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Dysmachus bilobus Loew, 1871 (Diptera: Asilidae): description of male terminalia and first record in Austria

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Abstract

The robber fly *Dysmachus bilobus* Loew, 1871 is reported for the first time in Austria. The record is based on a male specimen collected in the Donau-Auen National Park near the village of Stopfenreuth, Lower Austria, and represents the species' westernmost distribution to date. Additional records are provided for two localities in Northwestern Romania. A detailed description of the lectotype male terminalia is provided for the first time, supplemented with detailed images, an updated distribution map, and a brief discussion.

Keywords. Distribution, Romania, Donau-Auen, Lower Austria, robber fly, taxonomy.

Zusammenfassung

Die Raubfliege *Dysmachus bilobus* Loew, 1871 wird erstmals in Österreich nachgewiesen. Der Nachweis basiert auf einem Männchen, das im Nationalpark Donau-Auen nahe Stopfenreuth, Niederösterreich, gesammelt wurde, und stellt die bisher westlichste Verbreitung dieser Art dar. Weitere Nachweise werden für zwei Fundorte im Nordwesten Rumäniens angegeben. Eine detaillierte Beschreibung der männlichen Terminalia des Lectotypus wird erstmals mit detaillierten Abbildungen, einer aktualisierten Verbreitungskarte und einer kurzen Diskussion vorgelegt.

Introduction

Dysmachus Loew, 1860 is a Palearctic genus with approximately 60 valid species (Hull 1962, Lehr 1988, Cohen 2020), of which about 30 are reported in Europe (Weinberg & Bächli 1995). In Austria, seven species have already been reported: *Dysmachus bifurcus* (Loew, 1848), *D. bimucronatus* (Loew, 1854), *D. cochleatus* (Loew, 1854), *D. fuscipennis* (Meigen, 1820), *D. praemorsus* (Loew, 1854), *D. stylifer* (Loew, 1854), and *D. trigonus* (Meigen, 1804) (Lehr 1988, Wolff et al. 2018).

The genus comprises small to medium size robber flies (7–22 mm) mainly characterized by the following features: facial gibbosity strongly developed and occupying more than half of the facial length with the facial area between its dorsal margin and the antennal base shorter or as short as the length of antennal scape; postpedicel lanceolate; occipital setae relatively straight or only slightly curved forward, never strongly curved forward; dorsocentral macrosetae and acrostichal setae long and strongly developed (especially acrostichals) anterior to the transverse suture, reaching anterior margin of scutum; anatergite setose; wing with only two submarginal cells, vein R_5 ending below wing apex; basitarsus of fore and mid legs as long as or longer than tarsomeres 2–3 combined (never shorter); abdomen entirely pruinose, including segment 7 (except segment 8, in males of some

species); tergites with strong, prominent, lateral marginal macrosetae; female terminalia compressed laterally, female cerci enclosed by tergite 9+10; male terminalia relatively compact; epandrium usually possessing distal processes and indentations (Engel 1930, Hull 1962, Weinberg & Bächli 1995).

Representatives of this genus are found mainly in meadows and grasslands, including dry to semi-dry grasslands. Hilly hay grasslands, tall, dense vegetation, mountainous meadows, mesophytic meadows, and grassy sandbars of fine, loose sand are among their preferred habitats. Individuals commonly perch on grass leaves, spikes, flower heads, and stems, at heights of 10–40 cm above the ground. Oviposition usually occurs in the spikelets of different grass species or under the palets of the spikes (Adamovic 1973). Biological information on immature stages is scarce. Larval development occurs in sandy soil, at least for *Dysmachus trigonus* (Wolff et al. 2018), where pupae are also presumably found with the pupation period around May to July (Brauns 1954).

In this study, *Dysmachus bilobus* Loew, 1871 is reported for the first time in Austria. Further records from Northwestern Romania, as well as a redescription of the male terminalia are provided for the first time, images of the lectotype and the Lower Austrian specimen, and an updated distribution map are added.

Material and methods

The material studied in this work is deposited in the Natural History Museum Vienna (NHMW), Austria, and the Museum für Naturkunde Berlin (MfN), Germany. The specimens were identified with the aid of a Leica M165C stereomicroscope, equipped with a white light ring LED. For the identification, the original description of Loew (1871) and the works of Engel (1930) and Astakhov (2015) were used. Direct comparison with the lectotype of *D. bilobus* also aided in confirming the identification. Images of the specimens were taken using a Canon-EOS R5 camera with an MP-E 65 mm lens coupled to a manual macro-metric rail and using external white light. Stacked images were combined using Helicon Focus (v8.2.2), applying method C, smoothing 3.

