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A REPORT ON FLIES (DIPTERA : INSECTA) AS FLOWER VISITORS AND POLLINATORS OF KOLKATA AND IT'S ADJOINING AREAS

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Dipterans are among the most common insects that visit flowers, and considered to be primitive pollinators with their suctorial or lapping mouthparts (Kevan and Baker 1983). In tropical areas, the diversity of Diptera can rival or exceed that of Hymenoptera (Inouye, 2001). A total of 42 families (Nematocera 12 and Brachycera 30) of Diptera are reported as flower visitors in the tropical world (Roubik, 1995), of them 37 families (Nematocera 12 and Brachycera 25) are present in India. Some of the more notable pollinating flies belong to the families Syrphidae, Bombyliidae, Tabanidae, Tephritidae, Stratiomyidae, Tachinidae, Calliphoridae, Pipunculidae, Muscidae, Bibionidae, Chironomidae, Culicidae, Empididae, Mycetophilidae, and Cecidomyiidae (Datta, 1998).

There is very little work on the flower visiting dipteran species of India. Therefore, the conservation status of fly pollinators also remain undocumented in India. Important contributors to our knowledge on the flower visiting Diptera in India as well as in the world are : Thien (1969), Hobby & Smith (1961), Hunter (1979), Dhara Jothi & Tandon (1993), Mukherjee *et al.*, (2002), Mitra & Parui (2002), Mitra *et al.*, (2002, 2003, 2004 and 2005). The main impediment to implementing any of the large-scale studies recommended is that intensive collecting efforts produce large numbers of species that require identification. Fly species identifications are often difficult, and the number of fly taxonomists is limited. In view of above, a long-term study was initiated by Diptera section, Z.S.I., Kolkata to identify the dipteran flower visitors along with their visited plant species, duration of their visit in the field, and their effectiveness as pollinator *etc.*, in different ecosystems of India.

The main objective of this present study was to identify dipteran flower visiting species from the adjoining areas of Kolkata metropolitan city (in between 88°10' and 88°40' East longitude and 22°20' and 22°45' North latitude), and make an inventory of flower visiting flies along with their

visited plant species. For this purpose 9 localities were studied during the year 2002–2004. As a result of this study 30 dipteran species under 23 genera of 9 families have been identified as flower visitors from Kolkata and its adjoining areas. This is the first comprehensive as well as consolidated study made on the flower visiting dipterans in and around Kolkata or any other metropolitan city.

MATERIALS AND METHODS

The present study was conducted in 9 different localities of the south (Baruipur, Narendrapur and Sonarpur), north (Madhyamgram, Badu, Duttapukur), east (Dapha east & Dapha west) and west (Howrah Botanical garden) of Kolkata in the districts of Howrah and 24 Parganas (North & South). Most of the localities are urban in nature and coming under Greater Kolkata, (Map 1).

The surveys were made at least twice in each station and observations taken throughout the day (from 6 am to 6 pm). The collections were made from different habitats like agricultural fields, orchards, medicinal plant gardens, nurseries, road side herbage, bushes, trees, seasonal flower gardens, managed gardens as well as from the wild.

FLIES

Generally the flies are minute to small soft-bodied insects; head highly mobile with large compound eyes, antennae of variable size and structure; suctorial mouthparts; prothorax and metathorax small and fused with large mesothorax; wings present only on mesothorax, the major morphological feature which distinguishes flies from other insects is their reduced hind wings, termed halteres (small, club-like structures that function as balancing organs during flight); legs with 5-segmented tarsi; abdomen with variable number of visible segments, female genitalia simple in most species, male genitalia complex and presence of cerci.

