

The hangingfly genus *Bittacus* Latreille, 1805 in the Balkan countries

(Mecoptera, Bittacidae)

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A review of records of hangingflies (Mecoptera, Bittacidae) in the Balkan countries is presented. While *Bittacus italicus* was cited for all Balkan countries in the past, with the exception of the European part of Turkey, the much rarer *B. hageni* was reported from Romania and Slovenia only. Here we report both on published and unpublished older records and on recent findings. The occurrence of *B. hageni* in Nova Gorica is the first record in the Balkan Peninsula, and the individuals collected in Krapina are the first ones from Croatia. The find of *B. italicus* on Pag is the first record on a Mediterranean island. As their habitats are shrinking, hangingflies on the Balkan Peninsula are highly endangered.

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Introduction

Hangingflies (Mecoptera, Bittacidae) are well-known for their specialized prey capturing behaviour. While flying through low vegetation or from a hanging position they use their prehensile hind tarsi (Fig. 1) to grasp other insects or small spiders that come into their range (e. g., Byers & Thornhill 1983, Willmann 1986). Bittacids exhibit unusual mating behaviour, including the offer of a nuptial gift. The male captures prey and feeds it to the female before and during mating (Thornhill 1977, Mickoleit & Mickoleit 1978,

Byers & Thornhill 1983, Thornhill & Alcock 1983, Engqvist & Sauer 2003, Gao & Hua 2013). Attracted by pheromones, males may also try to steal prey from courting other males (Willmann 1986).

Bittacidae, with approximately 200 species in 18 extant genera, is distributed worldwide (Penny & Byers 1979, Bicha 2018, Machado et al. 2018). *Bittacus* Latreille, 1805 is the most diverse genus of Bittacidae, with more than 150 species (Bicha 2018). It is represented in all biogeographical regions, with high diversity in South America (Machado 2019), Africa (Byers 1971, Londt 1977), and China (Zhang

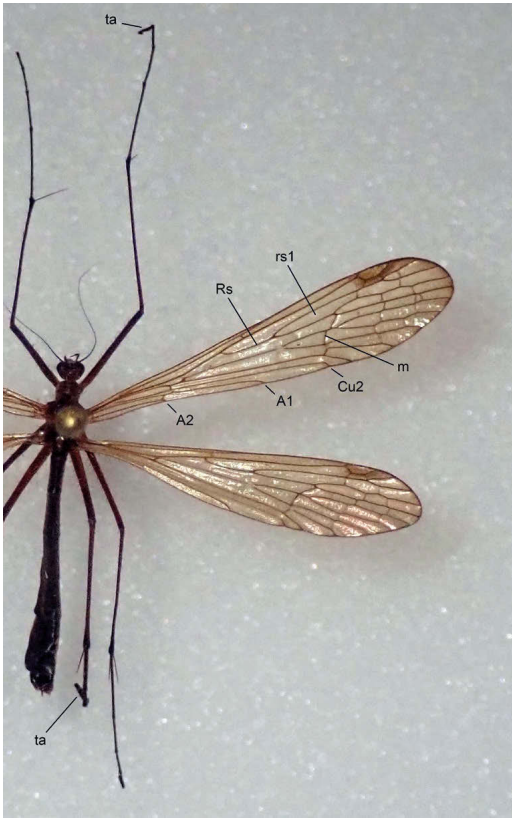


Fig. 1. *Bittacus italicus*, male; Ferketinec, 11 August 2021. Legend: A1, 1st anal vein; A2, 2nd anal vein; Cu2, 2nd cubital vein; m, cross-vein of 1st medial fork; Rs, Radial sector; rs1, 1st cell of radial sector; ta, prehensile tarsus. Photo: T. Koren.