The terminalia of the lectotype of *D. bilobus* were previously dissected by Tomasovic (2003), and the dissected parts were glued to a plastic board pinned under the specimen. To be able to illustrate these structures, they were de-glued from the plastic board, softened with KOH 10% for two days, and then placed in a concave slide with glycerin and imaged. To neutralize the KOH reaction, the dissected pieces were bathed in acetic acid 10% for 30 min. The detached pieces were properly stored in a genital vial using glycerin and pinned under the specimen. The male specimen collected in Austria was also dissected for comparison. The abdomen was cut at the base of abdominal segment 6 and macerated in KOH 10% for five days. After that, the same procedure adopted for the lectotype terminalia was performed. The images of the dissected terminalia were taken with a Nikon SMZ25 (Objective: Nikon SHE plan apo 1× wd 60) stereomicroscope coupled to a Nikon DS-Ri2 camera using the NIS Elements (v.6.20.01) software.

Information contained on the labels is transcribed in full, with data from different labels under the same specimen, separated by a slash (/). Complementary data not provided on the labels are indicated between square brackets ([]). The map was generated with QGIS 3.40 Bratislava (long-term release) software. Shapefiles of territorial limits and raster were obtained from Natural Earth (2024). Image plates were prepared and edited with Adobe Photoshop 2025 software.

Taxonomy

Dysmachus Loew, 1860

Dysmachus Loew, 1860: 143 (key for genus). Type species: *Asilus trigonus* Meigen, 1804 (by subsequent designation of Coquillett 1910: 536).

Dysmachus bilobus Loew, 1871 (Figs 1–35)

