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A note on Indian Dryomyzidae (Insecta: Diptera) with special reference to the distribution pattern

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Abstract

The present checklist reveals a total of three species *viz. Dryomyza formosa* Wiedemann, 1830, *Dryomyza pakistana* Kurahashi, 1989 and *Paradryomyza steyskali* Ozerov & Sueyoshi, 2002 under 2 genera belongs to subfamily Dryomyzinae Schiner, 1862 and tribe Dryomyzini Schiner 1862. Besides that, the present study also depicts their discontinuous and restricted distribution pattern. The current checklist will serve as a primary database to encourage future research on medically and forensically important flies of Indian Dryomyzidae.

Keywords: Checklist, diversity, distribution, dryomyzidae

Introduction

Dryomyzidae or Dryomizid Fly is a small fly family under the order Diptera. They are relatively large acalyptrate flies. Their size may range from 4 mm to 18 mm with a moderately robust and visibly setulose body. The body colour of the fly may vary from yellowish-brown to grey and their whole body is moderately micro tomentose (Mathis & Sueyoshi, 2011). Family Dryomyzidae can be characterized by some key morphological features (McAlpine, 1989) including (a) bare metasternum, and (b) 2 to 5 abdominal spiracles present in the ventral margins of their corresponding tergites. Mathis & Steyskal (1980) further resolved the previously existing ambiguity about the genus *Oedoparena* under the separate tribe Oedoparini within this family based on clypeal, acrostichal, and antennal characters.

The concept of family Dryomyzidae consists of 25 Species under six extant genera and two fossil genera (Mathis & Sueyoshi, 2011). The confusion regarding the status of three genera under this family (*Dryomyza*, *Dryope* and *Neurectena*) have led to errors regarding their usage which has been perpetuated and promulgated in the literature. The status of these three genera has been established in the "World Catalog and Conspectus on the Family Dryomyzidae (Diptera: Schizophora)" (Mathis & Sueyoshi, 2011). The species *D. vetula* Fallén (= *Musca flaveola* Fabricius, 1794) often has been cited as the type species of the genus *Dryomyza* by Westwood (1840: 165). As *D. vetula* is not listed in the original list of species of *Dryomyza* (Sabrosky 1999) and he did not show any synonymy that would link between that species and any enlisted species of *Dryomyza* genus. This designation of type species is thus invalid. Later in 1846, *Dryomyza anilis* Fallén was published as the type species of *Dryomyza* by Zetterstedt (1846: 2082) and this is originally included in the species list thus the designation of type species of *Dryomyza anilis* Fallén is valid.

The second genus *Dryope* has the type species *Dryomyza communis* (= *Musca flaveola* Fab., 1794) which was proposed by Robineau-Desvoidy in 1830 and is in the original list of species and this designation is thus valid (Mathis & Sueyoshi, 2011).

The third genus *Neurectena* has the type species *Dryomyza anilis* which was proposed by Rondani in 1868 but is invalid. Because *Dryomyza anilis* had previously been detected as the type species of *Dryomyza* (Zetterstedt 1846). Thus, *Neurectena* is invalid as the genus. Several authors such as Hendel 1937, Stackelberg 1970, Ozerov 1999, Chandler 1998, Zuijlen, and Beuk 2002, and Carles-Tolrá & Báez 2002, have recognized *Neurectena* as a separate genus. As specified above *Neurectena* is an invalid name and junior synonym of *Dryomyza*, Czerny *et al*.'s generic concept of "*Neuroctena*" is *Dryomyza*. In 1930, Czerny also recognized *Dryomyza* as a separate

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genus with *D. flaveola* and *D. decrepita* Zetterstedt in it. But *D. flaveola* and related species were earlier recognized as belonging to the genus *Dryope*, so the oldest and most valid name for the genus *Neurectena* is *Dryope* (Mathis & Sueyoshi, 2011).

The phylogenetic relationships for the included genera in the family Dryomyzidae and the families within the superfamily Sciomyzoidea have not been completely determined (McAlpine 1991). Most phylogenetic considerations are either primary or are concerned with the monophyly of a specific genus or small group of genera and not how these lineages are linked phylogenetically to other such clades (Mathis & Sueyoshi, 2011).

