

An Annotated Checklist and Identification Key to the Black Scavenger Flies (Diptera: Sepsidae) from Azad Kashmir, Pakistan

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ABSTRACT

An updated checklist and illustrated taxonomic identification key are presented for the known genera and species of the family Sepsidae from Azad Kashmir. Based on the present findings and published records, 14 species belonging to six genera within the subfamily Sepsinae are documented. Their regional distribution data, taxonomic identification key, and diagnostic characters are provided.

Keywords: Diptera, Sepsidae, morphology, ensign fly, Pakistan.

Hassan, M. A., Shehbaz, M. H., Ali, M., Hussain, R., Maryam, Z., & Abbas, A. (2026). An annotated checklist and identification key to the black scavenger flies (Diptera: Sepsidae) from Azad Kashmir, Pakistan. *Journal of the Entomological Research Society*, 28(1), 41-55.

Received: August 06, 2025

Accepted: March 17, 2026

INTRODUCTION

The family Sepsidae (Diptera: Sciomyzoidea) currently includes 37 genera and more than 312 described species, divided into two subfamilies: Orygmatinae represented by the single species, *Orygma luctuosum* Meigen, 1830, and Sepsinae (Ozerov, 2005; Letana, 2014). The adults can easily be distinguished from other flies by their shiny appearance, smaller to medium body size (2.0-12 mm), vary in color from dull black to brownish or yellowish, hyaline wings (sometimes with a black spot at the tip of vein R2+3), rounded and sub-spherical head, post-vertical setae divergent or absent, palpi usually vestigial, and the presence of one or more fine bristles near the posterior thoracic spiracle (Pont & Meier, 2002; Ozerov, 2005). They exhibit sexual dimorphism and often mimic wasps or ants, with a distinct constriction between the first two abdominal segments. These flies play a significant role in the decomposition of pasture dung (Meier, 1996). This group have received a considerable attention due to their unique mating behavior, sexual size dimorphism, forensic importance, and the role of their larvae in decomposing organic matters, and serves as a vector of many pathogens (Benecke, 2001; Pont & Meier, 2002; Blanckenhorn, 2005).

Taxonomic revisions of this group have been conducted by various taxonomists across different regions in Asia. Notable works include contributions from India (Brunetti, 1909; Zuska, 1974; Iwasa, 1982a; Iwasa & Tewari, 1990, 1994; Gangopadhyay & Parui, 2014), Bangladesh (Iwasa, 1989; Iwasa, Zuska, & Ozerov, 1991), Nepal (Zuska, 1968; Iwasa, 1984a, 1994; Iwasa & Thapa, 1994), China (Xia & Zhou, 2007, 2008), Japan (Zuska, 1974; Iwasa, 1980, 1981, 1984b, 1995), Vietnam (Iwasa & Thinh, 2008, 2012), Iran (Khaghaninia, Zarghani, & Gharajedaghi, 2014), the Philippines (Letana, 2014), Thailand (Iwasa, 1994), and Indonesia (Iwasa, 1982b, 2001). In Pakistan, the first landmark taxonomic study on the family Sepsidae was conducted by Iwasa in 1989. He examined sepsid specimens collected from various regions across the country during 1987-1988, reporting 25 species, 18 of which were new records for Pakistan, and described three new species. Following Iwasa (1989b), Hassan, Bodlah, Mahmmod, & Tamkeen (2017), Hassan et al. (2017), Hassan, Bodlah, & Aihetasham, (2017), Hassan et al. (2018), Hassan, Hussain, Ali, & Fatima (2021), Hassan et al. (2023), and Fatima, Tamkeen, & Hassan, (2019) reported additional records for this group, resulting in a total of nine genera and 31 species currently known to occur in Pakistan. Among these 12 species have been documented from Azad Kashmir (Fatima & Yang 2022). However, this economically important group of insects has received limited attention, and the entire region of Azad Kashmir remains unexplored. Therefore, the present study aims to investigate the sepsid fauna of Poonch District and develop an illustrated taxonomic identification key for the known genera and species present in Azad Kashmir, along with the checklist that will serve as a baseline study for future researchers.

