

New data on the hover fly fauna of Gilgit-Baltistan (Diptera: Syrphidae) with a new country record

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Abstract: Gilgit-Baltistan boasts a diverse array of flora and fauna, yet its hover fly species inventory remains relatively understudied. This study expands our understanding by documenting 21 hover fly species, including three new records for the region. Notably, three genera: *Betasyrphus* Matsumura, 1917, *Eupeodes* Osten Sacken, 1877, and *Helophilus* Meigen, 1822, are reported for the first time from Gilgit-Baltistan. Of particular significance is the discovery of *Helophilus pendulus* (Linnaeus, 1758), marking a novel addition to the hover fly fauna of Pakistan. This research contributes an updated checklist of hover fly species for Gilgit-Baltistan, and information on synonyms, diagnosis, flight periods, host plants, distribution maps, adult habitus and male genitalia of *Helophilus pendulus* is provided.

Keywords: checklist, new country record, Palaearctic region, Syrphinae

Introduction

Hover flies, commonly known as flower flies or syrphid flies that mimic wasps, bees, or bumble bees, are amongst the large family of true flies (Diptera: Syrphidae) with more 200 genera than 6200 described species worldwide (PAPE & EVENHUIS 2019). Syrphidae are currently divided into four subfamilies: Microdontinae, Eristalinae, Pipizinae and Syrphinae (MENGUAL et al. 2015, 2022). Recent phylogenetic studies recovered all subfamilies as monophyletic groups with the exception of Eristalinae (MENGUAL et al. 2015, 2022, MORAN et al. 2022, MULLENS et al. 2022). Syrphid flies are colorful and charismatic insects with a variety of striking body markings and distinctive patterns of stripes or markings on the eyes, making them well-liked by both professionals and amateurs. The adults can be distinguished from other families by the presence of spurious vein in the wing, their varied body color patterns, and flying habits (BALL & MORRIS 2015). The majority of adult hover flies frequently visit flowers to feed on pollen and nectar, while the larvae have diverse mood of feeding habits, including fungal fruiting bodies, inquilines in social insect nests, dung, tree sap, decaying vegetation and wood, mine the leaves and stems of plants or predate other insects (ROTHERAY 1993, 2003, MOGI & CHAN 1996, SORENSEN et al. 1995, ROJO et al. 2003, MENGUAL et al. 2003).

Among the four subfamilies of hover flies, only three subfamilies, 42 genera and 97 species are known to occur in Pakistan: Microdontinae (2 genera, 2 species), Eristalinae (21 genera, 53 species), and Syrphinae (19 genera, 42 species). Here, we document the

presence of the genus *Helophilus* Meigen, 1822, for the first time in Pakistan. Herein we recorded the genus *Helophilus* Meigen, 1822 for the first time in Pakistan. *Helophilus* (Eristalinae) is widely distributed in the Palaearctic region but only a few species have been reported from the Oriental and Nearctic regions. *Helophilus* species have also been reported from the Palaearctic parts of the neighbouring countries: three species in India, three species in Afghanistan, two species in Iran, and 13 species in China (GHORPADÉ 2015, WACHKOO et al. 2021, HOSEINI et al. 2014, HUANG & CHENG 2012, YANG et al. 2020). The present study reports the occurrence of *Helophilus pendulus* for the first time in Pakistan. Although, *Helophilus pendulus* is a very common and widespread European hover fly species that can be found in a wide range of habitats but only a single male individual was observed in 2015 and thereafter no further specimens has been collected from northern Pakistan. The larvae are saprophagous and develop in rotting plant matter in water and outside water, and can live in a wide range of waterways (VAN VEEN 2010). Notably, the diversity of hover flies in Pakistan exhibits regional variations, with the northern and eastern regions harboring a greater proportion of species compared to the southern and western parts. Specifically, Punjab (50 species), Azad Kashmir (49 species), Khyber Pakhtunkhwa (43 species), Balochistan (23 species), Gilgit-Baltistan (21 species), and Sindh (6 species) showcase varying levels of hover fly richness. The northern regions, characterized by high mountainous terrains where the Oriental and Palaearctic realms intersect, support a rich flora and fauna diversity, particularly in hover flies. These areas present promising opportunities for discovering new and intriguing hover fly species, especially along the western Himalayan edge, where unique valleys with diverse climates and topographies provide suitable habitats for flies.

