

REVIEW ARTICLE

A Synoptic Review on the Indian Small Dung Flies (Diptera: Sphaeroceridae) of India

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ABSTRACT

Altogether, 63 species belonging to 29 genera and 03 subfamilies of lesser dung flies (Diptera: Sphaeroceridae) have been reported from India, which is only 4.01% of total global species of Sphaeroceridae. Out of 36 states and UT's in India, the family Sphaeroceridae is so far known only from 15 states and UT's and maximum number of species reported from the state of West Bengal (26.98%). Among different biogeographic zones in India, the Indo-Gangetic Plains share maximum number of species (49.20%) whereas, Islands biogeographic zone has no record of these flies. The present communication is the first attempt in documenting the diversity, distribution and gaps in research of the family Sphaeroceridae from India.

Keywords: Bio-diversity, Bio geography, Sphaeroceridae, India.

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Abbreviation used

TL: Type Locality, HR: Himalayan Region; IGP: Indo Gangetic Plains; GPR: Ghats & peninsular regions; ASHD: Arid, Semi-Arid & Hot desert region; NER: North Eastern region; NSL: No specific Locality, IS: Islands.

INTRODUCTION

The family Sphaeroceridae is the species-rich family of acalyprate Diptera, belongs to the suborder Brachycera of the order Diptera. In general, the meaning of Sphaeroceridae indicates the association of many species with dung, but actually only a limited numbers are true coprophagous[4]. Several species are also necrophagous or develop in rotting fungi and the largest number of species are associated with decaying vegetation. This is one of the most ubiquitous family among arthropods, distributed from moist terrestrial environments of the arctic coastal plain to the Antarctic islands, but they are often overlooked due to their small size and generally dull colour. Out of 1,571 species under 137 genera of 5 subfamilies reported from world [28], only 63 species under 28 genera of 03 subfamilies were reported from India. This communication excludes *Archipterogrammoides* sp.[21] and includes another one species, *Borborillus sordida*[32] reported from India, which was not mentioned in the e-checklist published by Mitra and Sharma [21]. The present account on Sphaeroceridae fauna highlights that very little work has been done on this group in India, which has immense value in the ecosystem. Recent classification, validity of the species, current scientific name and zoogeographical distribution of the family is followed after Oriental Catalogue of Diptera[9], Systema Dipterorum [27], World Catalogue[19],[31] and other available related literatures.

REVIEW OF LITERATURE

According to earlier publication, Sphaeroceridae was not considered as separate family. Macquart [17] proposed the tribe "Sphaeroceridae" which was also followed by Haliday [10]. Earlier several authors treated this family as Borboridae. The genus *Sphaerocera* Latreille, 1804 is the valid taxon in this family which was described first. After one year, Latreille [16] described its type species, *Sphaerocera curvipes*. In 19th century the contribution of Olivier [22], Fallen (1820)[6], Meigen [20], Macquart (1835)[17], Greenberg [7] and Haliday [10] on this family were most significant. In the year 1830, Robineau-Desvoidy[30] erected a very original supra generic classification of this family, based on habitats of larvae and adults. In the beginning of 20th century, Becker [3] and Aldrich (1905)[1] published the catalogue of Palearctic and Nearctic sphaerocerids. The current stage of taxonomic research on Sphaeroceridae was initiated by Hackman [8-9]. Deeming [5], Hayashi and Papp [11-12], Papp [23-26]), Hayashi [13-15], Pape *et al.* [28], Pauwels [29], Roháček *et al.* [31]etc. have made their precious contribution on Oriental and Indian species of this family. In spite of significant contributions in the last two decades, the knowledge about Oriental species of Sphaeroceridae are not well known[9].

Distinguishing characters

Adult Sphaeroceridae are small (0.7-5.5 mm. long), robust, usually dull blackish to brownish flies. Presence of their short, thick first tarsomere of the hind leg helps to isolate them from other acalyptrate flies. The members of this family show extensive morphological diversity in all parts of the body, including the wing venation and post abdominal structures. The cross vein separating the 2nd basal, discal cell is missing. Veins 4 and 5 often lighten apically. But morphologically the sphaerocerids can be easily distinguished by their hind tarsi. Tarsi are with distal five segments of the leg, with the first one enlarged [18].