MATERIAL AND METHODS

The current study was conducted to explore the faunal diversity of black scavenger flies (Diptera: Sepsidae) based on the surveys conducted during 2015-2017 in different localities of District Poonch, Azad Kashmir, including Banjosa, Hajira, and Rawalakot. Adult specimens

were collected by sweeping a hand net over fresh and 2-3 days old cow and horse dung, as well as over grasses, human feces, excrement, garbage, wildflowers, coriander, and decomposing meat and bones. Fresh dung was also used as bait traps at the collection sites. Collected specimens were either killed immediately in a potassium cyanide for 3-5 minutes, after which they were mounted on triangular card for taxonomic study. Other specimens were preserved in vials containing 70-80% ethanol. The mounted specimens were then placed in a wooden box. The specimens were observed using an Olympus SZX7, Model SZ2-ILST light stereomicroscope and photographs were taken with a Nikon SMZ 1500 binocular microscope attached to a Nikon Digital Sight DS-Fi1 camera. Adobe Photoshop CS6 was used to create the figure plates. Taxonomic identification was done by the following literature: Iwasa (1980), Iwasa (1984a, b, 1989a, b, 1995, 2001), Iwasa, Zuska, & Ozerov (1991), Iwasa & Thinh (2012), Letana (2014), and Xia & Zhou (2014). The studied specimens are deposited at the Zoological Museum, University of Baltistan, Skardu, Gilgit-Baltistan, Pakistan.

TAXONOMY

Key to genera and species (males) of the family Sepsidae

1. First and second basal cells united (Fig. 1a). 2
 - First and second basal cell separated (Fig. 1b). 3
2. Scutellum shorter than half of width, upper surface slightly convex, with two pairs of strong apical and small basal scutellar setae. *Australosepsis frontalis* (Malloch)
 - Scutellum as long as width, upper surface flat, with two pairs of strong apical and basal scutellar setae. *Saltella setigera* Brunetti
3. Fronto-orbital setae present (Fig. 1c); wings clear; post-vertical bristles present; humeral bristle present; single well-developed vibrissa; male hypopygial process simple; male fore femora as in figure (Fig. 1d). *Meroplus minutus* (Wiedemann)
 - Fronto-orbital setae absent; wings clear or with black spot; humeral bristle present or absent; hypopygial process simple or bifurcated. 4
4. Humeral bristle absent (Fig. 1e). *Decachaetophora aeneipes* (De Meijere)
 - Humeral bristle present. 5
5. Abdomen in both sexes with distinct macrochaetae (Fig. 1f); wings with or without black spot at the ends of vein R2+3; hypopygial process not bifurcated at the tip (Fig. 1g). *Sepsis* Fallén. 6
 - Abdomen in both sexes without distinct macrochaetae (Fig. 1h); wings without black spot at the end of R2+3 vein; hypopygial process bifurcated at the tip (Fig. 1i). *Dicranosepsis* Duda. 11
6. Wings with a dark spot at the end of vein R2+3. 7
 - Wings without any dark spot at the end of vein R2+3. 8
7. Male fore femur with anterobasal patch of long hairs (Fig. 2a). *S. dissimilis* Brunetti
 - Male fore femur without patch of long hairs anterobasally (Fig. 2b); sternopleuron anteroventrally shining. *S. thoracica* (Robineau-Desvoidy)
8. Pteropleura shining; male fore femur with no or one median bump; medioventral spine present. 9

- Pteropleura pruinose; male fore femur with two distinct ventromedial bumps, medioventral spine absent (Fig. 2c). *S. indica* Wiedemann
- 9. Proclinate medio-ventral bump present with three apical spines (Fig. 2d).
..... *S. nitens* Wiedemann
- Medio-ventral bump reduced or absent. 10
- 10. Medioventral bump reduced; femora mostly yellow; male fore tibia without deeply excavated at sub-median part (Fig. 2e); genitalia long. *S. coprophila* De Meijere
- Medioventral bump absent; ventral surface of male fore tibia deeply excavated at sub-median part; fore femora yellow (Fig. 2f)..... *S. fissa* Becker
- 11. Male hind tibia without osmeterium; fore femora antero-ventrally 2 or 0 setae; hind metatarsus with or without row of long anterior seta. 12
- Hind tibia with distinct hollow osmeterium antero-dorsally (Fig. 2g), hind metatarsus with rows of long antero-ventral seta; mid tibia bend submedianly (Fig. 2h). *D. olfactoria* Iwasa
- 12. Male fore femora antero-ventrally with 4 long setae (Fig. 2i). *D. quadrigemina* Iwasa
- Male fore femora with 2 or without antero-ventral setae. 13
- 13. Male fore femora antero-ventrally 2 setae (Fig. 2j); hind metatarsus without row of long curved seta. *D. bicolor* (Wiedemann)
- Male fore femora without antero-ventral seta (Fig. 2k); hind metatarsus with rows of long seta curved apically (Fig. 2l). *D. parva* Iwasa

