

Article

Species composition and relative abundance of haematophagous and non-haematophagous muscid flies (Diptera: Muscidae) of West Bengal, India

Pravas Hazari¹, Nandan Jana¹, Amita Hajra², Sreejith Kanholi³, Shuvra Kanti Sinha¹

¹Calyptrate Research Centre, Department of Zoology, Sreegopal Banerjee College Mogra, Hooghly, West Bengal- 712148, India

²Govt. General Degree College, Kharagpur II, Madpur, Paschim Medinipur, West Bengal- 721149, India

³Department of Zoology, University of Calicut, Malappuram, Kerala- 673635, India

E-mail: suvrosinha@gmail.com

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Abstract

The family Muscidae (Diptera) represents one of the most ecologically and medically important groups of synanthropic flies. Members of this family act as mechanical and biological vectors of various disease-causing pathogens affecting humans, livestock and wild animals. Despite their immense significance, comprehensive regional assessments of muscid diversity and feeding guild structure remain limited in eastern India. The present study documents the species composition and relative abundance of haematophagous and non-haematophagous muscid flies across different ecological habitats of West Bengal, India. A field survey was conducted in rural, peri-urban, and urban landscapes, resulting in the collection of 3,272 muscid flies. Specimens were identified using standard taxonomic keys, and species were categorised based on feeding habits. Relative abundance analysis revealed a substantial representation of haematophagous taxa, indicating favourable ecological conditions for blood-feeding muscid species in the region. Non-haematophagous muscid species, though less dominant, contributed significantly to overall diversity and were associated with decomposing organic matter and synanthropic habitats. This study provides baseline data on muscid fly assemblages in West Bengal and highlights the need for continued taxonomic surveillance and ecological monitoring. The findings contribute to a better understanding of muscid biodiversity, feeding guild distribution, and their implications for public and veterinary health in eastern India.

Keywords Diptera; Muscidae; haematophagous flies; synanthropic; relative abundance; vector.

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1 Introduction

Muscid flies (Diptera: Muscidae) are among the most important medico-veterinary calyptate flies and commonly referred to as house flies and their allies. Owing to their synanthropic nature, muscid flies are

frequently associated with human habitations and are widely distributed in environments such as marketplaces, cattle sheds, garbage dumps, crop fields, and even cadavers (Ishijima, 1967; D'Almeida, 1992). Morphologically, members of this family are characterised by small to medium-sized compact bodies, a yellowish to brown or bluish abdomen, and well-developed compound eyes, accompanied by diverse feeding habits that enable them to exploit a wide range of ecological niches.

Ecologically, muscid flies play a dual role. On one hand, adult flies contribute significantly to ecosystem functioning by acting as pollinators, particularly in agro-ecosystems and natural habitats where they visit flowers in search of nectar and other resources (Orford et al., 2015; Tiusanen et al., 2016). On the other hand, their larval stages play a crucial role in nutrient cycling by facilitating the decomposition of decaying organic matter, including animal carcasses and waste materials, thereby facilitating the recycling of nutrients within ecosystems.

Despite their ecological importance, muscid flies are of considerable concern to public and veterinary health. Several species are recognised as mechanical or biological vectors of pathogenic microorganisms, including bacteria, viruses, protozoa, and helminths that affect humans, livestock, and wildlife (Khamesipour et al., 2018). Haematophagous muscid flies, in particular, are of special significance due to their blood-feeding behaviour, which enhances their potential to transmit pathogens and cause direct harm to domestic animals through irritation, blood loss, and reduced productivity. In addition, muscid flies are frequently used in forensic entomology for estimating post-mortem time intervals, highlighting their applied importance beyond medical and veterinary fields (Grzywacz et al., 2017).

Globally, more than 5,000 species of muscid flies have been described, with the greatest diversity occurring in tropical and subtropical regions (Pape et al., 2011). In India, the first comprehensive taxonomic account of the family Muscidae was provided by Emden (1965), who documented 169 species from the country, including 64 species from the state of West Bengal. Subsequent studies have continued to reveal the rich diversity of this family in the region. Sinha et al. (2021) reported substantial muscid diversity from the Neora Valley National Park of West Bengal, while Jana et al. (2024) worked on species composition and habitat distribution of haematophagous muscid flies within the state.

The state of West Bengal, characterised by diverse landscapes ranging from the Himalayan foothills to coastal plains, supports a rich assemblage of flora and fauna and provides an ideal ecological setting for the diversification of muscid flies. As the project unfolds, it has documented a remarkable diversity of 84 muscid species. This study not only contributes to the taxonomic and ecological understanding of Muscidae in eastern India but also emphasises the implications of muscid diversity for animal and human health.