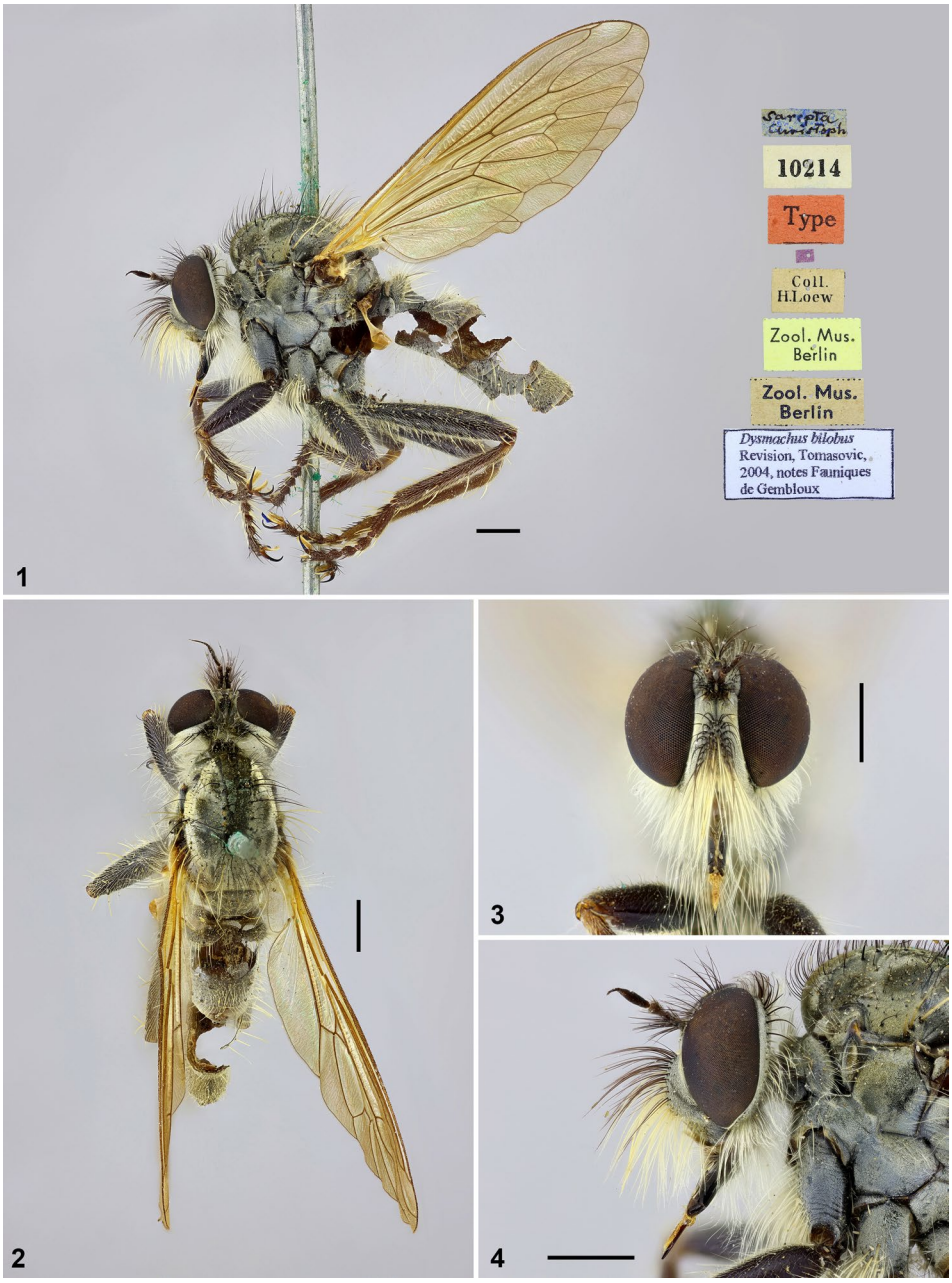
Dysmachus bilobus Loew, 1871: 138. Type locality: Sarepta [= Krasnoarmeyskiy Rayon near Volgograd, Russia] and Mehadia [Romania]; Becker 1880: 154 (species list); Bezzi 1903: 147 (Palaearctic catalogue); Kertész 1909: 275 (catalogue); Becker 1923: 17, 91, fig. 5 (species list); Engel 1930: 105, 109, fig. 97 (species key, diagnosis and illustration of type male terminalia); Adamovic 1950: 205, figs 1–5 (ecology); Hull 1962 (2): 567 (synopsis of world fauna); Adamovic 1963a: 56 (prey); 1963b: 20, figs 9–15, 17, 22, 28 (ecology); Moucha & Hradský 1963: 373 (species list); Hradský & Moucha 1964: 20, 25 (species list); Richter 1964: 175 (species list); Adamovic 1968: 126, figs 1, 2 (prey); Richter 1968: 10, 37, 255 (mention, key, diagnosis); Adamovic 1973: 121, figs 4a, b (mating, ovipositing); Weinberg 1974: 194 (species list); Lehr 1988: 287 (Palaearctic catalogue); Hayat 1993: 78, 80, fig. 4.15 d–f (species list); Lehr 1996: 109, 110, 111, 113, 116, figs 7, 10 (mention, key, ecology); Bosak & Hradský 2001: 19 (species list); Tomasovic 2003: 58, fig. 5 (lectotype designation); Lehr et al. 2007: 9 (species list); Astakhov 2015: 11, 14, 30, 37, 41, 49, 84, 201, 202, figs 518–533 (key, synopsis of Lower Volga fauna); Mohammadi et al. 2017: 248 (species list).

Type material examined. Lectotype (♂ MfN): Sarepta Christoph / 10214 / Type / [small squared red label] / Coll. H. Loew / Zool. Mus. Berlin / Zool. Mus. Berlin / *Dysmachus bilobus* Revision, Tomasovic, 2004, notes Fauniques de Gembloux (Fig. 1, insert) [right postpedicel missing; abdominal tergites 1–5 and posterior ventral part of thorax eaten away by dermestids; terminalia dissected and stored in microvial pinned along with the specimen (Figs 1–14)]; Paralectotype (1 ♂ MfN): [small squared red label] / Mehadia Erber / Type / [small squared red label] / Coll. H. Loew / Zoll. Mus. Berlin [both postpedicels missing; right wing, abdomen, right hind tarsus and left hind tarsomeres 3–5 missing; ventral half of mid left femur eaten away by dermestids].