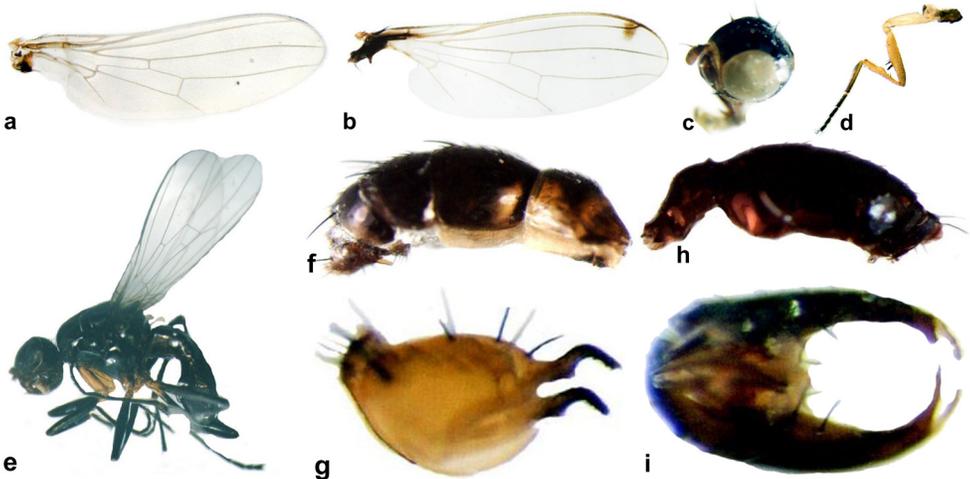


Figure 1. a) *Australosepsis frontalis*, right forewing; b) *Sepsis thoracica*, right forewing; c) *Meroplus minutus*, head in lateral view; d) *Meroplus minutus*, male fore femur in anterolateral view; e) *Decachaetophora aeneipes*, male in lateral view; f) *Sepsis thoracica*, male abdomen in lateral view; g) *Sepsis thoracica*, hypopygium in lateral view; h) *Dicranosepsis olfactoria*, male abdomen in lateral view; i) *Dicranosepsis olfactoria*, hypopygium in lateral view.

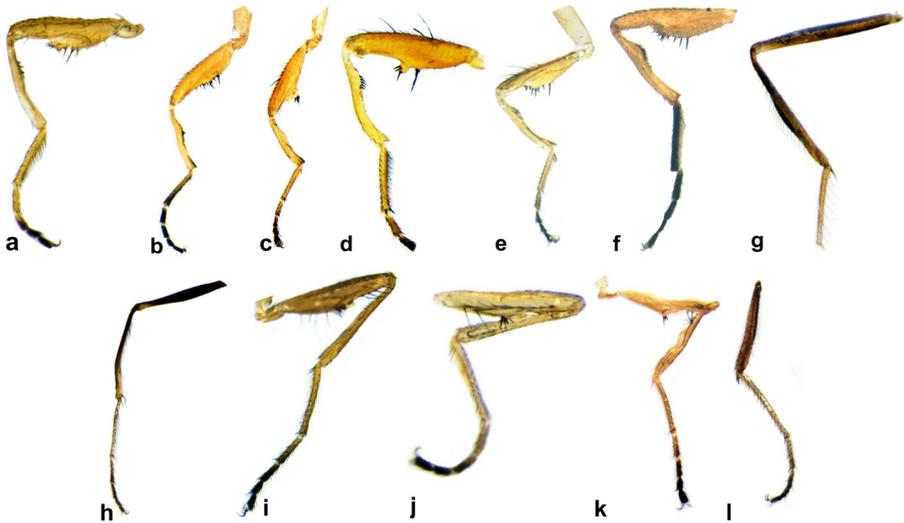


Figure 2. Male legs. a) *Sepsis dissimilis*, male fore femur in posterolateral view; b) *Sepsis thoracica*, male fore femur in posterolateral view; c) *Sepsis indica*, male fore femur in posterolateral view; d) *Sepsis nitens*, male fore femur in posterolateral view; e) *Sepsis coprophila*, male fore femur in posterolateral view; f) *Sepsis fissa*, male fore femur in posterolateral view; g) *Dicranosepsis olfactoria*, male hindleg with a distinct hollow osmeterium on tibia anterodorsally; h) *Dicranosepsis olfactoria*, male midleg in posterolateral view; i) *Dicranosepsis quadrigemina*, male fore femur in posterolateral view; j) *Dicranosepsis bicolor*, male fore femur in posterolateral view; k) *Dicranosepsis parva*, male fore femur in posterolateral view; l) *Dicranosepsis parva*, hind tibia and metatarsus.

