

**New records of flies (Insecta: Diptera) from the Podyjí National Park,
Czech Republic, with special focus on hoverflies (Syrphidae)**

**Nové záznamy dvoukřídlých (Insecta: Diptera) z Národního parku Podyjí
se zvláštním zaměřením na pestřenkovité (Syrphidae)**

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Abstract. During spring and summer 2016, several interesting species of hoverflies (Diptera: Syrphidae) and other Diptera were recorded in the Podyjí National Park (South Moravia, Czech Republic). *Callomyia speciosa* Meigen, 1824 (Diptera: Platypezidae) and *Asilus crabroniformis* Linnaeus, 1758 (Diptera: Asilidae) were recorded for the first time in the Podyjí National Park. Among syrphid species, *Myolepta potens* (Harris, 1777), *Sphiximorpha subsessilis* (Illiger in Rossi, 1807), *Xanthogramma dives* (Rondani, 1857), and *Xanthogramma stackelbergi* Violovitsh, 1975 were reported for the first time from the Podyjí National Park. Two of them, *Myolepta potens* (Harris, 1777) and *Xanthogramma stackelbergi* Violovitsh, 1975 are new for the fauna of the Czech Republic. We present here the entire list of syrphids caught with Malaise traps in June 2016 in three localities of the National Park (“Braitava” beech forest, top of “Ledové sluje” hill, and oak forest near “Čížov”). Additionally, in spring 2017, *Mallota fuciformis* (Fabricius, 1794) (Diptera: Syrphidae) was recorded for the first time in the Podyjí National Park.

INTRODUCTION

Podyjí National Park is one of the most habitat-diverse areas of the Czech Republic. It is located in the South Moravian Region (south-east of the Czech Republic), on the border between the central European deciduous forests region and the region of Pannonian plains with steppe vegetation (Chytrý et al. 1999). Due to the rain shadow of Vysočina highlands, the whole area is relatively dry. Mean annual precipitation varies from 564 mm (on the eastern part of the National Park) to 620 mm (on the western part of the National Park). The mean annual temperature varies from 7.0°C (on the western part of the National Park) to 8.8°C (on the eastern part of the National Park) (Barták & Kubík 2005).

The landscape structure of the National park is formed mainly by the Dyje River, which creates deep valleys and hillsides with varied expositions and slopes. The elevation of the area ranges from 207 m a.s.l. to 536 m a.s.l. (Barták & Kubík 2005). These landscape features are responsible for high diversity of microclimatic conditions, which results in a very diverse flora and fauna. On colder, shadowed and north-facing slopes, rocky forests with submontane elements are present. On the contrary, sunny and south-facing hillsides are covered by sparse acidophilous oak forests or open xerothermic vegetation (Chytrý et al. 1999). Due to its placement close to the state border, the valley of Dyje was only extensively economically exploited during past decades. Consequently, it is much better preserved than other valleys of west Moravian rivers.

Podyjí National Park is widely used as a migration corridor by many species; the most significant ones are migratory thermophilic species from southern parts of Europe. In comparison with other xerothermic localities in the region, Podyjí National Park has a more rugged landscape with many hills and rocks. Thus, it is much more acceptable for southern-European species to pass the National Park than crossing surrounding plains. Another important migration path is along the river Dyje.

Varied geological substrate is another factor that contributes to the high species diversity of the National Park. In the eastern part of the park, granite is the most common rock (Roetzel 2005). Thus, soils in this area are nutritionally very poor and are covered by heathland mixed with scrub vegetation or by sparse oak forests with many open areas. In the central part of the National Park, there is a diverse mosaic of geological subsoils, of which schist is the most abundant (Roetzel 2005). Especially on the western part of schist area, alkaline rocks such as marble are also present, and highly diverse herb vegetation occurs there, oak forest being the most common biotope. On the western part of the National Park, acid gneiss is the most common subsoil, but alkaline amphibolite also occurs there (Roetzel 2005).

The Podyjí National Park occupies quite a small area (only 63 km²), nevertheless, about 60% of the syrphid fauna of the Czech Republic is known to live in this park due to its well-preserved natural conditions and biogeographically strategic placement. 251 species of hoverflies (Diptera: Syrphidae) are documented on the check list of Diptera of Podyjí (Mazánek et al. 2005). In comparison with the rest of the Czech Republic, mainly xerothermic and submediterranean species are present here.

Regarding other groups of insects, the fauna of Lepidoptera (Šumpich 2011) from Podyjí NP is well documented and highly diverse. An overall study of other groups of insects is still needed. However, a high species-richness of groups such as Coleoptera or Hymenoptera in Podyjí NP is apparent.

