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Bibionidae (Diptera) of Uzbekistan

Bibionidae (Diptera) Узбекистана

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Ключевые слова: список видов, Bibionidae, *Ferula*, новая находка, Узбекистан.

Abstract. Two genera, *Bibio* Geoffroy, 1762 and *Dilophus* Meigen, 1803, have been confirmed in the fauna of Uzbekistan. *Bibio pravdini* N. Krivosheina, 2023 is recorded in Uzbekistan for the first time. Precise locality data, geographic coordinates, elevation, collection dates, diagnostic remarks and illustrations of male terminalia are provided for each species. A key to the genera and species found in Uzbekistan is presented alongside a distribution map.

Резюме. Для фауны Узбекистана подтверждено присутствие двух родов комаров-толстоножек *Bibio* Geoffroy, 1762 и *Dilophus* Meigen, 1803. Вид *Bibio pravdini* N. Krivosheina, 2023 впервые отмечен для Узбекистана. Для каждого вида приведены точные данные о местонахождении, географические координаты, высота над уровнем моря, даты сбора, диагностические замечания и иллюстрации строения терминалий самцов. Составлен определитель для родов и видов, зарегистрированных в Узбекистане, а также карта их распространения.

Introduction

In recent years, research on the invertebrate fauna of Uzbekistan has intensified considerably: checklists have been published both for the country as a whole [Naydenov et al., 2025] and for individual mountain ranges [Narzullayev, 2022; Khalimov, 2023; Rakhimov, 2023]; patterns of distribution and morphological variability of insects along elevational gradients are being investigated [Zokirova, Khalimov, 2022; Zokirova et al., 2025]; new species are described on a regular basis [Barkalov et al., 2020; Fomichev, Shodmonov, 2024; Mamanov et al., 2024]; and research is expanding both on the impacts of pest invertebrates on plants [Narzullayev et al., 2023] and on the role of insects in pollination [Khalimov et al., 2023]. Within this research agenda, we investigated pollinator communities on members of the family Apiaceae, especially *Ferula* L. [Usanov et al., 2025], and repeatedly recorded Bibionidae on inflorescences and in adjacent habitats. This prompted a closer focus on this ecologically significant but understudied fly family.

Bibionidae (Diptera: Bibionomorpha) are small to medium-sized flies whose adults are usually active in spring and autumn, while larvae develop in soil and litter, feeding on decaying organic matter and plant roots [Krivosheina, 1972]. In doing so, they contribute to decomposition processes and soil fertility. The family Bibionidae represents one of the most ancient lineages of nematocerous Diptera [Nel, Kundura, 2023]. Historically, closely related groups were sometimes treated as separate families (Pleciidae, Hesperinidae) [Rohdendorf, 1964; Krivosheina, 1969a], but both morphology and molecular data [Fitzgerald, 2004; Ševčík et al., 2016] support their inclusion within a broad concept of Bibionidae.

Globally, more than 1100 species are recognized [Catalogue, 2025], with most diversity concentrated in *Bibio* Geoffroy, 1762 (~377 spp.), *Dilophus* Meigen, 1803 (~224 spp.), *Penthetria* Meigen, 1803 (~88 spp.), and *Plecia* Wiedemann, 1828 (~399 spp.) [Fitzgerald, 2004]. In Central Asia, *Bibio* and *Dilophus* are reliably represented, while other genera appear rare or absent [Krivosheina, 1986]. Despite this ecological and taxo-

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nomic significance, the Bibionidae of Uzbekistan remain poorly documented: no annotated checklist exists, phenological and distributional data are fragmentary, and illustrated diagnostic resources are scarce.

The present contribution addresses these gaps by synthesizing literature records with new field collections and a revision of the entomological collection of Samarkand State University. We provide an annotated species list, document new country records with precise localities, coordinates, collection dates, and voucher codes, and supply diagnostic notes with illustrations of male terminalia, along with a distribution map and a simple identification key. All studied specimens are deposited in the entomological collection of Samarkand State University (SAMSU).