Material and methods

A single male *Helophilus pendulus* was collected during the daytime in July 2015 while hovering on grasses near a wheat field in Gilgit-Baltistan (Skardu: Kresmathang Olding). The specimen was collected by an aerial net and identified by using (van VEEN 2010). The list of synonyms for the genus and species follows that of YANG et al. (2020). Photographs of the adult habitus were taken with a Nikon D800 digital camera fitted with a Nikon MICRO NIKKOR 105 mm lens, while the genital photographs were taken with Canon 7D Mark II digital camera attached to a Nikon SMZ18 microscope. Photographs were adjusted and organized with Helicon focus (version 6.7.1, method B & C), and Adobe Photoshop CS 6.0. Detailed photographs of the habitus and male genitalia are presented. The studied specimen will be deposited at the National Insect Museum (NIM), Islamabad, Pakistan.

Results

The present study reports three genera and three species as new records for Gilgit-Baltistan: *Betasyrphus* Matsumura, 1917, *Eupeodes* Osten Sacken, 1877 and *Helophilus* Meigen along with *Helophilus pendulus* (Linnaeus) for the first time in Pakistan.

Family **Syrphidae** Latreille, 1802
 Subfamily **Eristalinae** Newman, 1834
 Tribe **Eristalini** Newman, 1834

Genus ***Helophilus*** Meigen, 1822

Basionym: *Helophilus* Meigen, 1822: 368. Type species: *Musca pendula* Linnaeus, 1758 (by designation of Curtis, 1832: 429).

Synonyms: *Kirimyia* Bigot, 1882. 2. Type species: *Kirimyia eristaloidea* Bigot, 1882. Monotypy.

Pilinasica Malloch, 1922: 227. Type species: *Syrphus cingulatus* Fabricius, 1775. Monotypy.

Palaeoxylota Hull, 1949: 361. Type species: *Xylota probosca* Hull, 1950. Original designation.

Prohelophilus Curran et Fluke, 1926: 210. Type species: *Syrphus trilineatus* Fabricius, 1775. Original designation.

Diagnosis: *Helophilus* can be distinguished by strongly sinuate vein R4+5 into cell r4+5 and the wing cell r1 open; thorax pollinosity velvet black with off-white fasciae along the lateral margin and two additional ones mediolaterally; protibia very short pilose; metafemur with a posterobasal patch of densely set, black setulae; bare eyes; male eyes widely dichoptic; face with medial bare vitta from central knob downwards; and face concave with clearly protruding ventral part.

Helophilus pendulus (Linnaeus, 1758) (Fig. 1A–G, Fig. 2A–C).

Basionym: *Musca pendula* Linnaeus, 1758. Type locality: Sweden (sensu Thompson et al. 1982).

Synonyms: *Musca trilevius* Harris, 1776: 58. Type locality: England.

Syrphus praecox Rossi, 1790: 294. Type locality: Italy.

Helophilus similis Curtis, 1832: 429. Type locality: England.

Helophilus pendulus turanicus Smirnov, 1923: 85. Type locality: Uzbekistan.

Tubifera biguttatus Szilády, 1940: 64. Type locality: Kazakhstan.

Tubifera trizonus Szilády, 1940: 65. Type locality: Kazakhstan.

Material examined:

1♂, Gilgit-Baltistan, Skardu district, Kresmathang Olding [35°11'36.6"N, 75°19'48.72"E], 2626 m, 19.vi.2015, leg. M.A. Hassan (NIM).

Body length: 11–14 mm.

