

Separation of the females of *Philodromus praedatus* O.P.-Cambridge and *Philodromus aureolus* (Clerck) (Philodromidae, Araneae)

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Abstract

Characters for the identification of females of *Philodromus praedatus* O.P.-Cambridge, 1871 are given, especially for the separation of this species from *Philodromus aureolus* (Clerck, 1757). The research is based on syntopic occurrence of females of *Ph. praedatus* and *Ph. aureolus* in the locality Dřínová hora (Central Bohemia). Female copulatory organs of *Ph. praedatus* are illustrated for the first time in the Czech Republic. Applying of some currently known and some new diagnostic characters to the material is discussed.

Key words: taxonomy, female copulatory organs, Czech Republic

INTRODUCTION

Taxonomic relations between species of the *Philodromus aureolus* group were uncertain until the 1990's. Taxonomy of the *aureolus* group has developed in a very complicated way. This is particularly true for *Philodromus praedatus*. *Ph. praedatus* O.P.-Cambridge, 1871 was described on the basis of the male holotype only (terra typica England). Simon (1875: 299) described the female of this species; however, he did not present a drawing of the epigynum but of the male tibial apophysis only (fig. 8/6). His description of the epigynum does not provide suitable diagnostic characters to separation from *Ph. aureolus*. Only the annulations on the legs mentioned in the key could correspond to *Ph. praedatus*. After Simon's death, this species was mistakenly synonymised with *Ph. collinus* C.L. Koch, 1935 (Simon 1932; and also Roewer 1955: 773; Bonnet 1958: 3559). This incorrect synonymisation was rejected by Braun (1965). He had studied the male palp of the holotype from the British

Museum of Natural History (fig. 20), which he believed to be a variant of *Ph. aureolus* (*Ph. a.* var. *variegatus* Kulczyński, 1891). Based on several male specimens, Locket et al. (1974) considered *Ph. praedatus* to be a separate species. Snazell (1976) gave a description of the general appearance and presented a good figure of the vulva (fig. 4). Precise diagnostic features of the copulatory organs were presented by Segers (1990) and especially by Harvey (1991). Difficulties might arise, as Blick & Segers (1993) point out: both species can occur together in the same habitat and males of one species could be collected along with the females of the second one.

During the study of spider communities of oak trees, relatively rich material of the genus *Philodromus* was collected. The rare *Ph. praedatus* was found along with *Ph. aureolus* (Clerck, 1757). Based on this material further reliable features for the differentiation of females of both species have been found.

STUDY AREA

The investigation took place 35 km southwest of Prague in the National Nature Reserve Karlštejn, situated in the Protected Landscape Area Český kras (Bohemian Karst). According to the phytogeographical classification of the Czech Republic, this area belongs to the Czech Thermophyticum (Skalický 1988). It presents the largest karst area in Bohemia (Culek 1996). The area is known for its relatively dry and hot climate (mean annual precipitation 500 mm, mean annual temperature 8–9 °C).

The material was collected at two sites at the foot of the hill Dřínová hora (380 m a.s.l., faunistic square 6050), 2 km west of the village Karlštejn. The first site (A) was located in the forest steppe formed by groups of low oaks (*Quercus pubescens*) with dense bushes (*Cornus mas*, *C. sanguinea*, *Ligustrum vulgare*, *Cotoneaster integerrima*) on the edges. Open areas of various sizes covered by xerothermic herbaceous vegetation (*Adonis vernalis*, *Scabiosa ochroleuca*, *Stachys recta*, *Dictamnus albus*) alternated with calcareous rocky formations (for detailed overview see Buchar & Žďárek 1960).

The second site (B) with mature oaks (*Quercus robur*, *Q. petraea*) was situated at the sunny edge of an oak-hornbeam forest fringed by a rich shrub layer (*Ligustrum vulgare*, *Acer campestre*, *Crataegus* sp., *Fraxinus excelsior*, *Prunus spinosa*).

MATERIAL AND METHODS

Beating (b), hand collecting (h) on branches and leaves of oaks, and arboreal photoelectors (e) (Funke 1971) placed on oak trunks at a height of 2 m were used to systematically collect spiders.

26 specimens of *Ph. praedatus* (5 males and 21 females) and 8 specimens of *Ph. aureolus* (3 males and 5 females) were collected from June 1999 to June 2003.