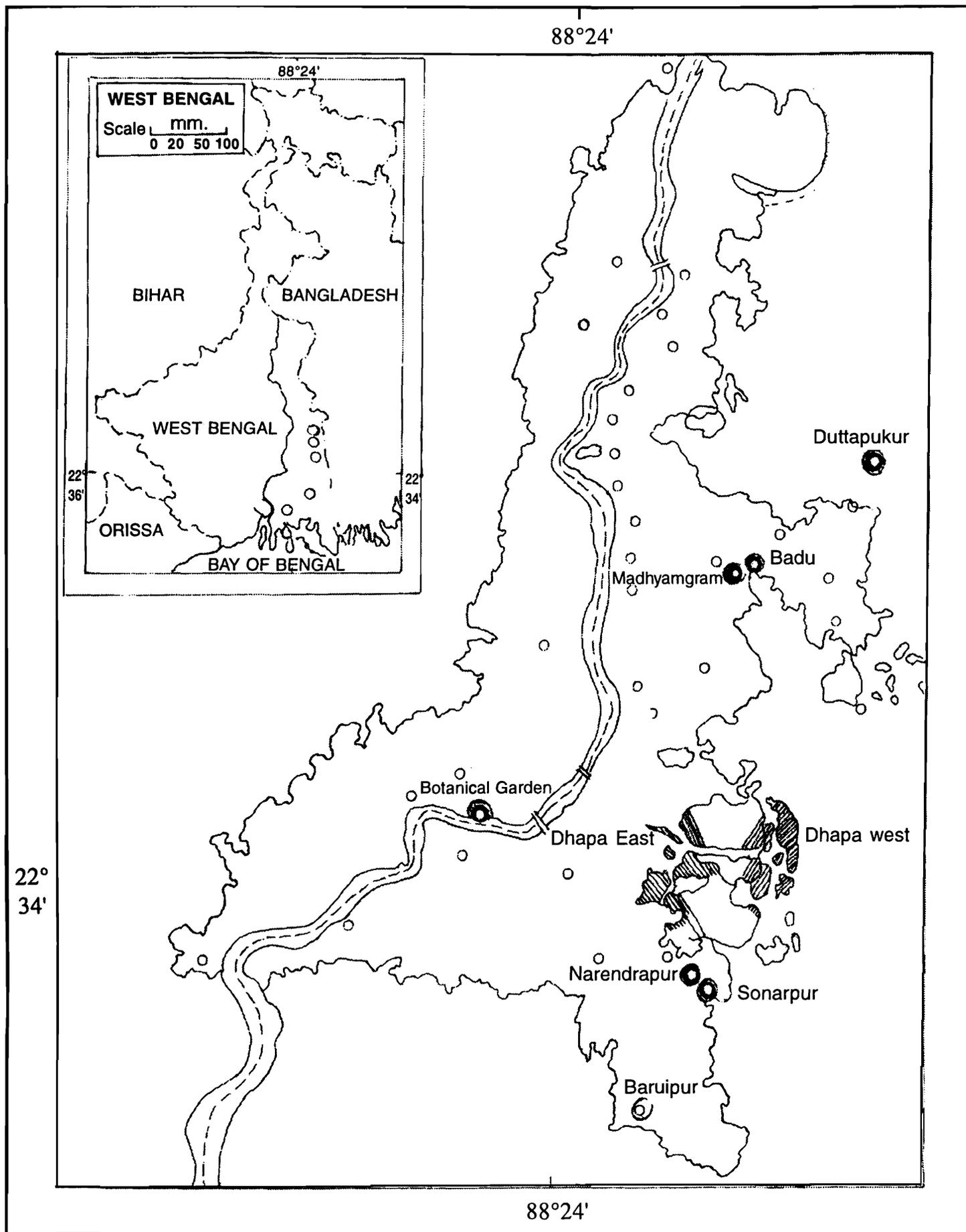
Family STRATIOMYIDAE

The members of the family Stratiomyidae are commonly known as 'soldier flies'. The flies are small to rather large, more or less flattened, and often colourfully white, yellow or metallic green. They are mostly strong fliers, and are often seen sitting on flowers; the adults are pollen or nectar feeders.

1. *Sargus metallinus* Fabricius

1805. *Sargus metallinus* Fabricius, *Syst. Antliat.*, : 258.

Diagnosis : Head brilliantly metallic violet-blue to light green, bearing moderately dense grey pubescence on upper part, and more brownish about the middle; face and lower part of head,



Map 1. : Map of Kolkata with adjoining areas (not to scale).

including proboscis, varying from brownish orange to pale yellowish with light yellowish pubescence; thorax with dorsum and scutellum brilliantly shining metallic green, bronze-green; abdomen metallic shining, yellowish bronze; legs pale yellow, with very short pale yellow setae in male or whitish in female; wings pale yellowish grey or pale brownish.

Visiting plant species : *Bauhinia variegata* var. *candida* Linnaeus.

Distribution : Andaman Islands, Arunachal Pradesh, Bihar, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Meghalaya, Orissa, Uttar Pradesh, West Bengal.

Remarks : The species is reported for the first time as flower visitor of *Bauhinia variegata* var. *candida*.

2. *Oplodontha rubrithorax* (Macquart)

1838. *Odontomyia rubrithorax* Macquart, *Mém. soc. sci. Agric. Lille*, : 189.

Diagnosis : The fly is small in size, with black thorax and yellowish abdomen; legs orange yellow with a brown ring on fore femora and brown streak on underside of middle femur.

Visiting plant species : *Tagetes patula* Linnaeus.

Distribution : Uttar Pradesh, West Bengal.

Remarks : The species was reported earlier as a flower visitor of *Tagetes patula* from West Bengal (Mitra, *et al.* 2003). During this present investigation, the species was found also from the same flower in Narendrapur and Baruipur of south 24 Parganas.

3. *Microchrysa flaviventris* (Wiedemann)

1824. *Sargus flaviventris* Wiedemann, *Analecta Ent.*, : 31.

Diagnosis : This species is a small green metallic, with upper facets much larger than lower ones; legs pale yellow, hind femora with a broad median band and hind tibia with a broad apical band.

Visiting plant species : *Tagetes patula* Linnaeus.

Distribution : West Bengal.

Remarks : The species was also reported earlier as flower visitor of *Tagetes patula* from West Bengal (Mitra *et al.*, 2003). During this present investigation, like other species of the family Stratiomyidae, this species was also collected from Narendrapur and Baruipur of south 24 Parganas.

Family TABANIDAE

Tabanids are relatively large stout flies belonging to the suborder Brachycera. Body length ranges from 5–25 mm, compound eyes are well developed. As with most haematophagous Diptera

it is only the females that suck blood in addition to nectar with the males being solely nectar feeders, the eyes are coloured and are also used to sex the flies. Males are holoptic and the female's dichoptic. The antenna is stiff and projected forward. Adults are of the minor importance as mechanical transmitters of diseases.

4. *Chrysops dispar* (Fabricius)

1798. *Tabanus dispar* Fabricius, *Ent. Syst. Suppl.*, : 567.

Diagnosis : Small, slender flies; abdomen with inverted black markings on tergum 2, extensively yellowish; wing with posterior cell 5 having a large hyaline area up to hind margin; tibia never swollen (Fig. 11).

Visiting plant species : *Merremia vitifolia*. Hallierf.

Distribution : Nagaland, Tripura, West Bengal.

Remarks : The species was collected from the yellow flower of *Merremia vitifolia* at Calcutta University campus, Baruipur. This flower visiting species was encountered only once throughout the survey.