Material and methods

The present study is based on material collected by the authors between 2018 and 2025 across multiple regions of Uzbekistan, covering foothill, montane, and alpine habitats (Fig. 1). Specimens were collected in various biotopes, including mountain steppe, shrubby slopes, forest plantations, alpine meadows, and flowering communities of *Ferula* (Apiaceae).

Adults were collected using a standard entomological sweep net. In most cases, specimens were captured directly from vegetation, including inflorescences of *Ferula* species, or during active flight. Collecting sites were georeferenced in the field.

Male genitalia were dissected for reliable species identification. The apical portion of the abdomen was removed and macerated in 10% KOH solution for 24 hours. After clearing, the genitalia were neutralized in acetic acid (approximately 45 seconds), rinsed in distilled water, and preserved in glycerine in microvials attached to the corresponding specimens.

Genital structures were examined under an MBI-9 stereomicroscope to ensure correct orientation and interpretation of diagnostic characters.

Specimens were identified by the first and second authors using the diagnostic characters and keys provided by Duda [1930] and Krivosheina [1969b, 2022c, 2023 a, b]. Identification was primarily based on male morphological characters, especially the structure of the terminalia.

Morphological terminology and general distributional concepts follow Krivosheina [1969b].

Specimens were photographed using a Carl Zeiss Stemi 508 stereomicroscope equipped with a digital camera. Images of habitus and genital structures were processed using Adobe Photoshop (version 20.0.5) for contrast optimization and figure preparation.

All examined specimens are deposited in the Entomological Collection of Samarkand State University (SAMSU), Samarkand, Uzbekistan.

All records presented in this study are based on examined voucher specimens. For each occurrence, specimen-level metadata are provided, including locality, geographic coordinates (in decimal degrees), elevation above sea level, date of collection and collector name.

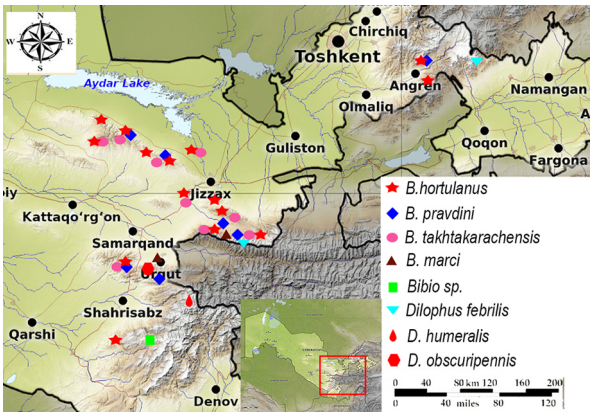


Fig. 1. Locality map of Bibionidae in Uzbekistan.
Рис. 1. Карта мест сборов Bibionidae в Узбекистане.

Geographic coordinates were standardized in decimal degrees and verified using digital mapping resources. Distributional data were critically compared with published literature to confirm the novelty of country records.

For species newly recorded from Uzbekistan, diagnostic characters distinguishing them from morphologically similar taxa were carefully examined and illustrated.

The base map of Uzbekistan used for the distribution map was obtained from an open-access online resource (https://www.bluegreenatlas.com).

The present work is registered in ZooBank (www.zoobank.org) under urn:lsid:zoobank.org:pub:F62228EE-E9A7-45F8-B24A-CAF949FB2FA3

Results

Due to the comparatively small size of the regional fauna, the study of this family has not progressed very actively; most of the published works belong to a limited circle of authors [Duda, 1930; Hardy, 1950; Hardy, Takahashi, 1960; Krivosheina, 1969b]. Only in recent years has a series of studies on the fauna and taxonomy of Bibionidae in Russia and adjacent countries been published [Krivosheina, Khruleva, 2015; Dvořák et al., 2022; Krivosheina, 2022a, b, 2023a, b].

This is the first record of *Bibio pravdini* for Uzbekistan. A key to the species of the family Bibionidae presented here is based on that published by N.P. Krivosheina [1969b; 2023a].

