Distribution and Systematic Accounts of Calliphoridae (Insecta: Diptera) in Sundarban Biosphere Reserve, West Bengal, India

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Abstract

The present work is an effort to cater the basic knowledge on the taxonomic aspects of blow-flies (Diptera: Calliphoridae) of Sundarban Biosphere Reserve. The results of the present study may serve as a baseline data on availability of blow fly species particularly recorded from this sort of ecosystem of mangroves and associated swamp forest of West Bengal. Present study has recorded a total of 15 calliphorid species under five genera and two subfamilies from Sundarban Biosphere Reserve and associated ecosystem. Two calliphorid species namely Lucilia bazini Seguy, 1934; Lucilia illustris (Meigen, 1826) are reported for the first time from this habitat. Besides that, first reference, material examined and distributional notes were provided. Present study will also provide furtherance of taxonomic knowledge on this dipteran family of forensic importance.

Keyword: Taxonomy; Calliphoridae; New records; Sundarban Biosphere Reserve; West Bengal

1. Introduction

The Blow flies have agricultural, medical, forensic and veterinary importance and are distributed in all zoogeographical regions. They play a significant role of vector and responsible for transmitting various enteric pathogens including viruses, bacteria, fungi, protozoans, helminthes which cause summer diarrhea, bacillary and amoebic dysentery, poliomyelitis, cholera, plague and tuberculosis. Since they are attracted and breed in different kinds of dead bodies, garbages, excreta of different animals, thus make public hazards by transmitting various pathogens mechanically from decomposed and decayed materials to human food. Mainly their larval stages are responsible to cause Myasis in different parts of man and animals. Some larvae are forensically important by helping in Post Mortem Interval estimation, while few are known parasites or predators of earthworms, frogs, locusts, snails and toads. A very few are sterile, and therefore have been used in surgery for treating tubercular abscesses and complex injuries. Overall their negative impact on economy due to loss in dried fish and meat industry is well known.

Taxonomically they are one of the important calyptrate flies belong to suborder Brachycera, family Calliphoridae. They are cosmopolitan in distribution with 96 genera and 1520 species known to the worldwide. Among them 119 species under 30 genera are reported from India. These calyptrate flies are closely related to Tachinidae and Sarcophagidae. Their life history stages are mainly studied due to their forensic, medical and vector importance, but relatively less focus is levied on their comprehensive taxonomy, particularly from West Bengal in comparison to other parts of the World. Few works on this important group of fly from this area have been reported. Majumdar and Parui (2001) reported a total of two species of Calliphorid fly namely Chrysomya megacephala (Fabricius) and Hemipyrellia pulchra (Wiedemann) from Sundarban Biosphere Reserve. Nandi (2002) updated and reported a total of 41 calliphorid species under 17 genera from West Bengal.

West Bengal is one of the most diverse state of India in respect to its variability in geo-morphology and climatic pattern. Hilly region (accompanying Himalayan Biodiversity hotspot and sub-himalayan terai and dooars), Gangetic plains (accompanying lower most gangetic plains and deltaic region), Plateau area (part of decayed Chotanagpur plateau), coastal region (accompanying mangrove and swamp forest ecosystem) make the state rich in Dipteran diversity, ideal for inventorization and taxonomic studies on Dipteran fauna, particularly this Calliphoridae family of calyptrate flies of huge importance. Sundarban Biosphere reserve on the other hand, is considered as a combination of three types of ecosystem viz. Mangroves, Swamp forest, and residual of moist deciduous forest in part of gangetic delta and coastal belts. Sundarban is the largest intertidal delta in the world and harbours the largest mangrove vegetation. It is bounded by Hooghly river on the West, Ichamoti-Kalindi-Raymongal rivers in the East, Dampare- Hodges line in the North and Bay of Bengal on the South. The area lies between 21° 30′–22° 45′ North latitude and 88° 66′ – 89 º 5′ East longitudes, consisting of a group of 54 islands, innumerable rivers, rivulets, creeks and mangrove forest. It hosts a national park, a tiger reserve and three wildlife sanctuaries. Indian Sundarban covers an area of 4,262 sq km. Present investigation is therefore imperative to analyse calliphorid faunal assemblage in this biodiversity rich area of Sundarban Biosphere Reserve.