Family Sepsidae Walker, 1833

Subfamily Sepsinae Walker, 1833

Genus *Australosepsis* Malloch, 1925

Australosepsis Malloch, 1925: 314. Type species: *Australosepsis fulvescens* Malloch, 1925.

Saltelliseps Duda, 1926: 25. Type species: *Sepsis niveipennis* Becker, 1903.

Diagnosis. Similar to the genus *Saltella* Robineau-Desvoidy, 1830, it has a fused first and second basal cell, but differs by having a scutellum shorter than its width, and with a small basal and a strong apical scutellar seta.

Australosepsis frontalis (Malloch, 1925)

Sepsis frontalis Walker, 1860: 163. Type locality: Indonesia.

Sepsis tenella de Meijere, 1906: 183. Type locality: Singapore.

Sepsis brevis Brunetti, 1910: 361. Type locality: India.

Sepsis lieveni Frey, 1917: 25. Type locality: Sri Lanka.

Diagnosis. It can be distinguished by the absence of a diffuse dark spot at the end of vein R4+5, which is present in *Australosepsis niveipennis* (Becker, 1903).

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 11♂♂, 16.09.2016, 10♂♂, 22.09.2016, 39♂♂, 23.09.2016, 7♂♂, 22.05.2017, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Rawalakot; Khyber Pakhtunkhwa: District Swat, Miandam (Iwasa, 1989b; Fatima & Yang, 2022).

General distribution: Australasian/Oceanian, Oriental, Palaeartic (Ozerov, 2005).

Genus *Decachaetophora* Duda, 1926

Decachaetophora Duda, 1926: 27. Type species: *Sepsis aeneipes* de Meijere, 1913.

Diagnosis. *Decachaetophora* represents only a single species, *D. aeneipes* de Meijere, 1913 which is widely distributed in the Oriental and Nearctic regions. This genus can be distinguished from the genus *Meropluis* Rondani due to the absence of humeral bristles and from *Themira* due to the presence of outer vertical bristles.

Decachaetophora aeneipes (de Meijere, 1913)

Sepsis aeneipes de Meijere, 1913: 119. Type locality: China (Taiwan).

Diagnosis. Wings hyaline, without dark spot; humeral bristles absent; outer vertical bristles present; abdomen not constricted between 2nd and 3rd segments.

Material examined. Azad Kashmir: Hajira, 33°46'17.59"N, 73°53'48.43"E, 1006 m, 34♂♂, 20.04.2016; Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 14♂♂, 25.09.2017, leg. M.A. Hassan

Distribution in Pakistan. Azad Kashmir: District Poonch, Hajira, Rawalakot; Gilgit-Baltistan: District Gilgit, Bagrote Valley, Naltar Valley, District Skardu, Hussain Abad; Khyber Pakhtunkhwa: District Mansehra, Lalazar, Naran Valley, Kagan Valley, District Swat, Miandam, District Shangla, Besham (Iwasa, 1989b; Hassan, Bodlah, Mahmmod, & Tamkeen, 2017; Fatima & Yang, 2022).

General distribution. Australasian/Oceanian, Nearctic, Oriental, Palaeartic (Ozerov, 2005).

Genus *Dicranosepsis* Duda, 1926

Dicranosepsis Duda, 1926: 43. Type species: *Sepsis bicolor* Wiedemann, 1830.

Diagnosis. First and second basal cell separated; humeral bristle present; fronto-orbital bristle absent; abdomen without distinct mactrochaetae; epandrial process bifurcate at apex.

Dicranosepsis bicolor (Wiedemann, 1830)

Sepsis bicolor Wiedemann, 1830: 468. Type locality: China.

Sepsis pubipes Brunetti, 1910: 365. Type locality: Nepal.

Diagnosis. Wings hyaline, without dark spot; coxa straight, fore femur with 1 or 2 anteroventral setae, mid tibia without distinct osmeterium, with 3-13 long anteroventral setae in distal half; anepimeron completely pruinose.

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Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 7♂♂, 10.09.2016, 8♂♂, 12.09.2016, 3♂♂, 15.09.2016, 12♂♂, 18.09.2016, 17♂♂, 12.06.2017, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Rawalakot, Goi Nala; Punjab: District Narowal, Bola Bajwa, District Rawalpindi, Murree; Khyber Pakhtunkhwa: District D.I. Khan, District Abbottabad, Ayubia Gali, Dunga Gali, Nathia Gali, District Mansehra, Balakot, Kagan Valley, District Dir, District Swat, Marghazar (Iwasa 1989b; Hassan et al. 2017; Fatima & Yang, 2022).