List of species of the family Bibionidae Latreille, 1802 from Uzbekistan

Bibio Geoffroy, 1762

Bibio pravdini N. Krivosheina, 2023

Figs 6, 7.

Material. Jizzakh Region: 2♂♂, 9♀♀ — Baxmal District, Jumjum village, Turkiston Range, 39.6951°N, 67.8441°E, h~1900 m a.s.l., on *Ferula kuhistanica*, 8–9.V.2024, U. Usanov leg.; 3♂♂ — Forish District, Balandosmon village, N slopes of Nuratau Range, 40.3205° N, 67.2846° E,

h~1034 m a.s.l., mountain shrubby steppe, 26.IV.2025, M. Rakhimov leg. ***Samarkand Region:*** 1♂ — Urgut District, 5.2 km NW Beshkal, 'Yetti uyli forest plantations', N spurs of Zarafshan Range, 39.4356° N, 66.9890° E, h~1047 m a.s.l., mountain steppe and forest plantations, 21–25.IV.2025, M. Rakhimov leg.

Distribution. Uzbekistan, Tajikistan [Krivosheina, 2023a, b]. Recorded from Uzbekistan for the first time.

Bibio hortulanus (Linnaeus, 1758)

Figs. 4, 5.

Material. Jizzakh Region: 8♂♂, 16♀♀ — Sh. Rashidov District, Sangzor, Molguzar Range, 40.0745° N, 67.6984° E, h~460 m a.s.l., on *Ferula dshizakensis*, 15–16.IV.2023, U. Usanov leg., 4♀♀ — Sh. Rashidov District, Sangzor, Molguzar Range, 40.0744° N, 67.6984° E, h~468 m a.s.l., on *Ferula dshizakensis*, 28–30.IV.2024, U. Usanov leg., 10♂♂, 7♀♀ — Baxmal District, Muzbuloq village, Zamin State Reserve, Guralashsoy, Turkiston Range, 39.6330° N, 68.2827° E, h~1780–2048 m a.s.l., on *Ferula samarkandica*, 27.V.2024, U. Usanov leg., 3♂♂, 7♀♀ — Baxmal District, Tangisoy village, Turkiston Range, 39.7191° N, 68.1191° E, h~1483 m a.s.l., on *Ferula samarkandica*, 17.V.2024, U. Usanov leg., 5♂♂ — Baxmal District, Jum-jum village, Turkiston Range, h~1900 m a.s.l., 39.6951° N, 67.8441° E, on *Ferula kuhistanica*, 8–9.V.2024, U. Usanov leg., 1♀ — Baxmal District, Usmat (Oqtosh) village, Turkiston Range, 39.7182° N, 67.7088° E, h~1453 m a.s.l., on *Ferula kuhistanica*, 2.V.2024, U. Usanov leg. ***Navoiy Region:*** 5♀♀ — Nurota District, Sumbuloq, steppe area, 40.6836° N, 66.5880° E, h~1433 m a.s.l., on *Ferula foetida*, 20.IV.2024, U. Usanov leg.

Distribution. Uzbekistan, Tajikistan [Krivosheina, 1986].

Bibio marci (Linnaeus, 1758)

Figs 2, 3.

Material. Jizzakh Region: 1♂, 2♀♀ — Baxmal District, Jum-jum village, Turkiston Range, 39.6951° N, 67.8441° E, h~1900 m a.s.l., on *Ferula kuhistanica*, 8–9.V.2024, U. Usanov leg. ***Samarkand Region:*** 1♂ — Urgut District, Yalpoktepa, 39.4344° N, 67.2339° E, h~900 m a.s.l., vineyard, 29.III.2023, M. Rakhimov leg.