2. Materials and Methods

2.1 Collection of calliphorid specimens:
Collections were made by sweeping by an insect net with fine white cloth through in collection sites of agricultural field, herbs, shrubs or tree tops nearby, along the sides of water bodies, even in the adjacent forest area. Besides that Malaise trap was also used with a Rohu fish as a bait, and adult flies were collected nearby the trap with swipe net. Collection method was used following Datta et al. (1997) [3] and Sinha and Nandi (2007) [27].

The perfect condition of specimens depends not only upon careful sweeping but also upon cautious killing and taking out of the net. After sweeping, fly specimens were transferred into the killing jar (glass jar having at the bottom, a layer of cotton soaked with benzene lined by a cover of blotting paper) and kept for sometime allowing the insects to die. Then dead specimens were collected in the insect envelopes (specially designed with blotting paper for keeping specimens dry) by means of a hair brush or a light forceps. Temporary labels were placed inside the envelopes. The specimens in the envelopes were then dried in the sun and are temporarily preserved in the paper/cardboard box containing naphthalene powder/ balls as fungicide.

2.2 Laboratory techniques:

2.2.1 Stretching, pinning and labelling
After the specimens were brought in the laboratory, they were transferred into relaxing chamber for proper relaxing and stretching. Then calliphorid samples were pinned, stretched and permanent computerised labels were assigned against study site information, collection date and name of collectors.
2.2.2 Identification and preservation
After the laboratory processing, calliphorid specimens were identified using previous literatures \cite{19}. Genitalia characters were taken as the main criteria for identification of the species besides chaetotaxy and the classification followed here is after Schumann (1986) \cite{24} and Rognes (1991) \cite{23}. Specimens were then preserved following method of Datta (1997) \cite{3}. All the identified calliphorid specimens were deposited in repository of National Zoological collection, after study.

2.3 Study area
Study area of Sundarban Biosphere Reserve and associated area in S 24 Paraganas district of West Bengal is mainly divided into three landscape patterns i.e. Forest area; adjacent agricultural habitat and isolated gangetic deltas nearby aquatic bodies for help in study. Study area comprises of following stations as shown in Map 1. (i) Bhandarkhali, (ii) Laxminarayanpur, (iii) Dhosa, (iv) Chandaneswar, (v) Jharkhali, (vi) Sonagaon, (vii) Jyotishpur and (viii) Gosaba.

Map 1: GIS map showing distribution pattern of calliphorid flies from Sundarban Biosphere reserve and associated mangrove ecosystem of S 24 Paraganas district of West Bengal.
2.4 Distribution maps
Distribution maps of calliphorid insects were generated using DIVA GIS software version 7.5.0.

3. Results
3.1 Detailed systematic accounts of species of Calliphoridae

Family Calliphoridae
Subfamily Caliphorinae
Genus Bengalia Robineau-Desvoidy

*Bengalia torosa* (Wiedemann, 1819)


Material examined: 1♀, collected from leaf litter in forest floor, 22°22′55.8″ N, 88°56′39.7″ E, 4.6 m, Bhandarkhali, S 24 Paraganas, 08.vi.2016, Coll. R.S. Mridha; 2♀♀, collected from agricultural field, 22°31′24.0″ N, 88°11′41.0″ E, 4.5 m, Laxminarayanpur, S 24 Paraganas, 04.vii.2016, Coll. A. Naskar.

Distribution: West Bengal (Alipurduar, Jalpaiguri, S 24 Paraganas), Karnataka, Kerala, Pondichery, Sikkim, Tamil Nadu, Uttar Pradesh

Elsewhere: Australia; Bangladesh; Indonesia; Japan; Laos; Malaysia; Nepal; Pakistan; Philippines; South China; Sri Lanka; Taiwan and Thailand.

Remarks: Adults are oviparous, forest species and can be collected from decaying leaves near termite mound. It is parasitic on ant pupae and was recorded to rear it from soil [19].

*Bengalia bezzii* Senior-White, 1923


Material examined: 1♀, collected from leaf litter in forest floor, 22°22′55.8″ N, 88°56′39.7″ E, 4.6 m, Bhandarkhali, S 24 Paraganas, 08.vi.2016, Coll. R.S. Mridha;

Distribution: West Bengal (Alipurduar, Jalpaiguri, S 24 Paraganas), Sikkim, Tamil Nadu, Uttar Pradesh

Elsewhere: China; Indonesia; Japan; Laos; Malaysia; Philippines; Singapore; Sri Lanka; Thailand; Vietnam.

Remarks: Adults are found on litter substance and on herbs in forest. They fly silently covering a small distance [29].