In 1998, Ozerov divided the six extant genera into two tribes Dryomyzini and Oedoparenini, but this scheme was not followed by Mathis & Sueyoshi, 2011, in their "World Catalog and Conspectus on the Family Dryomyzidae (Diptera: Schizophora)" because the placement of the extinct genera within this tribe is not stated clearly. *Oedoparena*, however, is undoubtedly different in its morphology and natural history from other genera of the family and may be recognized as a separate tribe.

Earlier, the genus *Helcomyza* Curtis and related genera have been classified into the subfamily Helcomyzinae under the family Dryomyzidae (Czerny 1930, Séguy 1934, Griffiths 1972, Steyskal 1987, McAlpine 1989). In 1991, McAlpine discovered several characters that gave subfamily Helcomyzinae the status of a separate family Helcomyzidae within the superfamily Sciomyzoidea. McAlpine also suggested that possibly the Helcomyzidae is the sister group of the Coelopidae (Mathis & Sueyoshi, 2011).

In the family Dryomyzidae there are prominently two different biologies established in nature. Some genera prefer humid environments such as forests where there is an understory of shaded, low vegetation and decaying organic matter. Larvae of these genera have been found in rotting flora and fungi, the carcasses of animals ranging from insects to molluscs to vertebrates and even in human excrement. The larvae of these flies are saprophagous by feeding nature and so females generally lay eggs directly on the rotting food source. However, the genera *Oedoparena* Curran acts as the predator of intertidal barnacles (Burger *et al.*, 1980; Suwa, 1981) and is only reported from the maritime coastal area. The female of *Oedoparena* lays an egg on the operculum of barnacles and the emerged larvae enter the test of the barnacles and feed on that barnacles.

Most of the species of the family Dryomyzidae are recorded from the temperate climatic zone of the Holarctic Region (Palearctic and Nearctic) (except the genus *Oedoparena*, which is recorded mainly from the coastal region of the northern Pacific). Some are exclusively recorded from the northern hemisphere. Only four species are recorded from the temperate climatic zone of the Oriental region. Strikingly, this family is not recorded from the Afrotropical, Australasian and Neotropical Regions (Mathis & Sueyoshi, 2011).

Dryomyzid fly has great importance in society. They have forensic (Jarmusz *et al.* 2020, Lenlanc & Strongman, 2002) as well as medical importance (Chigusa *et al.* 2000). Recently *Dryomyza flaveola* (Fabricius, 1794) and *Neuroctena anilis* Fallén, 1820 were reported in the hanging pig carcass abundantly from a hornbeam-oak forest, in western Poland (Jarmusz *et al.* 2020). A third-stage larva of *Dryomyza formosa* (Wiedemann) was reported for the first time in the fresh stool of a young woman in Tokyo, Japan (Chigusa *et al.* 2000).

It is a lesser-known acalyptrate brachyceran dipteran. Despite lots of importance (Forensic, medical and as a potential bio-controlling agent) sufficient taxonomic works on the family Dryomizidae have not been done in India and the world. Studies on Dryomyzidae have always been neglected by researchers. Therefore, more exhaustive taxonomic, forensic, and ecological studies on these flies are largely due, specifically concerning their multi-dynamic roles in the ecosystem.

Materials and Methods

The present checklist of Indian Dryomyzidae is based on the records of old and current literature. In 2012, two female Dryomyzidae were collected by the Zoological Survey of India survey team from Chamba, Himachal Pradesh. All relevant data from published papers on this family have been analyzed thoroughly. The present checklist follows the standard classification precedent of McAlpine (1989) which is also followed by (Mathis & Sueyoshi, 2011) in their Word Catalog. Here for each species, the first reference along with all the references have been given in the checklist. Also, the type locality, repository of type specimens and distribution (in the world, in the Oriental region and India) of each species have been given in this present checklist.