General distribution. Oriental (Ozerov, 2005).

***Dicranosepsis olfactoria* Iwasa, 1984**

Dicranosepsis olfactoria Iwasa, 1984: 84. Type locality: Nepal.

Diagnosis. Wings hyaline, without dark spot; fore coxa straight, mid tibia with distinct osmeterium anterodorsally, mid tibia bent at innerside near the middle.

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 3♂♂, 10.09.2016, 16♂♂, 12.09.2016, 23♂♂, 15.09.2016, 13♂♂, 18.09.2016, 5♂♂, 12.05.2017, 3♂♂, 22.06.2017; Banjosa, 33°48'37.05"N, 73°49'04.21"E, 1835 m, 6♂♂, 20.07.2016, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Rawalakot, Goi Nala; Balochistan: District Quetta; Khyber Pakhtunkhwa: District D.I. Khan, District Abbottabad, Dunga Gali, Nathia Gali, District Mansehra, Kagan Valley, Kawai, District Dir, District Shangla, Shangla Pass, Besham, District Swat, Kalam Valley, Marghazar, Miandam, Ushu; Punjab: District Narowal, Bola Bajwa, District Rawalpindi, Murree (Iwasa 1989; Hassan et al. 2017; Fatima & Yang, 2022).

General distribution. Oriental (Ozerov, 2005).

***Dicranosepsis parva* Iwasa, 1984**

Dicranosepsis parva Iwasa, 1984: 88. Type locality: Nepal.

Diagnosis. Wings hyaline, without black spot; fore trochanter with ventral triangular projection, fore femur antero-ventrally without setae, hind tibia without osmeterium, hind metatarsus with rows of long seta curved apically (Fig. 3a).

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 3♂♂, 10.09.2016, 27♂♂, 12.09.2016, 48♂♂, 15.09.2016, 9♂♂, 18.09.2016, 11♂♂, 12.06.2017; Banjosa, 33°48'37.05"N, 73°49'04.21"E, 1835 m, 1♂, 20.07.2016, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Rawalakot, Goi Nala, Banjosa Lake (Fatima & Yang, 2022).

General distribution. Oriental (Ozerov, 2005).

***Dicranosepsis quadrigemina* Iwasa, 1989**

Dicranosepsis quadrigemina Iwasa, 1989: 57. Type locality: Pakistan.

Diagnosis. Wings hyaline, without black spot; fore coxa straight, fore femur with four long anteroventral setae, hind tibia without osmeterium.

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 3♂♂, 18.09.2016, 10♂♂, 14.08.2017, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Rawalakot, Goi Nala; Gilgit-Baltistan: District Diamer, Chilas, Babusar Pass; Punjab: District Rawalpindi, Murree; Khyber Pakhtunkhwa: District Abbottabad, Ayubia Gali, Dunga Gali, Nathia Gali, District Mansehra, Kagan Valley, Lalazar, Naran Valley, District Shangla, Shangla Pass, Besham, District Swat, Marghazar, Miandam (Iwasa, 1989b; Hassan *et al.* 2018).

General distribution. Oriental (Ozerov, 2005).

Genus *Meroplius* Rondani, 1874

Meroplius Rondani, 1874: 175. Type species: *Nemopoda stercoraria* Robineau-Desvoidy, 1830.

Parameroplius Duda, 1926: 37. Type species: *Sepsis fasciculata* Brunetti, 1910.

Protomeroplius Ozerov, 1999: 92. Type species: *Meroplius trispinifer* Ozerov, 1999.

Diagnosis. Wings hyaline, first and second basal cells separated; head with fronto-orbital bristle developed, postvertical setae present, acrostichal setae absent; thorax with humeral bristle present.

Meroplius minutus (Wiedemann, 1830)

Sepsis minuta Wiedemann, 1830: 468. Type locality: USA.

Sepsis lutaria Fallén, 1820b: 22. Unavailable name [see notes by Pont *in* Pont & Meier, 2002: 135].

Nemopoda stercoraria Robineau-Desvoidy, 1830: 745. Type locality: not stated [probably France].

Nemopoda nigrilatera Macquart, 1835: 481. Type locality: France.

Sepsis rufipes Meigen, 1838: 349. Type locality: Germany.

Nemopoda coeruleifrons Macquart, 1847: 110. Type locality: USA.

Nemopoda varipes Walker, 1871: 345. Type locality: Egypt.

