguineum* was not present.

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