STUDIA UNIVERSITATIS BABEŞ-BOLYAI BIOLOGIA, 71, 1, 2026 (p. 5-16)
doi:10.24193/subbbiol.2026.1.01

First record of *Parasyrphus malinellus* (Collin, 1952) (Diptera: Syrphidae) in Romania at low altitude in the Danube Gorge

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Article history: Received 3 February 2026; Revised 26 March 2026; Accepted 4 April 2027; Available online 25 June 2026

Abstract. Hoverflies (Diptera: Syrphidae) represent an ecologically important group of pollinating insects. Of these, *Parasyrphus malinellus* (Collin, 1952) is a Palaearctic species, mainly distributed in northern Europe. In southern Europe, particularly on the Balkan Peninsula, its distribution is scattered and has been recorded only recently at high altitudes. Although Romania lies north of the Balkans, *P. malinellus* has not previously been recorded in the country. In April 2025, we recorded a female in the Mraconia Valley Basin (Danube Gorge, southwestern Romania). This is the first record of *P. malinellus* for the Romanian Carpathians and the country. This record partially fills the distribution gap between the species' known distribution in northern and western Europe and its southern Balkan occurrences (Serbia and Greece). Unlike other records from the Balkan Peninsula, where *P. malinellus* is present at high elevations, we recorded it at an unexpectedly low altitude, at only approximately 400 m a.s.l. Moreover, although *P. malinellus* is typically associated with coniferous forests, it was found in a humid valley surrounded by steep slopes dominated by beech and oak forests, in a region where conifers are not naturally present.

Thus, *P. malinellus* is another mountain species, probably relict, present in the Danube Gorge close to its southern distribution limit, at a low altitude and in atypical habitats. This finding further supports the role of the Danube Gorge as a refugium, increasing its conservation value. At the same time, it highlights the limited knowledge of hoverfly diversity in the Carpathian Mountains, even within well-studied protected areas.

Keywords: hoverflies, low altitude, forest, habitats, refugium, distribution record.

Introduction

Pollinating insects are crucial to both natural and agricultural ecosystems (see Takov *et al.,* 2025). An important group of pollinators that also provides numerous other ecosystem services is hoverflies (Diptera, Syrphidae) (Doyle *et al.,* 2020). However, the decline of these pollinating insects appears to have accelerated in recent years in some regions of western Europe, such as the Netherlands (Zeegers *et al.,* 2024). This fact is also true in other areas, as in the Carpathian region from central Europe, hoverflies are the insect group that has undergone the most significant abundance decline due to climate change (Haris *et al.,* 2025). Even in areas from south-eastern Europe where hoverflies had a relatively favorable status, these insects face many threats (Milosavljević *et al.,* 2026). In the Danube Gorge (south-western Romania), 111 syrphid species belonging to 44 genera were recorded (Dumbravă & Cupșa, 2025), representing almost a fourth of the total number of species from the country, namely 419 (Reverté *et al.,* 2023). However, the inventory remains incomplete, primarily due to the region's large area, which represents a Natural Park (Dumbravă & Cupșa, 2025). At the same time, Romania is still poorly represented in terms of the abundance of hoverfly records compared with other regions, especially in western Europe (Sentil *et al.,* 2026).

From the genus *Parasyrphus* Matsumura, 1917 eight species have been recorded in Romania (Stănescu & Pârvu, 2005), but in the Romanian Danube Gorge only one species was previously mentioned (Dumbravă & Cupșa, 2025). From this genus, *P. malinellus* (Collin, 1952) is a Palaearctic hoverfly species characteristic of northern and central Europe, with a distribution ranging from western Europe to Siberia, while reaching the Alps at the southern edge of its range (Reemer, 2009; Speight, 2024). The species is well represented in northern and western Europe, including Belgium, the Netherlands, Norway, Finland, and Sweden (Verlinden, 1994; Reemer, 2009; Hågvar & Nielsen, 2007; Nielsen &