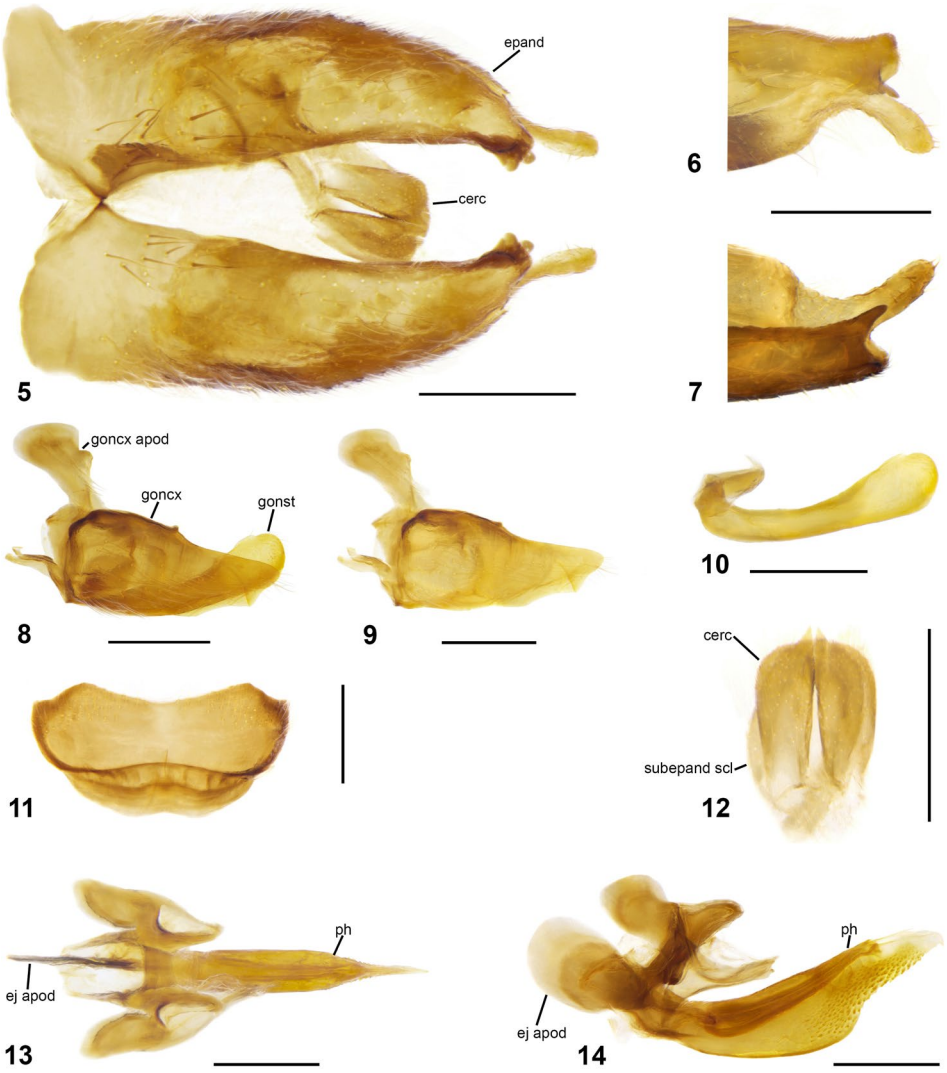
Additional material examined. 1 ♂ (NHMW), A.inf. [Austria inferior = Lower Austria], Gänserndorf E Stopfenreuth, Jägerwiese [48°10′16.0″N 16°56′49.0″E], 12.V.2012 1205122NOHZ DA2 / *Dysmachus bilobus* Loew, 1871 ♂, Det. A. Camargo 2025 / NHMW-ZOO-DIP-0001850 [dissected (Figs 15–19, 21–34)]; 1 ♂ (NHMW), Rumänien, Cluj, Sic (Szék), alte Salzmine, Sic Ost, 46°55′56″N, 23°54′43″E, 335 m, 21.V.2025, leg. Thomas Zechmeister; 11 ♂♂, 4 ♀♀ (NHMW), Rumänien, Cluj, Coasta, Schafweide 1.5 Km Süd Sic, 46°54′07″N, 23°53′38″E, 290 m, 22.V.2025, leg. A. Camargo & I. Menezes; 1 ♂, 1 ♀ (MfN), Obrenovac 21.VI.1955 Serbia / in copula mit X, Z. R. Adamovic leg. / Zool. Mus. Berlin.