The present investigation aims to assess the species composition of muscid flies in West Bengal, with special reference to haematophagous species, and to evaluate the relative abundance of haematophagous and non-haematophagous muscid flies across different habitats.

2 Materials and Methods

Muscid flies were usually collected using insect hand nets (ring diameter 30 and 15 cm) from different habitats such as marketplaces, cattle sheds, dead bodies or cadavers of vertebrate and invertebrate animals, flowering gardens, animal dung, pasture lands, fish and vegetable markets, hospital surrounding areas, human habitations areas and near water bodies. A Malaise trap was used in some forested areas and open grasslands for the collection of flies. After collection by sweeping method flies were killed in a killing jar containing liquid benzene vapour. In a few cases, pinning was done after the collection process, they were stored in envelopes with dichloro-benzene and labelled with date and collection place. Malaise traps-collected materials were stored in 70% ethanol. For studying the bionomics of each fly, their feeding habits, behaviour, breeding sites,

and habitat distribution were recorded simultaneously. Collected specimens were brought to the laboratories for subsequent investigation. Flies were morphologically identified under a stereoscopic microscope by studying chaetotaxy and description following Emden (1965), Shinonaga and Kano (1971) and available literature.

3 Results

A total of 3272 specimens belonging to 24 genera and 84 species were collected (Table 1). Among these, 1437 specimens (43.92% of the total collection) were identified as haematophagous (Tables 2 and 3). In 1835, the number of specimens (56.08% of the total collection) was identified as non-haematophagous flies (Table 3). All haematophagous flies are included under the genera *Musca*, *Stomoxys*, *Haematobosca* and *Haematobia* (Table 2). Out of which 1437 collected haematophagous flies, 1074 belong to genus *Musca*, 322 to genus *Stomoxys*, 2 to genus *Haematobosca* and 39 to genus *Haematobia*. The number of haematophagous and non-haematophagous species recorded in this study is presented in Table 4.

Table 1 List of muscid species and number of collected individuals.

S.L. NO	Species	No. of collected individuals (n)
1	<i>Musca (Musca) domestica</i> Linnaeus, 1758	401
2	<i>Musca conducens</i> Walker, 1860	162
3	<i>Musca (Viviparomusca) bezzii</i> Patton and Cragg, 1913	3
4	<i>Musca (Byomya) sorbens</i> Wiedemann, 1830	61
5	<i>Musca (Byomya) ventrosa</i> Wiedemann, 1830	270
6	<i>Musca (Eumusca) hervei</i> Villeneuve, 1922	9
7	<i>Musca (Ptilolepis) inferior</i> Stein, 1909	235
8	<i>Musca (Byomya) pattoni</i> Austen, 1910	23
9	<i>Musca (Philaematomyia) crassirostris</i> Stein, 1923	202
10	<i>Musca (Viviparomusca) formosana</i> Malloch, 1925	3
11	<i>Musca (Byomya) tempestiva</i> Fallén, 1817	9
12	<i>Musca (Viviparomusca) convexifrons</i> Thomson, 1869	93
13	<i>Musca</i> sp.	4
14	<i>Musca (Setimusca) malaisei</i> Emden, 1965	1
15	<i>Morellia nigrisquama</i> Malloch, 1928	18
16	<i>Morellia sordidisquama</i> Stein, 1918	7
17	<i>Morellia hortensia</i> (Wiedemann, 1830)	26
18	<i>Morellia</i> sp.	4
19	<i>Mitroplatia brunneisquama</i> (Emden, 1965)	13
20	<i>Neomyia timorensis</i> (Robineau-Desvoidy, 1830)	294
21	<i>Neomyia lauta</i> (Wiedemann, 1830)	47
22	<i>Neomyia indica</i> (Robineau-Desvoidy, 1853)	24
23	<i>Neomyia coeruleifrons</i> (Macquart 1851)	15
24	<i>Neomyia fletcheri</i> (Emden 1965)	5
25	<i>Neomyia gavis</i> (Walker, 1859)	17