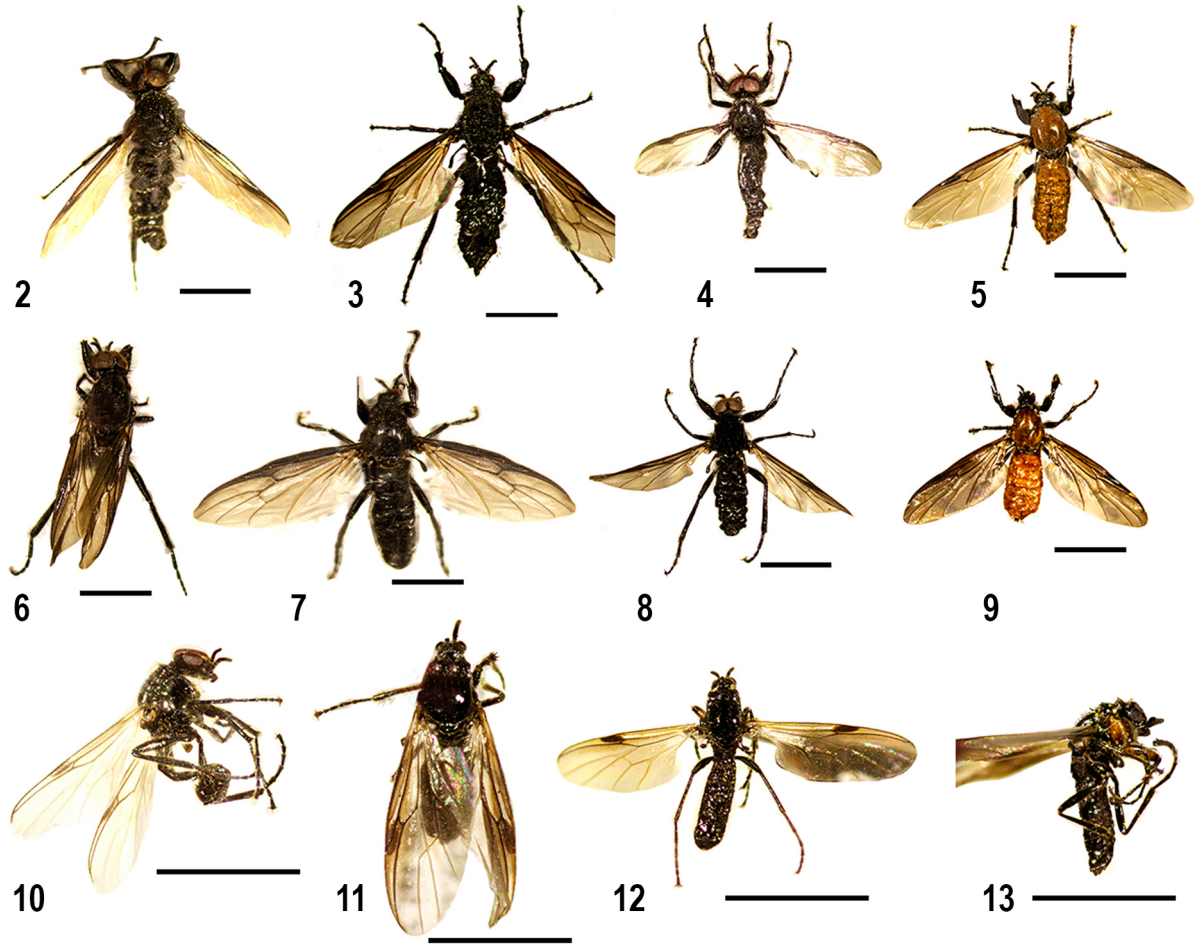
Distribution. Uzbekistan, Tajikistan [Krivosheina, 1986].

Bibio takhtakarachensis N. Krivosheina, 2023

Figs 8, 9.

Material. Jizzakh Region: 3♂♂, 2♀♀ — Baxmal District, Usmat (Oqtosh) village, Turkiston Range, 39.7182° N, 67.7088° E, h~1453 m a.s.l., on *Ferula kuhistanica*, 2.V.2024, U. Usanov leg., 2♂♂ — Baxmal District, Muzbuloq village, Zamin State Reserve, Guralashsoy, Turkiston Range, 39.6330° N, 68.2827° E, h~1780–2048 m a.s.l., 27.V.2024, on *Ferula* kokanica, U. Usanov leg., ibidem, 6♂♂ — on *Ferula* samarkandica, U. Usanov leg.