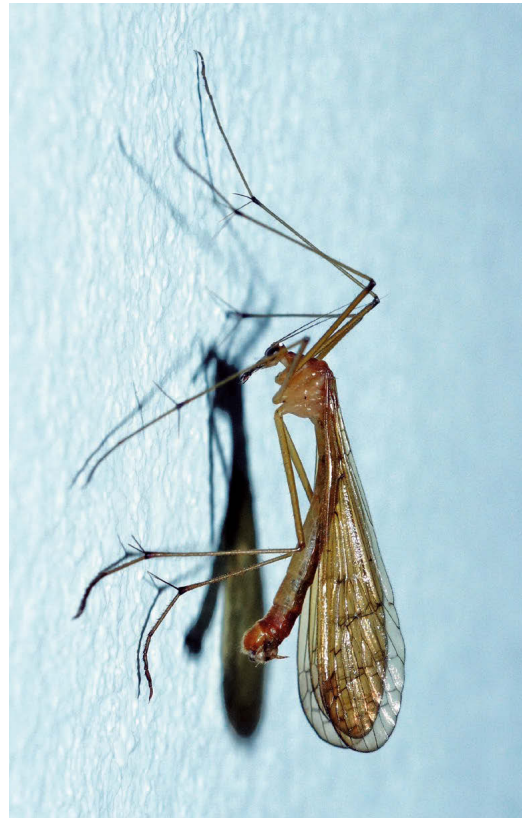


Fig. 2. *Bittacus hageni*, male; Nova Gorica – Panovec, 18 July 2016, the first record in the Balkan Peninsula. Photo: J. Kamin.

et al. 2020). In Europe, only two bittacid species occur – *Bittacus italicus* (Müller, 1766) and *Bittacus hageni* Brauer, 1860 (Figs 1, 2). While the distribution maps in ‘Fauna Europaea’ are mostly based on older records (Willmann 2013), the present study aims to present the current state of knowledge of the distribution of the hangingflies in the Balkan countries.

Material and methods

This study is based on new material examined, literature data, and photographic documentation. The following collections were surveyed: the entomology collection in the Croatian Natural History Museum, Zagreb (abbreviation: ZG), the entomology collection in the National Museum of Bosnia and Herzegovina, Sarajevo (SA), the entomology collection in the National Museum of Natural History, Sofia (SO), Mihailo Vujić collection,

Belgrade (MV), Toni Koren collection, Zagreb (TK), and Dušan Devetak collection, Maribor (DD). Both species can be easily identified by the keys and descriptions in Tajovský & Lauterer (1986), Petschenka (2006) and Savitsky & Timokhov (2021).

The distribution maps were created with RStudio (2020) using the ggplot2 (Wickham et al. 2020) and ggmap (Kahle et al. 2019) packages.

Results

The two species differ well in male genitalia and wing venation (Savitsky & Timokhov 2021). The diagnostic characters of the wings are shown in Fig. 1. In *B. italicus* with narrower wings cell rs1 is considerably longer than common stem of Rs and terminus of A1 lies much closer to that of Cu2 than to that of A2. Cross vein m is inclined to longitudinal wing axis (Savitsky & Timokhov 2021). In

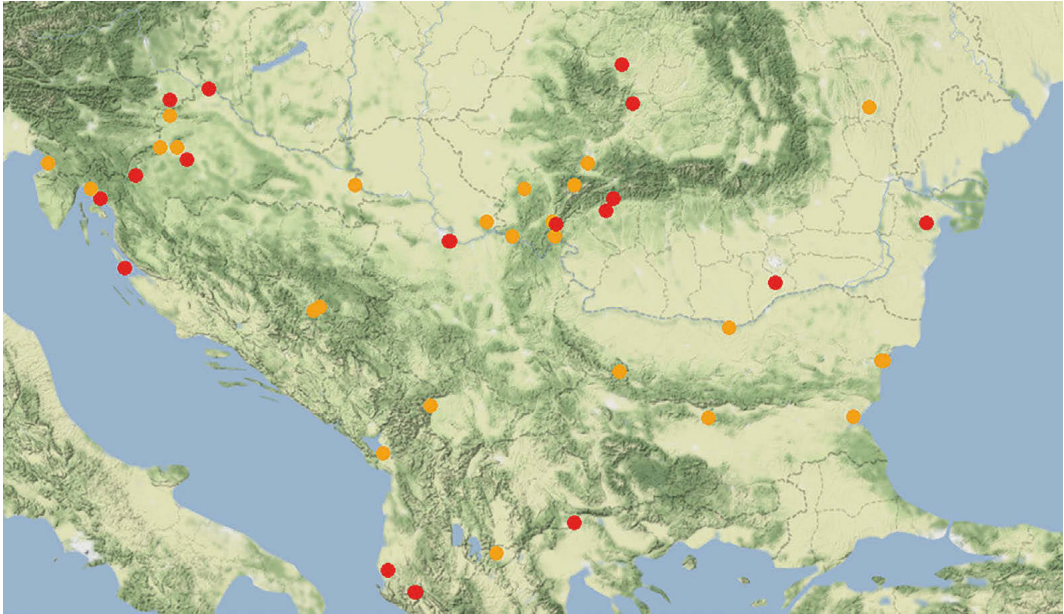


Fig. 3. Distribution of *Bittacus italicus* in the Balkan countries. ●, records before 1950; ●, records in the period 1950–2021.

wider-winged *B. hageni* cell rs_1 is slightly longer to slightly shorter than common stem of Rs , terminus of A_1 lies halfway between termini of Cu_2 and A_2 or slightly closer to A_2 in forewing. Cross vein m is almost perpendicular to the longitudinal wing axis (Savitsky & Timokhov 2021). Again, males of the two species differ remarkably in the shape of abdominal intertergal vesicles when everted; in courting males, the vesicles discharge sex pheromones (Petschenka 2006).