26	<i>Neomyia claripennis</i> (Malloch, 1923)	8
27	<i>Neomyia diffidens</i> (Walker, 1857)	15
28	<i>Dasyphora kemp</i> Emden, 1965	4
29	<i>Rypellia flavipes</i> Malloch, 1931	3
30	<i>Rypellia malaisei</i> (Emden, 1965)	3
31	<i>Stomoxys calcitrans</i> (Linnaeus, 1758)	298
32	<i>Stomoxys sitiens</i> Rondani, 1873	3
33	<i>Stomoxys bengalensis</i> Picard, 1908	18
34	<i>Stomoxys indicus</i> Picard, 1908	3
35	<i>Haematobosca sanguinolenta</i> (Austen, 1909)	2
36	<i>Haematobia exigua</i> de Meijere, 1903	34
37	<i>Haematobiaminuta</i> (Bezzi, 1892)	5
38	<i>Ophyra chalcogaster</i> (Wiedemann, 1824)	154
39	<i>Ophyra ignava</i> (Harris, 1780)	7
40	<i>Ophyra unispinosa</i> Stein, 1898	3
41	<i>Dichaetomyia subumbrosa</i> Emden, 1965	2
42	<i>Dichaetomyia indica</i> (Walker, 1856)	15
43	<i>Dichaetomyia luteiventris</i> (Rondani, 1873)	24
44	<i>Dichaetomyia bibax</i> (Wiedemann, 1830)	8
45	<i>Dichaetomyia apicalis</i> (Stein, 1925)	5
46	<i>Dichaetomyia quadrata</i> (Wiedemann, 1824)	4
47	<i>Dichaetomyia albiceps</i> (Wulp, 1881)	6
48	<i>Rhynchomydaea tuberculifacies</i> Stein, 1922	6
49	<i>Myospila rufomarginata</i> (Malloch, 1925)	7
50	<i>Myospila laevislaevis</i> (Stein, 1900)	24
51	<i>Myospila argentata</i> (Walker, 1915)	127
52	<i>Myospila angustifrons</i> (Malloch, 1922)	5
53	<i>Myospila bina bina</i> (Wiedemann, 1830)	14
54	<i>Myospila tenax</i> (Stein, 1918)	14
55	<i>Myospila steini</i> (Emden, 1965)	10
56	<i>Myospila femorata</i> (Malloch, 1935)	14
57	<i>Myospila lenticeps</i> (Thomson, 1869)	57
58	<i>Myospila himalayensis</i> Jana, Hazari & Sinha in Jana, Hazari, Sinha & Wei, 2023	5
59	<i>Mydaea longiscutellata</i> Emden, 1965	14
60	<i>Helina</i> sp.	3
61	<i>Helina appendiculata</i> (Stein, 1910)	1
62	<i>Graphomya maculata</i> (Scopoli, 1763)	8
63	<i>Graphomya rufitibia</i> Stein, 1918	10
64	<i>Graphomya adumbrata</i> (Wiedemann, 1824)	10
65	<i>Brontaea ascendens</i> (Stein, 1915)	14
66	<i>Brontaea distincta</i> (Stein, 1909)	11

67	<i>Brontaea lasiopa</i> (Emden, 1965)	19
68	<i>Brontaeatonitru</i> (Wiedemann, 1824)	12
69	<i>Heliographatonsa</i> (Stein, 1909)	12
70	<i>Heliographaceylanica</i> (Emden, 1965)	7
71	<i>Limnophora latiseta</i> Emden, 1965	12
72	<i>Limnophora brunescens</i> Emden 1965	1
73	<i>Limnophora conica</i> Stein, 1915	10
74	<i>Limnophora himalayensis</i> Brunetti, 1907	9
75	<i>Lispe sericipalpis</i> (Stein, 1904)	6
76	<i>Lispe orientalis</i> Wiedemann 1824	223
77	<i>Lispe pacifica</i> Shinonaga and Pont, 1992	6
78	<i>Lispe assimilis</i> Wiedemann, 1824	4
79	<i>Lispe glabra</i> Wiedemann, 1824	4
80	<i>Atherigona (Acritochaeta) orientalis</i> Schiner, 1868	18
81	<i>Phaonia kambaitiana</i> Emden, 1965	1
82	<i>Phaonia</i> sp.	1
83	<i>Polietes</i> sp.	1
84	<i>Coenosia</i> sp.	2

Table 2 Haematophagous muscid species and number of collected individuals.

S.L. No	Species	No. of collected individuals
1.	<i>Musca conducens</i> Walker, 1860	162
2.	<i>Musca (Viviparomusca) bezzii</i> Patton and Cragg, 1913	3
3.	<i>Musca (Byomya) sorbens</i> Wiedemann, 1830	61
4.	<i>Musca (Byomya) ventrosa</i> Wiedemann, 1830	270
5.	<i>Musca (Eumusca) hervei</i> Villeneuve, 1922	9
6.	<i>Musca (Ptilolepis) inferior</i> Stein, 1909	235
7.	<i>Musca (Byomya) pattoni</i> Austen, 1910	23
8.	<i>Musca (Philaematomyia) crassirostris</i> Stein, 1923	202
9.	<i>Musca (Viviparomusca) formosana</i> Malloch, 1925	3
10.	<i>Musca (Byomya) tempestiva</i> Fallén, 1817	9
11.	<i>Musca (Viviparomusca) convexifrons</i> Thomson, 1869	93
12.	<i>Musca</i> sp.	4
13.	<i>Stomoxys calcitrans</i> (Linnaeus, 1758)	298
14.	<i>Stomoxys bengalensis</i> Picard, 1908	18
15.	<i>Stomoxys sitiens</i> Rondani, 1873	3
16.	<i>Stomoxys indicus</i> Picard, 1908	3
17.	<i>Haematobosca sanguinolenta</i> (Austen, 1909)	2
18.	<i>Haematobia exigua</i> de Meijere, 1903	34
19.	<i>Haematobia minuta</i> (Bezzi, 1892)	5
	Total	1437