Distribution. Uzbekistan, Tajikistan [Krivosheina, 2023b].



Figs 2–13. External appearance of seven species of Bibionidae from Uzbekistan: male (2, 4, 6, 8, 10,) and female (3, 5, 7, 9, 11–13), dorsally (2–9, 11, 12) and laterally (10, 13). 2, 3 — *Bibio marci*; 4, 5 — *B. hortulanus*; 6, 7 — *B. pravdini*; 8, 9 — *B. takhtakarachensis*; 10 — *Dilophus humeralis*; 11 — *D. febrilis*; 12, 13 — *D. obscuripennis*. Scale bars 5 mm.

Рис. 2–13. Внешний облик семи видов Bibionidae Узбекистана: самец (2, 4, 6, 8, 10,) и самка (3, 5, 7, 9, 11–13), сверху (2–9, 11, 12) и сбоку (10, 13). 2, 3 — *Bibio marci*; 4, 5 — *B. hortulanus*; 6, 7 — *B. pravdini*; 8, 9 — *B. takhtakarachensis*; 10 — *Dilophus humeralis*; 11 — *D. febrilis*; 12, 13 — *D. obscuripennis*. Масштаб: 5 мм.

Bibio sp.

Material. ***Kashkadarya Region:*** 1♀ — Hissar Range, Chimboy mount 10 km E to Dukonkhona village, 38.6978° N, 67.3053° E, 3.VII.2024, M. Rakhimov leg.

Distribution. Uzbekistan.

Remarks. In the present study, one female specimen was examined; it differs from all species known to occur in Central Asia by the brown coloration of the abdomen. Because comparison with type material of other species was not possible, a formal description was not attempted.

Dilophus Meigen, 1803

Dilophus febrilis (Linnaeus, 1758)

Fig. 10.

Material. ***Namangan Region:*** 1♀ — Pop District, Parda Tursun village, Chatkal Range, 41.0796° N, 70.8539° E, h~1800 m a.s.l., 24.V.2024, M. Rakhimov leg. ***Jizzakh Region:*** 1♀ — Baxmal District, Muzbuloq village, Zamin State Reserve, Guralashsoy, Turkiston Range, 39.6330° N, 68.2827° E, h~2050 m a.s.l., on *Ferula kokanica*, 27.V.2024, Rakhimov leg.

Distribution. Europe, Caucasus, Uzbekistan, Tajikistan [Krivosheina, 1986].

Dilophus humeralis Zetterstedt, 1850

Material. ***Kashkadarya Region:*** 3♂♂, 8♀♀ — Hissar Reserve, Western Aksu River, 9 km SE to Kul village, 39.0500° N, 67.6000° E, h~2700–3100 m a.s.l., 25.VI.2025, M. Rakhimov leg.

Distribution. Europe, Uzbekistan, Tajikistan [Krivosheina, 1986].

Dilophus obscuripennis Lundström, 1913

Figs 12, 13.

Material. ***Samarkand Region:*** 5♀♀ — Urgut District, Saridukon pass, alpine meadows, 39.3297° N, 67.2073° E, 8.VI.2024, M. Rakhimov leg.

Distribution. Kazakhstan, Kyrgyzstan, Uzbekistan [Krivosheina, 1986].