Habit and Habitats:

Sphaeroceridae flies have an extensive range of developmental sites and food preferences. Adults often associated with decaying plants or fungi, many species are connected with a variety of faeces including human faeces. A few species found to swarm on moist organic matter (dung, compost, cave debris)[4].

Larvae live in dung and various decaying materials. Sometimes they are found in the same areas with phorid flies and fruit flies for same preferences of their food. Small dung flies, along with several other small gnats, voluntarily breed in poultry manure and other decaying materials. The larvae of some species developed in chicken houses whenever there is decomposing organic materials.

Economic importance:

Small dung flies have little economic impact directly on the ecosystem and to the human beings. Indirectly, most species are beneficial because they speed up the process of decay and nutrient recycling. Some may carry many pathogenic microorganisms[7]. Some species also infest crops and carcasses and make this family as an important tool in forensic entomology.

DISCUSSION

Out of 1,571 valid global species Indian sphaerocerid fauna represented by only 63 species (4.01% of the World sphaerocerid fauna) belonging to 29 genera distributed in 15 states of India. Among them, the maximum species diversity is found in West Bengal which represents 26.98% of total Indian sphaerocerids, followed by Uttarakhand (20.63%), Odisha (19.04%) and Uttar Pradesh (17.46%), both Madhya Pradesh and Assam (9.52% in each state), Maharashtra (7.93%), Rajasthan (6.34%), Tamil Nadu and Jammu & Kashmir (4.76% in each state), both Karnataka and Punjab (3.17% in each state). Rest of the three states, namely, Meghalaya, Sikkim and Chhattisgarh are representing with only 1.58% species respectively. There are 11.11% of flies are distributed in India, but without no specific localities, that remarks the lacunae of proper information in literature (Fig.- 1). Similarly, the study of these flies among different bio-geographical zones in India (followed by Alfred *et al.*, 2001)[2] reports that, the maximum number of flies are found in the Indo Gangetic Plains with 49.20% of total Indian sphaerocerids. The study reveals that, only 31.74% and 20.63% of total Indian flies of this family occupied in the Himalayan region and The Ghats and Peninsular Region respectively, while 11.11% and 9.52% of flies are distributed in North East Region and Arid- Semi arid Hot Desert Regions respectively whereas Islands have no record of occurrence of these flies. Due to non-availability of literature and information, this communication could not put 11.11% of species under any specific bio- geographic zones of India. Those species are treated here as NSL (No specific locality) (Fig.- 2). Among 63 sphaerocerid species, only 15 species (23.80%) have restricted their distribution in India. This review work serves as gaps in knowledge of the sphaerocerid fauna of India. Therefore, efforts should be given on survey to the unexplored or under explored areas in India and particular in Islands biogeographic regions.

TABLE. 1. DISTRIBUTION OF SPECIES IN INDIA

Sl.no	Subfamily	Genus	Species
1.	Copromyzinae	4	8
2	Sphaerocerinae	3	11
3.	Limosininae	22	44
	Total	29	63

Table. 2. List of the Indian species and their distribution within India and elsewhere (Biogeographical zones are classified as Alfred *et al.*, [2] and binomial nomenclature are followed after Systema Dipterorum, [27])