Genus *Calliphora* Robineau-Desvoidy

*Calliphora vicina* Robineau-Desviody, 1830

1♂, collected from fish carcass, 22°07′58.0″ N, 88°44′17.9″ E, 3 m, Jyotishpur, S 24 Paraganas, 09.vi.2016, Coll. R.S. Mridha;

2♀♀, collected from fish carcass, 22°15′04.0″ N, 88°32′36.0″ E, 4.5 m, Chandaneswar, S 24 Paraganas, 09.vi.2016, Coll. A. Naskar.

Distribution: West Bengal (Alipurduar, Darjeeling, Jalpaiguri, S 24 Paraganas), Himachal Pradesh, Sikkim, Uttar Pradesh.
Elsewhere: Australia; Canary Islands; China; Hainan Islands; Hawaiian Islands; Japan; Mauritius; Mongolia; Nepal; New Zealand; Pakistan; Russia; Saudi Arabia; South Africa and USA.
Remarks: They cause intestinal and urinary myiasis and are also involved in forensic science [19].

Genus Hemipyrella Townsend

Hemipyrella ligurriens (Wiedemann, 1830)

1830. Musca ligurriens Wiedemann, Ausserurop zweifl, Insect, 2: 655.

Material examined: 4♀, collected from fish carcass, 22°09’52.8” N, 88°48’25.4” E, 5.2 m, Gosaba, S 24 Paraganas, 14.viii.2016; Coll. T.K. Mondal; 2♀, collected from cow, 22°02’10.8” N, 88°40’42.9” E, 3.5 m, Jharkhali, S 24 Paraganas, 13.viii.2016, Coll. R.S. Mridha.
Distribution: West Bengal (Alipurduar, Burdwan, Darjeeling, Howrah, Jalpaiguri, Kolkata, N 24 Paraganas, S 24 Paraganas), Bihar, Sikkim, Tamil Nadu.
Elsewhere: Australia; Amboina; Bangladesh; Bhutan; China; Indonesia; Japan; Korea; Malaysia; Micronesia; New Britain; New Guinea; Nepal; New Ireland; New Zealand; Pakistan; Philippines; Samoa; Sri Lanka; Taiwan and Thailand.
Remarks: Adults are oviparous, mostly found in fish market and can be collected from garbages and carcases [19].

Hemipyrella pulchra (Wiedemann, 1830)


Material examined: 3♀, collected from fish carcass, 22°02’10.8” N, 88°40’42.9” E, 3.5 m, Jharkhali, S 24 Paraganas, 13.viii.2016, Coll. R.S. Mridha.
Distribution: West Bengal (Alipurduar, S 24 Paraganas), Bihar, Orissa, Pondichery, Punjab, Tamil Nadu, Uttar Pradesh.
Elsewhere: Indonesia; Malaysia; Nepal and Thailand.
Remarks: Adults are oviparous and are attracted to dead animals, garbages and sometimes to flowering plants and fruits [19].

Genus Lucilia Robineau-Desvoidy

Lucilia (Lucilia) bazini Seguy, 1934*


Material examined: 2♀, collected from forest leaf litter, 22°09’52.8” N, 88°48’25.4” E, 5.2 m, Gosaba, S 24 Paraganas, 14.viii.2016; Coll. T.K. Mondal.
Distribution: West Bengal (Howrah, S 24 Paraganas).
Elsewhere: China; East Siberia; Korea; Japan; Malaysia; Russia and Taiwan.
Remarks: Adults are attracted to carrion and can be collected from dead bodies of different animals [19].

Lucilia illustris (Meigen, 1826)*


Material examined: 2♀, collected from cow, 22°02’10.8” N, 88°40’42.9” E, 3.5 m, Jharkhali, S 24 Paraganas, 13.viii.2016, Coll. R.S. Mridha.
Distribution: West Bengal (Alipurduar, Darjeeling, Jalpaiguri, Kolkata, S 24 Paraganas), Sikkim.
Elsewhere: Australia; Bhutan; Europe; Japan; Korea; Manchuria; Myanmar; North America and Siberia.
Remarks: They are associated with few viruses and cause severe form of myiasis in human beings, and wound, ulcer and subdermal myiasis in other vertebrates also [19].