Svendsen, 2014; Haarto & Kerppola, 2014; van Steenis, 2011). To the south, *P. malinellus* reaches into Slovenia (de Groot & Govedič, 2008; van Steenis *et al.,* 2013) or into southern France (Lebard & Speight, 2019) in the Mediterranean area, but in the Alps region, where its presence is known (Speight, 2024). Recently, it was identified in the southern part of the Balkan Peninsula, in northern Greece, near the border with Bulgaria, where it is very localized, as it is present only in an area with spruce forests, at 1550 m altitude, in the Rhodope Mountains (Van de Meutter *et al.,* 2025). In Serbia, it is found in montane coniferous habitats above 1300 m (Vujić et al., 2018; *Parasyrphus malinellus* (Collin, 1952) in GBIF Secretariat, 2023), and in Hungary it occurs in higher northern and western forested regions (Tóth, 1995, 2011). It occupies coniferous forests (Löhr, 1990; Reemer, 2009; Speight, 2004; 2024), but it also appears sometimes in deciduous forests (Nilsson *et al.,* 2007; Reemer, 2009). In Romania, *P. malinellus* has not been reported previously, not only in the Danube Gorge (Dumbravă & Cupșa, 2025) but anywhere in the country (Brădescu, 1991; Stănescu & Pârvu, 2005). Thus, herein we report the first record of *P. malinellus* in Romania, from the Danube Gorge (Mraconia River basin), and describe its occurrence at an unusually low altitude and in an unusual habitat. However, the Danube Gorge is known to shelter mountain species at low altitudes (e.g., Paşcovschi, 1956; Covaciu-Marcov *et al.,* 2009, 2025; Teodor *et al.,* 2019; 2025; Petruș-Vancea *et al.,* 2024). The region's particularities are also clear for hoverflies (Dumbravă & Cupșa, 2025). Thus, our study also highlights the ecological and biogeographical importance of the presence of *P. malinellus* in the region and underlines the need for further research on hoverflies in the Romanian Carpathians.

Materials and methods

Fieldwork was conducted at the end of April 2025 in the Romanian Danube Gorge region, while also investigating other insect groups in the area (Teodor *et al.,* 2025). Investigations included the Mraconia River basin in the eastern sector of the Danube Gorge (Iron Gates Natural Park), situated in the Almăj Mountains. Along the Mușchiosul Mare tributary, a 2 km transect was surveyed along a forest road, and hoverflies were collected directly from flowering plants using hand nets, as previously (Dumbravă & Cupșa, 2025).

Collected specimens were preserved in ethanol and identified to species level in the laboratory under a stereomicroscope using the following references: van Veen (2004), Bartsch *et al.* (2009), and Speight & Sarthou (2017). This species closely resembles *P. proximus* (e.g., Speight, 2024) and is difficult to distinguish from other congeners (Löhr, 1990; van Steenis, 2011). Identification was confirmed using diagnostic characters indicated in the literature (van Veen, 2004; Bartsch

et al., 2009; Speight & Sarthou, 2017). Tergites 3 and 4 are black with distinct transverse yellow bands. The basoflagellomere is black, with yellow ventrally. Sternites 3 and 4 are yellow, each with a large triangular black marking. In males, about one-eighth of the hind femur is yellow, while the fore and mid tarsi are dark greyish. Females have mostly black hind femora. This species is morphologically very similar to *P. proximus* Mutin, 1991, from which it can be distinguished by the shape and pattern of dark markings on the sternites and the coloration of the lower part of the male face. In *P. malinellus*, sternites 3 and 4 have triangular black markings on the posterior half, whereas in *P. proximus*, these segments bear black bands. Male *P. malinellus* have a broadly black mouth edge, while male *P. proximus* have a narrowly black mouth edge, sometimes yellowish anteriorly (characters after van Veen, 2004).

Results

On 25 April 2025, a single *P. malinellus* specimen was collected from the Danube Gorge region, in the Mraconia River basin (Figure 1). The specimen was an adult female, identifiable by the pointed abdomen and dichoptic eyes (Figure 2). It was found at approximately 400 m altitude, near the Romania–Serbia border, about 8 km in a straight line from the Danube. The indicated altitude is approximate, because while walking the 2-kilometer-long transect on Mușchiosul Mare tributary, we collected numerous hoverflies, which were only subsequently determined in the laboratory. Thus, it is impossible to know which individual was captured at what meter of the transect. The hoverflies were personally collected and determined by the authors. The collected specimen is stored in the first author's personal collection. The valley is narrow and humid, with steep slopes dominated by beech (*Fagus* spp.) and oak (*Quercus* spp.) forests. *P. malinellus* was observed in open and sunny microhabitats along the forest road, in rocky areas adjacent to the water, and on concrete walls stabilizing the road edges. These locations contained numerous flowering plants (*Ranunculus repens, Tussilago farfara, Anemone nemorosa, Lamium galeobdolon, Lamium maculatum, Urtica dioica*, etc.), which likely attracted the specimen.