Key to genera and species

1. Spines present in middle part of fore tibia. (*Dilophus*).....2
— Spines absent in middle part of fore tibia (*Bibio*)..... 4
2. Four spines situated in middle part of fore tibia, three closely grouped, whereas one separated from them by distance not less than length of spine in males or slightly less in females. Wings of males almost hyaline, wing spot darkened only along first radial vein (R_1). Wings of females somewhat darkened, with only posterior margin and apex hyaline (brownish in old collection specimens) (Fig. 11). ..... *D. febrilis*
— All four spines of fore tibia closely set; largest, marginal spine separated from others by distance shorter than spine length. Wings of males and females hyaline or whitish, sometimes slightly brownish in females 3
3. Light hairs covering legs of males long; hairs on first segment of hind tarsi more than three times as long as width of segment. Body of females entirely black, including pleurae and lateral parts of prothorax between rows of combs. First coxae and fore femora bright reddish; fore tibiae, tarsi, and middle and hind legs black. In males, fore tibia with three spines arranged in single oblique row along tibia, equally spaced (Figs 12–13) ..... *D. obscuripennis*
— Light hairs covering legs of males relatively short; hairs on first segment of hind tarsi not exceeding 2–3 times width of segment. Body of females with light-brown pleurae; sometimes median part of thorax, first coxae and fore femora, or all femora reddish. In males, fore tibia with four spines arranged almost in single transverse row or slightly and irregularly displaced (Fig. 10) .....*D. humeralis*
4. Head and eyes large (♂) 5
— Head and eyes small (♀) 8
5. Body black, with black and greyish pubescence. Wing brownish, very dark along anterior margin. Body length 7.0–7.5 mm. Inner spur of fore tibia slightly shorter than half length of outer spur (Fig. 8). Ninth abdominal tergite with deep, step-like rounded apical incision; lobes of ninth tergite pointed and irregular in shape. Aedeagus broad, oval along apical two thirds of its length, stepwise narrowed in basal third. Inner parameres strongly sclerotized, dark brown throughout ..... *B. takhtakarachensis*
— At least posterior part of wing and posterior veins hyaline 6
6. Body black; abdomen with dense white hairs (Fig. 4) ....*B. hortulanus*
— Body and pubescence entirely black 7
7. Radial cell behind pterostigma with brown stripe not reaching apex of cell; apical part of cell light brown and evenly coloured. Posterior part of wing and posterior veins hyaline (Fig. 2). Lobes of ninth tergite conical, widening directly from apex. Gonocoxite apodeme with filamentous apex. Dark plate of hypoproct elongate, apically pointed .....*B. marci*
— Radial cell behind pterostigma with dark-brown conical stripe reaching apex of cell. Posterior part of wing with yellowish tint; posterior veins light yellow (Fig. 6). Lobes of ninth tergite narrowed directly at apex. Gonocoxite apodeme with ribbon-like apex. Dark plate of hypoproct conical, apically blunt .....*B. pravdini*
8. Mesonotum and abdomen reddish 9
— Mesonotum and abdomen black 10
9. Wing brownish; costal cell anterior to subcostal vein and radial cell behind pterostigma brown; anterior margin of basal cell only slightly darker than remaining wing surface (Fig. 9) ..... *B. takhtakarachensis*
— Anterior margin of wing brown; pterostigma slightly darker; remaining wing surface and posterior veins yellowish; wing apex whitish (Fig. 5) ..... *B. hortulanus*
10. Radial cell anterior to pterostigma with short brown stripe; area along basal–radial crossvein light brown. Behind pterostigma, conical brown or light-brown stripe almost reaching apex. Basal cell yellowish, darker along anterior margin; posterior veins dark yellow. Frons with short conical frontal tubercle, apically pointed; area between frontal and pterostigmal tubercles finely tuberculate, broad, its length only slightly exceeding its width (3.0:2.7). Pterostigma 1.5–2.0 times longer than section of radial vein anterior to it. Body length: 12.0 mm (Fig. 3) ..... *B. marci*
— Radial cell entirely light or yellowish, or only behind pterostigma with short conical light-brown or brown stripe not reaching apex. Frons with elongate frontal tubercle; length of frons exceeding its width by one fifth to one third. Body length: 13.0–15.0 mm (Fig. 7) .....*B. pravdini*

Discussion

The present study provides the first consolidated account of Bibionidae in Uzbekistan based on both historical data and newly collected material. The con-

firmed fauna currently includes representatives of *Bibio* Geoffroy, 1762 and *Dilophus* Meigen, 1803, which are known to dominate the continental Palaearctic fauna of the family [Krivosheina, 1986; Fitzgerald, 2004; Catalogue, 2025]. The absence of *Penthetria* and *Plecia* in our material is consistent with previous assessments indicating that these genera are rare or absent in arid and high-montane regions of Central Asia [Krivosheina, 1986].