Slno	Species	Distribution within India	Biogeography Zones in India	Distribution other than India
FAMILY: SPHAEROCERIDAE				
SUBFAMILY: COPROMYZINAE				
Genus: <i>Crumomyia</i> Macquart, 1835				
1	<i>Crumomyia deemingi</i> (Hackman, 1965) TL: India: Sikkim, Gnatang (HT M BMNH)	Sikkim (Gnatang)	HR	RI
2	<i>Crumomyia topali</i> Papp, 2003 TL: India. Odisha: daitari, Jajpur-Keonjhar (HT M HNHM)	Odisha (Daitari, Jajpur-Keonjhar)	IGP	RI
Genus: <i>Lotophila</i> Lioy, 1864				
3	<i>Lotophila norrbomi</i> Papp, 1988 TL: India: W Bengal, Darjeeling Dist., Tonglu (HT M MHNG)	Assam, West Bengal (Darjeeling Dist., Tonglu)	HR, NER	Nepal
Genus: <i>Norrbomia</i> Papp, 1988				
4	<i>Norrbomia indica</i> Papp, 1988 TL: India or. (HT M TMB)	Maharashtra	GPR	Pakistan, Sri Lanka, Thailand, Philippines, Oceania
5	<i>Norrbomia marginatis</i> (Admas, 1905) TL: Zimbabwe. Harare [as Rhodesia. Salisbury] (HT F UKAL)	India (NSL)	NSL	Pakistan, Sri Lanka, Taiwan, Thailand, Zimbabwe, Australia, Philippines, Israel
6	<i>Norrbomia somogyii</i> (Papp, 1973) TL: Mongolia, Central aimak, Altan- Bulak	Jammu & Kashmir (Kashmir)	HR	Nepal, Azores (Portugal), China (XIN), Greece, Hungary, Iran, Japan, Kirghizia, Mongolia, Morocco, Slovakia, Spain, Tajikistan, Ukraine, Uzbekistan, Slovakia
7	<i>Norrbomia tropica</i> Duda, 1923 TL: India	India (NSL)	NSL	Widespread in PA and AU, Ryukus, Thailand, Sri Lanka, Philippines, Pakistan
Genus: <i>Borborillus</i> Duda, 1923				
8	<i>Borborillus sordida</i> (Zetterstedt, 1847) TL: Sweden (T ZIL)	Punjab	ASHD	Australian, Nearctic, Neotropical,

				Palearctic, British Columbia to Massachusetts to California, New Mexico, and District of Columbia, Bermuda, Hawaii
SUBFAMILY: SPHAEROCERINAE Genus: <i>Ischiolepta</i> Lioy, 1864				
9	<i>Ischiolepta baloghi</i> Papp, 2003 TL: India. West Bengal: Darjeeling distr., Goomti (HT M HNHM)	West Bengal (Darjeeling distr., Goomti)	HR	RI
10	<i>Ischiolepta indica</i> Papp, 1993 TL: India. Uttar Pradesh	Uttar Pradesh	IGP	RI
11	<i>Ischiolepta loebli</i> Rohacek & Papp, 1984 TL: India	Uttarakhand	HR	Pakistan
12	<i>Ischiolepta orientalis</i> (Meijere, 1908) TL: Indonesia. Java: Semarang	Uttar Pradesh	IGP	Palaearctic
13	<i>Ischiolepta scabricula</i> (Haliday, 1836) TL: England, near London	Odisha	IGP	Nearctic, Neotropical, Palaearctic, Afrotropical
Genus: <i>Lotobia</i> Lioy, 1864				
14	<i>Lotobia asiatica</i> Hayashi & Papp, 2004, TL: Japan. Ryuku: Okinawa prefecture, Ishigaki I., Shiraho (HT M NIID)	Uttar Pradesh, Uttarakhand, Odisha, Tamil Nadu	HR, IGP, GPR	Japan, Pakistan, Nepal, Sri Lanka, Thailand, Vietnam, Taiwan, Philippines
15	<i>Lotobia latipes</i> Hyashi & Papp, 2004 TL: India. Karnataka: Nagarhole National Park, 720 m (HT M NIID)	Karnataka (Nagarhole National Park), Tamil Nadu (Gudalur-1200-1500m)	GPR	Thailand
16	<i>Lotobia pallidiventrtris</i> (Meigen, 1830) TL: France. Lyon (T A NMW)	Assam	NER	Corsica, Sardina, Mongolia, Nepal; North Africa
17	<i>Lotobia supraelegans</i> Hayashi & Papp, 2004 TL: Thailand. Mae Ta Man elephant park, 45 km N Chiang Mai (HT M HNHM)	Odisha, Karnataka, Tamil Nadu	IGP, GPR	Nepal, Thailand, Vietnam
Genus: <i>Sphaerocera</i> Latreille, 1804				
18	<i>Sphaerocera curvipes</i> Latreille, 1805 TL: Europe	Jammu & Kashmir	HR	Cosmopolitan
19	<i>Sphaerocera asiatica</i> Papp, 1988 TL: Pakistan	India (NSL)	NSL	Nepal, Pakistan
SUBFAMILY: LIMOSININAE Genus: <i>Acuminiseta</i> (Duda, 1925)				
20	<i>Acuminiseta elegantula</i> (Duda, 1925) TL: India. Bombay: Matheran (HT F HNHM, HNHM)	Maharashtra	GPR	RI
Genus: <i>Aptilotus</i> Mik, 1898				
21	<i>Aptilotus besucheti</i> (Papp, 1981) TL: India	West Bengal	IGP	RI