Lucilia papuensis (Macquart, 1843)  
Material examined: 2♀♂, collected from agricultural field, 22°15'04.0" N, 88°32'36.0" E, 4.5 m, Chandaneswar, S 24 Paraganas, 09.vi.2016, Coll. A. Naskar.  
Distribution: West Bengal (N 24 Paraganas, S 24 Paraganas), Arunachal Pradesh, Kashmir, Kerala.  
Elsewhere: Amboina; Australia; Bangladesh; Bhutan; Celebes; China; Indonesia; Japan; Korea; Malaysia; Nepal; Papua New Guinea; Philippines; Taiwan and Thailand.  
Remarks: Adults are oviparous and generally found in forests. They are mostly gathered on earthworms and other vertebrate's dead bodies [19].

Lucilia porphyrina (Walker, 1856)  
Material examined: 2♀♂, collected from agricultural field, 22°31'24.0" N, 88°11'41.0" E, 4.5 m, Laxminarayanpur, S 24 Paraganas, 04.vii.2016, Coll. A. Naskar.  
Elsewhere: Australia; Bhutan; Borneo; China; Korea; Indonesia; Japan; Malaysia; Nepal; New Britain; Papua New Guinea; Philippines; Sri Lanka; Taiwan and Thailand.  
Remarks: Adults are oviparous, saprophagous, attracted to decaying matters and dead bodies of different animals and human dwellings [19].

Lucilia cuprina (Wiedemann, 1830)  
Material examined: 1♀, collected from bushes nearby human faecal matter, 22°15'04.0" N, 88°32'36.0" E, 4.5 m, Chandaneswar, S 24 Paraganas, 09.vi.2016, Coll. A. Naskar; 2♀♂, collected from bushes, 22°02'10.8" N, 88°40'42.9" E, 3.5 m, Jharkhali, S 24 Paraganas, 13.viii.2016, Coll. R.S. Mridha.  
Distribution: West Bengal (Alipurduar, Kolkata, N 24 Paraganas, S 24 Paraganas).  
Elsewhere: Afghanistan; Australia; Myanmar; Chagos Islands; China; Cuba; Egypt; Europe; Hawaiian Islands; Indonesia; Japan; Kenya; Korea; Kiribati; Pakistan; Saudi Arabia; Seychelles; Singapore; South Pacific; Sumatra; Taiwan; Uganda and USA.  
Remarks: Adults are oviparous and are attracted to different kinds of dead bodies, garbages and animal dung. They are potential vector of enteric pathogens and are associated with various types of bacteria, protozoans and helminthes [19].

Lucilia sericata (Meigen, 1826)  
Material examined: 2♀♂, collected from agricultural field, 22°15'04.0" N, 88°32'36.0" E, 4.5 m, Chandaneswar, S 24 Paraganas, 09.vi.2016, Coll. A. Naskar.  
Distribution: West Bengal (Alipurduar, Darjeeling, Jalpaiguri, Malda, S 24 Paraganas).
Elsewhere: Australia; Easter Island; Europe; Hawaiian Islands; Marshall Islands; Pakistan; Sri Lanka; Volcano Islands; Wake Islands.
Remarks: Adults are oviparous, scavengers and typically a domestic species. They can be collected from decaying matters, carrion, open wounds, faeces, fruits and foods in the market. They are associated with various types of viruses, bacteria, protozoans and helminthes.[19]

Subfamily Chrysomyinae
Genus Chrysomya Robineau-Desvoidy
Chrysomya bezziana Villeneuve, 1914
Material examined: 1♀, collected from bushes near aquatic body, 22°07'58.0" N, 88°44'17.9" E, 3 m, Jyotishpur, S 24 Paraganas, 09.vi.2016, Coll. R.S. Mridha; 2♀♀, collected from agricultural field, 22°31'24.0" N, 88°11'41.0" E, 4.5 m, Laxminarayanpur, S 24 Paraganas, 04.vi.2016, Coll. A. Naskar.
Distribution: West Bengal (Burdwan, Howrah, Kolkata, N 24 Paraganas, S 24 Paraganas), Arunachal Pradesh.
Elsewhere: Africa; Bismark Archipelago; Indonesia; Malaysia; Philippines and Sri Lanka.
Remarks: Adults are found in bushes and leaves.[19]