At present, only 8 species are confirmed for Uzbekistan, whereas more than 15 species are known from Tajikistan [Krivosheina, 1986]. However, recent faunistic studies in neighboring regions [e.g., Dvořák et al., 2022; Krivosheina, 2022a,b, 2023a, b] demonstrate that additional taxa continue to be discovered in the broader Central Asian area. This suggests that the currently known diversity in Uzbekistan likely reflects historical under-sampling rather than actual low species richness.

The recorded species assemblage consists mainly of widespread Palaearctic elements such as *Bibio hortulanus, B. marci* and *Dilophus febrilis*, which are broadly distributed across Europe and western Asia [Krivosheina, 1969b; Catalogue, 2025]. The new country record of *Bibio pravdini* significantly extends the known distribution of this recently described species [Krivosheina, 2023a], indicating a broader Central Asian range than previously recognized.

The predominance of widely distributed Palaearctic taxa reflects the transitional biogeographic position of Uzbekistan between the Euro-Siberian and Irano-Turanian regions. Similar faunal patterns have been documented for other dipteran groups in Central Asia [Ševčík et al., 2016; Mamanov et al., 2024], supporting the view that the region represents a zone of faunal overlap rather than endemism-dominated assemblages.

Most specimens were collected at elevations between approximately 900 and 2100 m a.s.l., corresponding to mountain steppe and open woodland habitats. Such habitats provide well-developed soil horizons and organic litter layers suitable for larval development, as bibionid larvae are primarily saprophagous and associated with decomposing organic matter [Krivosheina, 1972].

The repeated occurrence of adults on flowering *Ferula* species suggests opportunistic nectar-feeding behaviour. While Bibionidae are not regarded as obligate pollinators, their flower-visiting activity has been documented in other Palaearctic regions, particularly during early spring [Fitzgerald, 2004]. In Uzbekistan, Apiaceae-dominated communities may represent important seasonal resources for adult bibionids, especially in montane ecosystems where floral availability is temporally constrained.

Accurate identification within *Bibio* requires examination of male terminalia, as external coloration and pubescence may exhibit substantial intraspecific variability [Krivosheina, 1969b, 2022c]. The illustrated genital structures and identification key provided here contribute to improving taxonomic resolution for the region.

The undetermined female specimen treated as *Bibio* sp. highlights persistent challenges in bibionid taxonomy, where reliable species delimitation often depends on male characters. The specimen may represent either an undescribed taxon or an atypical female of a known species. Recent molecular phylogenetic analyses of Bibionomorpha [Ševčík et al., 2016] demonstrate the importance of integrative approaches for resolving species boundaries. Future studies incorporating molecular data would be particularly valuable for testing the distinctiveness of problematic taxa in Central Asia.

Recent descriptions of new species within Bibionidae in adjacent regions [Krivosheina, 2022a, 2023b] indicate that the Central Asian fauna remains incompletely known. Continued targeted sampling across poorly studied mountain systems, combined with integrative taxonomic approaches, will likely increase the documented diversity of the family in Uzbekistan.

The baseline established in this study provides a necessary framework for future taxonomic, ecological, and biogeographic investigations of Bibionidae in Central Asia.

Conclusion

This study provides the first consolidated and critically verified account of Bibionidae in Uzbekistan. Eight species of the genera *Bibio* and *Dilophus* are confirmed, including the first national record of *Bibio pravdini*. The fauna is dominated by widespread Palaearctic species, reflecting the transitional biogeographic position of the region. The diagnostic illustrations and identification key presented here provide a foundation for future taxonomic and faunistic research. Given the limited previous sampling, the actual diversity of Bibionidae in Uzbekistan is likely higher than currently documented.

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