Genus: <i>Biconnecta</i> Papp, 2008				
22	<i>Biconnecta mirabilis</i> Papp, 2008 TL: India, Daitari, Jajpur-Keonjhar distr., Odisha	Odisha (Daitari, Jajpur-Keonjhar distr)	IGP	RI
Genus: <i>Biroina</i> Richards, 1973				
23	<i>Biroina orientalis</i> Papp, 1995 TL: India. Uttar Pradesh	Uttarakhand (Ramgarh, Gharwal, Dhanolti, Nainital)	HR	Nepal, Pakistan
24	<i>Biroina topali</i> Papp, 1995 TL: Odisha	Odisha	IGP	Argentina, Vietnam
Genus: <i>Eulimosina</i> Rohacek, 1983				
25	<i>Eulimosina dudai</i> (Papp, 1978) TL: Afghanistan (Prov. Nangarhar: Bande Darunta, near Jalalabad)	Madhya Pradesh (Kanha National Park), Odisha (Daitari, Jajpur-Keonjhar distr)	IGP, GPR	Afganistan, Vietnam, China, Thailand
Genus: <i>Eximilimosina</i> Papp, 2008				
26	<i>Eximilimosina major</i> Papp, 2008 TL: India, Ghum, West Bengal	Uttar Pradesh, West Bengal (Ghum)	IGP, HR	RI
Genus: <i>Chaetopodella</i> Duda, 1920				
27	<i>Chaetopodella nigrinotum</i> Hayashi & Papp, 2007 TL: Sri Lanka	Chhattisgarh	GPR	Sri Lanka
28	<i>Chaetopodella orientalis</i> Hayashi & Papp, 2007 TL: Thailand	India (NSL)	NSL	Bangladesh, China, Sri Lanka, Taiwan, Thailand
Genus: <i>Coproica</i> Rondani, 1861				
29	<i>Coproica ferruginata</i> (Stenhammar, 1854) TL: Sweden	Uttarakhand	HR	British Columbia, Widespread U.S., Bermuda
30	<i>Coproica hirtula</i> (Rondani, 1880) TL: Italy	India (NSL)	NSL	Widespread U.S., Bermuda, Italy, Hawaii, New Zealand, PNG, Pitcairn Isl.,
31	<i>Coproica lacteipennis</i> (Hayashi, 2005) TL: Japan. Okinawa Pref.: Iriomote I, Uehara (HT M NIID)	Uttar Pradesh, Rajasthan	IGP, ASHD	Palaeartic, Japan
32	<i>Coproica lugubris</i> (Haliday, 1836) TL: Ireland [not given]	Uttar Pradesh	IGP	Australian, Palaeartic, All parts of Europe, Sweden & Finland; Russia, Asia: Korea; N. Africa; PNG
33	<i>Coproica rufifrons</i> (Hayashi, 1991) TL: Pakistan	India (NSL)	NSL	Oriental, Australian, Nearctic, Palaeartic, Pakistan, Bonin Isl., PNG, Japan, Hong Kong
34	<i>Coproica saprophaga</i> (Papp, 2008) TL: THAILAND: Thung Khai Botanical gardens	Uttar Pradesh (Agra, Keetham Lake), Rajasthan (Bharatpur, Keoladeo Bird sanctuary)	IGP, ASHD	Thailand, Vietnam
35	<i>Coproica unispinosa</i> Papp, 2008 TL: THAILAND: Mae Taeng	Madhya Pradesh (Jabalpur)	GPR	Oriental, Palaeartic