Family BOMBYLIIDAE

The bombyliids or "bee-flies" are a group of moderate to large sized colourful and beautiful flies of the superfamily Asiloidea under the suborder Brachycera. These flies are actually considered as mimics of bees and as their bodies are clothed with a coat of soft, variegated hair and they are of great importance as conveyors of pollen.

5. *Petrorossia ceylonica* (Brunetti)

1909. *Argyramoeba ceylonica* Brunetti, *Rec. Indian Mus.*, 2 : 471.

Diagnosis : Small flies, frons and face quite black, with thick short black hair, antennae black, third joint shortly onion-shaped, basal joint with black bristles; thorax black with short yellow hairs, sides of thorax ash-grey, scutellum black; abdomen ovate, black with yellow hairs, dorsum bare, with microscopic black hairs; legs uniformly tawny yellow, with minute bristles; wings grey with costal cell yellowish, longitudinal vein 2 with a deep loop towards the tip, fork of third vein with distinct appendix, halteres yellow, knob yellowish white with a black mark.

Visiting plant species : *Mimosa pudica* Linnaeus.

Distribution : Assam, Bihar, Mizoram, Tripura, Uttar Pradesh, West Bengal.

Remarks : The species was collected from Naredrapur Ramakrishna Mission medicinal plant garden and Calcutta University campus, Baruipur.

6. *Villa aureohirta* Brunetti

1909. *Anthrax aureohirta* Brunetti, *Rec. Indian Mus.*, 3 : 223.

Diagnosis : Small size, black flies; antennal joints 1 and 2 with stiff black hairs; proboscis long; thorax black with dense yellow hairs laterally; abdomen shining black, first segment densely hairy; wings pale brown upto the middle.

Visiting plant species : *Scaevola sericea* Vahl.

Distribution : Andhar Pradesh, West Bengal.

Remarks : The species is reported for the first time as flower visitor of *Scaevola sericea* Vahl.

7. *Villa panisca* (Rossi)

1790. *Bibio paniscus* Rossi, *Fauna Etrusca.*, 2 : 256.

Diagnosis : Medium size, black flies; antennal tip pointed ended with bristle; thorax dull black; scutellum with closely adhering black scales; abdomen black, 1st and 2nd segment rufous laterally, 7th segment with whitish pubescence laterally; clear iridescent wings.

Visiting plant species : *Scaevola sericea* Vahl.

Distribution : Arunachal Pradesh, Uttaranchal, Tamil Nadu.

Remarks : The species is reported for the first time as flower visitor of *Scaevola sericea* Vahl.

Family SYRPHIDAE

The family Syrphidae under the superfamily Syrphoidea of the infra order Cyclorrhapha in the section Aschiza is one of the largest and easily recognized groups of Diptera. The members of this family are commonly known as "flower flies" or "hover flies" Usually moderate to large sized flies, almost always bristleless, very brightly coloured flies and may be striped, spotted or banded yellow on a blue, black or metallic ground-colour. The black and yellow colouration often imparts to them a superficial resemblance to a wasp; other species are densely hairy and resemble bumblebees. Nearly all members of this family are attracted to flowers and may frequently be observed poised in air, their wings vibrating with extreme rapidity, hence the name of hover-fly. The venaspuria is one of their most characteristic features and is rarely found in other dipterans. It is a vein-like thickening of the wing membrane and may be distinguished from the veins in being fainter and terminating without association with other veins. These flies are pollinators of major significance. In some agro ecosystems, such as orchards, they out perform native bees in pollinating the fruits.

8. *Asarkina (Asarkina) ericetorum* (Fabricius)

1781. *Syrphus ericetorum* Fabricius, *Spec. Insect.*, 2 : 425.

Diagnosis : A medium sized yellowish species; frons yellow, vertex black but both with black pubescence; thorax and scutellum covered with bright yellow pubescence; abdomen orange yellow with all the segments black banded at posterior margin; legs yellow (Fig. 6).

Visiting plant species : *Sida acuta* Burn.

Distribution : Arunachal Pradesh, Assam, Gujarat, Jammu & Kashmir, Manipur, Meghalaya, Sikkim, Tamil Nadu, Tripura, West Bengal.

Remarks : This species was reported as the flower visitor of *Cassia tora* and *Commelina* sp. from Gujarat (Mitra & Parui, 2002). This species is reported for the first time as flower visitor of *Sida acuta*.

9. *Episyrphus balteatus* (De Geer)

1776. *Musca balteata* De Geer, *Mém. pour serv. Hist. Ins.*, 6 : 116.

Diagnosis : A medium sized yellowish species; antennal prominence yellowish with a small black dot above base of antennae; thorax blackish with 2 greyish stripes on fore part; scutellum yellow, pubescence on basal half, rest black pubescence; abdomen wholly orange with second to fifth segment indistinctly median spotten or black banded.

Visiting plant species : *Zinnia elegance* Linnaeus, *Solanum melongena* Linnaeus, *Capsicum frutescens* Linnaeus.

Distribution : Assam, Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Manipur, Meghalaya, Orissa, Sikkim, Tamil Nadu, West Bengal.

Remarks : Reported earlier from *Solanum nigrum*, (Jammu & Kashmir) by Mukherjee, *et al.* 2002. During the present study, it has been found as flower visitor of *Zinnia elegance* (Botanical garden), *Solanum melongana* (Dhapa east & west) and *Capsicum frutescens* (Dhapa east & west).

10. *Ischiodon scutellaris* (Fabricius)

1805. *Scaeva scutellaris* Fabricius, *Syst Antliat.*, : 252.