Diagnosis. Head with outer vertical and orbital setae present; thorax with basal scutellar seta absent, but apical seta distinct; wing hyaline; male fore femur distally with two ventral spines, straight (Fig. 3b).

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m., 4♂♂, 25.09.2016, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Rawalakot (Fatima, Tamkeen, & Hassan, 2019).

General distribution. Europe, Oriental, Palaeartic, Nearctic, North Africa (Ozerov, 2005).

Genus *Saltella* Robineau-Desvoidy, 1830

Saltella Robineau-Desvoidy, 1830: 746. Type species: *Saltella nigripes* Robineau-Desvoidy, 1830.

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Brachygaster Meigen, 1826: 244. Type species: *Brachygaster analis* Meigen, 1826.

Pandora Haliday, 1833: 169. Type species: *Piophila scutellaris* Fallén, 1820.

Anisophysa Macquart, 1835: 543. Type species: *Piophila scutellaris* Fallén, 1820.

Pseudopandora Rapp, 1946: 500. Type species: *Trupanea sphondylii* Schrank, 1803.

Diagnosis. Wings hyaline, first and second basal cell fused; scutellum longer than width with strong basal and apical scutellar setae (Iwasa, Zuska, & Ozerov, 1991; Hassan, Hussain, Ali, & Fatima, 2021).

***Saltella setigera* Brunetti, 1910**

Saltella setigera Brunetti, 1910: 368. Type locality: India.

Saltella metatarsalis Brunetti, 1910: 369. Type locality: India.

Diagnosis. It can be distinguished by its yellowish-white legs with dark tarsi, the brownish to dark second tarsal segments of mid- and hind legs in males, and the absence of pruinose on katepisternum (Iwasa, Zuska, & Ozerov, 1991; Hassan, Hussain, Ali, & Fatima, 2021).

Distribution in Pakistan. Azad Kashmir: District Bagh; Islamabad Capital: Shahdara; Punjab: District Narowal, Shakargarh (Hassan, Bodlah, & Aihetasham, 2017; Hassan, Hussain, Ali, & Fatima; Fatima & Yang, 2022).

General distribution. Oriental (Ozerov, 2005).

Genus *Sepsis* Fallén, 1810

Sepsis Fallén, 1810: 17. Type species: *Musca cynipsea* Linnaeus, 1758.

Threx Gistel, 1848: 599. Type species: *Musca cynipsea* Linnaeus, 1758.

Acrometopia Lioy, 1864: 1088. Type species: *Sepsis cornuta* Meigen, 1826.

Beggiatia Lioy, 1864: 1088. Type species: *Sepsis barbipes* Meigen, 1826.

Sepsidimorpha Frey, 1908: 578. Type species: *Sepsis loewi* Hendel, 1902.

Nicarao Silva, 1995: 203. Type species: *Nicarao rarus* Silva, 1995.

Allosepsis Ozerov, 1992: 44. Type species: *Sepsis indica* Wiedemann, 1824.

Diagnosis. Wings with or without black spot at the end of vein R2+3, first and second basal cells separated; head with fronto-orbital setae very small or absent; scutellum with small basal and strong apical bristles; fore femur with complicated bristles showing the specific features; abdomen with distinct macrochaetae; male epandrial processes simple, not bifurcate at apex.

***Sepsis coprophila* de Meijere, 1906**

Sepsis coprophila de Meijere, 1906. Type locality: Singapore.

Diagnosis. Wings hyaline, without dark spot at the end of vein R4+5; fore femur without bump; sternopleura wholly pruinose; pteropleura shining; hypopygial processes long and stout (Fig. 3c).

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 11♂♂, 10.09.2016, 9♂♂, 15.09.2016, 1♂, 18.09.2016, 1♂, 22.09.2016, 8♂♂, 03.10.2016, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Banjosa Lake, Rawalakot; Islamabad Capital: Lake View Park, Quaid-e-Azam University; Punjab: District Rawalpindi, Murree (Hassan et al. 2023).

General distribution. Oriental, Palaearctic (Ozerov, 2005).

***Sepsis dissimilis* Brunetti, 1910**

Sepsis dissimilis Brunetti, 1910: 355. Type locality: India.

Sepsis albolimbata de Meijere, 1913: 115. Type locality: China.

Sepsis albopunctata Lamb, 1914: 323. Type locality: Seychelles.

Sepsis hirtifemur Malloch, 1925: 314. Type locality: Australia (New South Wales).

Sepsis acroleucoptera Duda, 1926b: 41. Type locality: China (Taiwan).

Sepsis natalensis Brunetti, 1929: 27. Type locality: Republic of South Africa.