Results

I. Checklist

Family **DRYOMYZIDAE** Schiner, 1862

Subfamily DRYOMYZINAE Schiner, 1862

Tribe DRYOMYZINI Schiner 1862

Key to the Genus of Tribe Dryomyzini

Prescutellar acrostichal seta present ……..... *Dryomyza* Fallén, 1820.

- Prescutellar acrostichal seta absent..... *Paradryomyza* Ozerov, 1987.

Genus ***Dryomyza*** Fallén, 1820

Key to Species of Genus *Dryomyza*

Pleura brown to blackish; yellow thoracic dorsum with broad median fuscous strips; abdomen brown; hind femora yellow on apical one-third……. *D. formosa* Wiedemann, 1830.

Pleura shining black; brownish thoracic dorsum without any median fuscous strips; abdomen shining black covered with black hairs; hind femora with an orange band on subapical position……. *D. pakistana* Kurahashi, 1989.

1. *Dryomyza formosa* Wiedemann, 1830

1830. *Scatophaga formosa* Wiedemann, *Aussereuropäische zweiflügelige Insecten*., **2**: 447.

Other Reference:

Macquart, 1851: 246; Loew 1858: 112 [generic combination]; Snellen von Vollenhoven, 1862: 18; Osten Sacken 1882: 20 [synonymy of *maculipennis* and *gigas*]; Wulp 1896: 163 [south Asia]; Coquillett 1898: 339 [generic combination]; Becker 1905: 37 [catalog, Palaearctic]; Matsumura 1905: 116 [review], 1931: 372 [review], 1932: 49 [review]; Brunetti 1907: 169 [list, India]; Lichtwardt 1909: 127 [discussion, comparison with formosa]; Czerny 1930: 5 [review, generic combination]; Shiraki 1932: 47 [review]; Hendel 1937: 186 [generic key]; Yasumatsu 1939: 419 [review]; Wu 1940: 385 [China]; Shiraki 1952: 1668 [review]; Takeuchi 1955: 151 [list]; Steyskal 1957: 63 [revision]; Kanou 1959: 603 [larval morphology and biology]; Steyskal 1977b: 173 [catalog, Orient]; Kurahashi 1981: 439 [revision]; Sóos 1984: 153 [catalog, Palaearctic]; Ozerov 1987: 431 [review, Russia], 1999: 554 [Russian Far East]; Morimoto 1989: 805 [checklist, Japan]; McAlpine 1995: 42 [new records, Fijian (island of Komo) – probably erroneous]; Mathis and Sueyoshi, 2011 [World Catalog]; Hassan *et al*. 2019 [Catalogue].

Synonym:

Scatophaga formosa Wiedemann, 1830

Dryomyza maculipennis Macquart, 1851

Dryomyza formosa Loew, 1858

Dryomyza gigas Snellen von Vollenhoven, 1862

Eggizoneura formosa Coquillett, 1898

Neuroctena (Stenodryomyza) formosa Hendel, 1924

Stenodryomyza formosa Czerny, 1930

Type locality: Japan.

Material examined: 2♀, Rajpura River Side, Chamba, Himachal Pradesh, 22.iv.2012, Coll.: R.S. Mridha, Reg. No. 15640/ H6 and 15641/ H6.

Repository: Male syntype is preserved in Zoologisches Museum, Humboldt Universität, Berlin, Germany (ZMHU) and Muséum National d'Histoire Naturelle, Paris, France (MNHNP).

Distribution: World [China, Japan (Honshu, Kyushu, Shikoku), Korea, Russia (Far East)].

Oriental [Taiwan, Vietnam].

India [Himachal Pradesh (Shimla, Chamba), Uttarakhand (Mussoorie)].

Remarks: This is a common species of the genus *Dryomyza*. This is reported mainly in the Palearctic region and moderately in the oriental region. In India, it was first recorded as *Dryomyza maculipennis* Macquart, 1851 by Brunetti in 1907. It has forensic as well as medical importance.

2. *Dryomyza pakistana* Kurahashi, 1989

1989. *Dryomyza pakistana* Kurahashi, A new species of *Dryomyza* (Diptera: Dryomyzidae) from Pakistan. *Proc. Jpn. Soc. Syst. Zool.* **39**: 44.