Diagnosis : A medium sized blackish species with frons and face bright sulphur yellow; thorax shining black with side margins bright yellow from anterior margin of wing; abdomen black with a pair of yellow spots on second segment, third and fourth with a yellow band on each segment, fifth segment with greater part orange; legs yellow with a broad subapical black ring on hind femora.

Visiting plant species : *Tagetes patula* Linnaeus, *Solanum melongena* Linnaeus, *Capsicum frutescens* Linnaeus.

Distribution : Andhra Pradesh, Assam, Arunachal Pradesh, Delhi, Gujarat, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Manipur, Meghalaya, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, West Bengal.

Remarks : This species has been reported earlier as the flower visitor of *Cassia tora* and *Anogeissus pendula* from Gujarat (Mitra & Parui, 2002). During the present survey, it has been found as flower visitor of *Tagetes patula* (Sonarpur, Narendrapur), *Solanum melongena* (Dhapa east & west, Sonarpur and Duttapukur) and *Capsicum frutescens* (Dhapa east & west) from West Bengal.

11. *Baccha (Allobaccha) amphithoe* Walker

1849. *Baccha amphithoe* Walker, *List Dipt. Br. Mus.*, 3 : 549.

Diagnosis : Frons shining black dorsally and little yellowish ventrally; vertex black; face yellow with a clear bluish stripe on face from antennae to mouth; thorax metallic black with short golden yellow pile, humeri with yellow calli; scutellum yellowish brownish in middle; fore and mid legs bright yellow, hind femur with a median black band, tibiae black on apical half; wings clear; first segment of abdomen pale yellow, segment 2 very narrow, pale brown with a yellow band on hind margin, segment 3 with a reddish brown triangular mark on hind margin, segment 5 black.

Visiting plant species : *Helichrysum* sp.

Distribution : Arunachal Pradesh, Assam, Meghalaya, Sikkim, West Bengal; Sri Lanka, Taiwan, Flores Island.

Remarks : This species was collected for the first time as flower visitor of *Helichrysum* from the adjoining areas of Kolkata (Botanical garden, Howrah and Narendrapur).

12. *Paragus serratus* (Fabricius)

1805. *Mulio serratus* Fabricius, *Syst. Antliat.*, : 186.

Diagnosis : A small black species; eyes with three longitudinal stripes of white pubescence; thorax blue black with a pair of longitudinal grey stripes; scutellum black with serrated hind margin; abdominal segments reddish brown and black patterned; legs black and brown.

Visiting plant species : *Weddelia calendulaceae* Less.

Distribution : Assam, Bihar, Delhi, Goa, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Punjab, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.

Remarks : This species was reported as flower visitor of *Weddelia calendulaceae* from West Bengal (Mitra *et al.*, 2004) and *Solanum nigrum* from Jammu & Kashmir (Mukherjee, *et al.*, 2002).

13. *Eristalinus (Eristalinus) arvorum* (Fabricius)

1787. *Syrphus arvorum* Fabricius, *Mantissa Insect.*, 2 : 335.

Diagnosis : A large yellow and black species; frons covered with black pubescence and face with pale yellow pubescence; thorax with four longitudinal black stripes, whole thorax and scutellum covered with pale yellow pubescence; abdomen black, second and third segments with a pair of yellow spots; all tibiae black basally to a varying extent (Fig. 7).

Visiting plant species : *Santalum album* Linnaeus, *Mangifera indica* Linnaeus, *Tagetes patula* Linnaeus.

Distribution : Arunachal Pradesh, Jammu & Kashmir, Meghalaya, Orissa, Sikkim, Tripura, West Bengal.

Remarks : Earlier reported by Mitra *et al.*, (2003) as the flower visitor of *Tagetes patula*. During the present study, this species was found to visit the flowers of *Santalum album* and *Mangifera indica* at Calcutta University campus, Baruipur.

14. *Eristalinus (Eristalinus) obscuritarsis* (de Meijere)

1908. *Eristalis obscuritarsis* de Meijere, *Tijdschr. Ent.*, 51 : 250.

Diagnosis : A medium black species with reddish antennae; thorax black with 3 yellow longitudinal stripes; scutellum yellowish; third abdominal segment with a pair of quadrate yellowish spot on each side; tip of all femora yellow, front, mid and hind tibiae at base yellow, rest black (Fig. 8).

Visiting plant species : *Aegle marmelos* (Linnaeus) *Corr. Tagetes patula* Linnaeus.

Distribution : Gujarat, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Orissa, Sikkim, West Bengal.

Remarks : This species was reported as flower visitor of *Aegle marmelos* and *Tagetes patula* from West Bengal (Mitra *et al.*, 2003 & 2004). During this present survey, it was collected only from the flower of *Tagetes patula* at Dhapa east.

15. *Eristalinus (Eristalinus) quinquestriatus* (Fabricius)

1794. *Syrphus quinquestriatus* Fabricius, *Ent. Syst.*, 4 : 289.

Diagnosis : A medium sized yellow and black species; frons and face with yellowish grey pubescence, antenna and arista brownish orange, thoracic dorsum with four black longitudinal stripes; scutellum yellowish; abdominal segments yellow and black patterned; all femora black except tip of fore and hind femora orange or yellow (Fig. 15).

Visiting plant species : *Tagetes patula* Linnaeus.

Distribution : Assam, Meghalaya, Bihar, Karnataka, Kerala, Madhya Pradesh, Orissa, Uttar Pradesh, West Bengal.

Remarks : This species was found very rare among the all syrphid flower visitors of *Tagetes patula*. Mitra *et al.*, (2003) reported earlier from Nadia of West Bengal. During this present study this species was also encountered once only from the flower head of *Tagetes patula* at Dhapa east (Fig. 15).

