

**OCCASIONAL PAPER NO. 308**

**Records of the  
Zoological Survey of India**

**Sarcophagidae, Calliphoridae and  
Muscidae (Diptera) of the Sundarbans  
Biosphere Reserve, West Bengal, India**

**SHUVRA KANTI SINHA**

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(Diptera) of the Sundarbans Biosphere Reserve,  
West Bengal, India**

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*Edited by the Director, Zoological Survey of India, Kolkata*



सत्यमेव जयते

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## INTRODUCTION

Sarcophagid, calliphorid and muscid flies are of great importance in medical, veterinary, forensic and agricultural sciences (James, 1947; Emden, 1965; Zumpt, 1965; Greenberg, 1971; Smith, 1986). Very little information is available on these flies from Sundarbans Biosphere Reserve. Nandi (1977) reported 5 calliphorid, 3 muscid and 8 sarcophagid species from this area. Later Majumder and Parui (2001) reported 2 calliphorid and 8 muscid species from this Biosphere Reserve. These flies are abundant in different parts of Sundarbans Biosphere Reserve. They carry the germs of different types of bacteria, viruses, protozoa and helminths that cause enteric diseases in man and other animals (Greenberg, 1971; Sinha *et al.*, 2003). Most of the adult flies are very important because of their relationship with man and dwellings. Their roles in dissemination of gastroenteric diseases are well known. Kettle (1995) reported more than 100 pathogens including the germs of typhoid, paratyphoid, tuberculosis, leprosy and plague that are carried by muscid flies. Few flies are hematophagous and lick sores of cattle and human and act as vectors of ophthalmic diseases. Some adults are predators and feeds on larvae, pupae and adults of Simuliidae and Culicidae (Pont, 1980) and these flies can be used for biological control of some of those vectors. A few larvae are predator and feed on the larvae of other flies of the genera *Musca*, *Orthellia*, *Haematobia* etc. which occur in dung (Shinonaga and Kano, 1971). A few larvae of these three fly families cause huge economic loss by lowering the production of dried fish Industry (Esser, 1991; Sinha and Nandi, 2003) and produce myiasis of live-stock. A very few larvae are helpful in investigation of untimely death of a person in murder case and thus they are helpful in forensic science (Smith, 1986). Few larvae can be used for the treatment of osteomyelitis and at present is also being used in cases where antibiotics are ineffective and surgery is impracticable (Stewart, 1934; Sherman and Pechter, 1988). Few species are facultative ectoparasites in living tissues and cause tissue myiasis in man and animals (Hall and Wall, 1994).

## STUDIED AREA

Sundarbans is the largest intertidal area of approximately 26,000 sq.kms formed by the meeting of the two great river systems Ganga and Brahmaputra with Bay of Bengal along India and Bangladesh. It has been included within the list of World Heritage Site by IUCN since 1984. The World's largest delta on the Indian side occupies an area of 9630 sq. kms and lies in between 21° 32' and 22° 40' North latitude and between 88° 3' and 89° 00' East longitude. Out of the total area of 9630 sq. kms, 1700 sq. kms form the core zone, and 7931

sq. kms form the buffer zone. In the buffer zone, 2225 sq. kms is forest area, 5460 sq. kms included agricultural lands and 245 sq. kms is human residential places. There are about 54 islands of variable sizes and shapes in Sundarbans and these are separated from each other by a network of tidal channels, inlets and creeks some of which act pathways for both freshwater discharge from upland and to-and-fro movement of flood and ebb. The area is a unique highly productive mangrove ecosystem and is the richest mangrove repository of India. Sundari (*Heritiera fomes*), Kalo Baen (*Avicennia officinalis*), Genwa (*Excoecaria agallocha*), Dhundul (*Xylocarpus granatum*), Kankra (*Bruguiera gymnorrhiza*), Goran (*Ceriops decandra*), Golpati (*Nypa fruticans*), Hatal (*Phoenix paludosa*) contains more than 60% of total Indian mangroves. The mangrove ecosystem also provides a large number of animal communities living either entirely within the mangrove or visiting the zone to feed or to breed. Sanitary conditions around human residential places are not so good and dry fishes are prepared through out the winter season. The climate of Sundarbans is subtropical. The temperature varies from an average of 20°C in December-January to an average of 28°C in June-July. The annual average rainfall is approximately 1763 mm. Humidity ranges normally between 70% and 80%. The region is exposed to storms and cyclones that generally occur during the onset of monsoon and also during post-monsoon period and cause damage to the human residents and forests. A total of 21 spots (vide Map) including the core and buffer area were visited regularly to collect specimens during the research work.

## MATERIAL AND METHODS

### A. Collection and preservation of the adult flies

The entire materials of sarcophagid, calliphorid and muscid flies included in the present study was collected by the author from different parts of Sundarbans Biosphere Reserve, West Bengal, India from various habitats such as mangrove bushes and forests, grasses, flowering plants, sea beaches, river-banks, dry fish processing centres, decaying organic matters, dead body of different fishes, animals and from and near human and animal excrement, with the help of butterfly net. In some cases the flies were also collected with bait traps. Two types of bait such as fish and meat were used. There was no special choice on fish and meat type. Coastal fishes available in local market and broiler chicken were used as fish and meat bait respectively. Prior to their use, meat and fish were allowed to rot for 24 hours.

The flies were killed in a killing-jar containing liquid benzene. In cases where the flies were collected in bait traps, the trap was covered with a polythene paper bag and poisonous vapoured cotton was introduced inside the bag. Later the specimens were taken out from killing jar or bait traps and preserved dry in insect-envelope. Locality, habitat, date of collection etc. were noted on a small piece of paper used as a label and the labels were kept along with

the collected specimens inside the envelopes. After returning to the field station, forest rest house or laboratory, the specimens were sorted out and relaxed in a relaxing-chamber for about 24 hours. Then they were pinned with entomological pin passing through the right side just a little anterior to the presuture. The legs and wings were spread fully at right angle to the body so as to facilitate easy study. The specimens were kept in a dry chamber for at least 4-5 days before being preserved in insect cabinet.

### **B. Morphological study and preparation of genitalia**

The chaetotaxy is best studied in dry condition. For studying male genitalia of the flies of family Sarcophagidae, they were kept in a relaxing jar in wet condition for about 24 hours and later the genitalia were pulled out with the help of a fine forcep. The best procedure for taking out the genitalia of the flies is by placing the pinned specimen with its abdomen slightly turned upward on a pinning board, at an angle of 45°-60°. After that the 5<sup>th</sup> tergite was pressed dorsoventrally with the help of a fine forcep held in the left hand and the genitalia was pulled backwards, very cautiously, with another fine forcep in the right hand. Attention was paid so that 1st and 2nd genitalia segment also came out smoothly along with the rest of the genitalia. In the fly families Calliphoridae and Muscidae, posterior portion of abdomen (3<sup>rd</sup> to last abdominal segment) was dissected out with fine scissor. Then the genitalia was boiled in a test tube immersed in 10% KOH solution for ½-1 minute. Caution was taken in not over-boiling the genitalia. After boiling, the genitalic parts were put in a cavity block and washed with distilled water to remove KOH. Then the parts were transferred to 30% alcohol and dissected out with the help of needles under stereoscopic binocular microscope. A blunt needle was used with the left hand for keeping the genitalia in a fixed position and also to remove the chitinous parts during dissection. Care was taken in not damaging bristles as these are also having taxonomic value. After study of the genitalia, the part was passed for dehydration through 50%, 70%, 90%, and finally absolute alcohol. Then the parts were cleared in clove oil for about 3 minutes, mounted on the tip of a triangular paperboard with gum and attached to the pin bearing the specimen.

In cases where they were to be figured, the genitalia was transferred to phenol from clove oil and the figures were drawn with the help of a Camera lucida, and then glued to a small paper piece carrying the genitalia and attached to the same pin of the specimen for further study.

To make sure of their identity, the females described in this dissertation were either collected from the field during copulation or were taken after rearing from the same generation. It is difficult to identify the females not so collected because the genitalia do not exhibit sufficient variation enabling one to ascertain their true identity. The female specimens collected

by bait traps were identified on the basis of chaetotaxy. For the study of female genitalia the specimens were relaxed and placed on the pinning board in the same way as males. In females the whole abdomen was dissected out from the rest of the specimen. Later, the parts were dehydrated in various grades of alcohol and mounted in Canada balsum as earlier.

### Key to Family Sarcophagidae, Calliphoridae and Muscidae

1. Hypopleuron with one or more rows of bristles below metathoracic spiracles..... 2
- Hypopleuron bare or with weak hairs below metathoracic spiracles ..... MUSCIDAE
2. Pteropleuron setose; propleuron and prosternum usually bare; abdomen usually gray or black tessellated; presence of three or four notopleural bristles .. SARCOPHAGIDAE
- Pteropleuron highly setose; propleuron and prosternum with hairs; abdomen olivaceous to green; presence of two notopleural bristles ..... CALLIPHORIDAE

### Family SARCOPHAGIDAE

The Sarcophagid flies, commonly known as flesh flies, belonging to the family Sarcophagidae of the superfamily Sarcophagoidea in the order Diptera are of cosmopolitan distribution.

These flies often carry the germs of diseases of man and animals in their gut and body surface and may also act as mechanical vector of such germs.

According to Greenberg (1971), different types of Protozoa, Bacteria, and Helminthes are associated with these flies.

The Sarcophagid larvae are parasitic on various arthropods like Cockroaches, Grasshoppers, Locusts, Mantids, Camel Crickets, Spider, Honeybees and Wasps, and certain coleopteran genera (*Aside*, *Eleodes*, *Plectodera*), Neuroptera and Lepidopterous larvae and pupae, have been discussed by various authors (Karsch, 1885; Aldrich, 1916; Smith, 1944; Smith and Finlayson, 1950).

Cases of parasitisation of Oligochaeta and Mollusca by the larvae of Sarcophagid flies were reported by Lopes (1940, 1942), Nair (1968) Pape, Mc Killup and Mc Killup, (2000).

Some Sarcophagid species cause myiasis in different parts of body of animals and man (James, 1947; Zumpt, 1965; James & Harwood, 1979).

Kano *et al.* 1967 reported several cases of intestinal myiasis caused by the larvae of *Parasarcophaga similis* (Meade) from Japan. Dasgupta *et al.* (1972) recorded a case of

intestinal myiasis in Leopard and its Keeper caused by the larvae of *Sarcophaga macroauriculata* Ho from Darjeeling, India. Ali-Khan and Ali-Khan (1974) reported two cases of myiasis from Quebee, by *Sarcophaga haemorrhoidalis* Fallen and *Sarcophaga crassipalpis* Macquart. Few *Helicophagella* cause traumatic myiasis in birds and mammals (Pape, 1987).

Nandi (1977) made extensive survey in West Bengal and described Sarcophagid fauna from different geographical climates. Some of that species were new to science.

There was a little work on Sundarbans Biosphere Reserve regarding Sarcophagidae except Mandal & Nandi (1989) reported 2, Mazumder and Parui (2001) reported 1 and Sinha and Nandi (2000) reported 10 species of Sarcophagid flies from this largest mangrove Biosphere Reserve.

Classification and terminology used in the text are followed here after Nandi (2002).

The present author reported a total of 18 species of sarcophagid flies under 6 genera from this Biosphere Reserve.

#### Key to subtribes

1. Arista basally plumose, parafacial and gena often with black hairs; lateral plate of paraphallus ill-developed, short and slightly projecting; apical part of paraphallus separate; male with narrow frons ..... 2
- Arista almost bare, except for short-fine hairs; parafacial and gena without black hairs; lateral plate of paraphallus paried, large, well sclerotised, elongated and overlapping; apical part of paraphallus not separate; male with broad frons .....  
..... LEUCOMYIINA BRANER AND BERGENSTAMM
2. Penis short, heavily sclerotised; lateral plate of paraphallus well developed .....  
..... PARASARCOPHAGINA ROHDENDORF
- Penis very large, slightly sclerotised and vesiculate; lateral plate of paraphallus ill-developed ..... SENIORWHITEINA ROHDENDORF

#### Key to genera and species

1. Upper part of propleuron bare ..... 2
- Upper part of propleuron covered with black hairs, often rather densely so ..... 3
2. 3<sup>rd</sup> abdominal tergite with or without median marginal bristles and with lateral marginal bristles; ventralia lobbed or curved; lateral plate of paraphallus long, sclerotized and pointed at end ..... 4

- 3<sup>rd</sup> abdominal tergite normally without long bristles in the middle of posterior margin; penis with long, stalked ventralia; lateral plate of paraphallus unpaired with short stalked process and split at the end ..... 5
3. Paraphallus with curvature; 5th sternite with double rows of closely set bristles laterally on arms and few hairs apically; apical plate of paraphallus with pointed apex .....  
..... *Boettcherisca peregrina* (Robineau-Desvoidy)
- Paraphallus with no curvature; 5th sternite with a row of closely set bristles laterally and few hairs terminally on arms; apical plate of paraphallus with blunt apex .....  
..... *Boettcherisca bengalensis* Nandi
4. Apical plate of paraphallus wide and transparent; styli of glans stout but without serrations; ventralia with 1 anterior membranous median and 2 posterior chitinous lobes .....  
..... *Lioproctia lothianensis* Sinha and Nandi
- Apical plate of paraphallus with a backward projection; styli of glans serrated anteriorly; ventralia pointed, hook-like and curved anteriorly ... *Sinonipponia bengalensis* Nandi
5. Lateral plate of paraphallus single, long and without process but pedunculate; styli of glans very slender, never closely adjacent to apical plate of paraphallus; theca long ..  
..... 6
- Lateral plate of paraphallus rudimentary; apical plate of paraphallus with backwardly projecting spines; styli of glans well developed, divided into a pointed membranous portion and another having a rosette-like structure; theca shorter than paraphallus .....  
..... *Parasarcophaga (Liosarcophaga) ruficornis* (Fabricius)
6. Penis without membranous bulbous portion in between theca and paraphallus ..... 10
- Penis with membranous bulbous portion in between theca and paraphallus ..... 7
7. Hind tibia without bristles on antero-ventral surface in addition to long villosity .... 8  
Hind tibia with bristles on antero-ventral surface in addition to long villosity ..... 9
8. Body colour grayish; apical plate of paraphallus slender and sharply pointed at end; anterior lobes of ventralia short and less curved .....  
..... *Parasarcophaga (s.str.) sericea* (Walker)
- Body colour brown; apical plate of paraphallus broad and blunt at end; anterior lobes of ventralia deeply curved and moderately developed .....  
..... *Parasarcophaga (s.str.) hirtipes* (Wiedemann)
9. Apical plate of paraphallus short and almost blunt at end; inner forceps long and slender; anterior lobes of ventralia well developed and not so curved, posterior lobes short ..... *Parasarcophaga (s.str.) misera* (Walker)