In this paper, we focus on important records of Diptera from the Podyjí National Park. With more than 150 000 described species, Diptera are one of the four largest insect orders and one of the most diverse groups of animal in general. They are very common in the landscape and they are known for their importance in a providing a wide range of ecosystem services such as biological control or pollination (Ssymank et al. 2008). However, even basic information such as the distribution of particular species is still absent, even for central Europe. Thus, our intention is to contribute to the knowledge of the distribution of Diptera.

MATERIAL AND METHODS

Two Malaise traps were set up between 6.–10.vi.2016. The first of them was located on the upper part of the east oriented hillside in “Braitava” beech forest in the western part of the National Park (48°52'43.042"N, 15°50'12.413"E, 480 m a.s.l.). The second Malaise trap was set up on the ridge of “Ledové sluje” hill (48°53'1.15"N, 15°50'35.55"E, 410 m a.s.l.), which is an east-west oriented steep forested hill above the river Dyje. Deciduous forest with high proportion of oak is present here. The third Malaise trap was placed by A. Solodovnikov in the oak forest near “Čižov” (48°52'0.0"N, 15°52'27.0"E, 420 m a.s.l.) between 5.–10.vi.2016. Unfortunately, the oak forests were already too dry for effective syrphid collecting.

Several keys were used to identify the specimens collected: Speight (2016), van Veen (2010), van Steenis et al. (2016), van Steenis & Lucas (2011), and Reemer et al. (2004). The species concept of *Chrysotoxum festivum* (Linnaeus, 1758) follows van Veen (2010).

All material from the Malaise traps is stored in Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany (ZFMK). Additional records were made by net collecting by Ximo Mengual, Jiří Hadrava and Michal Tkoč, mostly from south-east parts of the Podyjí National Park. They are housed in various collections, i.e. ZFMK, National Museum in Prague (NMPC) and some in personal collections of Jiří Hadrava (JH) or Martin Škorpík (MŠ). Abbreviations used in the text: NP – National Park, PLA – Protected Landscape Area.

RESULTS

All the hoverfly records from the three Malaise traps are listed in Table 1. Remarkable dipteran records are listed and discussed below.

Family Syrphidae

Chrysogaster coemeteriorum (Linnaeus, 1758)

Material examined. Moravia mer., Podyjí NP, Vranov nad Dyjí, Podmyče, border of Braitava forest, “U Rybníčku”, 48°52'41.0"N, 15°48'4.5"E, 440 m a.s.l., 10.vi.2016, 1 ♂, individually collected by net, X. Mengual lgt. et det. (ZFMK).

Notes. This species has not been recorded in Podyjí NP before. It is considered as vulnerable in the Czech Republic (Mazánek & Barták 2005).

Doros profuges (Harris, 1780)

Material examined. Moravia mer., Podyjí NP, Znojmo, Podmolí, Lipovecká louka near Šobes vineyard, 48°49'7.201"N, 15°58'3.466"E, 260 m a.s.l., 6.vi.2016, 1 ♀, individually collected by net, J. Hadrava lgt. et det. (JH).

Notes. The specimen was caught in flight only few centimetres above ground, on the foot-path between a forest and a meadow. Its flight behavior was very similar to that of eumenine wasps, the model for the mimicry of *Doros*. This species is very rare with a discontinuous distribution, but localities for this species can be found throughout the whole Palaearctic Region. It inhabits mainly well-lit oak and ash forests with both, mature trees and shrubs (Speight 2016). Its larvae are assumed to be commensals in ant nests, probably associated with *Lasius fuliginosus* (Latreille, 1798), a highly arboreal ant species (Speight 2016). This is the second record of *Doros profuges* from the Podyjí National Park. The previous record is from 2004, in a Malaise trap on Liščí skála, during the same seasonal period, and also on

the margin between oak forest and open vegetation (Barták & Kubík 2005). This species is included in the national Red List as critically endangered (Mazánek & Barták 2005).

Mallota fuciformis (Fabricius, 1794)

Material examined. Moravia mer., Podyjí NP, Znojmo, Havraníky, “Havranické vřesoviště” heathland, 48°48'39.44"N, 15°59'42.609"E, 320 m a.s.l., 14.iv.2017, 1 ♀, individually collected, T. Ryšan lgt., J. Hadrava det. (JH).