Diagnosis: It can be easily recognized the follow characters: face with a median shining black vitta (Fig. 1F); thorax black, laterally yellow with two median longitudinal yellow fasciae, scutellum brownish yellow with pale haired (Fig. 1E); legs yellow, fore- and mid-femora at proximal half and hind femur proximal 2/3 black, tibia and first two tarsomeres yellow (Fig. 1C–D); abdominal tergites with distinctive yellow bands, distal margin of tergites 2–5 yellow, tergites 3 and 4 with greyish spots (Fig. 1E).

Flight period: March–November (HUANG & CHENG 2012, YANG et al. 2020, VAN VEEN 2010, SPEIGHT 2017).

Flowers visited: Asteraceae (*Cirsium*), Berberidaceae (*Berberis*), Caprifoliaceae (*Succisa*), Compositae, Rosaceae, including flowering understory trees, Menyanthaceae (*Menyanthes*), Polygonaceae (*Polygonum*), Salicaceae (*Salix*), and Umbelliferae (SPEIGHT 2017).

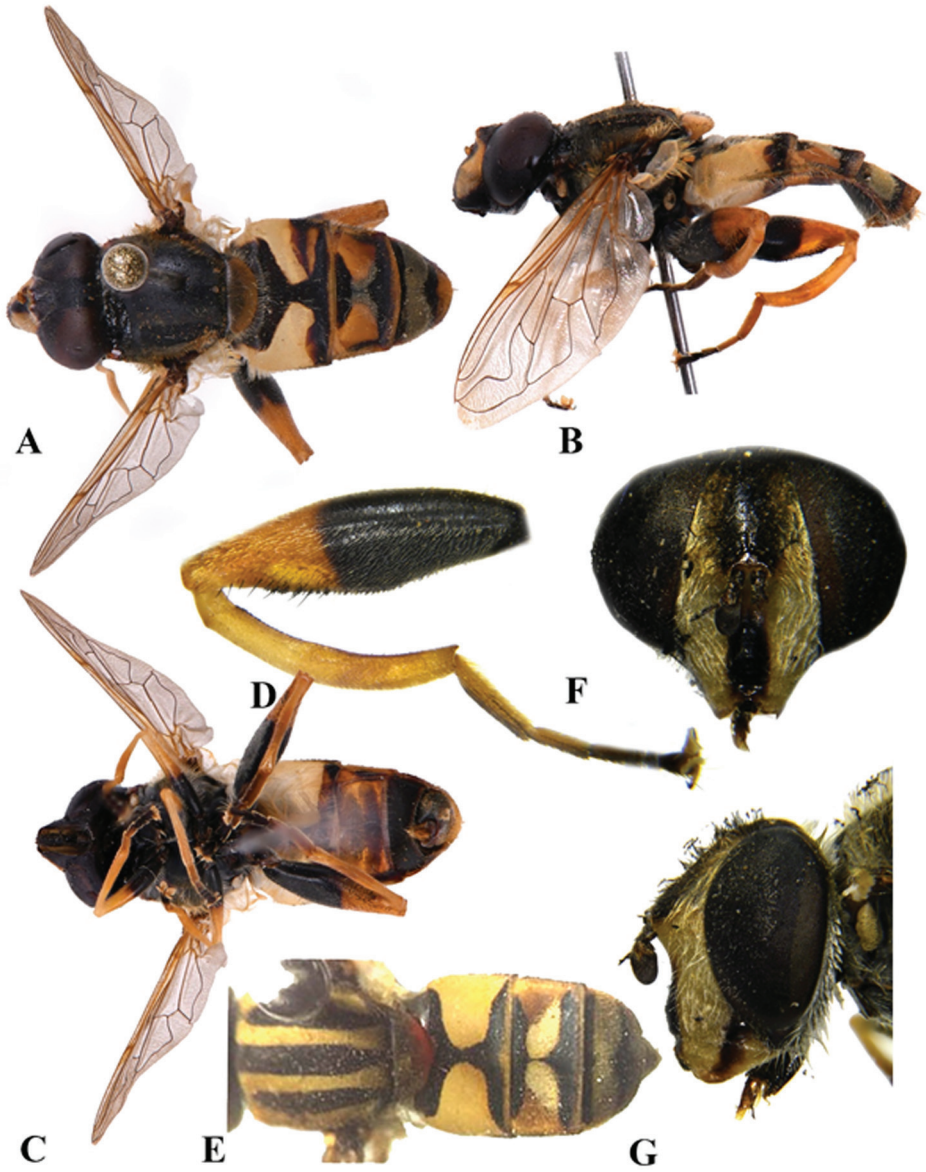


Fig. 1A–G: *Helophilus pendulus* (Linnaeus). Male. A. Dorsal habitus; B. Lateral habitus; C. Ventral habitus; D. Hind leg, anterior view; E. Thorax and abdomen, dorsal habitus; F. Head, frontal view; G. Head, lateral view