- Apical plate of paraphallus long and sharply pointed at end; inner foreceps moderately stout and broad; ventralia with long stalked wide lobe and the anterior portion deeply curved ..... *Parasarcophaga (s.str.) albiceps* (Meigen)
- 10. Lateral plate of paraphallus with a single pair of lamellate process; basal part of paraphallus only moderately elongate ..... 11
- Lateral plate of paraphallus in the form of narrow stout process extending forward, lateral process of apical plate of paraphallus deeply bifurcated .....  
..... *Parasarcophaga (Curranea) scopariiformis* (Senior-White)
- 11. Lateral plate of paraphallus symmetrical, apical plate of paraphallus well developed 12
- Lateral plate of paraphallus asymmetrical, apical plate of paraphallus small and ill developed ..... 15
- 12. Apical plate of paraphallus slightly curved backwards; ventralia almost oval with wide trilobed; inner forceps with grooved apex .....  
..... *Parasarcophaga (Liosarcophaga) choudhuryi* Sinha and Nandi
- Apical plate of paraphallus more or less straight, ventralia plate-like, inner foreceps with slightly curved apex ..... 13
- 13. Apical plate of paraphallus bifurcated; styli of glans comb-like anteriorly; long terminal hairs on arms of 5<sup>th</sup> sternite may be present or absent ..... 14
- Apical plate of paraphallus long, pointed with a pair of slender subbasal lateral process; styli of glans long and pointed; 5<sup>th</sup> sternite with 2-3 long hairs terminally on arms ..  
..... *Parasarcophaga (Pandelleisca) bainbriggei* (Senior-White)
- 14. Apical plate of paraphallus with equal bifurcation; lateral plate of paraphallus short; ventralia with two process; one heavily sclerotized and the other membranous; 5<sup>th</sup> sternite with many long hairs terminally on arms .....  
..... *Parasarcophaga (Liosarcophaga) brevicornis* (Ho)
- Apical plate of paraphallus with unequal ends; lateral plate of paraphallus wide; ventralia wide, well developed and plate like; 5<sup>th</sup> sternite with one long hair terminally on arms  
..... *Parasarcophaga (Liosarcophaga) dux* (Thomson)
- 15. Styli of glans remain invaginated within the paraphallus .....  
..... *Seniorwhitea reciproca* (Walker)
- Styli of glans long ..... 16
- 16. Ventralia membranous and moderately long; apical plate of paraphallus short and anteriorly curved; styli of glans transversely striated ..... *Leucomyia cinerea* (Fabricius)

- Ventralia serrated, apical plate of paraphallus long and with a pair of posteriorly bent transparent membranous process ..... 17
17. Anterior paramere without bifurcation; styli of glans short; not very slender .....  
..... *Iranihindia futilis* (Senior-White)
- Anterior paramere bifurcated at end; styli of glans long, slender and blunt .....  
..... *Iranihindia indica* Nandi

### 1. *Boettcherisca peregrina* (Robineau-Desvoidy)

1830. *Myophora peregrina* Robineau-Desvoidy, *Mem. pres. div. Sav. Sci. Inst. Fr.*, (2) 2 : 356.
1830. *Myophora rapida* Robineau-Desvoidy, *Mem. pres. div. Sav. Acad. Sci. Inst. Fr.*, (2) 2 : 360.
1851. *Sarcophaga tritonia* Macquart, *Mem. Soc. Sci. Agric. Lille*, 4 : 234.
1923. *Sarcophaga hutsoni* Parker, *Ann. Mag. nat. Hist.*, (9) 11 : 127.
1937. *Boettcherisca peregrina*: Rohdendorf, *Fauna USSR, Dipt.*, 19(1) : 271 Nandi, 1992 *J. Beng. nat. Hist. Soc.*, 11(2) : 36.

*Material examined* : 8♂♂, Banijungle, 31.i.2000; 2♂♂, Gangasagar, 1.ii.2000; 3♂♂, Bhagabatpur 18.xii.2003; 2♂♂, Banijungle, 19.iii.2004.

*Distribution* : India : Several places of Assam, Himachal Pradesh, Karnataka, Kerala, Maharastra, Manipur, Nagaland, Tamilnadu, Uttatr Pradesh, West Bengal; Australia; Borneo; Fiji; Gilbert Islands; Guam; Hainan Island; Hawaiian Islands; Indonesia; Japan; Kiribati; Korea; Madagascar Malaysia; Mariana Islands; Mauritania; Mauritius; New Britain; New Zealand; Norfolk Island; Ogasawara (Gunto Island); Papua New Guinea; Polynesia (Society Islands); Samoa; Rduinion; Russia; Seychelles; Singapore; South China; Taiwan; Thailand and Volcano Islands.

*Bionomics* : This is a common species which was collected from bushes. It can be reared on decaying coconut leaflets, meat, dead *Achatina fulica* (Gastropoda), *Lepidiota pinguis* (Coleoptera) and rabbits. It has been reported as parasites on Lumbricid worms and grasshoppers. The larvae of this species may cause human tissue myiasis. They are attracted to dead bodies of different animals and *Aristolochia ridicula* flowers (Aristolochiaceae). The larvae of this species breed mainly in dead animals, garbages, privies and decaying animal matters around human dwellings.

### 2. *Boettcherisca bengalensis* Nandi

1992. *Boettcherisca bengalensis* Nandi, *J. Beng. nat. Hist. Soc.*, 11 (1) : 35.

*Material examined* : 2♂♂, Bamankhali, 1.ii.2000; 1♂, Gangasagar, 20.viii.2000, 2♂♂, Hingalganj, 12.xii.2001; 1♂ Sandeshkhali, 11.xi.2001; 1♂, Namkhana, 17.xii.2003.

**Distribution** : India : Several places of Gujrat, Maharastra, West Bengal.

**Bionomics** : This is a relatively rare species that was collected by bush sweeping.

### 3. *Lioproctia lothianensis* Sinha and Nandi

2002. *Lioproctia lothianensis* Sinha and Nandi, *Proc. Zool. Soc. Calcutta*, 55(2) : 39-41.

**Material examined** : Holotype : 1♂, Lothian island, 18.x.2000, B.C. Nandi and Shuvra Kanti Sinha.

**Distribution** : India : Sundarbans (Lothian island).

**Bionomics** : This species is attracted to dead fishes and was collected from semi-dried fishes in forest rest house campus.

### 4. *Sinonipponia bengalensis* Nandi

1977. *Sinonipponia bengalensis* Nandi, *Revta bras. Biol.*, 37 (1) : 79; Nandi and Ray, 1982, *Rec. zool. Surv. India*, 80 : 124.

**Material examined** : 1♂, Dhabhlat Sibpur, 31.i.2000; 1♂, Bhagabatpur, 18.xii.2003, 2♂♂, Namkhana, 17.xii.2003.

**Distribution** : India : Several places of Assam, Orissa, West Bengal.

**Bionomics** : This species was collected from bushes.

### 5. *Parasarcophaga (Liopygia) ruficornis* (Fabricius)

1794. *Musca ruficornis* Fabricius, *Ent. Syst.*, 4 : 314.

1851. *Sarcophaga ruficornis* : Macquart, *Mem. Soc. Sci. Agric. Lille*, : 206 (preoccupied, Fabricius, 1794).

1928. *Liopygia ruficornis* : Enderlein, *Arch. klassif. phylogen. Ent.*, 1(1) : 41.

1830. *Sarcophaga ruficornis* : Wiedemann, *Aussereurop. zweifl. Insekt.*, 2 : 361; Kano and Shinonaga, 1994, *Jap. J. sanit. zool.*, 45 : 261.

1945. *Parasarcophaga ruficornis* : Lopes, *Revta bras. Biol.*, 5(3) : 401; Kano, Field and Shinonaga, 1967, *Fauna Japonica, Sarcophagidae* : 74.

1963. *Parasarcophaga (Liopygia) ruficornis* : Rohdendorf, *Stuttg. Beitr. Naturk.*, 124 : 1-22.

**Material examined** : 3♂♂, Gangasagar 20.viii.2000; 2♂♂, Chota Mollakhali 7.xi.2001; 1♂, Gosaba, 8.xi.2001; 4♂♂, Bakkhali, 17.vii.2003, 3♂♂, Ghoramara island, 16.xii.2003.

**Distribution** : India : Several places of Andhra Pradesh, Assam, Bihar, Gujrat, Himachal Pradesh, Karnataka, Kerala, Manipur, Mizoram, Nagaland, Orissa, Tamilnadu, Uttar Pradesh, West Bengal; Borneo; Botswana; Brazil; Canada; Guam; Hainan Island; Hawaiian Islands;

Japan; Korea; Madagascar; Malaysia; Mariana Islands; Moluccas Islands; Myanmar; Nigeria; Panama; Papua New Guinea; Philippines; Saudi Arabia; Singapore; Socotra Island; South Africa; Taiwan; Thailand; Uganda; USA; Western Samoa and Zaire.

**Bionomics** : The larvae of this species can be reared on *Achatina fulica* (Gastropoda) and the larvae cause intestinal myiasis in man and occasionally dermal myiasis in domesticated animals like dogs and poultry. Zumpt (1965) reported it as a facultative myiasis producer and Roy and Dasgupta (1977) recorded it as a parasite of *Bufo melanostictus* (Amphibia). Nandi (1980) described in detailed the different larval stages. Das and Dasgupta (1986) reported a short account of the life history of this species. Nandi (1992) reared it on a dead *Calotes versicolor* from India.

### 6. *Parasarcophaga* (*s. str.*) *sericea* (Walker)

1852. *Sarcophaga sericea* Walker, *Ins. Saunders. Dipt.*, 4 : 326; Kano and Shinonaga, 1994 *Jap. J. sanit. Zool.*, 45 : 258.
1917. *Sarcophaga knabi* Parker, *Proc. U.S. natn. Mus.*, 54 : 96.
1921. *Sarcophaga* (*Parasarcophaga*) *omega* Johnston and Tieggs, *Proc. R. Soc. Qd.*, 33(4) : 86.
1921. *Sarcophaga froggatti* Johnston and Tieggs, *Proc. R. Soc. Qd.*, 33(4) : 73 (misidentification, not Taylor, 1917).
1924. *Sarcophaga knabi* var. *flavipalpis* Senior-White, *Rec. Indian Mus.*, 26(3) : 235.
1937. *Parasarcophaga* (*s. str.*) *knabi* : Rohdendorf, *Fauna USSR, Dipt.*, 19(1) : 202; Fan, 1965, *Synan. flies China*, 15 : 270; Lopes, Kano, Shinonaga and Kurahashi, 1977, *Cat. Dipt. Orient. Region*, 3 : 571; Nandi, 1991, *J. Beng. nat. Hist. Soc.*, 10(2) : 40.
1959. *Parasarcophaga* (*s. str.*) *omega* : Lopes, *Studia Ent.*, 2(1) : 57.
1962. *Parasarcophaga knabi* : Park, *Korean J. Zool.*, 5(2) : 39; Kano, Field and Shinonaga, 1967, *Fauna Japponica, Sarcophagidae* : 42; 1979. *Parasarcophaga* (*s. str.*) *sericea* : Lopes and Kano, *Revta bras. Biol.*, 39(2) : 307; Verves, 1986, *Cat. palae. Dipt.*, 12 : 171; Lopes, 1989 *Cat. Dipt. Aust. and Oceanian Regions*, 86 728; Nandi, 1992, *J. Beng. nat. Hist. Soc.*, 11(2) : 38.

**Material examined** : 5 ♂♂, Gangasagar, 20.vii.2000; 6 ♂♂, Bhagabatpur, 18.x.2000; 2 ♂♂, Satjelia, 7.xi.2001; 1 ♂, Sajnekhali, 6.xi.2001; 1 ♂, Bamankhali, 16.xii.2003; 1 ♂, Moushini island, 16.i.2002.

**Distribution** : India : Several places of Andaman, Andhra Pradesh, Bihar, Gujrat, Himachal Pradesh, Karnataka, Kerala, Manipur, Meghalaya, Mizoram, Orissa, Tamilnadu, Tripura, Uttar Pradesh, West Bengal; Australia; Borneo; Caroline Islands; China (Kwangtung); East Indies; Guam; Hainan Island; Indonesia; Irian Jaya; Korea; Malaysia; Mariana Islands; Marshall Islands; Micronesia; Papua New Guinea; Philippines; Pitcairn Islands; Russia; Singapore; Society Islands; Taiwan, Thailand and Western Samoa.

**Bionomics** : This is a fairly common species which is attracted to dead bodies of different animals, *Aristolochia ridicula* flowers (Aristolochiaceae) and *Achatina* sp. (Gastropoda). This species breeds in human excrement and carrion and may be reared on such media.

### 7. *Parasarcophaga* (s. str.) *hirtipes* (Wiedemann)

1830. *Sarcophaga hirtipes* Wiedemann, *Aussereurop. zweifl. Insekt.*, 2 : 361.  
 1843. *Sarcophaga fulvipalpis* Macquart, *Mem. Soc. Sci. Agric. Lille*, 2(3) : 255.  
 1928. *Ptilocnema miniaticauda* Enderlein, *Arch. klassif. phylgen. Ent.*, 1(1) : 43.  
 1934. *Sarcophaga dura* Curran, *Am. Mus. Nov.*, 727 : 12.  
 1937. *Parasarcophaga* (s. str.) *hirtipes* : Rohdendorf, *Fauna USSR, Dipt.*, 19(1) : 270; Nandi, 1992, *Proc. zool. Soc. Calcutta*, 45 (2) : 190.  
 1963. *Parasarcophaga* (s. str.) *africana*. Rohdendorf *Stuttg. Beitr. Naturk.*, 124 : 15.  
 1972. *Sarcophaga* (*Parasarcophaga*) *hirtipes* : Zumpt, *Explor. Proc. natn. Virunga.*, 101 : 79.

**Material examined** : 2♂♂, Kakdwip, 12.ix.2000; 3♂♂, Bamankhali, 31.i.2000; 1♂, Frazerganj, 17.iv.2000; 4♂♂, Baradapur, 18.xii.2003.

**Distribution** : India : Several places of Andhra Pradesh, Bihar, Gujrat, Karnataka, Kerala, Manipur, Misoram, Tamilnadu, Uttar Pradesh, West Bengal; Afghanistan; Algeria; Angola; Arabia; Azerbaijan; Botswana; Bulgaria; China; Egypt; Gambia; Guinea; Iran; Iraq; Israel; Jordan; Kazakhstan; Kenya; Kyrgyzstan; Lebanon; Liberia; Morocco', Namibia; Russia; Saudi Arabia; Senegal; South Africa; Sudan; Syria; Tajikistan; Tanzania; Turkey; Turkmenistan; Uganda; Uzbekistan; Zaire; Zambia and Zimbabwe.

**Bionomics** : This is a common species which is attracted to decomposing organic matters, human excrement and animal dung. The larvae of this species cause human intestinal myiasis. This species is also associated with *Escherichia anaerogenes*, *E. anindolica*, *E. coli* and *Aerobacter* sp. (Greenberg, 1971).

### 8. *Parasarcophaga* (s. str.) *misera* (Walker)

1849. *Sarcophaga misera* Walker, *List. dipt. Br. Mus.*, 4 : 829; Kano and Shinonaga, 1994, *Jap. J. sanit. Zool.*, 45 : 257.  
 1864. *Sarcophaga innotata* Walker, J, *Proc. Linn. Soc. Lond. Zool.*, 7 : 214.  
 1913. *Sarcophaga orchidea* Boettcher, *Annl. hist. nat-Mus. natn. hung.*, 11 : 375.  
 1921. *Sarcophaga gamma* Johnston and Tiegs, *Proc. R. Soc. Qd.*, 33(4) : 60.  
 1922. *Sarcophaga brunneopalpis* Johnston and Tiegs, *Proc. R. Soc. Qd.*, 34 : 184.  
 1924. *Sarcophaga hirtipes* var. *orchidea* Senior-White, *Rec. Indian Mus.*, 2(3) : 239; Senior-White, Aubertin and Smart, 1940, *Fauna Br. India, Dipt.*, 6 : 244.  
 1929. *Sarcophaga noumea* Curran, *Am. Mus. Nov.*, 375 : 11.