Diagnosis. Small to medium size robber fly (14 mm) with mostly yellowish grey pruinose body (Figs 1–4, 15–16); mystax with black macrosetae dorsally and laterally, and pale-yellow macrosetae medially and ventrally (Figs 3–4); scutellum with pair of pale-yellow marginal macrosetae (Figs 2, 16); wing veins brown, except on basal fourth of wing and basal two thirds of radial branch yellow (Figs 1–2, 15–16); legs black, with pale-yellow macrosetae and setae (Figs 1–2, 15–16); tergites with well-developed lateral marginal macrosetae (Figs 15–16); sternites with strong macrosetae and setae more densely arranged in the center (Fig. 15); tergite and sternite 8 black, sternite 8 bilobed and with a depression at mid-posterior margin (Figs 18, 24).

Addenda to lectotype description. Male terminalia (Figs 5–14, 17–19, 21–34): tergite and sternite 8 shining black (Figs 17–19); sternite 8 with posterior margin bilobed, possessing a strong depression at mid-posterior margin, between each lobe (Figs 18, 24);

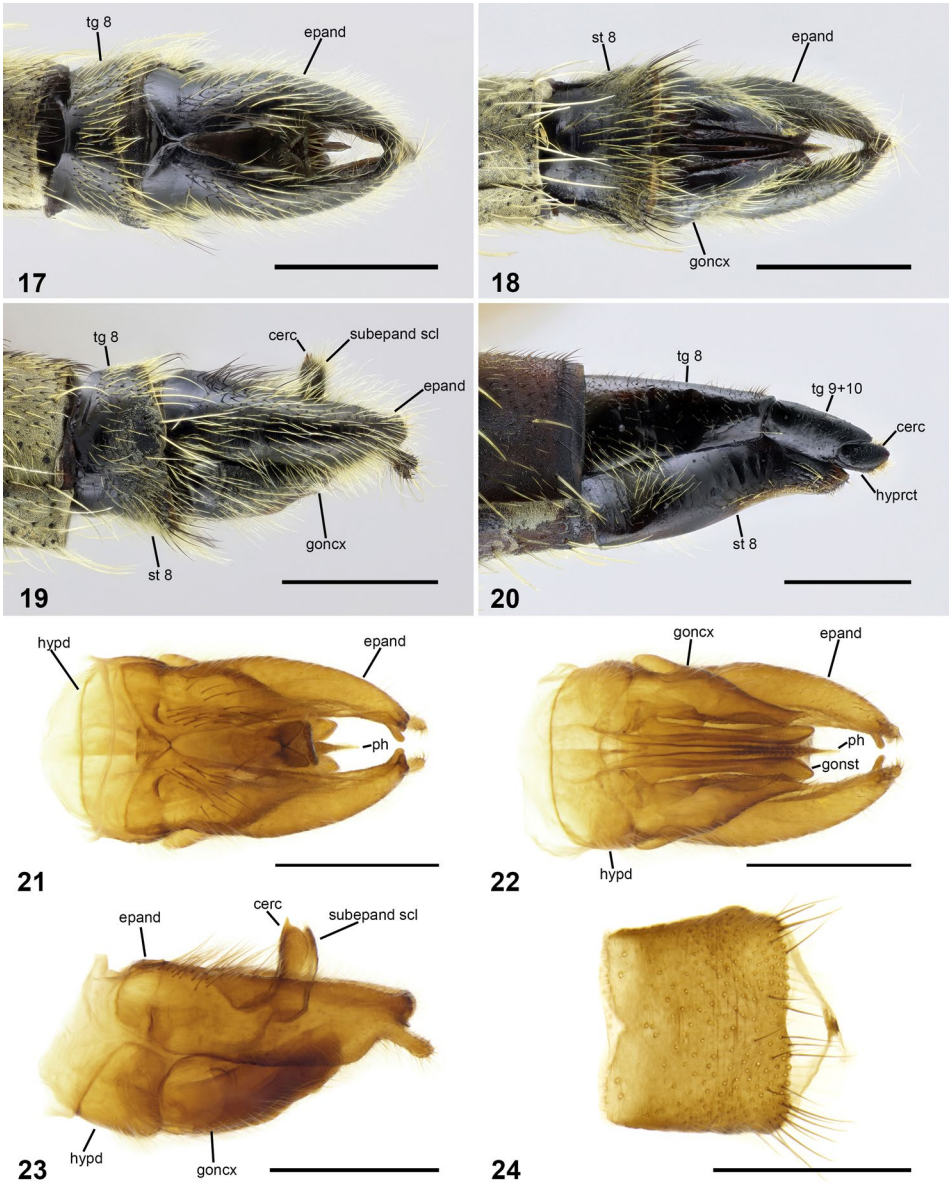


Figs 1–4. *Dysmachus bilobus*, lectotype male. (1–2) habitus in (1) lateral [insert: labels, not to scale] and (2) dorsal view. (3–4) Head in (3) frontal and (4) dorsal view. Scale bars: 1 mm.