Notes. A dying specimen with antennae amputated was found lying on the ground by a high school student, Tadeáš Ryšan, during a field excursion. Possibly, it was attacked by a wasp or an *Anthidium* bee (A. Ssymank, pers. comm.). Rare species, not previously reported from Podyjí (Mazánek et al. 2005). This species is included in national Red List as vulnerable (Mazánek & Barták 2005). *Mallota fuciformis* is a highly arboreal species, only occasionally descending to feed on flowers, so it could be overlooked in Podyjí National Park. Since species of *Mallota* are mainly associated with over-mature solitary trees with dead wood (A. Ssymank, pers. comm.), “Havranické vřesoviště” may provide suitable habitat for them.

Myolepta potens (Harris, 1777)

Material examined. Moravia mer., Podyjí NP, Znojmo, Podmolí, meadow below the Šobes vineyard, 48°48'46.27"N, 15°58'37.7"E, 250 m a.s.l., 7.vi.2016, 1 ♂, individually collected by net, X. Mengual lgt. et det. (ZFMK).

Notes. This species is known mainly from forests in Atlantic and Mediterranean parts of Europe (Speight 2016), but was not previously recorded from the Czech Republic (Mazánek 2009). *Myolepta potens* has similar ecological requirements as *M. dubia* (Fabricius, 1805), which is considered endangered in the Czech Republic (Mazánek & Barták 2005). First record from the Czech Republic.

Sphiximorpha subsessilis (Illiger in Rossi, 1807)

Material examined. Moravia mer., Podyjí NP, Vranov nad Dyjí, Horní Břečkov, Ledové sluje hill, 48°53'1.15"N, 15°50'35.55"E, 410 m a.s.l., 6.–10.vi.2016, 1 ♂, Malaise trap, X. Mengual lgt. et det. (ZFMK).

Notes. A rare species, known from Mediterranean parts of Europe. In the Czech Republic, it is considered endangered (Mazánek & Barták 2005). This is the first record from Podyjí National Park (Mazánek et al. 2005).

Xanthogramma dives (Rondani, 1857)

Material examined. Moravia mer., Podyjí NP, Vranov nad Dyjí, Podmyče, Braitava beech forest, 48°52'43.042"N, 15°50'12.413"E, 480 m a.s.l., 6.–10.vi.2016, 1 ♀, Malaise trap, X. Mengual lgt. (ZFMK); Moravia, Podyjí NP, Znojmo, Podmolí, meadow below the Šobes vineyard, 48°48'49.449"N, 15°58'31.526"E, 250 m a.s.l., 3.ix.2016, 1 ♂, individually collected by net, J. Hadrava lgt., X. Mengual det. (JH).

Notes. This species is very similar to the more common *X. pedissequum* (Harris, 1776). Due to the morphological similarity between these species, the distribution of *X. dives* is not well known. However, it was already known from the Czech Republic (Mazánek 2009), but it was not included in check list of Diptera of the Podyjí National Park (Mazánek et al. 2005). It can inhabit many types of forests, but it is mainly known from thermophilous oak forest from the Mediterranean and Submediterranean area, but its range is probably underestimated because it is often confused with other species of this genus. The species has even been recorded recently in Norway (van Steenis 2011).

Xanthogramma stackelbergi Violovitsh, 1975

Material examined. Moravia mer., Znojmo, Hnánice, road between “Fládnická chata” and “pramen Daníže”, 48°48'31.5"N, 15°57'19.0"E, 390 m a.s.l., 8.vi.2016, 1 ♀, individually collected by net, X. Mengual lgt. et det. (ZFMK).

Notes. This species is very similar to *X. pedissequum*. Due to frequent confusion, the distribution of *X. stackelbergi* is not well known. However, it was never previously recorded from the Czech Republic (Mazánek 2009). First record from the Czech Republic.

Family Tabanidae

Theriopectes gigas (Herbst, 1787)

Material examined. Moravia mer., Podyjí NP, Čížov, Čížovský lom, Klaperův potok stream, 48°51'43.9"N, 15°52'37.0"E, 300 m a.s.l., 10.vi.2016, 1 ♀, sweeping undergrowth, M. Tkoč lgt. et det. (NMPC).

Notes. European species with a broad distribution. In the Czech Republic, is known only from southern Moravia, in Bílé Karpaty PLA (Ježek & Omelková 2012), Pálava PLA (Ježek 1999) and Podyjí NP (Ježek et al. 2005). Previously recorded in Podyjí NP (Ježek et al. 2005) from Ledové sluje, Nad Šobesem, Hardegg vyhlídka and Vranov nad Dyjí. It is classified as vulnerable according to the Red List of threatened invertebrates (Ježek & Barták 2005).