1967. *Parasarcophaga orchidea* : Kano, Field and Shinonaga, *Fauna Japonica*, Sarcophagidae, 7 : 44.  
 1979. *Parasarcophaga* (s. str.) *misera* : Lopes and Kano, *Revta bras. Biol.*, 39(2) : 309; Nandi, 1992, *J. Beng. nat. Hist. Soc.*, 11(2) : 38.

*Material examined* : 4♂♂, Gangasagar, 20.viii.2000; 1♂, Narayanpur, 16.iv.2000; 1♂, Satjelia, 2♂♂, Dwarik Jungle, 10.xi.2001; 4♂♂, Hingalgang, 12.xii.2001; 2♂♂, Bamankhali, 16.xii.2003.

*Distribution* : India : Several places of Andaman, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Gujrat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Nagaland, Orissa, Tamilnadu, Tripura, Uttar Pradesh, West Bengal; Afghanistan; Australia; Bonin Islands; Borneo; Caroline Islands; China; Hainan Island; Indonesia; Iran; Japan; Kiribati; Korea; Malaysia; Mariana Islands; Marshall Islands; New Caledonia, New Guinea; New Hebrides; Papua New Guinea; Philippines; Samoa; Singapore; South Korea; Sumatra; Taiwan and Thailand.

*Bionomics* : This is a very common species that is attracted to human excrement and dead animals. It breeds in human excrement, meat, dead animals and dead *Achatina fulica* (Gastropoda) and it has been reared on such media including beef in the laboratory. This species is attracted to *Aristolochia ridicula* flowers (Aristolochiaceae). The larvae of this species cause human intestinal myiasis and myiasis in domesticated and poultry animals. Adults are associated with *Entamoeba histolytica*, *Habronema megastoma*, *H. microstoma* and *H. muscae* (Greenberg, 1971).

#### 9. *Parasarcophaga* (s. str.) *albiceps* (Meigen)

1826. *Sarcophaga albiceps* Meigen, *Syst. Besch. zweifl. Insekt.*, 5 : 22, Kano and Shinonga, 1994, *Jap. J. sanit. Zool.*, 45 : 256.  
 1860. *Sarcophaga privigna* Rondani, *Atti Soc. ital. Sci. nat.*, 3 : 387.  
 1896. *Sarcophaga cyathisans* Pandelle, *Revta Ent.*, 15 : 191.  
 1905. *Sarcophaga pauciseta* Karmar, *Z. syst. Hymenopt. Dipterol.*, 5 : 331.  
 1928. *Thyrsocnema albiceps* : Enderlien, *Arch. Klassif. phylogen Ent.*, 1(1) : 43.  
 1934. *Sarcophaga hypopygium* Malloch, *Mem. Mus. Nat. Hist. Belg.*, 4(10) : 22.  
 1936. *Sarcophaga zethus* Curran, *Proc. Calif Acad. Sci.*, (4) 22 : 60.  
 1937. *Parasarcophaga albiceps* : Rohdendorf, *Fauna USSR, Dipt.*, 19(1) : 199; Darber-Monko, 1973, *Fragm. faun. Warsz.*, 19(7) : 200; Kano, Field and Shinonaga, 1967, *Fauna Japonica*, Sarcophagidae : 39; Pape, 1987, *Notul. ent.*, 67 : 45.  
 1992. *Parasarcophaga* (s. str.) *albiceps* : Nandi, *J. Beng. nat. Hist. Soc.*, 11(2) : 38.

*Material examined* : 1♂, Kakdwip, 12.ix.2000; 2♂♂, Krishnagar, 24.viii.2000; 2♂♂, Ghoramara Island, 18.iii.2004.

**Distribution** : India : Several places of Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Gujrat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharastra, Manipur, Mizoram, Orissa, Tamilnadu, Tripura, Uttar Pradesh, West Bengal; Albania; Armenia; Australia; Austria; Azerbaijan; Belgium; Borneo; Bulgaria; Byelorussia; Chech Republic; China (including Kwangtung); Finland; France; Germany; Great Britain; Greece; Gruzia; Hawaiian Islands; Hungary; Indonesia (Java); Ireland; Israel; Italy; Japan; Kazakhstan; Korea; Latvia; Malaysia; Maldiva; New Britain; New Guinea; Norway; Papua New Guinea; Philippines; Poland; Romania; Russia; Servia; Singapore; Slovakia; Solomon Islands; Sweden; Switzerland; Taiwan; Thailand; Turkey; Ukraine and United Kingdom.

**Bionomics** : This is a fairly common species that is attracted to excrement and dead bodies of different animals. The larvae breed from meat, beef, animals dung, human excrement, dead rabbit, humman carcasses and garbages. This species is preying on ant pupae (Senior-White, 1924) and is parasitic on *Nonagria* sp. (Noctuidae, Lepidoptera) and other lepidopterous and coleopteran larvae (Blackith and Blackith, 1994). The larvae of this species cause myiasis in bulls.

#### 10. *Parasarcophaga (Curranea) scopariiformis* (Senior-White)

1927. *Parasarcophaga dux* Thomson var. *scopariiformis* Senior-White, *Spolia zeylan.*, 14(2) : 82; Senior-White, Aubertin and Smart, 1940, *Fauna Br. India, Dipt.*, 6 : 269; Kano and Shinonaga, 1994, *Jap. J. sanit., Zool.*, 45 : 260.
1958. *Sarcophaga pingiana* Hsien, *Acta ent. sin.*, 8 : 80.
1965. *Parasarcophaga (Curranea) scopariiformis* : Fan, *Synan. flies China*, 15 : 276; Nandi, 1979, *Revta bras. Biol.*, 39 (2) : 459; Nandi, 1992, *J. Beng. nat. Hist. Soc.*, 11(2) : 37.
1977. *Parasarcophaga (Liosarcophaga) scopariiformis* : Lopes, Kano, Shinonaga and Kurahashi, *Cat. Dipt. Orient. Region*, 3 : 569; Verves, 1986, *Cat. Palae. Dipt.*, 12 : 168.

**Material examined** : 1♂, Bani Jungle, 31.i.2000; 2♂♂, Gangasagar, 1.ii.2000; 1♂, Sandeshkhali, 11.xi.2001; 2♂♂, Namkhana, 17.xii.2003; 1♂, Bani Jungle, 19.iii.2004.

**Distribution** : India : Several places of Assam, Karnataka, Kerala, Manipur, Mizoram, Nagaland, Tamilnadu, West Bengal; China; Hainan Island; Kenya; Laos; Malaysia; Singapore; Taiwan; Thailand and Vietnam.

**Bionomics** : This species is not so abundant which was collected from bushes near human excrement.

#### 11. *Parasarcophaga (Liosarcophaga) choudhuryi* Sinha and Nandi

2002. *Parasarcophaga (Liosarcophaga) choudhuryi* Sinha and Nandi, *Rec. zool. Surv. India*, 100(3-4) : 117-121.

**Material examined :** *Holotype* : 1 ♂, Sagar Island; Bani Jungle, 24.xi.2000, B.C. Nandi and Shuvra Kanti Sinha; 2 ♂ ♂, *Paratypes*, same data as *Holotype*; *Allotype* 1 ♂, Bani Jungle, 24.xi.2000, B.C. Nandi and Shuvra Kanti Sinha; 1 ♂, Fraserganj, 26.xi.2000, B.C. Nandi and Shuvra Kanti Sinha.

**Distribution :** India : Sundarbans (Bani Jungle and Fraserganj).

**Remark :** Provisionally, we are placing this species under the genus *Parasarcophaga* Johnston and Tieg, 1921 on account of long 3rd antennal segment, serrated styli of glans and well-developed and complex apical plate of paraphallus. The structure of ventralia is more massive here than in any other species of the genus. This species is almost similar to *Parasarcophaga (Liosarcophaga) angarosinica* Rohdendorf, 1937, but differs from it by the structures of ventralia and lateral plate of paraphallus. Moreover, the styli of glans are more elongated here.

This species is named in honour of Prof. Amallesh Choudhury, renowned scientist and mangrove specialist and former Prof. and Head of the Department of Marine Science, Calcutta University, Kolkata.

**Bionomics :** This species was collected from bushes near dead mollusca.

## 12. *Parasarcophaga (Pandelleisca) bainbriggei* (Senior-White)

1924. *Sarcophaga bainbriggei* Senior-White, *Rec. Indian Mus.*, 26(3) : 212; Senior-White, Aubertin and Smart, 1940, *Fauna Br. India, Dipt.*, 6 : 274.

1924. *Sarcophaga fletcheri* Senior-White, *Rec. Indian Mus.*, 26(3) : 254 (preoccupied, Aldrich, 1916).

1977. *Parasarcophaga (Pandelleisca) bainbriggei* : Lopes, Kano, Shinonaga and Kurahashi, *Cat. Dipt. Orient. Region*, 3 : 570; Nandi, 1977, *Rec. zool. Surv. India*, 73 : 214; Nandi, 1989, *Mems Inst. Oswaldo Cruz*, 84(4) : 397; Nandi, 1990, *Hexapoda*, 2 : 25.

**Material examined :** 1 ♂, Bamankhali, 1.ii.2000; 2 ♂ ♂, Ghoramara island, 4.xi.1999; 1 ♂, Namkhana, 17.xii.2003; 2 ♂ ♂, Bhagabatpur, 18.xii.2003.

**Distribution :** India : Several places of Assam, Bihar, Himachal Pradesh, Karnataka, Orissa, Tamilnadu, Tripura, West Bengal.

**Bionomics :** It is relatively rare species which was collected from bushes near human excrement. This species is attracted to human excrement and breed from such media.

## 13. *Parasarcophaga (Liosarcophaga) brevicornis* (Ho)

1934. *Sarcophaga brevicornis* Ho, *Bull. Fan meml Inst. Biol.*, 5(1): 33; Senior-White, Aubertin and Smart, 1940, *Fauna Br. India, Dipt.*, 6 : 262; Kano and Shinonaga, 1994. *Jap. J. sanit. Zool.*, 45 : 260.

1937. *Parasarcophaga (Liosarcophaga) brevicornis*: Rohdendorf, *Fauna USSR, Dipt.*, 19(1) : 222; Nandi, 1992, *J. Beng. nat. Hist. Soc.*, 11(2) : 37.

1977. *Parasarcophaga brevicornis*: Park, *Bull. Tokyo med. dent. Univ.*, 24 (4) : 260, Kano, Field and Shinonaga, 1967, *Fauna Japonica, Sarcophagidae* : 50.

*Material examined* : 4♂♂, Jambu island, 1.xii.1999; 3♂♂, Gangasagar, 1.ii.2000; 3♂♂, Bagabatpur, 19.x.2000; 2♂♂, Canning, 7.ii.2000; 3♂♂, Chandanpiri, 20.x.2000; 2♂♂, Jharkhali, 8.xi.2001; 2♂♂, Basanti, 11.xii.2001, 3♂♂, Gangasagar, 16.xii.2003.

*Distribution* : India : Several places of Andaman, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Gujrat, Himachal Pradesh, Madhya Pradesh, Maharastra, Mizoram, Orissa, Tamilnadu, West Bengal; Australia; Borneo; China; Hainan Island; Indonesia; Japan; Malaysia; Philippines; Russia; Singapore; South Korea; Taiwan and Thailand.

*Bionomics* : This species is not so abundant which was collected from bush-sweeping near dead bodies. The larvae of this species develop in dead fish, meat and different vertebrate animal carcasses in nature and are easily reared in meat in the laboratory.

#### 14. *Parasarcophaga (Liosarcophaga) dux* (Thomson)

1869. *Sarcophaga dux* Thomson, *K. svenska Vetensk Akad. fregatten Eugenie resa omkring jorden*, 2(1) : 534; Kano and Shinonaga, 1994, *Jap. J. Sanit. Zool.*, 45 : 259.

1896. *Sarcophaga exuberans* Pandelle, *Revta Ent.*, 15 : 186.

1917. *Sarcophaga subtuberosa* Parker, *Proc. U. S. natn. Mus.*, 54 : 89.

1919. *Sarcophaga dux luzonensis* Parker, *Bull. Brooklyn ent. Soc.*, 14 : 43.

1923. *Sarcophaga Sri Lankaensis* Parker, *Ann. Mag. nat. Hist.*, (9) 11 : 125; Povolny', 1987, *Acta ent. Mus. natn. Prague*, 42 : 159.

1923. *Sarcophaga craggi* Parker, *Ann. Mag. nat. Hist.*, 9(11) : 126.

1937. *Parasarcophaga (Liosarcophaga) misera* : Rohdendorf, *Fauna USSR, Dipt.*, 19(1) : 223 (misidentification, not Walker, 1849).

1964. *Sarcophaga exuberansoides* Zumpt, *Verh. naturf. Ges. Basel*, 75 : 70.

1977. *Parasarcophaga (Liosarcophaga) dux* : Nandi, *Rec. zool. Surv. India*, 73: 214; Nandi, 1992. *J. Beng. nat. Hist. Soc.*, 11(2) : 37.

*Material examined* : 5♂♂, Jmbu island, 1.xii.1999; 3♂♂, Gangasagar, 1.ii.2000; 4♂♂, Canning, 7.ii.2000; 6♂♂, Hingalganj, 12.xii.2001; 2♂♂, Gangasagar, 16.xii.2003; 2♂♂, Frascrganj, 17.xii.2003.

*Distribution* : India : Several places of Andaman, Andhra Pradesh, Arunachal Pradesh, Bihar, Gujrat, Jammu & Kashmir, Karnataka, Kerala, Manipur, Maghalaya, Mizoram, Orissa, Tamilnadu, Tripura, Uttar Pradesh, West Bengal; Albania; Australia; Austria; Azerbaijan; Azores; Bismarck Archipelago; Bonin Islands; Borneo; Bulgaria; Cape Verde Islands; Caroline

Islands; China; Christmas Island; Cyprus; Croatia; Czech Republic; Denmark; Egypt; Fiji; Finland; France; Germany; Great Britain; Greece; Gruzia; Guam; Hainan Island; Hawaiian Islands; Hungary; Indonesia (Irian Jaya); Israel; Italy; Japan (including Ryukyu Islands; Kazakhstan; Kiribati; Madagascar; Malta; Mariana Islands; Marshall Islands; Micronesia; Mongolia; New Guinea; Niue; Palau; Philippines; Poland; Pitcairn Islands; Romania; Russia; Serbia; Singapore; Slovakia; South Korea; Spain; Sweden; Switzerland; Tajikistan; Taiwan; Thailand; Turkmenistan; Ukraine; Uzbekistan; Wake Islands and Western Samoa.

**Bionomics** : This species is abundantly available, attracted to human excrement and dead bodies of different animals and was mostly collected from bushes.