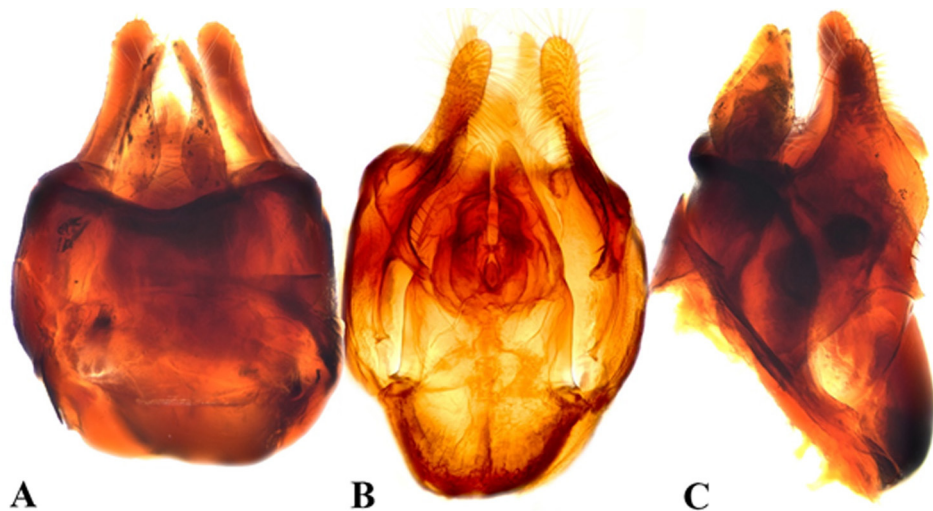


Fig. 2A–C: *Helophilus pendulus* (Linnaeus). Male genitalia. A. Dorsal view; B. Ventral view; C. Lateral view

Distribution: Widespread in the Palearctic region (SPEIGHT 2017, BARKALOV & MUTIN 2018). China (HUANG & CHENG 2012, YANG et al. 2020, LI & HE 1992), Czech Republic (MAZÁNEK et al. 2009), Georgia (MENGUAL et al. 2020), Iran (HOSEINI et al. 2014), Pakistan [present study], Republic of Macedonia (KRPAČ et al. 2011), Poland (BAŃKOWSKA 1961), Republic of Mordovia (LUTOVINOVAS et al. 2022); Nearctic: America (Savonoski, Alaska) (HINE 1923).

Subfamily Syrphinae Leach, 1815

Genus *Betasyrphus* Matsumura, 1917

Betasyrphus isaaci Bhatia, 1933

Material examined: Pakistan. Gilgit-Baltistan. District Kharmang, Ghasing valley, 1♀, [35°6'24.2376"N, 75°58'49.9584"E], 2991 m, 19.vii.2019, leg. M.A. Hassan.

Distribution: Pakistan. Azad Kashmir. District Poonch (Banjosa); Islamabad (Shakarparia); Khyber Pakhtunkhwa. District Haripur (Aamgah); Punjab. District Rawalpindi (Murree), District Narowal (Shakargarh) (SHEHZAD et al. 2017, FATIMA & YANG 2022, HASSAN et al. 2017, 2018a).