Diagnosis. Wings with a dark spot at the end of vein R4+5; sternopleuron almost shining, only dorsal margin pruinose; male fore femur with anterobasal patch of long hairs; hypopygial processes short and slender.

Material examined. Azad Kashmir: Rawalakot, 33°51'26.02"N, 73°45'38.07"E, 1700 m, 2♂♂, 24.06.2016, 3♂♂, 10.09.2016, 4♂♂, 22.05.2017, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Rawalakot; Gilgit-Baltistan: District Skardu, Hussain Abad; Punjab: District Rawalpindi, Charra Pani (Hassan, Bodlah, Mahmmod, & Tamkeen, 2017; 2023; Fatima, Tamkeen, & Hassan, 2019).

General distribution. Afrotropical, Australasian/Oceanian, Oriental, Palaearctic (Ozerov, 2005).

***Sepsis fissa* Becker, 1903**

Sepsis fissa Becker, 1903: 143. Type locality: Egypt.

Diagnosis. Wings with a dark spot at the end of vein R4+5; male fore femur without tubercle; ventral surface of male fore tibia deeply excavated at sub-median part.

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 7♂♂, 14.04.2017, 22♂♂, 24.07.2017, 17♂♂, 10.09.2017, leg. M.A. Hassan

Distribution in Pakistan. Azad Kashmir: District Poonch, Rawalakot; Balochistan: District Kalat, District Quetta; Punjab: District Dera Ghazi Khan, Fort Munro (Iwasa, 1989b; Fatima, Tamkeen, & Hassan, 2019; Hassan et al. 2023).

General distribution. Afrotropical, Oriental, Palaearctic (Ozerov, 2005).

***Sepsis indica* Wiedemann, 1824**

Sepsis indica Wiedemann, 1824: 57. Type locality: India.

Sepsis decipiens de Meijere, 1906: 177. Type locality: New Guinea.

Diagnosis. Wings hyaline, without dark spots at the end of vein R2+3; ventral tubercle of male fore femur oriented anteriorly, making angle with body of femur; katepisternum anteroventrally shining; hypopygial processes short and small (Fig. 3d).

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 3♂♂, 15.09.2016, 1♂, 18.09.2016, 5♂♂, 22.09.2016, 10♂♂, 3.10.2016, 2♂♂, 2.06.2017, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Rawalakot; Islamabad Capital: Lake View Park; Punjab: District Rawalpindi, Charra Pani (Hassan et al. 2023).

General distribution. Australasian/Oceanian, Oriental, Palaearctic (Ozerov, 2005).

***Sepsis nitens* Wiedemann, 1824**

Sepsis nitens Wiedemann, 1824: 57. Type locality: India.

Sepsis brevicosta Brunetti, 1910: 360. Type localities: India.

Sepsis tuberculata Duda, 1926: 51. Type locality: China.

Diagnosis. Body coloration varies ranging from reddish yellow to reddish brown; wings hyaline, without dark spots at the end of vein R2+3; ventral tubercle of male fore femur with three spines; sternopleuron completely pruinose; anepimeron wholly shining; hypogeal processes short.

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 10♂♂, 22.09.2015, 2♂♂, 10.09.2016, 1♂, 15.09.2016, 5♂♂, 18.09.2016, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Banjosa Lake, Rawalakot; Balochistan: District Kalat; Islamabad Capital: Lake View Park; Khyber Pakhtunkhwa: District Bannu, District Dir, District Swat, District Peshawar; Punjab: District Dera Ghazi Khan, Fort Munro, District Rawalpindi, Charra Pani (Iwasa, 1989b; Hassan et al. 2023).

General distribution. Australasian/Oceanian, Oriental (Ozerov, 2005).

***Sepsis thoracica* (Robineau-Desvoidy, 1830)**

Micropeza thoracica Robineau-Desvoidy, 1830: 742. Type locality: France.

Sepsis tridens Becker, 1903: 145. Type locality: Egypt.

Sepsis propinquus Adams, 1905: 175. Type locality: Zimbabwe.

Sepsis modesta de Meijere, 1906: 172. Type localities: Sri Lanka.

Sepsis consanguinea Villeneuve, 1920: 355. Type localities: France, England.

Sepsis goetghebueri Frey, 1925: 71. Type locality: Belgium.

Sepsis quadratipunctata Brunetti, 1929: 29. Type locality: Republic Of South Africa: Natal.

Sepsis longisetosa Brunetti, 1929: 30. Type locality: Republic of South Africa.

Sepsis idmais Séguy, 1932: 187. Type locality: France.