### 15. *Seniorwhitea reciproca* (Walker)

1856. *Sarcophaga reciproca* Walker, J. Proc. Linn. Soc. Lond., Zool., 1 : 22.  
 1912. *Sarcophaga krameri* Boettcher, Ent. Mitt., 1 : 166.  
 1924. *Sarcophaga orientaloides* Senior-White, Rec. Indian Mus., 26(3) : 244; Senior-White, 1930, Rec. Indian Mus., 32 : 73.  
 1932. *Sarcophaga procax* Seguy, Bull. mens. Ass. Nat. Vall. Loing., 8 : 23.  
 1965. *Seniorwhitea orientaloides*: Fan, Synan. Flies China, 15 : 260.  
 1977. *Seniorwhitea krameri*: Lopes, Kano, Shinonaga and Kurahashi, Cat. Dipt. Orient. Region, 3 : 581.  
 1979. *Seniorwhitea reciproca*: Lopes and Kano, Revta brasil Biol., 39(2) : 315; Verves, 1986, Cat. Palae. Dipt., 12 : 179, Nandi, 1992, J. Beng. Nat. Hist. Soc., 11(2) : 44.  
 1984. *Harpagophalla reciproca* : Sugiyama and Kano, Jap. J. sanit. Zool., 35 (4) : 349.

**Material examined** : 5♂♂, Gangasagar, 1.ii.2000; 3♂♂, Bamankhali, 21.x.2000, 4♂♂, Gangasagar, 26.i.2002; 1♂, Kacchuberia, 16.xii.2003; 4♂♂, Sudanyakhali, 6.xi.2001; 10♂♂, Gosaba, 8.xi.2001; 5♂♂, Bakkhali, 17.xii.2003; 2♂♂, Bhagabatpur, 18.xii.2003.

**Distribution** : India : Several places of Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Gujrat, Hariyana, Himachal Pradesh, Manipur, Mizoram, Nagaland, Orissa, Puajab, Tamilnadu, Uttar Pradesh, West Bengal; China, France; Hainan Island; Hawaiian Islands; Indonesia; Laos; Malaysia; Singapore; Taiwan and Thailand.

**Bionomics** : This is a common species which was collected from dead fish, dead animals and other decaying organic matters. This species is attracted to *Aristolochia ridicula* flowers (Aristolochiaceae), human excrement and dead *Achatina* sp. (Gastropoda). The larvae of this species breed in dead *Achatina fulica*, grasshoppers, sphingid and other lepidopterous and lepidiota larvae. It is recorded as a parasite, the larvae feeding on the waxy secretion of a Fulgorid (Hemiptera) and on a Noctuid (Lepidoptera).

16. *Leucomyia cinerea* (Fabricius)

1794. *Musca cinerea* Fabricius, *Ent. syst.*, 4 : 331.  
 1868. *Sarcophila alba* Schiner, *Reise Novara*, Dipt., 6 : 315.  
 1891. *Leucomyia cinerea* Brauer and Bergenstamm, *Denkschr. Akad. Wiss. Wien. KL. naturw.*, 58 : 368  
 Kano, Field and Shinonaga, 1967, *Fauna Japonica*, Sarcophagidae 36.  
 1924. *Sarcophila cinerea* Senior-White, *Rec. Indian Mus.*, 26(3) : 257; Senior-White, Aubertin and Smart,  
 1940, *Fauna Br. India*, Dipt., 6 : 227.  
 1984. *Sarcophaga cinerea*: Sugiyama and Kano, *Jap. J. sanit. Zool.*, 35(4) : 350.

**Material examined** : 20♂♂, Jambu island, 1.xii.1999; 16♂♂, Gangasagar, 1.ii.2000; 12♂♂, Gangasagar, 16.i.2002.

**Distribution** : India : Several places of Andhra Pradesh, Karnataka, Kerala, Orissa, Pondicherry, Tamilnadu, Uttar Pradesh, West Bengal; China; Japan (including Ruykyu Islands); Laos; Philippines; Taiwan and Thailand.

**Bionomics** : This is a relatively common species which was collected from weeds, rocks and bushes on sea shore and also from dead animals and other organic debris. It is entirely restricted to the sea-shore species and has been reported as the prey of *Cicindela biramosa* (Coleoptera). The larvae are found on dead animals on the sea-shore and the species are reared on dead fishes, birds and mammals.

17. *Iranihindia futilis* (Senior-White)

1924. *Sarcophaga futilis* Senior-White, *Rec. Indian Mus.*, 26(3) : 246; Senior-White, Aubertin and Smart, 1940, *Fauna Br. India*, Dipt., 6 : 257.  
 1961. *Iranihindia futilis*: Rohdendorf, *Stuttg. Beitr. Naturk.*, 58 : 2; Nandi, 1979, *Orient. Insects*, 13(1-2); 206; Nandi, 1992, *Hexapoda*, 4(1) : 76.

**Material examined** : 1♂, Bamankhali, 31.i.2000; 1♂, Kalinagar, 10.xi.2001.

**Distribution** : India : Several places of Andhra Pradesh, Assam, Bihar, Gujrat, Karnataka, Kerala, Maharastra, Mizoram, Orissa, Tamilnadu, Tripura, Uttar Pradesh, West Bengal; Sri Lanka.

**Bionomics** : This is a common species which was collected from bushes, grasses and flowering plants. Probably this species is attracted to nectar.

18. *Iranihindia indica* Nandi

1979. *Iranihindia indica* Nandi, *Orient. Insects*, 13(1-2) : 211; Nandi, 1990, *Hexapoda*, 2 : 27.

**Material examined** : 1♂, Jharkhali, 8.xi.2001; 2♂♂, Bakkhali, 17.xi.2003.

**Distribution** : India : Several places of Bihar, West Bengal.

**Bionomics** : This is a relatively rare species which was collected from bushes and flowering plants near human excrement.

### Family CALLIPHORIDAE

Calliphorid flies commonly known as blowflies are very important in medical, veterinary, forensic and agricultural sciences. These flies are distributed in all zoogeographical regions. They carry the germs of different types of bacteria, viruses, protozoa and helminthes that cause enteric diseases in man and other animals (Greenberg, 1971). Some larvae are parasitic on earthworms, snails, toads, frogs, nesting birds and other live stock (Draber-Monko, 1981; Rognes, 1992) Roy and Dasgupta, (1971) studied the behaviour of *Chrysomya megacephala* (Fabr.) and *Hemipyrellia ligurriens* (Wied.) as parasites of living animals like Earthworm, Cockroach, Land snail, Catfish, Toad, Frog, Wall-lizard, Pigeon and Shrew, under experimental condition and concluded that *Chrysomya megacephala* may assume a totally parasitic mode of life. Some blowflies can cause myiasis in domesticated animals like Cow, Pig, Sheep, Buffalo, Horse, Dog, Camel, Donkey, Goat and Fowl. (Roy and Dasgupta, 1982). Larvae of *Chrysomya megacephala* (Fabricius) and *Lucilia cuprina* (Wiedemann) also cause huge economic loss by lowering the production of dried fish industry in southeast Asia (Esser, 1991) and in Sundarbans Biosphere Reserve, (Sinha and Nandi, 2003). Few blowfly larvae (*Phaenicia sericata*, *Phormia regina*, *Lucilia illustris*) can be used for the treatment of Osteomyelitis and at present is also being used in cases where antibiotics are ineffective and Surgery is impracticable (Stewart, 1934; Sherman and Pecher, 1988). *Phaenicia cuprina*, *Phaenicia sericata*, *Chrysomya megacephala*, *Chrysomya bezziana*, *Chrysomya rufifacies* are facultative ectoparasites in living tissues and cause tissue myiasis in man and animals (Pont, 1980; Hall and Wall, 1994; James and Harwood, 1979). Some calliphorid larvae are parasitic on bird (Walter, 1990; Iwasa and Hori, 1990). Larvae of *Chrysomya megacephala*, *Chrysomya pinguis*, *Chrysomya rufifacies*, *Hemipyrellia ligurriens*, *Lucilia cuprina* and *Lucilia porphyrina* are useful in investigation of untimely death of a person in murder case and they are helpful in forensic science (Smith, 1986). Very little is known about the Calliphorid flies from Sundarbans Biosphere Reserve, except Majumder and Parui (2001) who reported only 2 species from this area. These flies are abundant in different parts of this Biosphere Reserve.

The present author reported a total of 9 species of family Calliphoridae under 4 genera from this Biosphere Reserve.

Classification is followed here after Kano and Shinonaga (1968) and terminology used in the text are from Kano and Shinonaga (1968) and Rognes (1992).

**Key to subfamily**

- 1. Body colour grayish to brown; suprasquamal ridges not hairy ..... BENGALIINAE
- Body colour metallic; susprasquamal ridges hairy ..... 2
- 2. Stem vein without setae on dorsal surface; ventralia with denticle ..... LUCILIINAE
- Stem vein with setae on dorsal surface; ventralia circular ..... CHRYSOMYINAE

**Key to genera and species**

- 1. Propleuron hairy ..... 2
- Propleuron not hairy ..... 6
- 2. Medium to small flies, 6-10 mm; Supraspiracular convexity clothed with long, upstanding fine hairs, acrophallus long, projection on distal part of paraphallus very strong .....  
..... *Hemipyrellia ligurriens* (Wiedemann)
- Medium to small flies, 5-11 mm; Supraspiracular convexity bare or pubescent; acrophallus short or long; projection on distal part of paraphallus not very strong ..... 3
- 3. Lower squama without hairs on upper surface; Sternopleural bristles 2 + 1; hypophallus well sclerotized and denticulate ..... 4
- Lower squama without hairs on upper surface; Sternopleural bristles 1 + 1; hypophallus more or less circular ..... 7
- 4. Acrophallus long; apical portion of outer forceps curved .....  
..... *Lucilia (s.str.) papuensis* (Macquart)
- Acrophallus short; apical porition of outer forceps not so curved ..... 5
- 5. Acrophallus wide and strong ..... *Lucilia (s.str) cuprina* (Wiedemann)
- Acrophallus with a ventral projection ..... *Lucilia (s.str.) sericata* (Meigen)
- 6. Dorsocentral bristles 2 + 2; terminalia with a very distinct short thumblike process on anterior margin of posterior paramere; inner forceps with blunt tip .....  
..... *Bengalia torosa* (Wiedemann)
- Dorsocentral bristles 2 + 3; terminalia with hariy ventralia; paraphallus characterstic with finger like processes; inner foceps gradually ponted and long .....  
..... *Bengalia bezzii* Senior-White

7. Eye facets small and uniform; gena dark brown with silvery pollinosity; dorsocentral bristles 3 + 3; no gap in between inner forceps; outer forceps slender and curved distally; ventralia more or less circular with some denticles; acrophallus wide or curved ..... 8
- Eye facets of upper 2/3rd enlarged in male; gena yellow-orange; dorsocentral bristles 2 + 3; inner forceps separated, outer forceps short and blunt; ventralia circular; acrophallus long with some inconspicuous denticles ..... *Chrysomya megacephala* (Fabricius)
8. Acrophallus slightly curved ..... *Chrysomya rufifacies* (Macquart)
- Acrophallus wide at end and with a wide stalked projection posteriorly ..... *Chrysomya indica* Sinha and Nandi

### 1. *Hemipyrellia ligurriens* (Wiedemann)

1830. *Musca ligurriens* Wiedemann, *Auss. zweiflug. Ins.*, 2 : 655.

2000. *Hemipyrellia ligurriens* : Nandi, *Rec. zool. Surv. India*, 98(4) : 3.

*Material examined* : 11 ♂♂, Gangasagar, 20.viii.2000; 2 ♂♂, Narayanpur, 16.iv.2000; 12 ♂♂ Bhagabatpur, 18.x.2000; 5 ♂♂, Chotomollakhali, 7 ♂♂, xi.2001; 6 ♂♂, Satjelia, 7.xi.2001; 2 ♂♂, Sajnekhali, 6.xi.2001; 2 ♂♂, Kalinagar, 18.xi.2001; 3 ♂♂, Dwarikjungle, 10.xi.2001; 19 ♂♂, gosaba, 8.xi.2001; 2 ♂♂, Hingalganj, 12.xii.2001; 5 ♂♂, Bamankhali, 16.xii.2003; 1 ♂, Bakkhali, 17.xii.2003; 6 ♂♂, Ghoramara island, 15.i.2002; 3 ♂♂, Moushini island, 16.i.2002.

*Distribution* : India : Several places of Assam, Bihar, Sikkim, Tamilnadu, West Bengal; Australia; China; Indonesia; Japan; Korea; Laos; Malaysia; Papua New Guinea; Philippines; Singapore; Sri Lanka; Taiwan; Thailand; VietNam.

*Bionomics* : This is a scavenger species and is mostly available in carcasses and human excrement. The adult flies are regarded as the most potential vector of enteric pathogens because they visit both human food for consumption and excrement and the larvae with parasitic adaptation are able to utilize pre-existing wounds under laboratory conditions (Roy and Dasgupta, 1971). The larvae are also parasitic on different animals.

### 2. *Lucilia* (s. str.) *papuensis* (Macquart)

1849. *Musca metilia* Walker, *List dipt. Coll Br. Mus.*, 4 : 898.

1852. *Musca inducta* Walker, *Insecta Saundersina.*, 4 : 335.

1887. *Somomyia nebulosa* Bigot, *Bull. Soc. Zool. Fr.* 12 : 604.

1843. *Lucilia papuensis* Macquart, *Mem. Soc. Sci. Agric. Lille.*, 2 (3) : 298.

1997. *Lucilia (s.str.) papuensis* : Nandi and Bhattacharya, *J. Beng. Nat. Hist. Soc.*, 16(2) : 23.

**Material examined** : 3♂♂, Kakdwip, 12.ix.2000; 1♂, Bamankhali, 31.i.2000; 3♂♂, Krishnagar, 24.viii.2000; 3♂♂, kakdwip, 12.ix.2000; 2♂♂, Frasersganj, 17.iv.2000, 3♂♂, Ghoramara island, 18.iii.2004, 2♂♂, Baradapur, 18.xii.2003, 3♂♂, Bhagabatpur, 18.xii.2003, 2♂♂, Kakdwip, 14.i.2002.

**Distribution** : India : Several places of Arunachal Pradesh, Jammu & Kashmir, Kerala, Meghalaya, Tamilnadu, West Bengal; Australia; China; Indonesia; Japan; Laos; Malyasia; Papua New Guinea; Philippines; Sri Lanka; Taiwan; Thailand; Vietnam.

**Bionomics** : This is a scavenger species and is mostly available in carcasses and human excrement. The adult flies are regarded as the most potential vector of enteric pathogens because they visit both human food for consumption and excrement and the larvae with parasitic adaptation are able to utilize pre-existing wounds under laboratory conditions (Roy and Dasgupta, 1971). The larvae are also parasitic on different animals.

### 3. *Lucilia(s.str.) cuprina* (Wiedemann)

1830. *Lucilia amica* Robineau-Desvoidy, *Mem. pres. div. Sav. Acad. Sci. Inst.Fr.*, 2 : 453.

1852. *Musca serenissima* Walker, *Insecta Saundersiana*, 4 : 340.

1924. *Strongyloneura nigricornis* Senior-White, *Spolia zeylan.*, 13 : 115.

1830. *Musca cuprina* Wiedemann, *Auss. Zweiflug Ins.*, 2 : 654.

2002. *Lucilia (s. str.) cuprina* : Nandi, *Rec. zool. Surv. India*, 100(1-2) : 121.

**Material examined** : 8♂♂, Banijungle, 31.i.2000; 15♂♂, Gangasagar, 1.ii.2000; 3♂♂, Dhablat Sibpur, 31.i.2000; 7♂♂, Jambu island, 16.ii.2001, 3♂♂, Banijungle, 14.i.2002; 2♂♂, Bhagabatpur, 18.xii.2003; 6♂♂, Baradapur, 18.xii.2003; 2♂♂, Banijungle, 19.iii.2004.