Table 3 Relative proportion of collected haematophagous and non-haematophagous muscid flies.

Feeding habits	No. of collected individuals	Percentage (%)
Haematophagous muscid flies	1437	43.92
Non-haematophagous muscid flies	1835	56.08
Total	3272	100

Table 4 Percentage of haematophagous and non-haematophagous species.

Feeding Habits	No. of species	Percentage (%)
Haematophagous	19	22.62
Non-haematophagous	65	77.38
Total	84	100

4 Discussion

The present study documents a considerable diversity of Muscidae in West Bengal, with 84 species recorded across different habitats. This high species richness reflects the ecological heterogeneity of the region and confirms the adaptability of muscid flies to a wide range of environmental conditions. Members of this family occupy diverse ecological niches and have multiple functional roles, including pollination, decomposition, and nutrient recycling, thereby contributing substantially to ecosystem stability and agricultural productivity.

A notable proportion of the recorded species are involved in pollination, particularly in agro-ecosystems and semi-natural landscapes, where muscid flies frequently visit flowers in search of nectar and other resources. Their role as pollinators is especially relevant in habitats where traditional pollinators such as bees may be seasonally scarce or declining. In addition, the larval stages of many non-haematophagous muscid species contribute to the breakdown of decaying organic matter, facilitating nutrient turnover and supporting soil health.

From a functional and applied perspective, the muscid fauna recorded in this study can be broadly categorised into haematophagous and non-haematophagous groups. Eighteen species, representing four genera, *Musca*, *Stomoxys*, *Haematobosca*, and *Haematobia*, were identified as haematophagous. These genera are of particular significance due to their direct interactions with vertebrate hosts. Haematophagous muscid flies exhibit specialised mouthparts adapted for blood feeding and are primarily associated with livestock, although some species may opportunistically feed on humans.

The proportion of haematophagous species (22.62%) within the total muscid assemblage documented in this study is noteworthy and warrants careful consideration. Blood-feeding muscid flies are well known for their capacity to act as mechanical vectors of a wide range of pathogens, including bacteria, viruses, protozoa, and helminths affecting domestic animals and, indirectly, human populations. Their feeding behaviour, frequent host contact, and movement between contaminated substrates and living hosts enhance the risk of pathogen transmission. Moreover, persistent biting by these flies can cause significant stress, blood loss, reduced weight gain, and lowered milk production in livestock, leading to substantial economic losses.

The high abundance and wide distribution of haematophagous muscid flies observed in this study may be attributed to favourable climatic conditions, extensive livestock rearing practices, and the availability of breeding substrates such as dung, organic waste, and moist soil. West Bengal's diverse landscapes, coupled with intensive agricultural and animal husbandry activities, provide ideal conditions for the proliferation of

these species. This ecological context underscores the importance of continuous monitoring of haematophagous muscid populations, particularly in rural and peri-urban areas.

While the ecological contributions of muscid flies, especially non-haematophagous species, should not be underestimated, the relatively high representation of blood-feeding taxa highlights a critical interface between biodiversity and public and veterinary health. Understanding the species composition, relative abundance, and habitat preferences of haematophagous muscid flies is therefore essential for developing effective management strategies. Such knowledge can inform integrated pest management programs, disease surveillance efforts, and livestock health interventions.

5 Conclusion

This study highlights the rich diversity of muscid flies in West Bengal, with 84 species recorded from a range of habitats, reflecting the ecological flexibility of the family Muscidae. While many species play beneficial roles in pollination and organic matter recycling, the presence of a considerable proportion of haematophagous taxa (22.62%) draws attention to their importance in veterinary and public health contexts. Blood-feeding genera such as *Musca*, *Stomoxys*, *Haematobia*, and *Haematobosca* maintain close associations with livestock and may contribute to animal stress, reduced productivity, and pathogen transmission. The findings provide essential baseline information on muscid fauna in eastern India and emphasise the need for continued ecological and applied research to better understand the distribution, seasonal dynamics, and potential impacts of haematophagous muscid flies.

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