In the Balkan countries, both European bittacid species occur.

Bittacus italicus (Müller, 1766)

Synonym: *B. tipularius* (Fabricius, 1793).

Distribution in the Balkan countries: Fig. 3.

Albania

Literature records:

Devetak (1991): Shkodër, 3.VIII.1918 (ZG).

iNaturalist (2021): Tepelenë, along Vjosa river, 40.289394° N, 20.027276° E, 2.VI.2021; Tepelenë, confluence of Vjosa and Drinos, 40.281627° N, 20.039827° E, 18.VI.2019; Vlorë, Beshisht, 40.560174° N, 19.562789° E, 31.V.2021.

Bosnia and Herzegovina

Literature records:

Esben-Petersen (1921): Bosnia.

Material:

Ilidža, ca. 1910, V. Apfelbeck leg., 6 ♂ 4 ♀, 2 individuals without abdomen, one specimen with the additional label: “*Bittacus tipularius* L/ Neuroptera/ det. Dr. Hensch 1911” (SA).

Sarajevo, Koševo; 10.VIII.1933, A. Winneguth leg., 1 ♀, 21.IX.1933, A. Winneguth leg., 1 ♂ (SA).

Bulgaria

Literature records:

Nedelkov (1909): Sredna Gora Range, Svishtov; Varna. Buresch (1936): Sredna Gora Range, Svishtov; Varna; Burgas; Eliseina Railway Station in Iskar Gorge.

Material:

Euxinograd Park, 2.VIII.1935 (SO) (Alexi Popov, in litteris).

Croatia

Literature records:

Brauer (1860): Dalmatia (without detailed information). It is the first mention in the Balkan Peninsula. Frauenfeld (1860): Dalmatia (without detailed information).

Mocsáry (1899): Vukovar; Crikvenica.
Pongrácz (1914): Vukovar; Crikvenica.
Devetak (1991): Bakar, 16.VII.1903 (ZG); Crikvenica, 10.–15.VII.1955 (DD); Peščenica – Turopolje, 16.VIII.1978 (ZG); Samobor, 10.VIII.1895 (ZG); Zagreb, 20.VII.1893, 5.IX.1989 (ZG).

Material:

Ferketinec, 46.477342°N, 16.522763°E, 11.VIII.2021, light traps, Toni Koren leg., 1 ♂ 2 ♀ (TK). Habitat: grassland close to the river Mura; altitude 210 m a. s. l. Island/Otok Pag, Poveljana, 44.3534°N, 15.0968°E, 26.VI.1981, F. Perović leg., 1 ♀ (DD). The discovery on Pag is the first record on a Mediterranean island.

Greece

Literature records:

Navás (1923): Florina, VII.1917.

Italy (part of Friuli-Venezia Giulia which belongs to the Balkan Peninsula)

Literature records:

Tajovský & Lauterer (1986): Trieste, VII.1899.

Kosovo

Literature records:

Pongrácz (1923): Peja/Peć [»Ipek«], 26.VII.1917.

North Macedonia

Literature records:

Devetak (1991): Dojran Lake/Dojransko Ezero, Dojran, 19–24.VII.1974 (DD).

Romania

Literature records:

Brauer (1860): Mehadia.

Mocsáry (1899): Reșița; Orșova; Mehadia; Hațeg.

Kempny (1905): Barlad (Berlad) river valley [Zorleni].

Montandon (1905): Zorleni.

Szilády (1912): Retezat [= Retezat].

Pongrácz (1914): Reșița; Orșova; Mehadia; Moldova Noua.

Kis (1959): Cluj, 2.VII.1954; Tirgu Jiu, 13.VIII.1956;

Bumbești, 12.VIII.1956; Babadag, 6.VII.1957; Comana,

20.VII.1955; Aiud-Nagyenyed, 18.VIII.1957; Băile

Herculane, 2.VIII.1956.