Other Reference: Wachkoo *et al*. 2017 [New record from India]; Hassan M.A. *et al.* 2018 [New record from Poonch district, Azad Kashmir, Pakistan].

Type locality: Murree, Punjab Prov., Pakistan.

Material examined: Reported from Literature (Wachkoo *et al*. 2017).

Repository: The holotype and Paratypes are preserved in the National Science Museum, Tokyo. Male and female pairs of paratypes are also deposited in the Pakistan Museum of Natural History, Islamabad; B.P. Bishop Museum, Honolulu; British Museum (Natural History), London; and the U.S.

Distribution: World [China (Guizhou Prov., Jiangkou, Fanjingshan,)].

Oriental [Pakistan (Poonch district, Azad Kashmir)].

India [Jammu and Kashmir (Srinagar)].

Remarks: This is the new species recorded from Pakistan which is closely related to *Dryomyza formosa* Wiedemann, 1830. It is found generally at high altitudes (2000 m- 2500 m).

Genus ***Paradryomyza*** Ozerov, 1987

3. *Paradryomyza steyskali* Ozerov & Sueyoshi, 2002

2002. *Paradryomyza steyskali* Ozerov & Sueyoshi, Two new species of *Paradryomyza* Ozerov (Diptera, Dryomyzidae) from Asia. *Stud. Dipt.* **8 (2001)**: 567.

Type location: Dobang Kharka, Nepal.

Material examined: Reported from Literature (Ozerov & Sueyoshi, 2002).

Repository: The female holotype is preserved in the Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu University, Fukuoka, Japan (BLKU).

Distribution: World [Nil].

Oriental [Nepal].

India [Uttar Pradesh].

Remarks: It is found at an altitude of 2400 m (Ozerov & Sueyoshi, 2002). This is a lesser-known species of this family.

II. Distributional Map of Indian Dryomyzidae

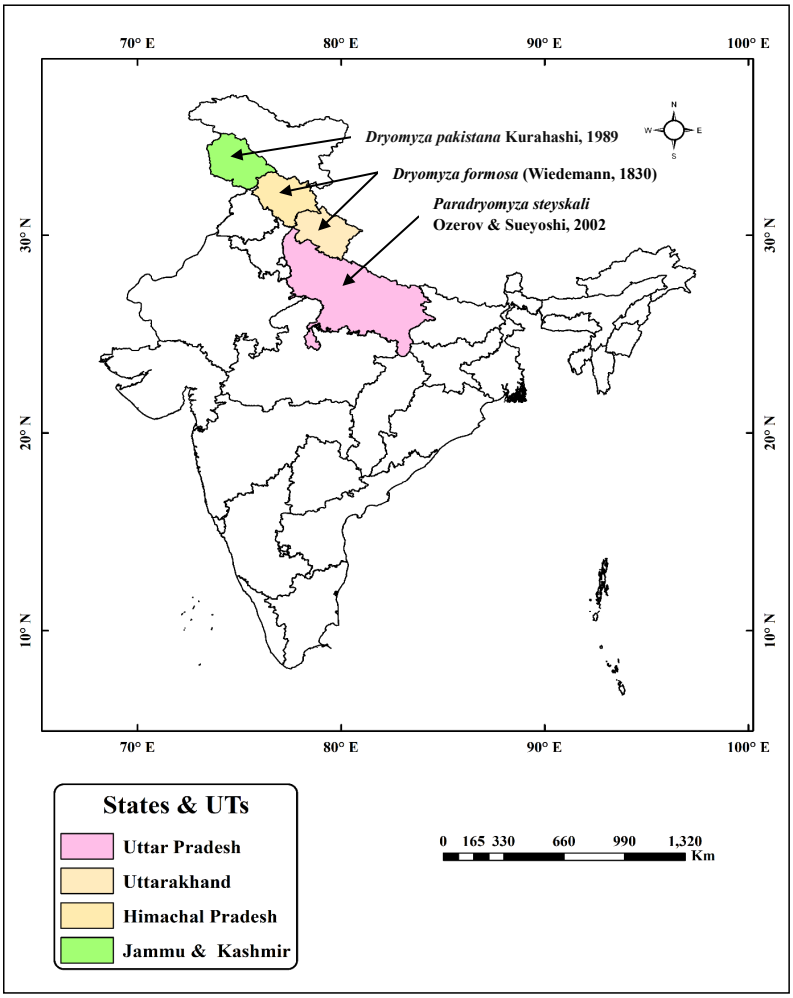

Figure 1. Distributional map of Indian Dryomyzidae.