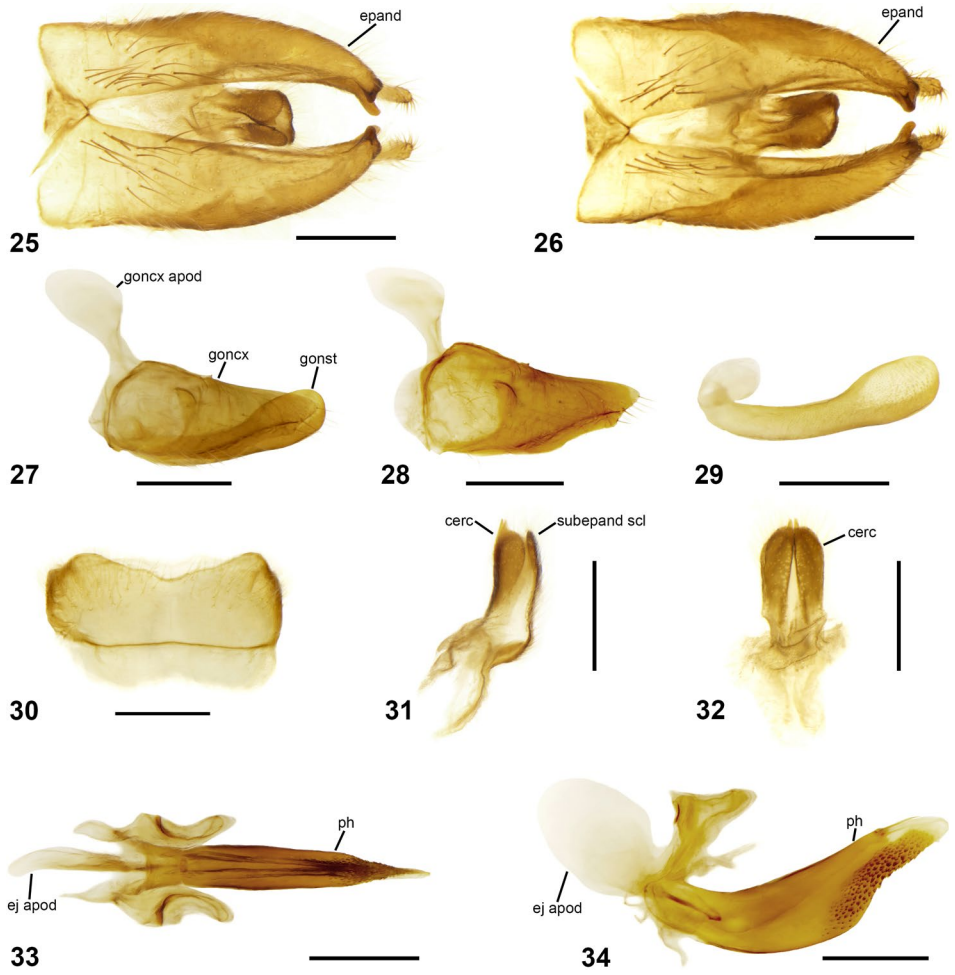


Figs 5–14. *Dysmachus bilobus*, lectotype male, dissected terminalia. (5) Epandrium, dorsal. (6–7) Epandrial apex, lateral and ventral. (8) Gonopods, lateral. (9) Gonocoxite, lateral. (10) Gonostylus, lateral. (11) Hypandrium, ventral. (12) Cerci, dorsal. (13–14) Phallus, dorsal and lateral. – Abbreviations: cerc: cercus; ej apod: ejaculatory apodeme; epand: epandrium; goncx: gonocoxite; goncx apod: gonocoxal apodeme; gonst: gonostylus; ph: phallus; subepand scl: subepandrial sclerite. Scale bars: 0.5 mm.

Figs 15–16. *Dysmachus bilobus*, male from Austria. Habitus in (15) lateral and (16) dorsal view. Scale bars: 1 mm.