Serbia

Literature records:

Frivaldszky (1877): Grebenac.

Mocsáry (1899): Grebenac.

Pongrácz (1914): Grebenac.

Material:

Beograd, Vrčin, Grab, 44.672148°N, 20.621238°E, 08.VII.2017, Mihailo Vujić leg., 1 ♀ (MV).

Beograd, Vrčin, Lug, 44.674516°N, 20.610801°E, 07.VII.2017, Mihailo Vujić leg., 1 ♀ (MV).

Slovenia

Literature records:

Devetak (1988, 1991): Majske vrh – Tržec, 46.351078°N, 15.876258°E, 6.VIII.1983 (DD). Habitat: meadow with sporadic bushes, close to the river Dravinja; altitude: 245 m a. s. l. (Tone Novak, in litteris).

Devetak (1991): Zilje – Vinica, 45.465654°N, 15.282840°E, 17.VIII.1985 (DD). Habitat: meadow/forest edge close to the river Kolpa; altitude: 200 m a. s. l. (Tone Novak, in litteris).

Distribution

The species is widely distributed in Europe (including the Iberian Peninsula, and Ukraine; but it does not occur in Great Britain and Northern Europe); in the Caucasus: Russia, Georgia, and Azerbaijan (e. g., Hoffmann 1966, Gepp 1982, Dobosz & Hadaś 1999, Rezbanyai-Reser 2007, Tillier 2008, Tillier et al. 2009, Monserrat & Tillier 2013, Willmann 2013, Shchurov & Makarkin 2017, Savitsky & Timokhov 2021). The European northern border of the areal of *B. italicus* runs through northern France, Belgium, Germany and Poland (Willmann 2013).

Bittacus hageni Brauer, 1860

Distribution in the Balkan countries: Fig. 4.

Croatia

Material:

Krapina, 20(21).VIII.1907, 1 ♀ (SA); 14.VII.1910, 1 ♀ (SA), additional label on both: “acqu. 1910 Hensch”. First record in Croatia.

Romania

Literature records:

McLachlan (1898): Comana, 12.VII.1898.

Esben-Petersen (1910): Șerbotești; Vaslui.

Slovenia

Literature records:

Devetak (1991): Rimske toplice – Globoko, 46.121740°N, 15.203024°E, 14.VII.1983 (DD). Habitat: An extensive meadow along the river Savinja; altitude 203 m a. s. l. (Tone Novak, in litteris).

Material – observation:

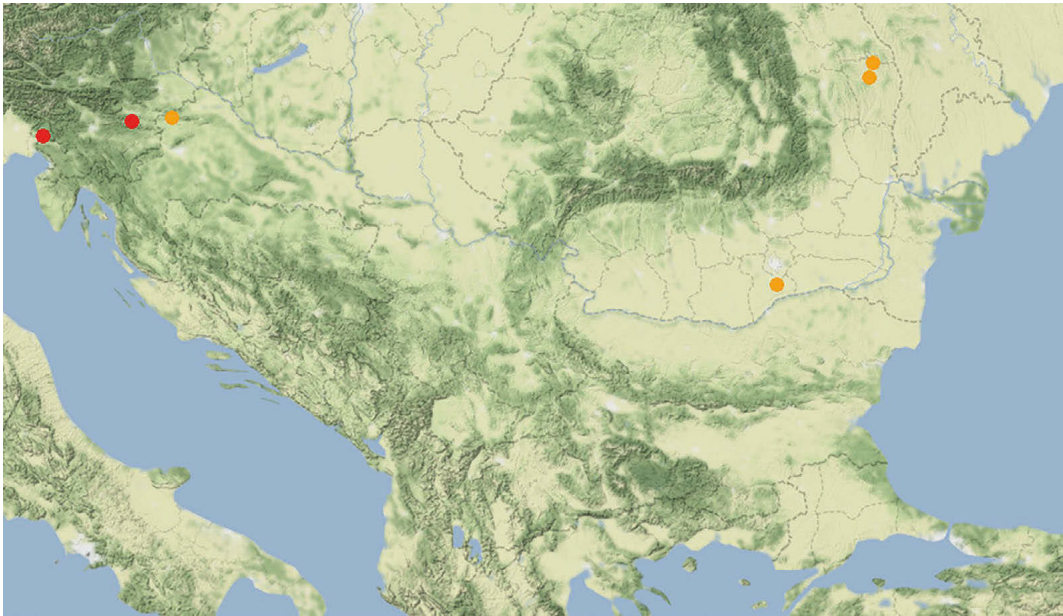


Fig. 4. Distribution of *Bittacus hageni* in the Balkan countries. ●, records before 1950; ●, records in the period 1950–2021.