III. Diversity Analysis of Indian Dryomyzidae concerning the World and Oriental Dryomyzidae

Table 1. Numbers of the subfamily, Tribe, Genus and Species in the World, Oriental region and India.

	No. of subfamily	No. of tribe	No. of genus	No. of species
World	2	2	8	25
Oriental region	1	1	2	4
India	1	1	2	3

Discussion

The lesser-known yet very valuable Brachyceran fauna is being treated as a neglected subject of research interest because of many obstructions such as their discontinuous distribution pattern, lack of morphological experts on this family, low availability of specimens, etc. despite its forensic, and medical importance and potential bio controlling ability in an ecosystem. However, their limited and patchy distribution pattern restricted them to the Nearctic, Palearctic and Oriental regions only. Their distinct biological features and life cycle strategies may have a greater impact on their feeding biology and habitat preference. But their overall taxonomic study remains very difficult due to their similarity with other families, mostly within the superfamily Sciomyzoidea (Coelopidae, Helcomyzidae, Helosciomyzidae, Heterocheilidae, Platystomatidae). Besides that, the family Dryomyzidae was treated as an ill-defined family under the superfamily Sciomyzoidae (Hennig 1958). Therefore, the status of the family Dryomyzidae was in great ambiguity for several decades. Nevertheless, this taxonomic complication needs to be resolved more conspicuously through comprehensive taxonomic treatments and DNA barcoding studies in future. Zoological catalogues, checklists, and equivalent databases are usually regarded as indispensable tools for anyone needing a reference to a currently accepted name, and frequently to other information relating to that taxon, such as bibliographic and distributional data and may further serve as stepping stones before such taxonomic practice. The present checklist on Dryomyzid fauna of India may serve this purpose and for the furtherance of study in future. The present checklist also includes several information on this lesser-known fauna including their current accepted name, synonyms, type locality, repository, distribution pattern, etc.

The current checklist reported the presence of 3 species under two genera of this lesser-known yet important fly from India. All species were collected from the higher altitudes (1,500m- 2,500m) of temperate zones in northern India (Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh, Uttarakhand; as evident from their distribution map, Figure 1).

The present study also depicts the comparative scenario of relative abundance and species richness at different levels of taxa. India alone records 50% subfamily richness (1 out of 2 subfamilies) in comparison to the World and this only Indian subfamily (Dryomyzinae) also belongs to the oriental region (Figure 2). However, the current study also reveals that 50% tribe richness (1 out of 2 tribes) of Indian Dryomyzidae as compared to the World and the only Indian tribe Dryomyzini belongs to the oriental region (Table 1). Whereas it reveals only 25% generic abundance (2 out of 8 genra) when compared to the World and all these two genera, i.e., *Dryomyza* Fallén, 1820 and *Paradryomyza* Ozerov, 1987, also confined to the oriental region (Figure 4). Indian Dryomyzidae has recorded only 12% species richness (3 out of 25 species) in comparison to the World and 75% (3 out of 4 species) in comparison with species richness of the oriental region (Figure 5).