	Elephant Camp			
Genus: <i>Indiosina</i> Papp, 1981				
36	<i>Indiosina loebli</i> Papp, 1981 TL: India	West Bengal	IGP	Nepal
Genus: <i>Leptocera</i> Olivier, 1813				
37	<i>Leptocera (Leptocera) nigra</i> Olivier, 1813 TL: France. Seine	Uttarakhand	HR	Nepal, Palaearctic, Europe, Russia; Asia, Nepal, Japan; Algeria, Egypt, Canary Is.
38	<i>Leptocera (Leptocera) nigrolimbata</i> (Duda, 1925) TL: Taiwan, Taihorin, Chip-Chip, Hokuto (ST M F ZMHU, HNHM)	West Bengal	IGP	Palaearctic, Nepal; Ussuri, Taiwan
39	<i>Leptocera (Leptocera) paranigrolimbata</i> (Duda, 1925) TL: Taiwan. T'ai-pei: Taipei [=Taihoku]	Assam, West Bengal	NER, IGP	Taiwan
40	<i>Leptocera salatigae</i> (de Meijere, 1914) TL: Indonesia. Java: Salatiga	Jammu & Kashmir	HR	Australian, Palaearctic
41	<i>Leptocera (Leptocera) sterniloba</i> Rohacek, 1983 TL: Nepal	Uttarakhand	HR	Nepal, Thailand, Vietnam
Genus: <i>Monorbiseta</i> Papp, 2008				
42	<i>Monorbiseta monorbiseta</i> (Deeming, 1969) TL: Nepal. Taplejung District	Uttar Pradesh, West Bengal, Punjab	IGP, ASHD	Nepal
Genus: <i>Opacifrons</i> Duda, 1918				
43	<i>Opacifrons brevisecunda</i> Papp, 1991 TL: Sri Lanka	Rajasthan, Uttar Pradesh	IGP, ASHD	Sri Lanka, Vietnam
44	<i>Opacifrons pseudimpudica</i> (Deeming, 1969) TL: Nepal. Taplejung District	Uttarakhand	HR	Nepal, Sri Lanka
Genus: <i>Paralimosina</i> Papp, 1973				
45	<i>Paralimosina dimorpha</i> Rohacek & Papp, 1988 TL: India	Uttarakhand, West Bengal, Odisha	HR, IGP	RI
46	<i>Paralimosina gigantea</i> Rohacek & Papp, 1988 TL: India	West Bengal	IGP	RI
47	<i>Paralimosina icaros</i> Rohacek & Papp, 1988 TL: India	Uttarakhand	HR	RI
48	<i>Paralimosina indica</i> Rohacek & Papp, 1988 TL: India	Uttar Pradesh, Uttarakhand	HR, IGP	RI
Genus: <i>Paramera</i> Papp, 2008				
49	<i>Paramera robusta</i> Papp, 2008 TL: THAILAND: Mae Fang N.P.	Madhya Pradesh (Kanha)	GPR	Thailand, Papua New Guinea
Genus: <i>Paraminilimosina</i> Papp, 2008				
50	<i>Paraminilimosina elephantis</i> Papp, 2008 TL: Mae Taeng Elephant Camp	India (NSL)	NSL	Thailand
Genus: <i>Piliterga</i> Papp, 2008				
51	<i>Piliterga thaii</i> Papp, 2008	Odisha	IGP	Thailand, Vietnam