Chrysomya indica Sinha, 2004
Material examined: 1♀, collected from forest floor, 22°15'20.0" N, 88°32'46.0" E, 4 m, Dhosa, S 24 Paraganas, 11.vi.2016, Coll. R.S. Mridha; 1♀, collected from forest floor, 22°31'24.0" N, 88°11'41.0" E, 4.5 m, Laxminarayanpur, S 24 Paraganas, 20.vi.2014, Coll. A. Naskar.
Distribution: West Bengal (S 24 Paraganas).
Elsewhere: None.
Remarks: This species is endemic to the state of West Bengal.[20]. This species was originally discovered by Sinha and Nandi (2004).[27]

Chrysomya megacephala (Fabricius, 1794)
Material examined: 1♀, collected from forest floor, 22°31'24.0" N, 88°11'41.0" E, 4.5 m, Laxminarayanpur, S 24 Paraganas, 20.vi.2014, Coll. A. Naskar; 8♀♀, collected from faeces near human dwellings, 22°07'35.5" N, 88°47'10.2" E, 6.3 m, Sonagaon, S 24 Paraganas, 11.vi.2016, Coll. R.S. Mridha.
Distribution: West Bengal (Alipurduar, Darjeeling, E Midnapore, Howrah, Jalpaiguri, Kolkata, Malda, N 24 Paraganas, S 24 Paraganas), Sikkim, Tamil Nadu.
Elsewhere: Bhutan
Remarks: Adults are oviparous, saprophagous and are attracted to dead fishes, human excreta, carcases and sweets. They produce myiasis in different parts of man and domestic animals and can be reared on dead animals in the laboratory. They are serious pest of fish products.[19].

Chrysomya rufifacies (Macquart, 1843)
Material examined: 1♀, collected from forest floor, 22°15’20.0” N, 88°32’46.0” E, 4 m, Dhosa, S 24 Paraganas, 11.vi.2016, Coll. R.S. Mridha; 4♀♀, collected from faeces near human dwellings, 22°07’35.5” N, 88°47’10.2” E, 6.3 m, Sonagaon, S 24 Paraganas, 11.vi.2016, Coll. R.S. Mridha.

Distribution: West Bengal (Alipurduar, Darjeeling, Howrah, Jalpaiguri, Kolkata, N 24 Paraganas, S 24 Paraganas), Nicobar Islands, Sikkim.

Elsewhere: Bangladesh

Remarks: Adults are viviparous, saprophagous and are attracted to garbages, dead bodies of different animals and excreta of man. They are associated with various types of bacteria, protozoans and helminthes [19].

4. Discussion

A total of 15 Calliphorid species under five genera and two subfamilies are recorded from the present study. Two calliphorid species namely Lucilia bazini Seguy; Lucilia illustris (Meigen) are reported for the first time from this habitat. 11 species under four genera are recorded under subfamily Calliphorinae from the present study. Two species namely Bengalia torosa (Wiedemann, 1819) and Bengalia bezzii Senior-White, 1923 under genus Bengalia Robineau-Desvoidy; Calliphora vicina Robineau-Desvoidy under genus Calliphora Robineau-Desvoidy; Hemipyrellia liguriensis (Wiedemann, 1830) and Hemipyrellia pulchra (Wiedemann, 1830) under genus Hemipyrellia Townsend; Lucilia (lucilia) bazini Seguy, 1934; Lucilia illustris (Meigen, 1826); Lucilia papuensis (Macquart, 1843); Lucilia porphyrina (Walker, 1856); Lucilia cuprina (Wiedemann, 1830) and Lucilia sericata (Meigen, 1826) under genus Lucilia Robineau-Desvoidy are recorded from the present study. Four species i.e. Chrysomya bezziana Villeneuve, 1914; Chrysomya indica Sinha, 2004; Chrysomya megacephala (Fabricius, 1794) and Chrysomya rufifacies (Macquart, 1843) under genus Chrysomya Robineau-Desvoidy are recorded from subfamily Chrysomyinae in the present study. Among them two species namely Lucilia (lucilia) bazini Seguy, 1934 and Lucilia illustris (Meigen, 1826) are recorded for the first time from Sundarban Biosphere Reserve. Single species i.e. Chrysomya indica Sinha, 2004 shows endemism to the India. Two species namely Bengalia bezzii Senior-White, 1923 and Chrysomya indica Sinha, 2004 exhibit endemism to the Sundarban Biosphere Reserve of S 24 Paraganas district of West Bengal.

5. Conclusion

Overall results indicated that most of the calliphorid species exhibited continuous distribution pattern except few species. Calliphorid fauna from this Biosphere Reserve is therefore expected to show continuous and uniform distribution pattern in the long run.

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7. References


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