**Distribution** : India : Several places of West Bengal; Africa; Australia; Cambodia; China; Japan; Korea; Laos; North and South America; Taiwan; Vietnam.

**Bionomics** : This is a scavenger species and is primary facultative ectoparasite which are mostly available in dead bodies of different animals. The adults are associated with *Escherichia coli*, *Proteus mirabilis*, *Proteus morgani*, *Proteus rettger*, *Proteus vulgaris* and *Ascaris lumbricoides* and may cause dysentery to human beings. They also carry *Morganella* sp.(Kano and Shinonaga, 1968). The larvae cause external myiasis in sheep, toad, and wound myiasis in man and other warm-blooded vertebrates. They are obligate parasite in living tissue and may cause melign tissue myiasis in man. This species is very notorious sheep maggots in Australia and cause wide loss of sheep. This species is suspected to transmit *Poliomyelitis* virus to human beings (Rognes, 1991).

#### 4. *Lucilia (s.str.) sericata* (Meigen)

1843. *Lucilia flavipennis* Macquart, *Mem. Soc. Sci. Agric. Lille.*, 2(3) : 296.  
 1826. *Musca sericata* Meigen, *Syst. Besch. europ. zweifl. Insekt.*, 5 : 53.  
 1830. *Lucilia modesta* Robineau-Desvoidy, *Essai Myod.*, 24 : 454.  
 1896. *Lucilia sericata* : Pandelle', *Rev. Ent.*, 15 : 219.  
 1926. *Phaenicia sericata* : Malloch, *Ann. Mag. Nat. Hist.*, 17(9) : 506.  
 1997. *Lucilia (s.str.) sericata* : Nandi, *J. Beng. Nat. Hist. Soc.*, 16(2) : 67.

*Material examined* : 2 ♂♂, Bamankhali, 1.ii.2000; 3 ♂♂, Ghomara island, 4.xi.1999; 2 ♂♂, Gangasagar, 20.vii.2000; 1 ♂, Dhablat Sibpur, 31.i.2000; 2 ♂♂, Hingalganj, 12.xii.2001; 1 ♂, Sandeshkhali, 11.xi.2001; 3 ♂♂, Kakdwip, 27.i.2002; 4 ♂♂, Namkhana, 17.xii.2003; 2 ♂♂, Bhagabatpur, 18.xii.2003.

*Distribution* : India : Several places of West Bengal; Viet Nam; widely distributed in the temperate regions of the world.

*Bionomics* : This is a synanthropic and domestic species and mostly available not so far from human dwellings. It is an important primary facultative ectoparasite. The dispersal rate showed by *Lucilia sericata* was approximately 350 m per day, and the population could spread, therefore, at a maximum rate of 31-42 km. per year (Smith and Wall, 1998). Greenberg (1971) reported its biological association with several species of *Poliovirus*, *Proteus*, *Coxsackievirus*, *Flavobacterium*, *Aerobacter*, *Serratia*, *Enterococcus*, *Pneumonia*, *Salmonella*, *Shigella*, *Herpatomonas*, *Clostridium*, *Staphylococcus*, *Streptococcus*, *Bacillus*, *Escherichia*, *Leptospira*, *Crithidia*, *Entamoeba*, *Toxoplasma*, *Trichuris*, *Ancylostoma*, *Mycobacterium* and *Ascaris*. They also carry *Morganella* sp. (Kano and Shinonaga, 1968). The larvae cause wound myiasis in man and other animals and are serious sheep pest in Africa, Britain, Europe and Australia causing myiasis. This is an important economic and welfare problem in many areas (MacLeod, 1943; Wall et al. 1992a; Fisher et al. 1998). The larvae have been used in surgical cases and its role has been discussed by Stewart (1934). They have also forensic importance because the larvae can be used to detect the approximate time of death of a person in murder case. It is mere dangerous fly under condition of poor sanitation. Attack by *Lucilia sericata* increases body temperature, decline in food intake, that leading to weight loss and if, untreated, death of the host from anaemia and toxemia (Broadmeadow et al., 1984).

#### 5. *Bengalia torosa* (Wiedemann)

1819. *Musca torosa* Wiedemann, *Zool. Mag. Keil.*, 1(3) : 21.  
 1830. *Musca testacea* Robineau-desvoidy, *Mem. Pres. div. Sav. Aead. Sci. Inst. Fr.*, 2 : 426.  
 1843. *Anisomyia lateralis* Macquart, *Mem. Soc. Sci. Agric. Lille.* 1842 : 277.

1887. *Ochromyia quadrinotata* Bigot, *Bull. Soc. zool. Fr.* 12 : 608.

1924. *Bengalia jejuna* Senior-White, *Spolia zeylan.*, 13 : 104.

1940. *Bengalia jejuna* Senior-White, Aubertin and Smart, 1940 : 88.

1977. *Bengalia torosa* : James, *Cat. Dipt. Orient. Region*, 3 : 530.

1994. *Bengalia torosa* Kurahashi and Thapa, *Jap. J. sanit. Zool.*, 45 : 219.

*Material examined* : 4♂♂, Bakkhali, 8.vii.2002, 3♂♂, Kakdwip, 20.vi.2001.

*Distribution* : India : Several places of Bihar, Karnataka, Kerala, Pondicherry, Sikkim, Tamilnadu, Uttaranchal, Uttar Pradesh, West Bengal; Australia; Bangladesh; Indonesia; Japan; Laos; Malaysia; Nepal; Pakistan; Philippines; South China; Sri Lanka; Taiwan; Thailand.

*Bionomics* : Life history is unknown but probably covers a long period. They are oviparous and usually found on litter substances and on ground surface on forest area. They are also found on and near termitarium. The adult flies fly silently and shade-lover. They avoid mid day sunlight. In laboratory, Sugar solution, fruit (mango), broiler chicken meat and fresh water fishes were offered to the adult flies and they used those materials as food. But the flies did not breed in laboratory. Often ant pupae and eggs were offered to the adults in laboratory to observe their natural feeding practice with strong raptorial and sucking proboscis. In laboratory an adult female fly survived for about 55 days and male fly survived a period for about 42 days.

### 6. *Bengalia bezzii* Senior-White

1924. *Bengalia bezzii* Senior-White, *Spolia zeylan.*, 12 : 306.

*Material examined* : 2♂♂, Bamankhali, 8.vii.2002, 1♂, Beguakhali, 7.vii.2002.

*Distribution* : India : Several places of Orissa, Tamilnadu, West Bengal, China; Indonesia; Japan; Laos; Malaysia; Philippines; Singapore; Sri Lanka; Thailand; Vietnam.

*Bionomics* : Adults are found on litter substance and on herbs in forest. They fly silently covering a small distance. Life cycle still unknown, but adults prey on ant pupae or eggs.

### 7. *Chrysomya megacephala* (Fabricius)

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

1830. *Chrysomya duvaucelii* Robineau-Desvoidy, *Mem. Pres. div. Sav. Acad. Sci. Inst. Fr.*, : 451.

1843. *Lucilia flaviceps* Macquart, *Mem. Soc. Agric. Lille.*, 2(3) : 302.

1849. *Musca bata* Walker, *List Dipt. Colln Br. Mus.*, 4 : 875.

2000. *Chrysomya megacephala* : Nandi, *Rec. zool. Surv. India*, 98(4) : 4.

2001. *Chrysomya megacephala* : Kurahashi and Chowanadisai., *Species Diversity*, 6 : 213.

**Material examined** : 31 ♂♂, Jambu island, 1.xii.1999; 12 ♂♂, Gangasagar, 1.ii.2000; 7 ♂♂, Dhablatsibpur, 31.i.2000; 18 ♂♂, Kakdwip, 3.xi.1999; 16 ♂♂, Kakadwip, 16.iv.2000; 13 ♂♂, Namkhana, 16.iv.2000; 8 ♂♂, Bhagbatpur, 19.x.2000. 4 ♂♂, Mohisani island, 12.xi.2000; 11xi, Canning 7.ii.2000; 16 ♂♂, Frasersganj, 17.iv.2000; 4 ♂♂, Chandanpiri, 20.x.2000; 14 ♂♂, Gangasagar, 1.ii.2000; 2 ♂♂, Lothian island, 18.x.2000; 9 ♂♂, Sundnyakhali, 6.xi.2001; 4 ♂♂, Kalinagar, 10.xi.2001; 8 ♂♂, Jharkhali 8.xi.2001; 10 ♂♂, Basanti, 1.xii.2001; 22 ♂♂, Gosaba, 8.xi.2001; 6 ♂♂, Hingalganj, 12.xii.2001; 9 ♂♂, Sajnekhali, 6.xi.2001; 5 ♂♂, Chottomollakhali, 7.xi.2001; 16 ♂♂, Najat, 10.xi.2001; 8 ♂♂, Sandeshkhali, 11.xi.2001; 11 ♂♂, Gangasagar, 16.xii.2003; 8 ♂♂, Frasersganj, 17.xii.2003; 9 ♂♂, Bakkhali, 17.xii.2003; 10 ♂♂, Baradapur, 18.xii.2003; 5 ♂♂, Bhagabatpur, 18.xii.2003.

**Distribution** : India : Several places of Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Jharkand, Meghalaya, Orissa, Sikkim, Tamilnadu, Tripura, West Bengal; widely distributed throughout the Oriental and Australasian regions.

**Bionomics** : This is a synanthropic species and secondary facultative ectoparasite (Stevens and Hall, 1997) which is available in dead fishes, sweet shops, carcasses, human excrement and different kinds of fruits. The adult flies are known as vector of infectious diseases of digestive tract and also have been reported to carry *Morganella* sp. which cause summer diarrhoea. Greenberg (1971) reported its biological association with Poliovirus, *Escherichia coli*, *Proteus mirabilis*, *P. morgani*, *P. rettgeri*, *P. vulgaris*, *Salmonella typhi*, *Shigella dysenteriae*, *Leptomonas mirabilis*, *Chilomastix mesnili*, *Giardia intestinalis*, *Trichomonas hominis*, *Endolimax nana*, *Entamoeba coli*, *Entamoeba histolytica*, *Iodamoeba butschlii*, *Hymenolepis diminuta*, *Trichuris trichiura*, *Ancylostoma duodenale* and *Ascaris lumbricoides*. This fly also play the role as vector of many enteric pathogens of people who live under substandard conditions of sanitation and malnutrition. Its importance in forensic science has been mentioned by Smith (1986). In South-East Asia, the larvae are parasitic on semi-dried and dried fishes and are major problem for fish product in fish industry (Esser, 1991). It is a secondary myiasis producer of man and domestic animals. *Chrysomya megacephala*, which is a saprophagous fly may assume a totally parasitic mode of live in experimental condition (Roy and Dasgupta, 1971) leading to the myiasis and death of the vertebrate hosts.

### 8. *Chrysomya rufifacies* (Macquart)

1843. *Lucilia orientalis* Macquart, *Mem. Soc. Sci. Agric. Lille*. 1842 : 302.

1877. *Somomyia barbata* Bigot, *Annl. Soc. ent. Fr.*, (5) 7 : 39.

1842. *Lucilia rufifacies* Macquart, *Mem. Soc. Sci. Agric. Lille*, 2 (3) : 303.

2000. *Chrysomya rufifacies* : Nandi, *Rec. zool. Surv. India*, 98(4) : 4.

2001. *Chrysomya rufifacies* : Kurahashi and Chowanadisai, *Species Diversity*, 6 : 25.

**Material examined** : 13♂♂, Bamankhali, 21.x.2000; 8♂♂, Chandanpiri, 20.x.2000; 2♂♂, Beguakhali, 13.ii.2001; 18♂♂, Bhagabatpur, 16.xii.2002; 3♂♂, Ghoramara island, 4.xi.1999; 7 mm, Bakkhali, 16.iii.2000; 7♂♂, Fraserganj, 1.xi.2001; 4♂♂, Gangasagar, 26.i.2002; 12♂♂, Bhagabatpur, 28.i.2002; 3♂♂, Bamankhali, 16.xii.2003; 2♂♂, Kacchuberia, 16.xii.2003; 6♂♂, Baradapur, 18.xii.2003.

**Distribution** : India : Several places of Andaman & Nicobar Islands, Jharkand, Sikkim, West Bengal; Laos; Vietnam; throughout the Oriental and Australasian regions.

**Bionomics** : This is a synanthropic and saprophagous species and is attracted to dead bodies of different animals. The adults are biologically associated with *Bacillus* sp., *Mycobacterium tuberculosis*, *Leptomonas mirabilis* and *Taeniarhynchus saginatum* (Greenberg, 1971). The larvae are primarily scavengers and have been used successfully in the treatment of osteomyelitis (James, 1947). It is a secondary myiasis producer and produce myiasis in different parts of human and other animals. It is said to be one of the main pest of sheep in Australia and Hawaii. It is more serious parasite, especially of young calves (Shishido and Hardy, 1969). It is likely to transmit enteric pathogens under unsanitary condition.

### 9. *Chrysomya indica* Sinha and Nandi

2004. *Chrysomya indica* Sinha and Nandi, *J. Bombay Nat. Hist. Soc.*, **101**(3) : 415-420.

**Material examined** : *Holotype* : 1♂ Canning, Sundarbans Biosphere Reserve, West Bengal, India, 7.ii.2001, coll. Shuvra Kanti Sinha; *Paratypes* : 6♂♂ same data as *Holotype*.

**Distribution** : India : Sundarbans (Canning).

**Remark** : This species is almost similar to *Chrysomya rufifacies* (Macquart, 1842) but differs from it by the number of mpl and hpl bristles and the structure of acrophallus. Acrophallus is with a stalked wide projection at posterior end.

**Bionomics** : It was collected on animal dead bodies.

### Family MUSCIDAE

Muscid flies are of great importance in medical, veterinary, forensic and agricultural sciences and are mostly attracted to decaying organic matters, carcasses, dung, privies, salted meat, cheese, dead bodies of different animals and flowering plants. Most of the adult flies are very important because of their relationship with man and dwellings. They carry different types of viruses, bacteria, protozoa, and helminthes (Greenberg, 1971; Sinha *et al.*, 2003) and their role in dissemination of gastroenteric diseases are well known. Kettle (1995) reported more than 100 pathogens including the germs of Typhoid, Paratyphoid, Tuberculosis, Leprosy

and Plague which are carried by these flies. Few flies are haematophagous and lick sores of cattle and human and act as vectors of Ophthalmic diseases. *Hydrotaea irritans* transmits bacteria of Summer mastitis (Chirico *et al.* 1997). *Musca domestica* was reported to carry Rotavirus by legs and wings (Tan *et al.*, 1997), *Helicobacter pylori* (Grubel *et al.*, 1997), Aujeszky's disease (Pseudorabies) (Medveczky *et al.*, 1988). *Musca vetustissima* Walker is vector of *Neisseria gonorrhoeae* (Weinstein, P., 1991). *Dermatobia hominis* can be transmitted by *Fannia heydenii*, *Morellia humeralis* and *Musca domestica* (Polaschi *et al.* 1991). Some flies also feed on blood and sweat and play an important intermediate host in the cyclical transmission of filarial diseases of domestic stock particularly poultry and also act as potential mechanical vectors of diseases of domestic and wild animals. Some adults are predators and feed on larvae, pupa and adults of Simuliidae and Culicidae (Pont, 1980) and these flies can be used for biological control of some of these vectors. Few species live in the nests of birds and hymenoptera and act as parasites. The larvae of some species like *Musca domestica*, *Muscina stabulans*, *Fannia canicularis*, *Fannia scalaris* produce intestinal, urino-genital, dermal and aural myiasis in man and other domestic and wild vertebrate animals. A few larvae are predator and feed on the larvae of other flies of the genera *Musca*, *Orthellia*, *Haematobia* etc. which occur in dung (Shinonaga and Kano, 1971). Larvae of *Atherigona* are plant feeders and bore into the shoots of cereal crops and grasses causing dead hearts and thus they play a significant role in the destruction of crops. Some muscid flies like *Muscina assimilis* (Fallen). *Musca stabulans* (Fallen) are of great forensic importance to calculate approximate time of death of a person in murder cases. Muscid flies are very little known from Sundarbans Biosphere Reserve except Majumder and Parui (2001) reported 8 and Sinha and Nandi (2002) reported 3 species from this Biosphere Reserve.