16. *Mesembrius bengalensis* (Wiedemann)

1819. *Eristalis bengalensis* Wiedemann, *Zool. Mag.*, 1 : 16.

Diagnosis : Frons and face wholly covered with yellow tomentum and concolorous pubescence; thorax bright yellow with three longitudinal black stripes; wings pale grey (Fig. 13).

Visiting plant species : *Weddelia calendulaceae* Less, *Sida acuta* Burn, *Tagetes patula* Linnaeus.

Distribution : Assam, Bihar, Gujarat, Karnataka, Kerala, West Bengal.

Remarks : This species was reported earlier by Mitra *et al.*, (2004) as flower visitor of *Weddelia* from Narendrapur and Mitra, *et al.*, (2003) also reported as flower visitor of *Tagetes patula* from Nadia of West Bengal. In this present study the species was collected only from the flower of *Tagetes* at various fields of Duttapukur, Madhyamgram and Badu. This species is also reported as flower visitor of *Sida acuta* from Baruipur.

17. *Mesembrium quadrivittatus* (Wiedemann)

1819. *Eristalis quadrivittatus* Wiedemann, *Zool. Mag.*, 1 : 17.

Diagnosis : A large yellow and black species; eyes not touching at any point in male; thorax yellow with three longitudinal black stripes; abdomen orange with black patterns; femora black, brownish tinge at tip, anterior and middle tibiae orange yellow on basal half (Fig. 5).

Visiting plant species : *Weddelia calendulaceae* Less, *Aegle marmelos* (Linnaeus) Corr., *Rauvolfia serpentina*, Benth.

Distribution : Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka, Madhya Pradesh, Orissa, Tamil Nadu, Tripura, West Bengal.

Remarks : Mitra *et al.*, (2002 & 2004) reported this species from the flowers of *Rauvolfia*, *Aegle* and *Weddelia* from Narendrapur and New Barrackpore of West Bengal. During the present survey, the species was collected as the flower visitor of *Aegle marmelos* from Madhyamgram, Baruipur and Sonarpur. It is interesting to note that the species was attracted to three different colour of flowers (Green-white, Yellow and Reddish-white) of three different families of plant species (Table 1).

Table 1. : Dipteran flower visitors so far reported from adjoining areas of Kolkata with their visited plant species.

Pollinator Species	Family	Plant species	Family	Flower Colour
<i>Sargus metallinus</i>	Stratiomyidae	<i>Bauhinia variegata v. candida</i>	Leguminosae	White
<i>Oplodontha rubrithorax</i>	Stratiomyidae	<i>Tagetes patula</i>	Asteraceae	Yellow
<i>Microchrysa faviventris</i>	Stratiomyidae	<i>Tagetes patula</i>	Asteraceae	Yellow
<i>Chrysops dispar</i>	Tabanidae	<i>Merremia vitifolia</i>	Convolvulaceae	Yellow
<i>Petrorossia ceylonica</i>	Bombyliidae	<i>Mimosa pudica</i>	Leguminosae	Pink
<i>Villa aureohirta</i>	Bombyliidae	<i>Scaevola sericea</i>	Goodeniaceae	White
<i>Villa panisca</i>	Bombyliidae	<i>Scaevola sericea</i>	Goodeniaceae	White
<i>Paragus serratus</i>	Syrphidae	<i>Weddellia calendulaceae</i>	Asteraceae	Yellow
<i>Mesembrius bengalensis</i>	Syrphidae	<i>Weddellia calendulaceae</i>	Asteraceae	Yellow
		<i>Tagetes patula</i>	Asteraceae	Yellow
		<i>Sida acuta</i>	Malvaceae	Yellow
<i>Mesembrius quadrivittatus</i>	Syrphidae	<i>Weddellia calendulaceae</i>	Asteraceae	Yellow
		<i>Aegle marmelos,</i>	Rutaceae	Greenish white
		<i>Rauvolfia serpentina</i>	Apocyanaceae	Reddish-white
<i>Asarkina (A) ericetorum</i>	Syrphidae	<i>Sida acuta</i>	Malvaceae	Yellow
<i>Eristalinus (E) obscuritarsis</i>	Syrphidae	<i>Tagetes patula,</i>	Asteraceae	Yellow
		<i>Aegle marmelos,</i>	Rutaceae	Greenish white
<i>Eristalinus (E) arvorum</i>	Syrphidae	<i>Santalum album</i>	Santalaceae	Purplish
		<i>Tagetes Patula</i>	Asteraceae	Yellow
		<i>Mangifera indica</i>	Anacardiaceae	White
<i>Eristalinus quinquestriatus</i>	Syrphidae	<i>Tagetes patula</i>	Asteraceae	Yellow
<i>Ischiodon scutellaris</i>	Syrphidae	<i>Tagetes patula,</i>	Asteraceae	Yellow
		<i>Solanum melongena,</i>	Solanaceae	Violet
		<i>Capsicum frutescens</i>	Solanaceae	White

Table 1. : (Cont'd.)