	TL: THAILAND: Prov. Fang, 5 km N of Mae Ai			
Genus: <i>Poecilosomella</i> Duda, 1925				
52	<i>Poecilosomella aciculata</i> (Deeming, 1969) TL: Nepal. Taplejung District (HT M BMNH)	West Bengal	IGP	Sri Lanka, Nepal
53	<i>Poecilosomella borboroidis</i> (Walker, 1860) TL: Indonesia. Sulawesi: Makassar [Ujung Padang] (ST F BMNH)	Assam, Odisha	NER, IGP	Indonesia, Java, Malaysia, Phillipines [Luzon], Sri Lanka
54	<i>Poecilosomella brunettii</i> (Deeming 1969) TL: India. West Bengal: Darjeeling	West Bengal (Darjeeling)	HR	RI
55	<i>Poecilosomella multipunctata</i> (Duda, 1925) TL: Taiwan. Hanaku & Phillipines. Luzon	West Bengal	IGP	Nepal, Taiwan, Phillipines (Luzon, Palawan)
56	<i>Poecilosomella nepalensis</i> (Deeming, 1969) TL: Nepal. Taplejung District (HT M BMNH)	Uttarakhand, West Bengal, Odisha, Madhya Pradesh, Maharashtra	IGP, HR, GPR	Australian, Palaeartic, Nepal
57	<i>Poecilosomella punctipennis</i> (Wiedemann, 1824) TL: E India; & Mysol (Moluccas)	Uttarakhand, West Bengal, Odisha, Madhya Pradesh, Maharashtra, Assam	HR, IGP, GPR, NER	Australian, Palaeartic, Sri Lanka, Taiwan, Nepal, Phillipines (Luzon)
58	<i>Poecilosomella varians</i> (Duda, 1925) TL: Singapore, Malaya; & Taiwan	West Bengal, Maharashtra	IGP, GPR	Nepal, Malaysia, Singapore, Sri Lanka, Taiwan, Myanmar
Genus: <i>Pterogrammoides</i> Papp, 1972				
59	<i>Pterogrammoides indica</i> Papp, 1989 TL: India	Meghalaya, West Bengal	NER, IGP	RI
Genus: <i>Rachispoda</i> Lioy, 1864				
60	<i>Leptocera (Rachispoda) subtinctipennis</i> (Brunetti, 1913) TL: India, Assam, Dibrugarh (T A ZSI)	Assam (Dibrugarh)	NER	Australia, Egypt, Nepal, Canary Is., Cape Verde Is, Belau, Micronesia, Java, Taiwan, Vietnam
Genus: <i>Rohacekia</i> Papp, 2008				
61	<i>Rohacekia baechlii</i> Papp, 2008 TL: INDIA: Madhyapradesh, Kanha National Park	Madhya Pradesh (Kanha National Park)	GPR	RI
Genus: <i>Bifronsina</i> Rohacek, 1983				
62	<i>Spelobia (Bifronsina) bifrons</i> (Stenhammar, 1854) TL: Sweden?	Uttar Pradesh, Rajasthan	IGP, ASHD	Widespread in North America, Cosmopolitan, Hawaii, Australia, Niue
Genus: <i>Terrilimosina</i> Rohacek, 1983				
63	<i>Terrilimosina longipexa</i> Marshall, 1987 TL: Japan	Uttarakhand	HR	Palaeartic