Figs 17–24. *Dysmachus bilobus*, male from Austria and female from Serbia. (17–19) Male terminalia, dorsal, ventral, and lateral view. (20) Female terminalia, lateral. (21–23) Dissected male terminalia, dorsal, ventral, and lateral. (24), sternite 8, ventral. – Abbreviations: cerc: cercus; epand: epandrium; goncx: gonocoxite; gonst: gonostylus; hypd: hypandrium; hyprct: hypoproct; ph: phallus; subepand scl: subepandrial sclerite; st: sternite; tg: tergite. Scale bars: 1 mm.



Figs 25–34. *Dysmachus bilobus*, male from Austria, dissected terminalia. (25–26) Epandrium, dorsal and ventral. (27) Gonopods, lateral. (28) Gonocoxite, lateral. (29) Gonostylus, lateral. (30) Hypandrium, ventral. (31–32) Cerci and subepandrial sclerite, lateral and dorsal. (33–34) Phallus, dorsal and lateral. – Abbreviations: cerc: cercus; ej apod: ejaculatory apodeme; epand: epandrium; goncx: gonocoxite; goncx apod: gonocoxal apodeme; gonst: gonostylus; ph: phallus; subepand scl: subepandrial sclerite. Scale bars: 0.5 mm.

epandrium apex ending truncate dorsally with a narrow and short, chitinous, spine-like process ventrally (directed inward, similar to an open end wrench when seen laterally and posteriorly), below with a longer process, ventrally directed, rounded distally, with sparse, tiny setae, and hollowed on internal side (Figs 5–7, 21–23); hypandrium with a concave indentation at its posterior margin (Figs 11, 30); gonocoxite subrectangular on basal half and cone-shaped on apical half, with ventral side obliquely truncate possessing 5–6 setae, gonocoxal apodeme fan-shaped (Figs 8–9, 27–28); gonostylus slender

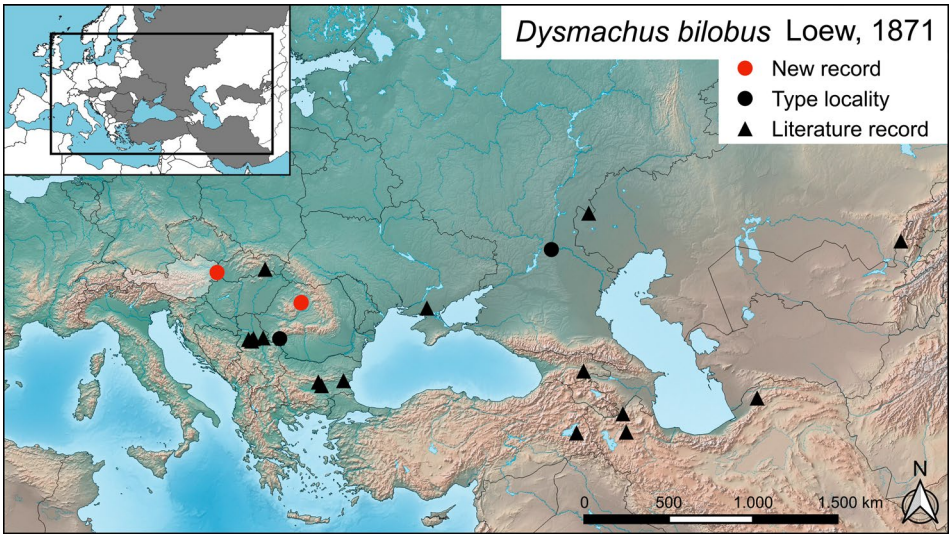


Fig. 35. Distribution map of *Dysmachus bilobus*.

and clavate (Figs 10, 29); cerci spatulate, ending in a short, spine-like projection at inner posterior margin; subepandrial sclerite rounded distally, tongue-shaped (Figs 12, 31–32); ejaculatory apodeme fan-shaped; phallus blade-shaped distally ending in three tiny prongs dorsally (Figs 13–14, 33–34). Female terminalia (Fig. 20): shining black, tergite 8 with short, sparse yellowish setae, slightly longer at the sides anteriorly; sternite 8 slightly concave subapically, with thin yellowish setae anteriorly and very short brownish setae at the posterior tip; tergite 9+10 only with a few scanty yellowish setae; cercus with short, comb-like, dorsal and posterior, yellowish setae.