Pollinator Species	Family	Plant species	Family	Flower Colour
<i>Baccha (A) amphithoe</i>	Syrphidae	<i>Helichrysum sp.</i>	Asteraceae	White
<i>Episyrphus balteatus</i>	Syrphidae	<i>Zinnia elegance</i>	Asteraceae	Violet
		<i>Solanum melongena,</i>	Solanaceae	White
		<i>Capsicum frutescens</i>	Solanaceae	
<i>Dacus (Z) cucurbitae</i>	Tephritidae	<i>Cucurbita maxima</i>	Cucurbitaceae	Yellow
<i>Musca (M) domestica</i>	Muscidae	<i>Weddelia calendulaceae</i>	Asteraceae	Yellow
<i>Musca (B) ventrosa</i>	Muscidae	<i>Polianthus tuberosa</i>	Amaryllidaceae	White
<i>Orthellia timorensis</i>	Muscidae	<i>Scaevola sericea</i>	Goodeniaceae	White
<i>Lucilia porphyrina</i>	Calliphoridae	<i>Scaevola sericea</i>	Goodeniaceae	White
<i>Stomorphina discolor</i>	Calliphoridae	<i>Tagetes patula</i>	Asteraceae	Yellow
		<i>Syzygium jambos</i>	Myrtaceae	Greenish
		<i>Callistemon citrinus</i>	Myrtaceae	Red
<i>Hemipyrellia pulchra</i>	Calliphoridae	<i>Santalum album</i>	Santalaceae	Purplish
		<i>Psidium guajava</i>	Myrtaceae	White
<i>Isomyia viridaurea</i>	Calliphoridae	<i>Catharanthus roseus</i>	Apocyanaceae	White, Pink
<i>Phaenicia cuprina</i>	Calliphoridae	<i>T. coronaria</i>	Apocyanaceae	White
<i>Phaenicia sericata</i>	Calliphoridae	<i>T. coronaria</i>	Apocyanaceae	White
		<i>Begonia sp.</i>	Begoniaceae	Pink- white
		<i>Ficus carica</i>	Moraceae	
<i>Chrysomya megacephala</i>	Calliphoridae	<i>Mikania cordata</i>	Asteraceae	White
<i>Iranihindia futilis</i>	Sarcophagidae	<i>T. coronaria</i>	Apocyanaceae	White
<i>Thelaira macropus</i>	Tachinidae	<i>Helichrysum sp.</i>	Asteraceae	White

Family TEPHRITIDAE

Most species of fruit flies are highly ornamented with brightly contrasting colour patterns on their bodies and usually elaborate markings on the wings. Many species are of great economic importance and causes serious damage to commercial fruits and vegetables.

18. *Dacus (Zeugodacus) cucurbitae* Coquillett

1899. *Dacus cucurbitae* Coquillett, *Ent. News.*, **10** : 129.

Diagnosis : Head light yellow; a median vitta on the posterior half of mesonotum; large spot on each side of metanotum; scutellum bearing two bristles; abdomen light yellow on first two segments, rest reddish yellow; wings hyaline; legs light yellow; hind tibiae reddish yellow or dark brown (Fig. 9).

Visiting plant species : *Cucurbita maxima* Duchesne.

Distribution : Throughout India.

Remarks : A good number of specimens were found as flower visitor of *Cucurbita maxima* in agricultural fields at Duttapukur.

Family MUSCIDAE

A family Muscidae is one of the most diversified and economically important group of the calyptrate Diptera belonging to the suborder Brachycera (Mc Alpine *et al.*, 1989). Adult Muscidae are generally small to medium sized flies and seldom exhibit any striking developments of colour or form (Pont, 1972).

19. *Musca (Musca) domestica* Linnaeus

1758. *Musca domestica* Linnaeus, *Syst. Nat.*, *ed. 10*, **1** : 596.

Diagnosis : Four black vittae on thorax, inner pair terminating towards posterior end, propleural depression with fine setulose hair; suprasquamal ridge without black setulae, all post dc strong; mid tibia without av and ad setae (Fig. 17).

Visiting plant species : *Weddelia calendulaceae* Less.

Distribution : Andaman Islands, Andhra Pradesh, Assam, Bihar, Chandigarh, Goa, Himachal Pradesh, Jammu & Kashmir, Karnataka, Maharashtra, Nagaland, Punjab, Tripura, Sikkim; Cosmopolitan.

Remarks : This species was reported earlier by Mitra *et al.*, (2004) as flower visitor of *Weddelia calendulaceae* from Narendrapur.

20. *Musca (Byomya) ventrosa* Wiedemann

1830. *Musca ventrosa* Wiedemann, *Aussereurop. zweifl. Insekt.*, 2 : 656.

Diagnosis : Eyes bare; propleural depression and suprasquamal ridge without any setulae; thorax shining black, thinly and evenly covered with whitish-grey dust, dorsum with four narrow rather inconspicuous vittae, the broad central silver pollinose stripe more definite; abdomen entirely orange, with few small patches of silver dust; wings hyaline, veins yellow towards base; legs black (Fig. 14).

Visiting plant species : *Polianthus tuberosa* Linnaeus.

Distribution : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Tamil Nadu, Uttar Pradesh, West Bengal.

Remarks : This is the first report of this species as flower visitor of *Polianthes tuberosa* from Baruipur and Duttapukur.

21. *Orthellia timorensis* (Robineau-Desvoidy)

1830. *Lucilia timorensis* Robineau-Desvoidy, *Mém. prés. div. Sav. Acad. sci. Inst. Fr.*, 2 : 460.

Diagnosis : A medium metallic colored species; in male inner facets of eye markedly enlarged; thorax with 2 pairs of presutural dorsocentrals; mid tibia with an ad seta only; discal cell of wing with a bare longitudinal stripe, close to $M_3 + Cu_1$ (Fig. 12).

Visiting plant species : *Scaevola sericea* Vahl.

Distribution : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Kerala, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.

Remarks : Reported earlier by Mitra *et al.*, (2003) from Narendrapur medicinal plant garden. During this present survey, this species was observed as common visitor of *Scaevola sericea* Vahl (Fig. 12).

Family CALLIPHORIDAE

The members of the family Calliphoridae are commonly referred to as blowflies, blue bottle flies or green bottle flies. The flies commonly frequent vegetation, flowers, decaying organic matter and excrement, some species are the causal agents of myiasis in man and domestic animals.