The present author reported a total of 13 species under 7 genera from this greatest mangrove Biosphere Reserve.

Classification and terminology used in the text are followed here after Shinonaga and Kano (1971).

#### Key to subfamily

1.  $M_{1+2}$  vein usually bending anteriorly ..... MUSCINAE
- $M_{1+2}$  vein usually straight or slightly bending anteriorly ..... PHAONIINAE

#### Key to genera and species

1. Apophallus short, membranous and without spines ..... 2

— Apophallus large, wide, with or without spines .....	10
2. Epiphallus membranous .....	<i>Synthesiomyia nudiseta</i> (Van der Wulp)
— Epiphallus not membranous .....	3
3. Epiphallus projected, long, and curved .....	5
— Epiphallus not projected .....	4
4. Apophallus club-shaped .....	<i>Gymnodia tonitruui</i> (Wiedemann)
— Apophallus pointed and hook-shaped .....	<i>Gymnodia flexa</i> (Wiedemann)
5. Epiphallus more curved, apodeme straight but slightly covered at terminal End .....	..... <i>Musca (s.str.) domestica</i> (Linnaeus)
— Epiphallus less curved, apodeme straight or curved .....	6
6. Posterior paramere short .....	7
— Posterior paramere long .....	9
7. Apodeme straight, anterior paramere with a single long spine .....	..... <i>Musca (Byomya) ventrosa</i> Wiedemann
— Apodeme curved, anterior paramere with more than one short spines .....	8
8. Apodeme curved at middle, anterior paramere long, 5th sternite uniformly pigmented .....	..... <i>Musca (Byomya) emdeni</i> Sinha and Nandi
— Apodeme curved, anterior paramere short, 5th sternite deeply pigmented near two terminal Projections .....	<i>Musca (Byomya) conducens</i> Walker
9. Apodeme membranous .....	<i>Musca (Byomya) sorbens</i> Wiedemann
— Apodeme not membranous .....	<i>Musca (Eumusca) hervei</i> Villeneuve
10. Apophallus without spines .....	<i>Ophyra leucostoma</i> (Wiedemann)
— Apophallus with spines .....	11
11. Epiphallus pointed and long .....	12
— Epiphallus bulb-like, short .....	<i>Orthellia timorensis</i> (Robineau–Desvoidy)
12. Anterior paramere with a fine projection .....	<i>Neomyia indica</i> (Robineau–Desvoidy)
— Anterior paramere without projection .....	<i>Neomyia lauta</i> (Wiedemann)

### 1. *Synthesiomyia nudiseta* (van der Wulp)

1883. *Cyrtoneura nudiseta* Wulp, *Tijdschr. Ent.*, 26 : 42.

1965. *Synthesiomyia nudiseta* : Emden, *Fauna India, Muscidae*, 7(1) : 192.

*Material examined* : 6♂♂, Namkhana, 4.xi.2001.

*Distribution* : India : Several places of West Bengal; Borneo; China; Malaya; Nepal.

*Bionomics* : The species is generally found on decaying vegetables. It is also attracted to carcasses and dead molluscs but rarely enters houses. The larvae breed in various animals and vegetable materials like human and animal cadavers, decayig cotton seeds, dead locusts, faeces and kitchen refuse and generally develop on carrion and human faeces. Greenberg (1971) reported its biological association with *Poliovirus*, *Escherichia coli* and *Shigella dysenteriae*. This species has been recorded as involved in secondary wound myiasis (James, 1947) but has little hygienic significance. The larvae form cocoon gallery on dried grasses, pieces of wood and sands.

### 2. *Gymnodia tonitrui* (Wiedemann)

1824. *Anthomyia tonitrui* Wiedemann, *Anal. ent.*, 1824 : 52.

1965. *Gymnodia tonitrui* : Emden, *Fauna India, Muscidae*, 7(1) : 631; 1977. Pont, *Cat. Orient. Diptera*, 3 : 475.

*Material examined* : 2♂♂, Bakkhali, 8.vii.2001.

*Distribution* : India : Several places of Andhra Pradesh, Assam, Himachal Pradesh, Madhya Pradesh, Maharashtra, Uttar Pradesh, West Bengal; China; Formosa; Malaya; Nepal; Pakistan; Sri Lanka.

*Bionomics* : Collected on human and animal dungs. This species is abundantly available on faeces and in low bush adjacent to native village.

### 3. *Gymnodia flexa* (Wiedemann)

1830. *Anthomyia flexa* Wiedemann, *Aussereurop. zweifl. Insekt.*, 2 : 434.

1977. *Gymnodia flexa* : Pont, *Cat. Orient. Dipt.*, 3 : 475.

*Material examined* : 2♂♂, Bakhali, 8.vii.2001; 2♂♂, Bhagabatpur, 18.xi.2000, 10♂♂, Sagar Island, 18.vi.2001.

*Distribution* : India : Several places of Assam, Tamilnadu, Uttar Pradesh, West Bengal; Formosa; Ryukyu Islands.

*Bionomics* : This species was collected on dead bodies of animals and dried fish processing centres in Sundarbans.

#### 4. *Musca (s.str.) domestica* Linnaeus

1758. *Musca domestica* Linnaeus, *Syst. nat.*, 10 : 596.  
 1794. *Musca nebulosa* Fabricius, *Ent. Syst.*, 4 : 321.  
 1830. *Musca soror* Robineau-Desvoidy, *Mem. pres. div. Sav. Acad. Sci. Inst. Fr.*, 2 : 399.  
 1843. *Musca rufifrons* Macquart, *Mem. Soc. Sci. Agric. Lille.*, 1842 : 309.  
 1851. *Musca vicina* Macquart, *Mem. Soc. Sci. Agric. Lille.*, 1850 : 226.  
 1852. *Musca determinata* Walker, *Insecta Saundersiana*, 4 : 345.  
 1869. *Musca flavinervis* Thomson, *K.svenska Fregatten Eugenie Resa, Zool., Dipt.* : 547.  
 1916. *Musca divaricata* Awati, *Indian J. med. Res.*, 4 : 138.  
 1916. *Musca multispina* Awati, *Indian J. med. Res.*, 4 : 138.  
 1977. *Musca domestica* : Pont, *Cat. Orient. Diptera*, 3 : 459.

**Material examined** : 5♂♂, Jambu island, 16.ii.2001; 5♂♂, Ghoramara island, 14.ii.2001; 1♂, Canning, 7.ii.2001; 2♂♂, Basanti, 11.xii.2001; 2♂♂, Hasnabad, 12.xii.2001; 4♂♂, Jharkhali, 9.xi.2001; 1♂, Bakkhali, 16.ii.2001; 12♂♂, Ganga Sagar, 20.viii.2000; 1♂, Gosaba, 8.xi.2001; 1♂, Bani Jungle, 31.i.2000; 1♂, Kakdwip, 3.xi.1999.

**Distribution** : India : Several places of Andhra Pradesh, Assam, Bihar, Goa, Himachal Pradesh, Kashmir, Maharashtra, Punjab, Sikkim, Tamilnadu, Uttar Pradesh, West Bengal; Borneo; Burma; Sri Lanka; China; Christmass Island; Cocos Island; Nepal; Pakistan; Philippines; Ryukyu Islands; Simenlue Island; Sumatra; Sumbawa; Talaur Islands; Thailand; Cosmopolitan.

**Bionomics** : This is a synanthropic species. They are generally called common bazaar and house fly and the adults were mainly collected from liquefying food-stuffs, sweets, meats, excrement of different animals, decaying vegetables, garbage, slaughter houses and, carcasses. They are oviparous and lay eggs on human faeces, cow, poultry and horse dung. They are capable of transmitting a large number of viral diseases (poliomyelitis, coxsackie virus, Q fever) bacterial diseases (many diarrhoea and enteric fevers, infantile summer dysentery, typhoid and paratyphoid fevers, bacillary dysentery, conjunctivitis, tuberculosis, leprosy, plague, streptococci and staphylococci), protozoan parasites (cysts and trophozoites, trypanosomiasis, amoebic dysentery), tapeworms and nematodes (Smith, 1973). They are found with cattle or domestic animals in the field, irritate them and gather on food and excrement, especially in rural areas. The larvae produce intestinal, urino-genital, traumatic, aural, nasopharyngeal and cuticular myiasis in man and other domestic animals. Cases of ocular myiasis have also been reported by James (1947). They cause a wide loss of dried fishes in dry fish farm (Sinha and Nandi, 2003). 3rd stage larva was described by Ishijima (1967) and in nature it breeds in animal excrements and cow dung. Greenberg (1971) reported its biological association with *Poliovirus*, *Pseudomonas sp.*, *Alcaligenes faecalis*, *Escherichia coli*, *Paracolobactrum sp.*,

*Proteus vulgaris*, *Salmonella typhi*, *Salmonella typhimurium*, *Shigella dysenteriae*, *Shigella flexneri*, *Shigella sonnei*, *Hemophilus influenzae*, *Staphylococcus sp.*, *Streptococcus sp.*, *Lactobacillus sp.*, *Corynebacterium sp.*, *Bacillus anthracis*, *Bacillus subtilis*, *Clostridium sp.*, *Treponema pertenue*, *Herpetomonas muscarum*, *Chilomastix mesnili*, *Giardia intestinalis*, *Trichomonas hominis*, *Endolimax nana*, *Entamoeba coli*, *Entamoeba histolytica*, *Iodamoeba butschli*, *Hymenolepis nana*, *Taeniarrhynchus saginatum*, *Trichuris trichiura*, *Ancylostoma sp.*, *Enterobius vermicularis*, *Ascaris lumbricoides*, *Allantonema muscae* and *Allantonema stricklandi*.

### 5. *Musca (Byomya) ventrosa* Wiedemann

1830. *Musca ventrosa* Wiedemann, *Aussereurop. Zweifl. Insekt.*, 2 : 565.

1994. *Musca (Byomya) ventrosa* : Shinonaga and Singh, *Jap. J. sanit, Zool.*, 45 : 107.

*Material examined* : 1 ♂, Mohisani island, 22.xi.2000; 4 ♂♂, Bhagabatpur, 18.x.2000; 1 ♂, Bamankhali, 21.x.2000; 2 ♂♂, Sajnekhali, 6.xi.2001; 1 ♂, Nayajat, 8.xi.2001; 4 ♂♂, Jharkhali, 9.xi.2001; 6 ♂♂, Gosaba, 8.xi.2001.

*Distribution* : India : Several places of Andhra Pradesh, Assam, Bihar, Tamilnadu, Uttar Pradesh, West Bengal; Borneo; Burma; Celebes; China; Java; Krakatau; Malaya; Nepal; Philippines; Ryukyu Island; Sri Lanka; Sumatra; Sumbawa; Thailand; Australia.

*Bionomics* : This is a synanthropic and haematophagous species and the adults are available on cattle, horse and human bodies and feed on wounds, sores and tears. They are attracted to dung of different animals and the larvae breed there usually that of cow and buffalo. Ishijima (1967) described its 3rd stage larva from Japan. Greenberg (1971) reported its biological association with *Habronema megastoma* and *Habronema muscae*.

### 6. *Musca (Byomya) emdeni* Sinha and Nandi

2004. *Musca (Byomya) emdeni* Sinha and Nandi, *Rec. zool. Surv. India*, 102(1-2) : 11-26.

*Material examined* : *Holotype* : 1 ♂, South 24-Parganas; Sagar Island (Bamankhali), 18.vi.2001, B.C. Nandi and Shuvra Kanti Sinha; *Paratypes*: 2 ♂♂, Kakdwip, 3. ♂♂.2001, B.C. Nandi and Shuvra Kanti Sinha; *Allotype* : 1 ♂, Same data as *Holotype*.

*Distribution* : India; Sundarbans (Bamankhali and Kakdwip).

*Remark* : This species is almost similar to *Musca (Byomya) pattoni* (Austen, 1910) but differs from it by the grayish abdomen with silvery-checked pattern. Moreover, 2 + 3 dorsocentral bristles present in this species.

This species is named in honour of Emden, F.I. Van of renowned Oriental Dipterologist.

**Bionomics** : This species was collected from cow-dung and the larvae breed therein.

### 7. *Musca (Byomya) conducens* Walker

1859. *Musca conducens* Walker, *J.Proc.Linn.Soc.Lond.Zool.*, 4 : 138.

1965. *Musca (Byomya) conducens*: Emden, *Fauna India, Muscidae.*, 7(1) : 68.

**Material examined** : 1?, Bamankhali, 21.x.2000; 1♂, Kakdwip, 3.xi.1999; 1♂, Ganga Sagar, 1.ii.2000; 1♂, Bani Jungle, 20.xii.2000; 1♂, Shibpur, 20.xii.2000; 2♂♂, Gosaba, 8.XI.2001.

**Distribution** : India : Several places of Andaman, Andhra Pradesh, Assam, Madhya Pradesh, Orissa, Punjab, Uttar Pradesh, West Bengal; Borneo; Burma; China; Flores Islands; Formosa; Java; Lombok; Malaya; Nepal; Philippines; Ryukyu Islands; Sarawak; Sri Lanka; Sumatra; Sumbawa; Thailand; New Guinea.

**Bionomics** : This is a haematophagous species and the adults were collected from dung of different phytophagous animals. They gather on wounds and sores of cattle and licks from them. Greenberg (1971) reported its biological association with *Stephanofilaria assamensis*. It is also a mechanical vector of stephanofilariasis. It generally feeds on the blood oozing from bites of other insects and acts as intermediate host of *Stephanofilaria* (Shinonaga and Kano, 1971).

### 8. *Musca (Byomya) sorbens* Wiedemann

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

1994. *Musca (Byomya) sorbens* : Shinonaga and Singh, *Jap. J. sanit. Zool.*, 45 : 106.

**Material examined** : 2♂♂, Baradapur, 19.x.2000; 2♂♂, Ganga Sagar, 21.xi.2000; 1♂, Bani Jungle, 2b.xi.2000; 3♂♂, Jharkhali, 8.xi.2000; 1♂, Ghoramara island, 4.xi.1999; 3♂♂, Pakhiralaya, 6.xi.2001; 1♂, Krishnagar, 4.xi.1999; 1♂, Nayajat, 8.xi.2001; 1♂, Sahara Fish Farm, 5.xi.1999.