Variation. In some of the analyzed specimens, the scutellar macrosetae are black or black on one side and yellow on the other. In the legs, some specimens present black ventral macrosetae on fore femur and black macrosetae at the tibial ventral apex. Loew (1871) also noted color differences between the type specimens. In a remark section under the original description, he noted the lectotype (from "Sarepta") as being a lighter and more greyish specimen with the base of the tibiae reddish-brown; and the paralectotype (from Mehadia) as being more brownish and with entirely black tibiae. He also stated that despite this difference, both specimens agreed perfectly in all other remaining characters. The lighter and darker variations observed by Loew could simply be the result of changes caused by different collecting, preparing, and storing techniques, where the body fat of the specimen may have caused changes in the colors observed.

Distribution. Austria (new record), Bulgaria (Hradský & Moucha 1964), Georgia (Moucha & Hradský 1963), Iran (Lehr et al. 2007, Mohammadi et al. 2017), Romania (Loew 1871, additional record), Russia (Loew 1871, Becker 1880, Astakhov 2015), Serbia (Adamovic 1950), Slovakia (Weinberg 1974), Turkey (Hayat 1993, Bosak & Hradský 2001), Ukraine (Lehr 1996), Uzbekistan (Moucha & Hradský 1963) (Fig. 35). Lehr (1996, 1988) also mentioned Armenia, Azerbaijan and Kyrgyzstan (as Transcaucasia). However, for these countries, it was not possible to find any precise records in the available literature. Additionally, the drawing depicting the terminalia of *D. bilobus* in Hayat (1993:

80, fig. 4.15 d–f) pertains to a different *Dysmachus* species, likely *D. bimucronatus*, and therefore this record was not included in the distribution map (Fig. 35).

Phenology. The material analyzed was collected around mid-May. In the literature, this species has been reported in spring and early summer, from late April until the end of July, with a peak in May and June (Adamovic 1950, 1963a, b).

Discussion

The distribution of *D. bilobus* ranges from the lowland steppe areas of southwestern Russia (Lower Volga), reaching the continental and Pannonian grasslands of southeastern Europe, including records from montane regions in Georgia, Iran, Turkey, and Uzbekistan. Although the species distribution covers quite a vast area, literature records can be considered scarce (see distribution).

Adamovic (1950) made the first report of this species from Serbia and conducted detailed ecological studies on prey, courtship, oviposition, and development of immature stages (Adamovic 1950, 1963a, b, 1968, 1973). His observations occurred in mesophytic meadows of the alluvial plains of the Sava and Kolubara rivers. *Dysmachus bilobus* is considered euryphagic, hunting prey in flight, with cannibalism also being reported (see Adamovic 1963a, b for a detailed list of prey).

Specimens were usually observed perching on low and vertical grass stems and leaves, usually seated on the leaves, flower heads, spikes, but particularly on the grass stems, at heights of 20 to 30 cm above the ground. It was always observed in meadows, especially at the borders, next to forest edges, flying low and slow at about 0.5 m above the ground and frequently landing on plants. Females were observed ovipositing on the same day and place where copulation took place. The oviposition was frequently observed in the spikelet of different grass species, mainly in *Alopecurus pratensis* L., *Poa pratensis* L., *Poa trivialis* L., *Agropyron repens* (L.) Gould, and seldomly in flowers like *Oenanthe silaifolia* M. Bieb., and *Veronica longifolia* L. (see Adamovic 1973 for details on mating and ovipositing).

The Jägerwiese, the locality where the Austrian male specimen was collected, is a meadow surrounded by woods located in the Danube alluvial plain. At the end of June 2025, this area was visited by the author in the hope of collecting additional specimens; however, the grass was already mown, and not a single specimen of *Dysmachus* was seen. The specimens from Romania were collected in low hills (250–350 m a.s.l.) with low grass meadows grazed by sheep, located in the surroundings of the town of Sic, in Cluj. During the collecting period (21–22 May 2025), the species was fairly abundant in those grasslands.

Recently, Camargo & Menezes (2024) also reported the robber fly *Choerades mouchai* Hradský, 1985 as new to Austria, based on a male specimen collected near Vienna. The present record of *Dysmachus bilobus* increases the number of *Dysmachus* species known to occur in Austria to eight. These new records highlight how underestimated the knowledge of the Austrian robber fly fauna is, reinforcing the importance of increasing sampling effort and reviewing material deposited in collections.

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