22. *Lucilia porphyryna* (Walker)

1856. *Musca porphyryna* Walker, *J. Proc. Linn. Soc. Lond. Zool.*, 1 : 24.

Diagnosis : A small green to purple coloured fly; third antennal segment 5 times of second; wing tinged brown, subcostal sclerite with stiff black hairs; squama dark brown.

Visiting plant species : *Scaevola sericea* Vahl.

Distribution : Arunachal Pradesh, Assam, Jammu & Kashmir, Himachal Pradesh, Sikkim, West Bengal.

Remarks : Reported earlier by Mitra *et al.*, (2003) from Narendrapur medicinal plant garden.

23. *Stomorhina discolor* (Fabricius)

1794. *Musca discolor* Fabricius, *Ent. Syst.*, 4 : 320.

Diagnosis : A small species with green coloured thorax and blackish abdomen; face, epistome and anterior half of gena shining black; anterior and middle femora black, rest of legs otherwise coloured.

Visiting plant species : *Tagetes patula* Linnaeus, *Syzygium jambos* Alston, *Callistemon citrinus* (Curtis).

Distribution : Arunachal Pradesh, Assam, Bihar, Kerala, Manipur, Meghalaya, Tripura, Uttar Pradesh, West Bengal.

Remarks : This species was reported as the flower visitor of *Zizyphus* sp. and *Anogeissus pendula* from Gujarat by Mitra & Parui (2002). During this present survey, this species was collected from Dhapa (east & west), Sonarpur and Baruipur.

24. *Hemipyrellia pulchra* (Wiedemann)

1830. *Musca pulchra* Wiedemann, *Aussereurop. zweiffl. Insekt.*, 2 : 406.

Diagnosis : Flies are wholly or partially metallic in colour; thorax metallic green with purple reflections, heavily dusted anteriorly and on the hypopleura; abdomen greenish to purple; genitalia hairy. Adults are oviparous and are attracted to dead animals, garbage and sometimes to flowering plants and fruits.

Visiting plant species : *Santalum album* Linnaeus, *Psidium guajava* Linnaeus.

Distribution : Tamil Nadu, West Bengal.

Remarks : During this present survey, this species was collected from Sonarpur and Baruipur and the first report as flower visitor of *Santalum* and *Psidium*.

25. *Isomyia viridaurea* (Wiedemann)

1819. *Musca viridaurea* Wiedemann, *Zool. Mag.*, 1 : 22.

Diagnosis : Medium to large flies, metallic green or blue; antennae dark brownish-yellow; thorax golden green, with very little white pile; abdomen golden-green, with some white pilose tessellation; femora metallic.

Visiting plant species : *Catharanthus roseus*.

Distribution : Throughout India.

Remarks : This is the first flower visiting Diptera reported from this medicinal plant.

26. *Phaenicia cuprina* (Wiedemann)

1830. *Musca cuprina* Wiedemann, *Aussereurop. zweifl. Insekt.*, 2 : 654.

Diagnosis : Medium size; thorax shining green; abdomen somewhat arched in profile, shining green, sternites with tufts of long hairs; wings hyaline, slightly yellow at the base, legs black.

Visiting plant species : *Tabernaemontana coronaria* R. Br.

Distribution : Throughout India.

Remarks : A large number of this calliphorid species was found to visit the flower of *Tabernaemontana coronaria* at Narendrapur and Baruipur.

27. *Phaenicia sericata* (Meigen)

1826. *Musca sericata* Meigen, *Syst. Besch. Europ. zweifl. Insekt.*, 5 : 53.

Diagnosis : Medium size; thorax shining green; abdomen shining green, not arched in profile, sternites without tuft of long hairs; wings hyaline, legs black (Fig. 18).

Visiting plant species : *Tabernaemontana coronaria* R. Br., *Begonia* sp., *Ficus carica* Linnaeus.

Distribution : Chandigarh, Punjab; Cosmopolitan.

Remarks : This species was collected from the Calcutta University campus, Baruipur.

28. *Chrysomya megacephala* (Fabricius)

1794. *Musca megacephala* Fabricius, *Syst. Ent.*, 4 : 317.

Diagnosis : A medium blue or green coloured fly with upper eye facets greatly enlarged, larger than lower third in male; wing hyaline, slightly dark at base; legs black (Fig. 16).

Visiting plant species : *Mikania cordata* Willd.

Distribution : Throughout India.

Remarks : The species was earlier reported as flower visitor of *Holarraena antidysenterica*, *Lantana camara* and *Tectona grandis* from Gujarat (Mitra & Parui, 2002). During this survey, the species was collected from Baruipur and Sonarpur.

Family SARCOPHAGIDAE

29. *Iranihindia futilis* (Senior-White)

1924. *Sarcophaga futilis* Senior-White, *Rec. Indian Mus.*, 26(3) : 246.

Diagnosis : Width of frons about two-fifths that of one eye; frontal vitta black; thorax black with three black longitudinal stripes; wings hyaline with brown veins; legs black; abdomen black with silvery checkered pattern; apical plate of paraphallus long and wide at end; lateral plate of paraphallus with unequal bifurcations, inner forceps with long hairs on basal part and a row of 4–5 stout comb-like spines on distal part.

Visiting plant species : *Tabernaemontana coronaria* R. Br.

Distribution : Arunachal Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Mizoram, Orissa, Tamil Nadu, Tripura, Uttar Pradesh, Uttaranchal, West Bengal.

Remarks : Reported earlier by Mitra *et al.*, (2003) from Narendrapur medicinal plant garden. The species is reported for the first time from the flower of *Tabernaemontana coronaria*.