**Distribution** : India : Several places of Andhra Pradesh, Assam, Bihar, Goa, Tamilnadu, Uttar Pradesh, West Bengal; Burma; China; Christmass Island; Cocos Island; Flores Island; Formosa; Java; Lombok; Malaya; Maldive Islands; Nepal; Pakistan; Peloc Endeh; Philippines; Ryukyu Islands; Simeulue Island; Sri Lanka; Sumatra; Sumbawa; Taur Islands; Thailand; Hawaii; Micronesia.

**Bionomics** : This is a synanthropic species and are very common and bothersome in camps and bazars. The adults are attracted to food-stuffs, wounds, eyes on sores, lesions and diseases of human being and poultry. They feed on food-stuffs and the larvae are found in

garbage, dumps and dung of different animals including human faeces and the larvae breed therein. Pont (1980) mentioned it as vector of ophthalmic diseases.

Busvine (1980) reported this species swarming over children's faces in the villages and it transmits the germs of trachoma. The larvae can be reared from dung of pig, dog, horse and cow refuse and carcasses. Adults are frequently attracted to eye and nose and are the principal mechanical vectors of certain eye infections (ophthalmia, blepharitis and corneal ulcers) that may result in permanent damage to the eyes (Smith, 1973). They are associated with cattle or other domestic animals in the field and irritate them. This species is also a vector of hebronemiasis (Shinonaga and Kano, 1971). They can transmit the germs of tuberculosis, leprosy, yaws, streptococci and staphylococci. The larvae cause traumatic myiasis (Smith, 1973). Ishijima (1967) described its 3rd stage larva from Japan. Greenberg (1971) reported its biological association with *Shigella dysenteriae*, *Shigella flexneri*, *Haemophilus influenzae*, *Streptococcus* sp., *Staphylococcus* sp., *Sarcina* sp., *Neisseria gonorrhoeae*, *Corynebacterium* sp., *Bacillus* sp., *Clostridium* sp., *Mycobacterium leprae*, *Mycobacterium tuberculosis*, *Treponema pertenuae*, *Herpetomonas muscarum*, *Leishmania donovani*, *Leishmania tropica*, *Trypanosoma brucei*, *Trypanosoma congolense*, *Trypanosoma rhodesiense*, *Trypanosoma suis*, *Chilomastix mesnili*, *Giardia intestinalis*, *Trichomonas hominis*, *Endolimax nana*, *Entamoeba coli*, *Entamoeba histolytica*, *Iodamoeba batschlii*, *Taeniarrhynchus saginatum*, *Trichuris trichura*, *Ancylostoma* sp., *Ascaris lumbricoides*, *Habronema megastoma* and *Habronema muscae*.

### 9. *Musca (Eumusca) hervei* Villeneuve

1922. *Musca hervei* Villeneuve, *Ann. Sci. nat. Zool.*, 10(5) : 335.

1965. *Musca (Eumusca) hervei* : Emden, *Fauna India, Muscidae*, 7(1) : 75.

*Material examined* : 5 ♂♂, Sandeshkhali, 11.xi.2001; 2 ♂♂, Chotta Mollakhali, 7.xi.2001; 1 ♂, Gosaba, 8.xi.2001.

*Distribution* : India : Several places of Assam, Himachal Pradesh, Punjab, Sikkim, West Bengal; Bonin Island; Burma; China; Japan; Nepal; Viet Nam; Sri Lanka.

*Bionomics* : This is a haematophagous species and is generally found on cattle, horses and cowdung. It feeds on wounds and tears of cattle. This species is oviparous and the eggs are laid in patches on fresh cow-dung in the field. It was reported as vector of *Thalazia* sp. (Shinonaga and Kano, 1971).

### 10. *Ophyra leucostoma* (Wiedemann)

1817. *Anthomyia leucostoma* Wiedemann, *Zool. Mag. Keil.*, (1)1 : 82.

1965. *Ophyra leucostoma* : Emden, *Fauna India, Muscidae*, 7(1) : 302.

**Material examined** : 3♂♂, Canning, 7.ii.2001; 1♂, Mohisani island, 22.xi.2001; 4♂♂, Sajnekhali, 6.xi.2001; 7♂♂, Beguakhali (Sagar Island), 13.ii.2001; 1♂, Bhagabatpur, 18.x.2000; 2♂♂, Chotta Mollakhali, 1.ii.2001; 2♂♂, Gosaba, 8.xi.2001; 2♂♂, Jharkhali, 9.xi.2001; 1♂, Basanti, 11.xi.2001; 2♂♂, Chandanpiri, 20.x.2000.

**Distribution** : India : Several places of Kashmir, West Bengal; China; Malaya; Nepal.

**Bionomics** : This is a synanthropic species. They are generally available on decaying animals and vegetable matters and the larvae breed in garbages, privies, decaying vegetables and dead animals. The larvae are coprophagous or saprophagous and are found on faeces, carrion, garbages and privies. Ishijima (1967) described its 3rd stage larva from Japan. Greenberg (1971) reported its biological association with Poliovirus, *Alcaligenes faecalis*, *Flavobacterium devorans*, *Flavobacterium invisible*, *Escherichia coli*, *Aerobacter aerogenes*, *Klebsiella cloacae*, *Serratia marcescens*, *Proteus inconstans*, *Proteus morgani*, *Proteus rettgeri*, *Proteus mirabilis*, *Proteus vulgaris*, *Citrobacter freundii*, *Staphylococcus afermentans*, *Staphylococcus lactis*, *Staphylococcus aureus*, *Staphylococcus saprophyticus*, *Streptococcus durans*.

### 11. *Orthellia timorensis* (Robineau-Desvoidy)

1830. *Lucilia timorensis* Robineau-Desvoidy, *Essai Myodaires*, 2(2) : 460.

1977. *Orthellia timorensis* : Pont, *Cat. Orient. Diptera*, 3 : 465.

**Material examined** : 1♂, Beguakhali (Sagar Island), 1.xi.2001; 1♂, Gosaba, 8.xi.2001; 2♂♂, Sajnekhali, 6.xi.2001; 1♂, Sandeshkhali, 11.xi.2001; 1♂, Bhagabatpur, 18.x.2001; 1♂, Canning, 7.xi.2001; 1♂, Ganga Sagar, 20.viii.2001; 1♂, Baradapur, 19.x.2000; 9♂♂, Basanti, 12.xii.2001.

**Distribution** : India : Several places of Andhra Pradesh, Assam, Bihar, Kerala, Sikkim, Tamilnadu, Uttar Pradesh, West Bengal; Borneo; Burma; China; Japan; Java; Pakistan; Malaya; Nepal; Philippines; Ryukyu Islands; Sumatra; Thailand; VietNam.

**Bionomics** : This species is generally found on cattle dung, human faeces and also often available on plants and houses.

### 12. *Neomyia indica* (Robineau-Desvoidy)

1830. *Lucilia indica* Robineau-Desvoidy, *Essai Myodaires*, 2(2) : 453.

1965. *Orthellia indica* : Emden, *Fauna India, Muscidae*, 7(1) : 126.

1994. *Neomyia indica* : Shinonaga and Singh, *Jap. J. sanit. Zool.*, 45 : 115.

**Material examined** : 1♂, Baradapur, 19.x.2000; 1♂, Bhagabatpur, 18.x.2000; 11♂♂, Beguakhali (Sagar Island), 13.ii.2001; 1♂, Ganga Sagar, 20.vii.2000; 2♂♂, Ghoramara island, 1.ii.2001; 4♂♂, Canning, 7.ii.2001.

**Distribution** : India : Several places of Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Maharashtra, Tamilnadu, Uttar Pradesh, West Bengal; Borneo; Burma; China; Sri Lanka; Sumatra; Thailand.

**Bionomics** : The species is generally found on dung of cattle and horse and the larvae breed therein. It is also found on human excrement.

### 13. *Neomyia lauta* (Wiedemann)

1830. *Musca lauta* Wiedemann, *Aussereurop. zwiefl. Insekt.*, 2 : 410.

1965. *Orthellia lauta* : Emden, *Fauna India, Muscidae*, 7(1) : 128.

1994. *Neomyia lauta* : Shinonaga and Singh, *Jap. J. sanit. Zool.*, 45 : 116.

**Material examined** : 1 ♂, Bhagabatpur, 18.x.2000.

**Distribution** : India : Several places of Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Uttar Pradesh, West Bengal; Australia; Borneo; Burma; China; Formosa; Iran; Java; Lombok; Malaya; Nepal; Pakaistan; Philippines; Sri Lanka; Sumatra; Thailand.

**Bionomics** : This species is commonly found on cow-dung, dead animals and meat and breed therein.

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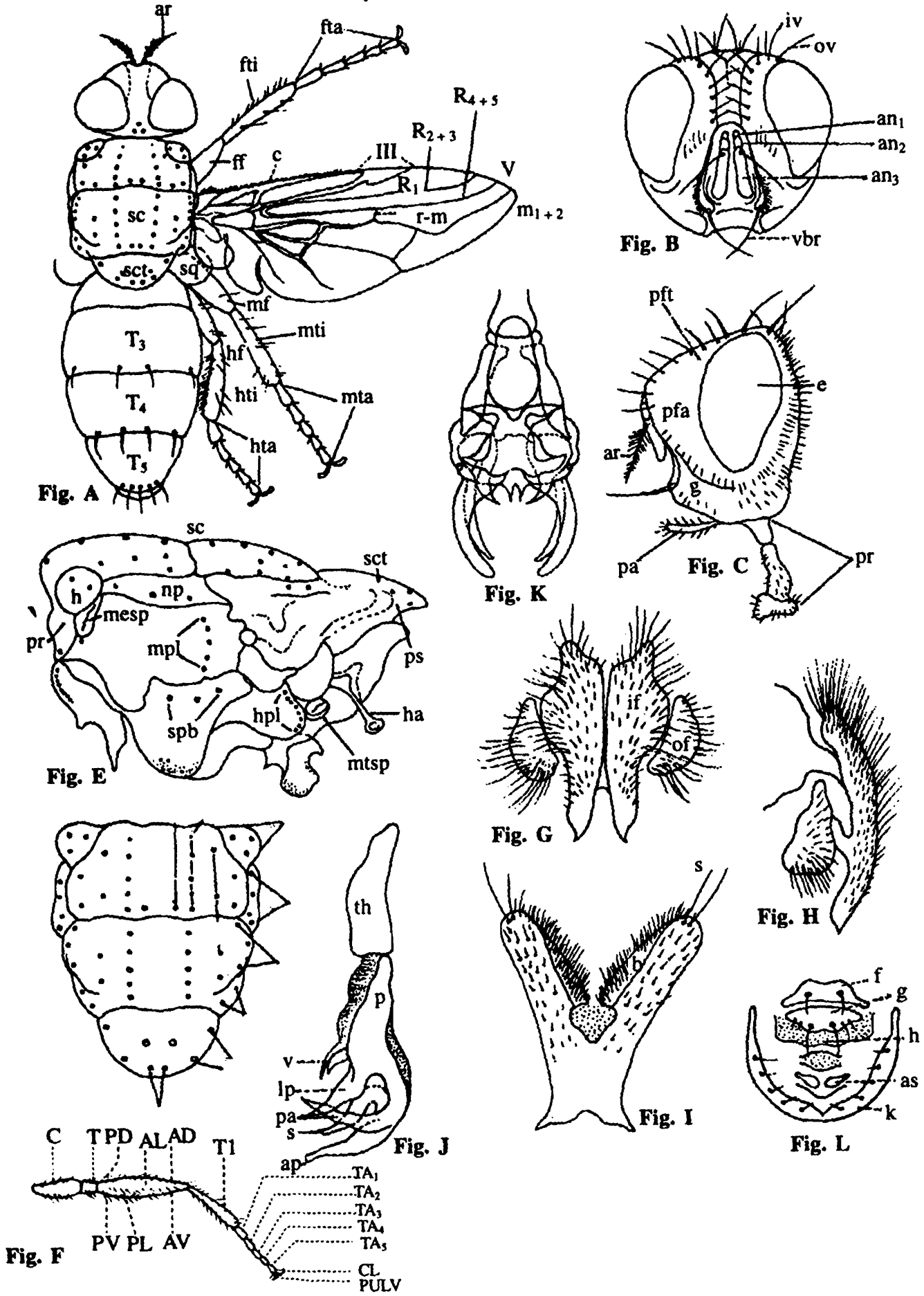
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**Explanation of text figure****Family SARCOPHAGIDAE**

- Fig. A :** Dorsal view of fly: ar = arista, c = costa, ff = first femur, fti = first tibia, fta = first tarsus, hf = hind femur, hti = hind tibia, hta = hind tarsus, III = third costal segment, V = fifth costal segment,  $m_{1+2}$  = upper crossvein, mf = mid femur, mti = mid tibia, mta = mid tarsus,  $R_1$  = first radial vein,  $R_{2+3}$  = radial veins - 2,  $R_{4+5}$  = radial veins -3, r-m = radio-median cross vein, sc = scutum, sct = scutellum, sq = squama,  $T_3$  = third tergite,  $T_4$  = fourth tergite,  $T_5$  = fifth tergite.
- Fig. B :** Dorsal view of head:  $an_1$  = first antennal segment,  $an_2$  = second antennal segment,  $an_3$  = third antennal segment, iv = inner vertical, ov = outer vertical, vbr = vibrissae.
- Fig. C :** Lateral view of head: ar = arista, e = eye, g = gena, pa = palpi, pfa = parafacial, pft = parafrontal, pr = proboscis.
- Fig. D :** Dorsal view of thorax: ac = acrostichal bristle, as = apicoscutellar bristle, dc = dorsocentral bristle, ds = discoscutellar bristle, h = humeral bristle, ia = intra-alar bristle, ls = lateroscutellar bristle, np = notopleural bristle, pa = postalar bristle, sa = supra-alar bristle.
- Fig. E :** Lateral view of thorax: h = humeral bristle, ha = halter, hpl = hypopleural bristle, mesp = mesothoracic spiracle, mpl = mesopleural bristle, mtsp = metathoracic spiracle, np = notopleural bristle, pr = propleuron, ps = postscutellum, sc = scutum, sct = scutellum, spb = sternopleural bristle.
- Fig. F :** Leg: c = coxa, cl = claws, pulv = pulvinus, t = trochanter, ta = tarsus, ad = antero dorsal surface, al = antero lateral surface, av = antero ventral surface, pd = postero dorsal surface, pl = postero lateral surface, pv = postero ventral surface.
- Fig. G :** Dorsal view of forceps of male genitalia: if = inner forcep, of = outer forcep.
- Fig. H :** Lateral view of forceps of male genitalia: terminology same as in Fig.- G.
- Fig. I :** Fifth sternite of male: b = brush of spine, s = stout spine.
- Fig. J :** Male genitalia (Lateral view): ap = apical plate of paraphallus, lp = lateral plate of paraphallus, p = penis, pa = apophysis of epical plate of paraphallus, s = styli of glans, th = theca of penis, v = ventrallia.
- Fig. K :** Male genitalia (ventral view): terminology same as in Fig.- J.
- Fig. L :** Female genitalia (ventral view): as = anal sternite, f = sixth sternite, g = seventh sternite, h = eighth sternite, k = seventh tergite.