Material examined: (Abbreviations A, B, b, h, e explained above.) The material is deposited in the collection of L. Kubcová (Faculty of Natural History, Charles University, Prague).

Philodromus praedatus

Site A: 5 July–16 August 2000, 1 female, e; 20 June 2001, 1 male, h; 20 June 2001, 3 females, b, 1 female, h; 24 August 2001, 1 female, b; 21 September 2001, 1 female, h; 5 October 2001, 1 female, h; 26 June 2002, 3 females, h; 9 July 2002, 3 females, h; 21 August 2002, 1 female, h; 26 August 2002, 1 female, h; 26 May 2003, 1 juvenile specimen (= male, 30 May 2003), b; 26 May 2003, 1 juvenile specimen (= female, 1 June 2003), h; 4 June 2003, 2 males, b.

Site B: 4 June–19 July 1999, 1 female, e; 26 May–5 July 2000, 1 male, e; 16 August–8 September 2000, 2 females, e; 25 August 2001, 1 female, b.

Philodromus aureolus

Site B: 4 June–19 July 1999, 1 male, e; 5 July–16 August 2000, 1 female, e; 13 June 2001, 1 male, 2 females, b; 3 June–28 June 2001, 2 females, e; 1 November 2002, 1 juvenile specimen (= male, 20 January 2003), h.

Other material for comparison: *Ph. praedatus* 11 males, 11 females; *Ph. aureolus* 24 males, 73 females (Kubcová 2004).

RESULTS

Males and females of both species were found at the study sites. The following diagnostic features of the vulva, as described in the literature (Table 1), were tested for their applicability in the process of determination: sclerotised cross ridges (Fig. 1), shape of copulatory ducts (Figs. 1, 2), position of receptacula to copulatory ducts (Figs. 1, 2).

I found additional separating characters during my study of these very similar species. All these characters are related to the external structures of the epigynum (Table 2).

The shape of the epigynal field of *Ph. praedatus* females was triangular in all cases (Fig. 3), whereas the shape of the epigynal field of *Ph. aureolus* rather resembled a trapezoid or pentagon (Fig. 4).

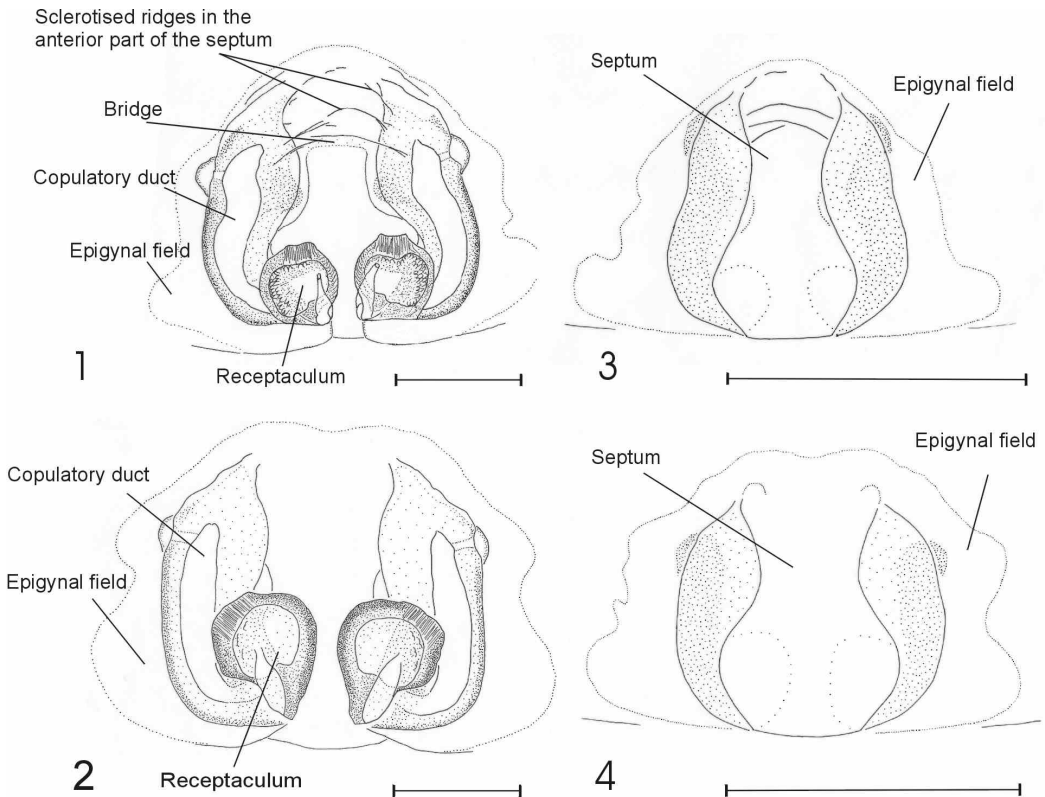
The anterior part of the septum of *Ph. praedatus* appears as a closed arc with the general appearance resembling the grip of a