Family TACHINIDAE

This immense family of flies is very heterogeneous in the adult morphology, but a biologically uniform because the larvae are all endoparasites in Arthropods (Crosskey, 1977). They are commonly known as 'tachina flies'. The tachinids are free living, as adults visiting flowers and vegetation. Quite a few have been employed as biological control agents against different insect species but a few others, the so called-oozy fly cause serious damage to sericultural industries.

30. *Thelaira macropus* (Wiedemann)

1830. *Dexia macropus* Wiedemann, *Aussereurop. Zweiffl. Ins.*, 2 : 375.

Diagnosis : Large size; abdominal segments 2, 3 & 4 bright yellow front margin of fifth segment pale yellow; scutellum largely yellow on posterior half; T₂ with 2 ad setae in proximal half besides smaller setae in distal third, 0 pd and 2 hind setae; R₁ setose on most of its length; edge of 2nd segment as long as ½ to 3/5 of 3rd segment (Fig. 10).

Visiting plant species : *Helichrysum* sp.

Distribution : Assam, Himachal Pradesh, Jammu & Kashmir, West Bengal.

Remarks : Only once encountered throughout the survey and collected from Narendrapur.

SUMMARY

Altogether 30 species of 23 genera under 9 families of Diptera are reported here as flower visitors/pollinators of various plants of wild, orchards, managed gardens and agricultural crops

from Kolkata and its adjoining areas. Among the dipteran flower visitors, the family Syrphidae shares maximum number of species (10 spp.), followed by Calliphoridae (7 spp.), Muscidae (3 spp.), Stratiomyidae (3 spp.), Bombyliidae (3 spp.), Sarcophagidae (1 sp.), Tephritidae (1 sp.), Tachinidae (1 sp.) and Tabanidae (1 sp.), (Table 1). All these dipteran species were found to visit on 25 plant species of 15 families (Table 2). Among the plant species maximum number of visitor/pollinator species were found in *Tagetes patula* (7 spp.), followed by *Scaevola sericea* (4 spp.), *Weddelia calendulaceae* (4 spp.), *Tabernaemontana coronaria* (3 spp.), *Sida acuta* (2 spp.), *Aegle marmelos* (2 spp.), *Capsicum frutescens* (2 spp.), *Helichrysum* sp. (2 spp.). Rest of the plant species are having single insect visitor (Table 2). During this survey, it has been also observed that flies are mostly attracted by yellow and white flowers (Table 1).

Table 2 : Plant species and their flower visitors in and around Kolkata.

Sl. No.	Plant Species	Flower Visitors
1.	<i>Aegle marmelos</i>	<i>Mesembrius quadrivittatus</i> , <i>Eristalinus (E) obscuritarsis</i>
2.	<i>Begonia</i> sp.	<i>Phaenicia sericata</i>
3.	<i>Capsicum frutescens</i>	<i>Ischiodon scutellaris</i> , <i>Episyrphus balteatus</i>
4.	<i>Catharanthus roseus</i>	<i>Isomyia viridaurea</i>
5.	<i>Callistemon citrinus</i>	<i>Stomorphina discolor</i>
6.	<i>Cucurbita maxima</i>	<i>Dacus (Zeugodacus) cucurbitae</i>
7.	<i>Ficus carica</i>	<i>Phaenicia sericata</i>
8.	<i>Helichrysum</i> sp.	<i>Baccha (Allobaccha) amphithoe</i> , <i>Thelaira macropus</i>
9.	<i>Merremia vitifolia</i>	<i>Chrysops dispar</i>
10.	<i>Mimosa pudica</i>	<i>Petrorossia ceylonica</i>
11.	<i>Mikania cordata</i>	<i>Chrysomya megacephala</i>
12.	<i>Polianthes tuberosa</i>	<i>Musca (Byomya) ventrosa</i>
13.	<i>Psidium guajava</i>	<i>Hemipyrellia pulchra</i>
14.	<i>Rauvolfia serpentina</i>	<i>Mesembrius quadrivittatus</i>
15.	<i>Santalum album</i>	<i>Hemipyrellia pulchra</i> , <i>Eristalinus (E) arvorum</i>
16.	<i>Scaevola sericea</i>	<i>Orthellia timorensis</i> , <i>Lucilia porphyrina</i> , <i>Villa aureohirta</i> , <i>Villa panisca</i>
17.	<i>Solanum melongana</i>	<i>Ischiodon scutellaris</i> , <i>Episyrphus balteatus</i>
18.	<i>Syzgium jambos</i>	<i>Stomorphina discolor</i>
19.	<i>Tabernaemontana coronaria</i>	<i>Phaenicia cuprina</i> , <i>Phaenicia sericata</i> , <i>Iranihindia futilis</i>

20.	<i>Tagetes patula</i>	<i>Microchrysa flaviventris, Oplodontha rubrithorax, Eristalinus quinquestriatus, Mesembrius bengalensis, Eristalinus (E) obscuritarsis, Ischiodon scutellaris, Stomorhina discolor, Eristalinus arvorum</i>
21.	<i>Weddelia calendulaceae</i>	<i>Paragus serratus, Musca (M) domestica, Mesembrius quadrivittatus, Mesembrius bengalensis</i>
22.	<i>Bauhuinia variegata v. candida</i>	<i>Sargus metallinus</i>
23.	<i>Sida acuta</i>	<i>Asarkina (A) ericetorum, Mesembrius bengalensis</i>
24.	<i>Mangifera indica</i>	<i>Eristalinus (E) arvorum</i>
25.	<i>Zinia elegance</i>	<i>Episyrphus balteatus</i>

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