Discussion

In the Danube Gorge region, *P. malinellus* was recorded for the first time in Romania, as it had not been previously mentioned in the country (Brădescu, 1991; Stănescu & Pârvu, 2005). The Romanian Carpathians likely provide suitable habitats for this species, which is associated with coniferous forests (Speight,

2024; Reemer, 2009; Löhr, 1990; Hågvar & Nielsen, 2007). The species was not observed in the high-altitude, humid spruce forests of the Carpathians but was found in the Danube Gorge, one of the warmest regions of southwestern Romania (Gheorghe *et al.,* 2025), at approximately 400 m altitude. This is considerably lower than altitudes reported elsewhere in the Balkan Peninsula (*Parasyrphus malinellus* (Collin, 1952) in GBIF Secretariat, 2023, Van de Meutter *et al.,* 2025), suggesting that the species can persist at low elevations under favorable microclimatic conditions. It is well known that the Danube Gorge shelters certain mountain species at low-altitudes, both among plants (Csürös *et al.,* 1968; Schneider-Binder, 2014; 2016; Petruș-Vancea *et al.,* 2024) and animals (Iftime, 2005; Cicort-Lucaciu *et al.,* 2017; Covaciu-Marcov *et al.,* 2009, 2025; Teodor *et al.,* 2019). Even nowadays, such species, considered potentially glacial relicts, are identified in the region (Teodor *et al.,* 2025). In the Mraconia valley, plant species and associations were recorded at their lowest altitude in the Carpathians (Schneider-Binder, 2016). Also, in the case of hoverflies, mountain species were recorded at low altitudes alongside southern, Mediterranean species (Dumbravă & Cupșa, 2025). As in other cases (Teodor *et al.,* 2025), the record of *P. malinellus* in the Danube Gorge seems to partially fill the gap between populations in the Balkan Peninsula and those situated north and west of Romania (Tóth, 2011; Żoralski & Kowalczyk, 2015; Mazánek *et al.,* 2025). The specimen was collected at the end of April, consistent with the species' known flight period (April–July; Speight, 2024).

In the upper sector of Mraconia valley, the annual average temperature is lower than in most of the Danube Gorge region (Stoenescu *et al.,* 1966; Gheorghe *et al.,* 2025), thus, probably this valley functions as a microclimate refugia for cold climate species. This is important in the context of the intense heat waves of recent years, as evidenced in certain mountain regions in Europe, where those microrefugia could disconnect from the macroclimatic trends of the surrounding regions (Finocchiaro *et al.,* 2024). A similar situation was previously reported in the neighboring Eșelnița valley, whose colder microclimate is likely responsible for the presence of *Vaccinium myrtillus* at very low altitudes (Petruș-Vancea *et al.,* 2024). This phenomenon is likely widespread in the Danube Gorge region and is responsible for the co-occurrence of warm-climate and mountainous species at low altitudes (e.g., Pașcovschi, 1956; Covaciu-Marcov *et al.,* 2009). Moreover, in recent years in the region, both mountain species associated with a colder climate (Petruș-Vancea *et al.,* 2024; Covaciu-Marcov *et al.,* 2025; Teodor *et al.,* 2025) and Mediterranean species (Ruicănescu & Dumbravă, 2020; Dumbravă & Ruicănescu, 2023; Manci & Dumbravă, 2026) have been recorded. Probably the narrow valleys in the Danube Gorge preserved from the last glacial maximum glacial and postglacial relicts, as other remarkable habitats from central Europe (Słowińska *et al.,* 2026), a fact mentioned as possible also in the case of other lowland insect populations in Romania (Sitar *et al.,* 2025). Even in the

case of hoverflies, climatic peculiarities could generate a local microclimate that could ensure the survival of residual populations of some northern species (Burgio *et al.,* 2025).