Family Asilidae

Asilus crabroniformis Linnaeus, 1758

Material examined. Moravia mer., Podyjí NP, Znojmo, Havraníky, heathland “Havranické vřesoviště”, 48°48'48.439"N, 15°59'55.667"E, 325 m a.s.l., 3.ix.2016, 1 ♀, individually collected by net, J. Hadrava lgt., M. Škorpík det. (MŠ).

Notes. It was caught during the late morning, flying very conspicuously about 1 m above the vegetation. This species is considered to be critically endangered in the Czech Republic (Bosák 2005) and was not known from the Podyjí National Park before (Bosák et al. 2005). However, *Asilus crabroniformis* has recently been found in several new localities in the Czech Republic (M. Škorpík, pers. comm.). It is associated with horse pastures, which are near heathland. In a few years, the horse pastures are to be restored directly to heathland (M. Škorpík, pers. comm.).

Family Platypezidae

Agathomyia antennata (Zetterstedt, 1819)

Material examined. Moravia mer., Podyjí NP, Čížov, Čížovský lom, Klaperův potok stream, 48°51'43.9"N, 15°52'37.0"E, 300 m a.s.l., 10.vi.2016, 1 ♀, sweeping undergrowth, M. Tkoč lgt. et det. (NMPC).

Notes. Palaearctic species, penetrating into the Oriental Region (Taiwan). Previously recorded in Podyjí NP from the localities of Ledové sluje, Braitava and Hnanice – Baštův mlýn (Vaňhara et al. 2005). Most common species of the genus in central Europe.

Callomyia amoena Meigen, 1824

Material examined. Moravia mer., Podyjí NP, Vranov nad Dyjí, “U rybníčku”, forest close to two ponds, 48°52'38"N, 15°48'8.7"E, 440 m a.s.l., 10.vi.2016, 1 ♀, sweeping undergrowth, M. Tkoč lgt. et det. (NMPC).

Notes. Palaearctic species. Common in the Czech Republic (Vaňhara 1995). Previously recorded in Podyjí NP from localities Havraníky and Braitava (Vaňhara et al. 2005).

Callomyia speciosa Meigen, 1824

Material examined. Moravia mer., Podyjí NP, Vranov nad Dyjí, “U rybníčku”, forest close to two ponds, 48°52'38"N, 15°48'8.7"E, 440 m a.s.l., 8.vi.2016, 1 ♂, 10.vi.2016, 1 ♀, sweeping undergrowth, M. Tkoč lgt. et det. (NMPC).

Notes. Palaearctic species. Documented from many Czech localities (Vaňhara 1995), but so far not found in Podyjí NP. First record for Podyjí NP.

Paraplatypeza atra (Meigen, 1804)

Material examined. Moravia mer., Podyjí NP, Vranov nad Dyjí, Ledové sluje, 48°53'5.5"N, 15°50'44.0"E, 430 m a.s.l., 10.vi.2016, 1 ♀, sweeping undergrowth, M. Tkoč lgt. et det. (NMPC).

Notes. Palaearctic species. Previously recorded in Podyjí NP from six localities (Vaňhara et al. 2005). Common Platypezidae species in central Europe (Chandler 2001).

Patterns in composition of syrphid fauna recorded by Malaise traps

In total 21 species of hoverflies were caught by Malaise traps over 4 days, and 16 out of them (76.2%) occurred only at only one locality. Only one species (*Temnostoma vespiforme*) was recorded at all three localities.

The highest diversity of Syrphidae in mid-June was found on the “Ledové sluje” hill, where 12 species were recorded. However, its species composition was not very unique as 41.7% of the collected species in “Ledové sluje” were also collected in other localities. Conversely, a small amount of species overlap was found between the other two localities.

Table 1. List of Syrphidae collected in the Podyjí National Park by Malaise traps in June 2016. (-) indicates absence, and (+) indicates presence in the Malaise trap.

Tabulka 1. Seznam pestířenek odchytených v národním parku Podyjí pomocí Malaiseho pastí během června 2016. (-) značí nepřítomnost a (+) značí přítomnost druhu v Malaiseho pasti.