All these three Indian Dryomyzid species *viz. Dryomyza formosa* Wiedemann, 1830; *Dryomyza pakistana* Kurahashi, 1989 and *Paradryomyza steyskali* Ozerov & Sueyoshi, 2002 moreover exhibits a restricted and discontinuous distribution pattern as evident from their distribution map and more or less their distribution remains restricted to temperate climatic zones, in higher altitudes of hilly regions of northern India. But their discontinuous and restricted (Mathis & Sueyoshi, 2011) distribution pattern may be correlated with their habitat

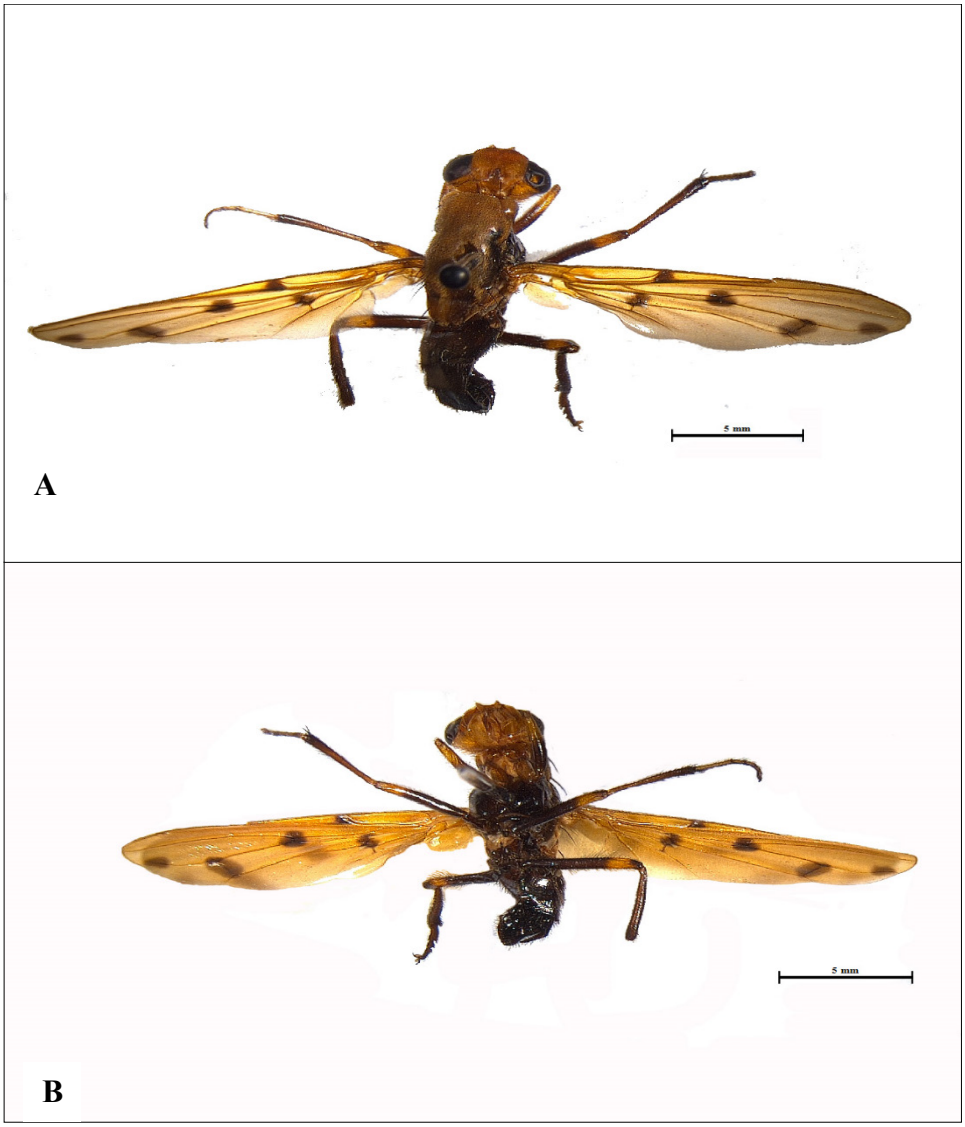

Figure 2. *Dryomyza formosa* Wiedemann, 1830; **A.** Dorsal view, **B.** Ventral view.

and climatic preference and it may also be attributed to difficulties in the thorough survey in non-accessible parts of North and Eastern Himalayan belts, especially along the international borders of Nepal, China and Pakistan.

Nevertheless, this checklist will perhaps encourage more rigorous taxonomic, distribution and diversity studies of this lesser-known Brachyceran fly of forensic and medical importance and may serve as a primary database for researchers and entomologists shortly.

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