Nova Gorica: Panovec, 45.9532° N, 13.6915° E, 18.VII.2016, 1 ♂; photo Janez Kamin (Fig. 4). Habitat: A hygrophilous forest in the Submediterranean part of Slovenia with a high average annual temperature; altitude 75 m a.s.l. First record in the Balkan Peninsula.

Distribution

B. hageni is a rare species. It was recorded in Austria, Belgium, Croatia (this paper), Czech Republic, France (mainland), Germany, Hungary, Italy (mainland), Kazakhstan, Poland, Romania, Russia, Slovakia, and Slovenia (e.g., Chládek 1985, Letardi 1998, Ábrahám 2000, Vidlička & Kmeřová 2002, Schubert 2003, Przybyłowicz 2006, Petschenka 2006, Willmann 2013, Tillier 2008, Tillier et al. 2009, Dobosz & Pacuk 2018, Hahn et al. 2021, Savitsky & Timokhov 2021).

Discussion

We present published and unpublished records of hangingflies in the Balkan Peninsula and adjacent regions based on material in museum or private collections and a few recent findings. Two records of *B. hageni* in Nova Gorica (Slovenia) and Krapina (Croatia) are worth mentioning. Taking into account the geographic borders of the Balkan Peninsula (e.g.,

see Popov 1992), the observation in Nova Gorica represents the first record in the Peninsula, and the individuals from Krapina the first record in Croatia.

Interesting is the discovery of *B. italicus* on a Mediterranean island, the island of Pag. Pag is the fifth largest island in the western Adriatic and the first in respect to coastal length (Duplančić Leder et al. 2004). It is a rather diverse island with large karstic open areas but also several larger lakes, swamps, and many small ponds. This may be the reason for this species to be present on the island. However, some other islands like Rab and Krk have the same or very similar riparian vegetation around water bodies and the species may be recorded there during future surveys.

Knowledge of the ecology and distribution of the hangingflies is still unsatisfactory. *Bittacus hageni* prefers dense vegetation – shady thickets and humid undergrowth, often (not always) along river banks. While *B. hageni* is often associated with forest habitats, *B. italicus* can also be found at forest edges and in open habitats (Savitsky & Timokhov 2021). In Hungary, *B. hageni* occurs in thermophilous, dry habitats, while *B. italicus* is associated with hygrophilous wet meadows (Ábrahám 2000). In Austria, bittacids are typically associated with riparian forests and nearby meadows (e.g., Gepp 1982), while in the Czech Republic they can be found in river valleys, deciduous forests and forest steppes (Chládek 1985,

Dvořák 2017).

In the Balkan Peninsula, hangingflies were mostly found close to waterbodies (rivers, lakes), in riparian vegetation. Besides the preference for freshwater, in Croatia (Bakar, Crikvenica, Pag) they were collected close to the sea shore. *Bittacus hageni* was collected in a hygrophilous, thermophilous forest, not associated with water bodies (Panovec, Nova Gorica) or, in an extensive meadow along the river (Rimske Toplice).

The habitats of hangingflies are shrinking as a result of human activities, from global warming to the waterbody shore management at the local scale (e. g., clearing the shore vegetation, water pollution, over-use of pesticides in the nearby agroecosystems, etc.). Since riparian habitats and ecosystems have become extremely threatened and destroyed on a large scale, hangingflies are listed as protected and included in the Red Data Lists in some European countries and regions (e. g., Austria: Gepp 2005; Bulgaria: Popov 2015; Czech Republic: Dvořák 2017; Germany: Willmann 1984; Germany – Saxony-Anhalt Land: Rolke & Röhricht 2020; Russia – Belgorod Province: Prisyi 2005; Slovenia: Devetak 1992). It is quite certain that the distribution patterns of European bittacids became scattered and restricted from reduction of landscapes that were formerly close to nature, while in some countries, *Bittacus hageni* appears to have gone regionally extinct only in recent times (e. g., Gepp 2005). Conservation measures needed to prevent the extinction of the populations at the local and global level are the conservation of wet grasslands, riparian forests, forest edges, and other hangingfly habitats. Additionally, the IUCN Red List assessment for both species at the European level would be beneficial for streamlining the possible conservation activities for their preservation.

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