Genus *Eupeodes* Osten Sacken, 1877

Eupeodes bucculatus Rondani, 1857

Material examined: Gilgit-Baltistan. District Ghanchy, Machulu valley, 1♂, 5♀, [35°6'50.04"N, 76°13'14.88"E], 4441 m, 12.vii.2019, leg. M.A. Hassan.

Distribution: Pakistan. Azad Kashmir. District Poonch (Banjosa, Rawalakot, Jandala, Sangolla); Punjab. District Narowal (Shakargarh) (HASSAN et al. 2017, 2018a, FATIMA & YANG 2022).

Genus *Sphaerophoria* Lepeletier & Serville, 1828

Sphaerophoria scripta Linnaeus, 1758

Material examined: Gilgit-Baltistan. District Ghanchy, Machulu valley, 6♂, 4♀, [35°6'50.04"N, 76°13'14.88"E], 4441 m, 10-12.vii.2019, leg. M.A. Hassan.

Distribution. Pakistan. Azad Kashmir. District Poonch (Banjosa, Hajira, Rawalakot); Khyber Pakhtunkhwa. District Dir, District Hangu, District Peshawar, District Swat; Punjab. District Multan, District Narowal (Shakargarh) (SHEHZAD et al. 2017, HASSAN et al. 2017, 2018a, FATIMA & YANG 2022).

List of known and new records of hover flies from Gilgit-Baltistan

Subfamily **Eristalinae** Newman, 1834

1. *Ceriana dimidiatipennis* (Brunetti, 1923)

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Azad Kashmir (ALAM et al. 1969, HASSAN et al. 2017), Khyber Pakhtunkhwa (ASLAMKHAN et al. 1997), Balochistan (BRUNETTI 1923).

2. *Eristalis albibasis* (Bigot, 1880)

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017).

3. *Eristalis arbustorum* (Linnaeus, 1758)

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Azad Kashmir (ASLAMKHAN et al. 1997), Punjab (SHEHZAD et al. 2017), Khyber Pakhtunkhwa (SHEHZAD et al. 2017), Balochistan (SHEHZAD et al. 2017).

4. *Eristalis tenax* (Linnaeus, 1758)

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Azad Kashmir (HASSAN et al. 2018a), Punjab (SHEHZAD et al. 2017), Khyber Pakhtunkhwa (HAQ et al. 2014), Balochistan (SHEHZAD et al. 2017).

5. *Eumerus sogdianus* Stackelberg, 1952

Distribution: Pakistan. Gilgit-Baltistan (HASSAN et al. 2022).

6. *Helophilus pendulus* (Linnaeus, 1758)

Distribution: Pakistan. Gilgit-Baltistan (present study).

7. *Mallota rufipes* Brunetti, 1913

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Khyber Pakhtunkhwa (GHORPADÉ & SHEHZAD 2013, GHORPADÉ 2015).

8. *Mesembrius quadrivittatus* (Wiedemann, 1819)

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017, HASSAN et al. 2018a).

9. *Volucella peleterii* (Macquart, 1834)

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Azad Kashmir (SHEHZAD et al. 2017), Punjab (SHEHZAD et al. 2017, HASSAN et al. 2020a).

10. *Volucella ruficauda* Brunetti, 1907

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Punjab (HASSAN et al. 2020a).

Subfamily **Syrphinae** Leach, 1815

11. *Betasyrphus isaaci* (Bhatia, 1933)

Distribution: Pakistan. Azad Kashmir (HASSAN et al. 2018a), Punjab (BRUNETTI 1923,

ASLAMKHAN et al. 1997, GHORPADÉ & SHEHZAD 2013, GHORPADÉ 2015, SHEHZAD et al. 2017), Khyber Pakhtunkhwa (SHEHZAD et al. 2017).

12. *Chrysotoxum intermedium* Meigen, 1822

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Khyber Pakhtunkhwa (ALAM et al. 1969, ASLAMKHAN et al. 1997, GHORPADÉ & SHEHZAD 2013, GHORPADÉ 2015, SHEHZAD et al. 2017).