Table 1. Diagnostic characters for the separation of *Ph. praedatus* and *Ph. aureolus* females.

	<i>Philodromus praedatus</i>	<i>Philodromus aureolus</i>
Sclerotised cross ridges (Harvey 1991)	Present	Absent
Shape of copulatory ducts (Segers 1990)	Clearly curved (S-shaped)	Straight
Position of receptacula in relation to the copulatory ducts (Harvey 1991)	At same level	Receptacula dorsally to the copulatory ducts

Table 2. Newly discovered diagnostic characters for separation between females of *Ph. praedatus* and *Ph. aureolus*.

	<i>Philodromus praedatus</i>	<i>Philodromus aureolus</i>
Shape of epigynal field	Triangular	Trapezoidal or pentagonal
Shape of septum	Stamp-shaped	Vase-shaped
The course of depression in the anterior part of the septum	Refracted, steep, deep	Gradual, shallow

**Fig. 1.** *Philodromus praedatus*, vulva, dorsal view. Scale line = 0.2 mm.**Fig. 2.** *Philodromus aureolus*, vulva, dorsal view. Scale line = 0.2 mm.**Fig. 3.** *Philodromus praedatus*, epigynum. Scale line = 0.5 mm.**Fig. 4.** *Philodromus aureolus*, epigynum. Scale line = 0.5 mm.

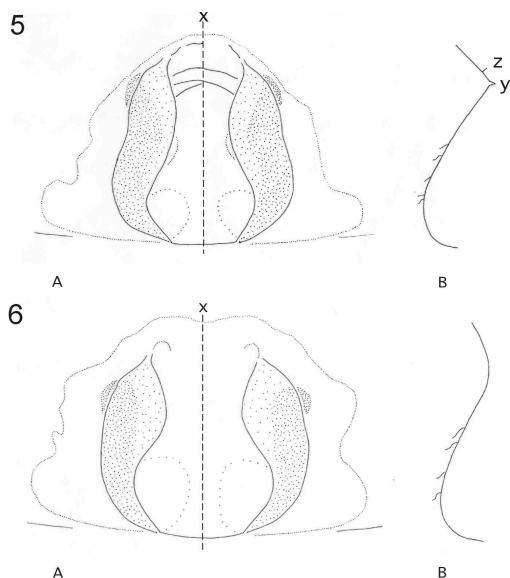


Fig. 5. *Philodromus praedatus* (A) epigynum, form of the median line at the bottom of the septum (x); (B) Ditto (Schema), lateral view; cross ridge located in the anterior part of the septum (y) and in the steep front side (z).

Fig. 6. *Philodromus aureolus*. (A) epigynum, form of the central line of the bottom of septum (x); (B) Ditto (Schema), lateral view.

stamp (Fig. 3), whereas the anterior part of the septum of *Ph. aureolus* resembles a wide open vase (Fig. 4). Generally, the septum is slender in *Ph. praedatus*, while it is broad in *Ph. aureolus*.

Both species differ in the form of the median line of the bottom in the anterior part of the septum. The septum is marked by a depression in its anterior part. This depression is deep and takes a steep course in *Ph. praedatus* while it is shallow with a gentle course in *Ph. aureolus*, which can be best observed in lateral view. In *Ph. praedatus* females, the deepest point of the septum is marked by a distinct kink or fold (y in Fig. 5B, Fig. 1) (also called a chitinised bridge, sclerotised arch or sclerotised ridge by other authors, see Discussion). Anterior to this fold the steep course of the septum is marked by sclerotised horizontal ridges and crinkles (z in Fig. 5B, Fig. 1). In the

Ph. aureolus female the anterior part of the septum is shallow (Fig. 6B), without the noticeable cross ridges and crinkles.