Species	Braitava	Ledové sluje	Čížov
<i>Dasyrphus tricinctus</i> (Fallén, 1817)	-	+	-
<i>Dasyrphus venustus</i> (Meigen, 1822)	-	+	-
<i>Epistrophe eligans</i> (Harris, 1780)	-	+	-
<i>Epistrophe melanostoma</i> (Zetterstedt, 1843)	+	+	-
<i>Episyrphus balteatus</i> (De Geer, 1776)	-	+	+
<i>Eristalis pertinax</i> (Scopoli, 1763)	+	-	-
<i>Eupeodes corollae</i> (Fabricius, 1794)	-	-	+
<i>Ferdinandea cuprea</i> (Scopoli, 1763)	+	+	-
<i>Cheilosia mutabilis</i> (Fallén, 1817)	-	-	+
<i>Cheilosia</i> cf. <i>vicina</i> (Zetterstedt, 1849)	-	-	+
<i>Chrysotoxum cautum</i> (Harris, 1776)	-	+	-
<i>Chrysotoxum festivum</i> (Linnaeus, 1758)	+	-	-
<i>Chrysotoxum verralli</i> Collin, 1940	-	+	-
<i>Meligramma triangulifera</i> (Zetterstedt, 1843)	-	+	-
<i>Meliscaeva auricollis</i> (Meigen, 1822)	-	-	+
<i>Myathropa florea</i> (Linnaeus, 1758)	-	-	+
<i>Sphiximorpha subsessilis</i> (Illiger in Rossi, 1807)	-	+	-
<i>Syrphus vitripennis</i> Meigen, 1822	-	+	+
<i>Temnostoma bombylans</i> (Fabricius, 1805)	+	-	-
<i>Temnostoma vespiforme</i> (Linnaeus, 1758)	+	+	+
<i>Xanthogramma dives</i> (Rondani, 1857)	+	-	-

Due to the differences in species diversity at the sampled localities, where the least speciose locality presents less than half the number of species of the most speciose locality, Lennon's index of similarity (Lennon et al. 2001) was used to compute similarities between localities. The value of the index is equal to the number of shared species divided by the number of species of the more speciose locality. Thus, values close to 1 indicate a more similar fauna between localities than values close to 0. The values of Lennon's similarity index are in the Table 2.

Table 2. Similarities in syrphid faunas.

Tabulka 2. Podobnosti ve fauně pestířenek.

Lennon's similarity index	Braitava	Ledové sluje	Čížov
Braitava	1	-	-
Ledové sluje	0.429	1	-
Čížov	0.143	0.375	1

The species composition between Braitava beech forest and Čížov oak forest was almost completely different (Lennon's index = 0.143, only 1 species shared by both sites). The locality Ledové sluje hill is quite close to the Braitava forest, but its vegetation is more similar to the Čížov forest. Thus, this locality contains species shared with both, Braitava and Čížov (Lennon's index = 0.429 and 0.375 respectively).

CONCLUSIONS

Many interesting species of Diptera were recorded in Podyjí NP during only a short time period. It shows us, how little we know about the fauna even of such a well-known area as Podyjí NP. We suggest that some of the newly recorded species have possibly recently expanded due to climate change (Reemer et al. 2003) or recent changes in environmental management (for example *Asilus crabroniformis*). Other species might inhabit Podyjí NP from earlier times, but they were not previously noted due to their rarity (for example *Mallota fuciformis*) or to lack of taxonomic knowledge (for example *Xanthogramma stackelbergi*). Anyway, our results suggest that such a naturally diverse area as Podyjí NP deserves further attention from researchers, and the diversity of biotopes should be protected in order to conserve local biodiversity, both known and unknown.

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SOUHRN

V průběhu jara a léta 2016 byla v Národním parku Podyjí zaznamenána řada zajímavých druhů pestřenkovitých (Diptera: Syrphidae) a dalších dvoukřídých. V tomto článku poprvé dokumentujeme výskyt druhů *Callomyia speciosa* Meigen, 1824 (Diptera: Platypezidae) a *Asilus crabroniformis* Linnaeus, 1758 (Diptera: Asilidae) v NP Podyjí. Z pestřenek zde popisujeme první záznamy o výskyt druhů *Myolepta potens* (Harris, 1777), *Sphiximorpha subsessilis* (Illiger in Rossi, 1807), *Xanthogramma dives* (Rondani, 1857) a *Xanthogramma stackelbergi* Violovitsh, 1975 v NP Podyjí. Dva z těchto druhů, *Myolepta potens* a *Xanthogramma stackelbergi* jsou novými druhy pro faunu České republiky. Kromě těchto a několika dalších vybraných zajímavých nálezů zde publikujeme také kompletní seznam druhů pestřenek, které byly během června 2016 odchyceny na třech lokalitách v NP Podyjí pomocí Malaiseho pastí. Těmito lokalitami byl bukový les Braitava, hřeben kopce nad Ledovými slujemi a dubový les poblíž obce Čížov. Dodatečně, na jaře 2017 byla na Havranickém vřesovišti ještě odchycena pestřenka *Mallota fuciformis* (Fabricius, 1794), která byla dosud též v NP Podyjí neznámá.