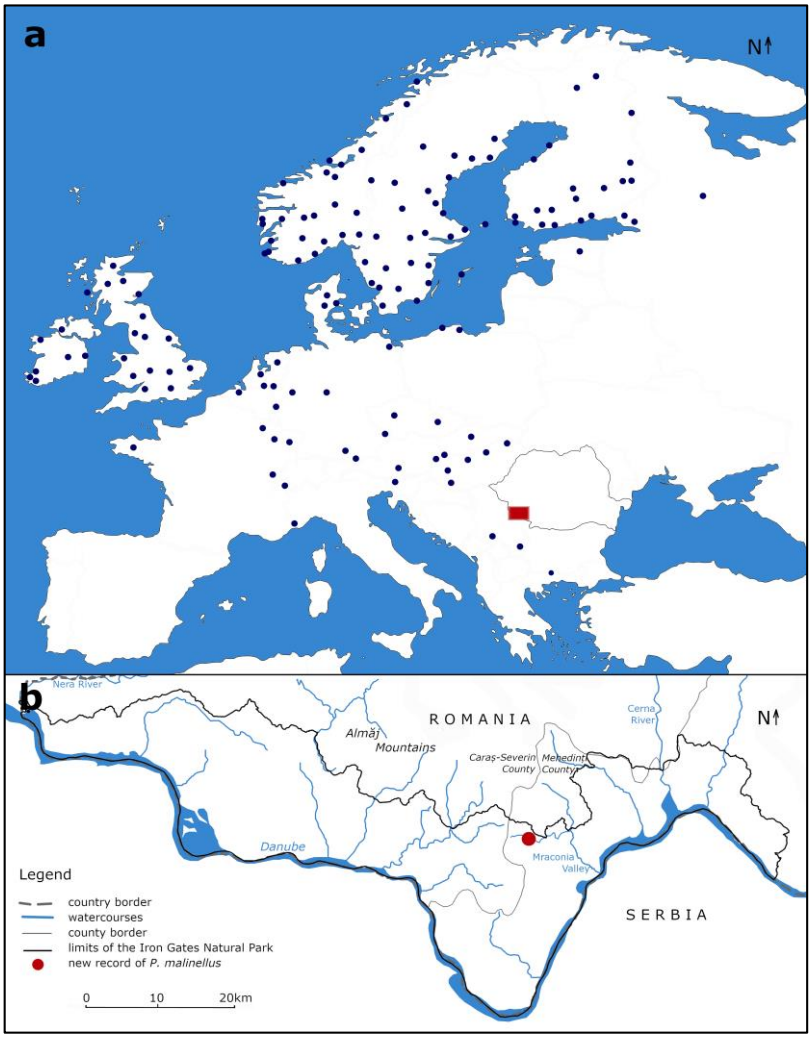

Figure 1. a. Distribution of *P. malinellus* in Europe, according to data available on GBIF (*Parasyrphus malinellus* (Collin, 1952) in GBIF Secretariat, 2023) and other sources (Tóth, 2011; Żoralski & Kowalczyk, 2015; Mazánek *et al.,* 2025; Van de Meutter *et al.,* 2025; in some cases a point represents an entire region, not a specific occurrence record); **b.** first record of *P. malinellus* in Romania

The habitat where *P. malinellus* was found is also notable. Although primarily associated with coniferous forests (Löhr, 1990; Reemer, 2009; Speight, 2004, 2024), it can occasionally occur in deciduous forests (Nilsson *et al.,* 2007; Reemer, 2009). At the southern edge of its range in Greece, it occurs only in coniferous forests (Van de Meutter *et al.,* 2025). In contrast, in the Danube Gorge, there are no coniferous forests; only beech and oak forests (e.g., Reif *et al.,* 2022), except for the black pine (Schneider-Binder, 2014), which is anyway very rare in the gorge, and to our best knowledge absent from the Mraconia valley. The only coniferous trees from the Mraconia basin are a few small-sized and relatively recent plantations. This suggests that *P. malinellus* may be a relict of ancient coniferous forests that once occurred in the Banat Mountains, surviving the extinction of native conifers after the last glacial maximum (Paşcovschi, 1967; Rösch & Fischer, 2000) and subsequently adapting to deciduous habitats and present coniferous plantations. This seems plausible, as the southwestern Carpathians were considered a potential glacial refugium for certain species (e.g., Paşcovschi, 1967; Fijarczyk *et al.,* 2011; Magyari *et al.,* 2012; Şuteu *et al.,* 2023; Voisin *et al.,* 2026).

Figure 2. *Parasyrphus malinellus*: **a, d.** female, habitus ventral view; **b.** head lateral view; **c.** habitus dorso-lateral view.

The microhabitat characteristics, sunny edges inside forests, align with the species' ecological requirements (Reemer, 2009). Although widely distributed in northern Europe, *P. malinellus* remains rare throughout its range (Bartsch *et al.,* 2009). Thus, probably it was not previously mentioned in Romania because of its general rarity and largely arboreal life (Speight, 2024), even if the hoverflies on the Danube Gorge were recently studied (Dumbravă & Cupșa, 2025), while the neighboring areas in the Southern Carpathians were studied in the past (Brădescu, 1975-1976; 1986; 1995). Nevertheless, studies on hoverflies in Romania are likely insufficient, as the entire Balkan region is understudied (Reverté *et al.,* 2023). The recent first-time identification of another insect species in Romania was also attributed to the low number of entomological studies (Iacob *et al.,* 2021). Also, the population could be isolated and thus difficult to identify, as the large surface area of the protected areas has repeatedly been considered an impediment to faunistic studies (Covaciu-Marcov *et al.,* 2025; Dumbravă & Cupșa, 2025). This discovery highlights the need for further research in the Romanian Carpathians to determine whether the Danube Gorge population is isolated or whether other populations remain unrecorded due to insufficient study.

Acknowledgements. Our study was made in collaboration and with the support of the Iron Gates Natural Park Administration.

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