Sepsis ino Séguy, 1932: 188. Type locality: France.

Sepsis inermis Séguy, 1933: 28. Type locality: Republic of South Africa.

Sepsis kamahoroensis Vanschuytbroeck, 1963: 58. Type locality: Democratic Republic of the Congo.

Diagnosis. Body coloration varies ranging from reddish to blackish; wings with a dark spot at the end of vein R4+5; male fore femur without anterobasal patch of long hairs; katapisternum posterodorsally pruinose; hooked shape hypopygial processes.

Material examined. Azad Kashmir: Rawalakot, 33°51'32.18"N, 73°45'34.93"E, 1680 m, 12♂♂, 24.06.2016, 22♂♂, 20.04.2016, 16♂♂, 18.09.2016, 12♂♂, 23.05.2017, leg. M.A. Hassan.

Distribution in Pakistan. Azad Kashmir: District Poonch, Banjosa Lake, Rawalakot; Balochistan: District Quetta; Gilgit-Baltistan: District Skardu, Hussain Abad, District Shigar, Chutron; Khyber Pakhtunkhwa: District Dir, District Mansehra, District Swat; Punjab: District D.G. Khan (Iwasa, 1989b; Hassan, Bodlah, Mahmmod, & Tamkeen, 2017; Hassan et al. 2023).

General distribution. Afrotropical, Australasian/Oceanian, Oriental, Palaeartic (Ozerov, 2005).

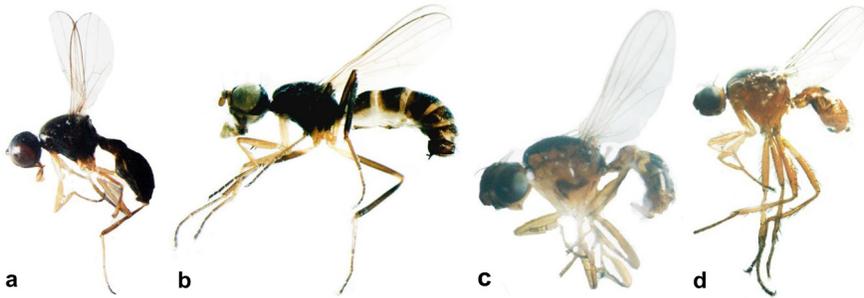


Figure 3. Males in lateral view. a) *Dicranosepsis parva*, b) *Meropterus minutus*, c) *Sepsis coprophila*, d) *Sepsis indica*.

DISCUSSION

A total of 14 species under six genera within the subfamily Sepsinae of the family Sepsidae have been recorded in Azad Kashmir, Pakistan. Interestingly, among these, only two species, *Meropterus minutus* and *Dicranosepsis parva*, were found only in Azad Kashmir. In terms of regional diversity, different provinces of Pakistan exhibit unique distribution patterns among the recorded species. Azad Kashmir shares 77% of its species with Punjab, 54% with Khyber Pakhtunkhwa, and 38% with Islamabad Capital. In contrast, Gilgit-Baltistan and Balochistan share only 31% of their species with Azad Kashmir, a pattern that reflects their relatively low diversity. Notable, no species from Azad Kashmir are documented in Sindh Province. This distribution may suggest ecological or biogeographical differences between these regions, or it could indicate that this group has been poorly explored in the south. Overall, these distribution patterns may reflect habitat preferences, specific ecological conditions, or the fact that both the current study and previous records have primarily focused on the selected parts of the country, such as the northern regions of Pakistan.

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Adult sepsid flies are commonly associated with habitats such as animal dung, human excrement, carrion, decaying organic matter, grasses, and wild flowers, where they oviposit and their larvae develop. This strong habitat association facilitates their collection across diverse regions. In this study, most species were collected from cow dung. Notable exceptions include *Australosepsis frontalis*, also found on *Coriandrum sativum*; *Dicranosepsis olfactoria*, collected from horse dung; and *Decachaetophora aeneipes*, which occurred in different habitats including cattle pastures, human feces, and grasses. *Sepsis coprophila* was common in garbage disposal areas. Notably, *Meroplius minutus* was recorded only from the bones and meats of animal carcasses.

In conclusion, this study provides a detailed overview of the diversity, distribution, and ecology of Sepsidae in Azad Kashmir. These findings highlight the importance for further research on the taxonomy, ecology and distribution of Sepsidae in different parts of Pakistan.

ACKNOWLEDGMENTS

The first author extends sincere gratitude to Dr. Mitsuhiro Iwasa (Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Hokkaido, Japan) for his valuable guidance and for providing important references on the family Sepsidae

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