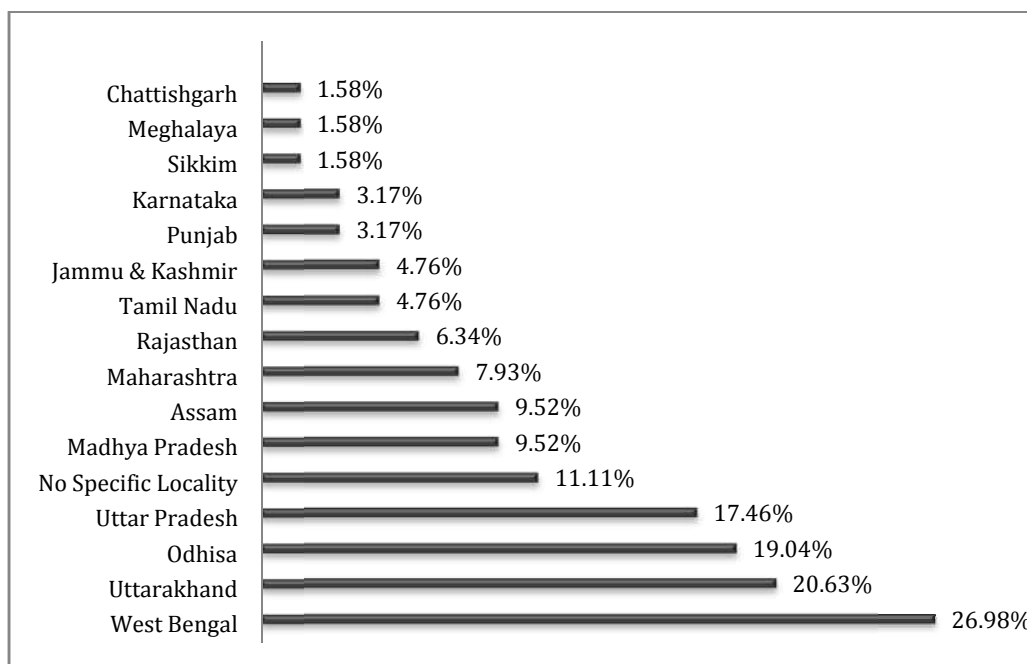


Fig. 1: State-Wise Percentages of Reported Species of Sphaerocerid Flies in India

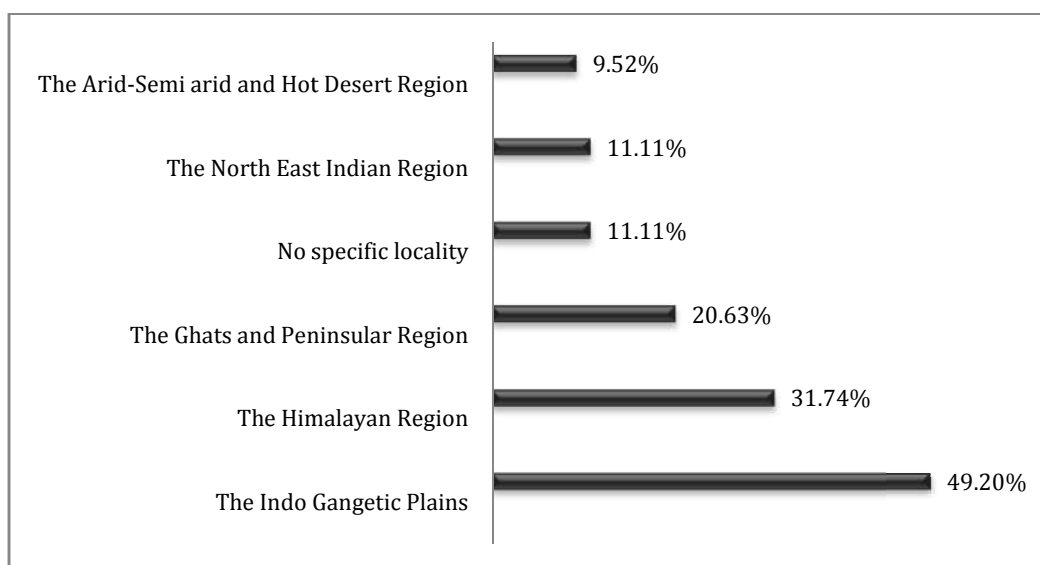


Fig.2: Biogeographic Zone-Wise Percentages of Reported Species of Sphaerocerid Flies in India

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