13. *Episyrphus balteatus* (De Geer, 1776)

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Azad Kashmir (SHEHZAD et al. 2017, HASSAN et al. 2018a), Khyber Pakhtunkhwa (ALAM et al. 1969, ASLAMKHAN et al. 1997, SHEHZAD et al. 2017); Punjab (SHEHZAD et al. 2017), Sindh (SHEHZAD et al. 2017)

14. *Eupeodes bucculatus* (Rondani, 1857)

Distribution: Pakistan. Azad Kashmir (HASSAN et al. 2018a), Punjab (HASSAN et al. 2017, 2018a).

15. *Scaeva latimaculata* (Brunetti, 1923)

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Khyber Pakhtunkhwa (ASLAMKHAN et al. 1997, SHEHZAD et al. 2017), Punjab (SHEHZAD et al. 2017), Sindh (SHEHZAD et al. 2017).

16. *Sphaerophoria indiana* Bigot, 1884

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Azad Kashmir (HASSAN et al. 2018a), Khyber Pakhtunkhwa (ASLAMKHAN et al. 1997, ARIF et al. 2001), Punjab (ARIF et al. 2001).

17. *Sphaerophoria scripta* (Linnaeus, 1758)

Distribution: Pakistan. Azad Kashmir (HASSAN et al. 2018a), Khyber Pakhtunkhwa (GHORPADÉ & SHEHZAD 2013), Punjab (GHORPADÉ & SHEHZAD 2013, GHORPADÉ 2015).

18. *Syrphus vitripennis* Meigen, 1822

Distribution: Pakistan. Gilgit-Baltistan (SHEHZAD et al. 2017), Punjab (SHEHZAD et al. 2017).

19. *Graptomyza flavonotata* Brunetti, 1917

Distribution: Pakistan. Gilgit-Baltistan (HASSAN et al. 2020a).

20. *Paragus quadrifasciatus* Meigen, 1822

Distribution: Pakistan. Gilgit-Baltistan (GHORPADÉ & SHEHZAD 2013, HASSAN et al. 2018b).

21. *Paragus compeditus* Wiedemann, 1830

Distribution: Pakistan. Gilgit-Baltistan (HASSAN et al. 2018b), Khyber Pakhtunkhwa (GHORPADÉ & SHEHZAD 2013, GHORPADÉ 2015).

Discussion

During the last five years, a number of rarely known Oriental and a few Palearctic hover fly species have been published from the northern territories, i.e. *Asarkina incisuralis* (Macquart, 1855), *Baccha maculata* Walker, 1852, *Ceriana ornatifrons* (Brunetti, 1915), *Eristalis albibasis* (Bigot, 1880), *Eristalinus obliquus* (Wiedemann, 1824), *Eristalinus tarsalis* (Macquart, 1855), *Eumerus sogdianus* Stackelberg, 1952, *Graptomyza brevirostris* Wiedemann, 1820, *Graptomyza flavonotata* Brunetti, 1917, *Mesembrius quadrivittatus* Wiedemann (1819), *Myolepta mahmoodii* Hassan & Bodlah, 2021, *Paragus (Pandasyopthalmus) annandalei* Ghorpadé, 1992, *Paragus (Paragus) quadrifasciatus* Meigen, 1822, *Rhingia siwalikensis* Nayar, 1968, *Paramixogaster contractus*

(Brunetti, 1923), *Spilomyia manicata* (Rondani, 1865), *Syrphus dalhousiae* Ghorpadé, 1994, *Volucella peleterii* (Macquart, 1834), *Volucella ruficauda* Brunetti, 1907, *Volucella pellucens tabanoides* Motschulsky, 1859, *Xylota coquilletti* Hervé-Bazin, 1914, and *Xylota nursei* Brunetti, 1923 (HASSAN et al. 2018a,b, 2020a,b, 2021, 2022), but many unidentified species are still waiting for expert's opinions for identification. In the last two decades, the fauna of Syrphidae has been considerably studied in various parts of northern Pakistan, however, the southern and western parts are still poorly sampled, which needs a thorough sampling in future studies.

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