Females of the two species were remarkably different in their size - *Ph. praedatus* (4.1-5.3 mm) being much smaller than *Ph. aureolus* (6.0-8.0 mm).

As for habitats inhabited - females of *Ph. praedatus* preferred lower branches of low oaks (A) - 17 specimens, whereas *Ph. aureolus* females were exclusively found at the edge of a mature oak forest.

Most females of *Ph. aureolus* were collected in June, while most females of *Ph. praedatus* were collected from end of June till August. Males of both species were found from the end of May till July. They were determined according to Segers (1990), Harvey (1991), and Nentwig et al. (2002).

DISCUSSION AND CONCLUSIONS

The present study confirms that a reliable identification of female specimens of the species *Ph. praedatus* and *Ph. aureolus* is possible, based on features known from the literature along with the additional characters mentioned above.

Coloration represents a highly variable characteristic and therefore is not reliable, especially in case of specimens stored in alcohol. Moreover, the coloration of females can be influenced by physiological changes when making the egg sacs (Roberts 1995). Particularly the length of the dark brown heart mark (sagittate mark) on the abdomen and the shape of the dorsal abdominal spots (paired spots behind the heart mark, called chevrons) were not constant in the specimens investigated. In accordance with Harvey (1991), the heart mark does extend to the second pair of impressed dots even in females of *Ph. praedatus*. This feature is usually presented as the key feature for determination of both species (Segers 1990; Nentwig et al. 2002): the heart mark in the *Ph. praedatus* females should not reach to the second pair of impressed dots, while in *Ph. aureolus* the heart mark reaches

the second pair of impressed dots. However, some differences in coloration (Snazell 1976, Segers 1990, Harvey 1991) were observed: females of *Ph. praedatus* had, overall, a paler appearance than *Ph. aureolus*; while females of *Ph. praedatus* had mottled lateral bands on the carapace and their legs were clearly annulated and spotted, the females of *Ph. aureolus* had homogeneously dark brown lateral carapace bands and their legs were without annulations and spots.

In addition to the variation in coloration, the existence of postcopulatory markings in the epigynal septum (cf. Wiehle 1953: 127) can make identification difficult. This problem can be solved by viewing the vulva dorsally or by removing the plug from the septum.

Terminological ambiguities obstruct the comparison of important structures at the epigynum/vulva of *Ph. praedatus*. In the anterior part of the septum, different authors distinguish different structures.

Braun (1965) pointed out for the first time the "Chitinbrücke", a typical structure for some species of the *Ph. aureolus* group. It is a cross invagination of the septum surface clearly evident in dorsal view. The presence of this structure ("chitinised bridge") at *Ph. praedatus* vulvas was also mentioned by Snazell (1976: fig. 4). Harvey (1991) described "sclerotised ridges" across the anterior end of the vulva (usually visible when the epigynum is viewed ventrally). He did not distinguish a sole structure of chitinised bridge. These sclerotised cross ridges had (without any name) already been shown by Segers (1990: fig. 7). Segers (1992) described a "sclerotised arch" dividing the median plate from the atrium in epigynums of *Ph. longipalpis* and *Ph. fuscolimbatus*. The bridge was depicted at the same place on the vulva in these species.

Although the bridge (= sclerotised arch) is mentioned in the description of the epigynum, the whole course of the fold of cuticle (invagination) is apparent in dorsal view of the vulva only.

In the Czech Republic the variability of *Ph.*

aureolus had been overvalued for a long time (Šilhavý 1947), as it was in a very detailed key by Miller (1971). Both authors do not even differentiate between *Ph. cespitum* and *Ph. aureolus*, let alone *Ph. praedatus*. *Ph. praedatus* has so far been found only individually in the Czech Republic (rare, on herb vegetation and shrubs) on nine squares of the grid map (Buchar & Růžička 2002). New records therefore contribute to a better understanding of its ecological demands. In the area of Dřínová hora, *Ph. praedatus* prefers lower branches of the oaks (similarly to the findings of Snazell (1976) and Harvey (1991)). In contrast, *Ph. aureolus* utilises a vast spectrum of habitats: shrubs and trees in forest steppes, oak forests and orchards (Buchar & Růžička 2002).

Distribution of *Ph. praedatus*: European. Records from Siberia (Mikhailov 1997) should be revised, as they might refer to *Ph. aureolus* var. *variegatus*.

Distribution of *P. aureolus*: Palaearctic.

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