Family SARCOPHAGIDAE



**Explanation of text figure****Family CALLIPHORIDAE**

- Fig. A :** Dorsal view of fly: ar = arista, bc = basicostal scale, ff = first femur, fti = first tibia, fta = first tarsus, hf = hind femur, hti = hind tibia, hta = hind tarsus, III = third costal segment, V = fifth costal segment,  $m_{1+2}$  = upper crossvein, mf = mid femur, mti = mid tibia, mta = mid tarsus, oc = ocallus,  $R_1$  = first radial vein,  $R_{2+3}$  = radial veins 2,  $R_{4+5}$  = radial veins -3, r-m = radio-median cross vein, sc = scutum, sct = scutellum, sq = squama,  $T_3$  = third tergite,  $T_4$  = fourth tergite,  $T_5$  = fifth tergite.
- Fig. B :** Dorsal view of head:  $an_1$  = first antennal segment,  $an_2$  = second antennal segment,  $an_3$  = third antennal segment, iv = inner vertical, ov = outer vertical, ps = postocular setae.
- Fig. C :** Lateral view of head: ar = arista, e = eye, g = gena, pa = palpi, pfa = parafacial, pft = parafrontal, pr = proboscis, vbr = vibrissae.
- Fig. D :** Dorsal view of thorax: ac = acrostichal bristle, as = apicoscutellar bristle, dc = dorsocentral bristle, ds = discoscutellar bristle, h = humeral bristle, ia = intra-alar bristle, ls = lateroscutellar bristle, np = notopleural bristle, pa = post-alar bristle, sa = supra-alar bristle.
- Fig. E :** Lateral view of thorax: h = humeral bristle, ha = halter, hpl = hypopleural bristle, mesp = mesothoracic spiracle, mpl = mesopleural bristle, mtsp = metathoracic spiracle, np = notopleural bristle, pc = prealar callus, pr = propleuron, ps = postscutellum, sc = scutum, sct = scutellum, spb = sternopleural bristle, sr = suprasquamal ridge, ssc = supra spiracular convexity.
- Fig. F :** Leg: c = coxa, cl = claws, pulv = pulvinus, t = trochanter, ta = tarsus, ad = antero dorsal surface, al = antero lateral surface, av = antero ventral surface, pd = postero dorsal surface, pl = postero lateral surface, pv = postero ventral surface.
- Fig. G :** Lateral view of forceps of male genitalia: if = inner forcep, of = outer forcep.
- Fig. H :** Dorsal view of forceps of male genitalia: terminology same as in Fig.- F.
- Fig. I :** Fifth sternite of male.
- Fig. J :** Male genitalia (Lateral view): ap = anterior paramere, aph = acrophallus, pp = posterior paramere, pph = paraphallus, th = theca of penis, v = ventrallia.
- Fig. K :** Male genitalia (ventral view): terminology same as in Fig. I.
- Fig. L :** Female genitalia: t = tergite, s = sternite.

Family CALLIPHORIDAE

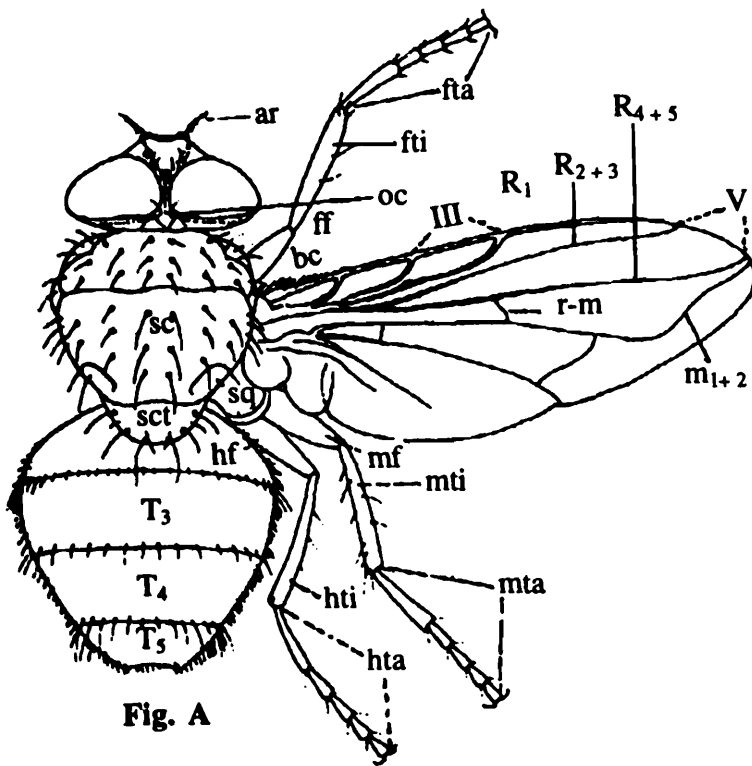


Fig. A

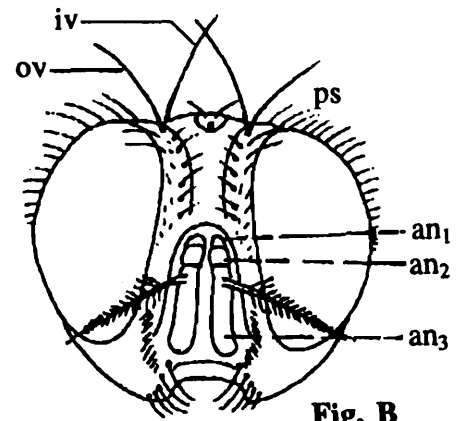


Fig. B

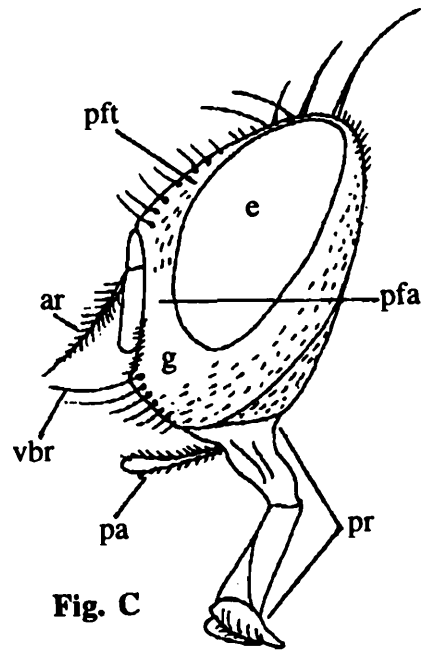


Fig. C

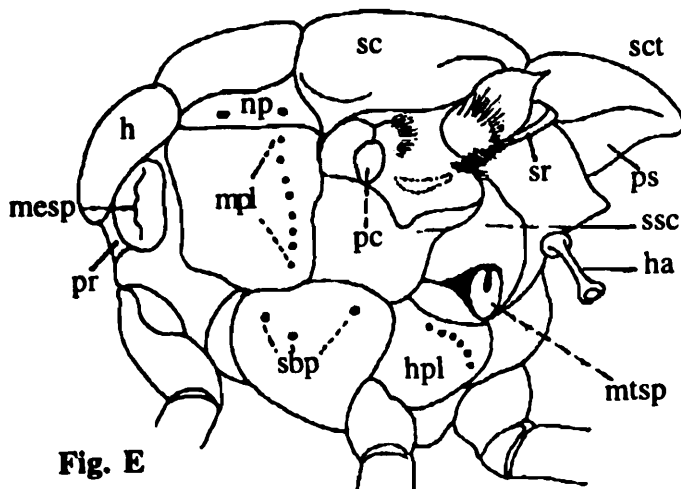


Fig. E

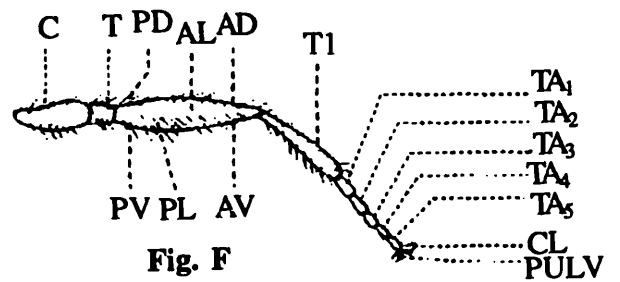


Fig. F

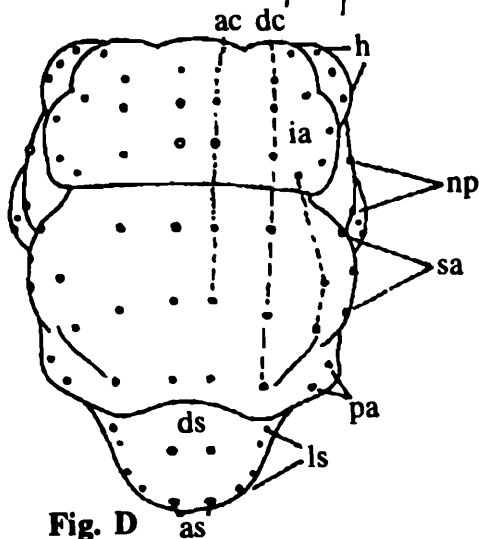
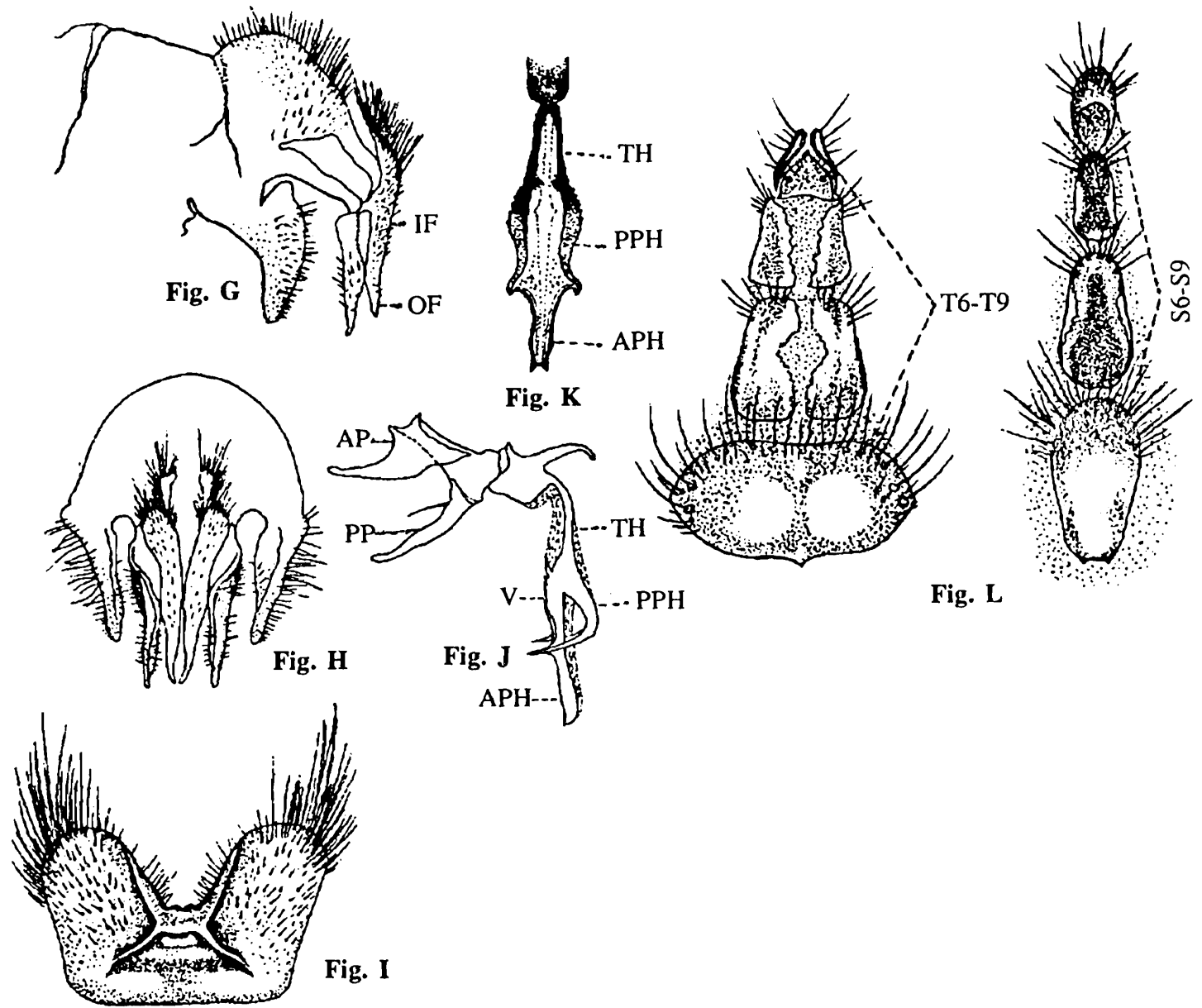


Fig. D



**Explanation of text figure**

## Family MUSCIDAE

- Fig. A :** Dorsal view of fly: ar = arista, ff = first femur, fti = first tibia, fta = first tarsus, hf = hind femur, hti = hind tibia, hta = hind tarsus, III = third costal segment, V = fifth costal segment,  $m_{1,2}$  = upper crossvein, mf = mid femur, mti = mid tibia, mta = mid tarsus, pft = parafrontals,  $R_1$  = first radial vein,  $R_{2,3}$  = radial veins - 2,  $R_{4,5}$  = radial veins - 3, r-m = radio-median cross vein, sc = scutum, sct = scutellum, sq = squama,  $T_3$  = third tergite,  $T_4$  = fourth tergite,  $T_5$  = fifth tergite.
- Fig. B :** Dorsal view of head:  $an_1$  = first antennal segment,  $an_2$  = second antennal segment,  $an_3$  = third antennal segment, iv = inner vertical, ov = outer vertical, ps = postocular setae, vbr = vibrissae.
- Fig. C :** Lateral view of head: ar = arista, e = eye, g = gena, pa = palpi, pfa = parafacial, pft = parafrontal, pr = proboscis.
- Fig. D :** Dorsal view of thorax: ac = acrostichal bristle, as = apicoscutellar bristle, dc = dorsocentral bristle, ds = discoscutellar bristle, h = humeral bristle, ia = intra-alar bristle, ls = lateroscutellar bristle, np = notopleural bristle, pa = post-alar bristle, sa = supra-alar bristle.
- Fig. E :** Lateral view of thorax: h = humeral bristle, ha = halter, hpl = hypopleural bristle, mesp = mesothoracic spiracle, mpl = mesopleural bristle, mtsp = metathoracic spiracle, pd = post-alar declivity, pr = propleuron, ps = postscutellum, sc = scutum, sct = scutellum, spb = sternopleural bristle, sr = suprasquamal ridge, ssc = supra spiracular convexity.
- Fig. F :** Leg: c = coax, cl = claws, pulv = pulvinus, t = trochanter, ta = tarsus, ad = antero dorsal surface, al = antero lateral surface, av = antero ventral surface, pd = postero dorsal surface, pl = postero lateral surface, pv = postero ventral surface.
- Fig. G :** Dorsal view of male abdomen.
- Fig. H :** Dorsal view of female abdomen.
- Fig. I :** Fifth sternite of male.
- Fig. J :** Dorsal view of forceps of male genitalia: if = inner forcep, of = outer forcep.
- Fig. K :** Male genitalia (Lateral view): ap = anterior paramere, apd = apodeme, apl = apophallus, epl = epiphallus, pp = posterior paramere, th = theca of penis.
- Fig. L :** Female genitalia: t = tergite, s = sternite.

Family MUSCIDAE

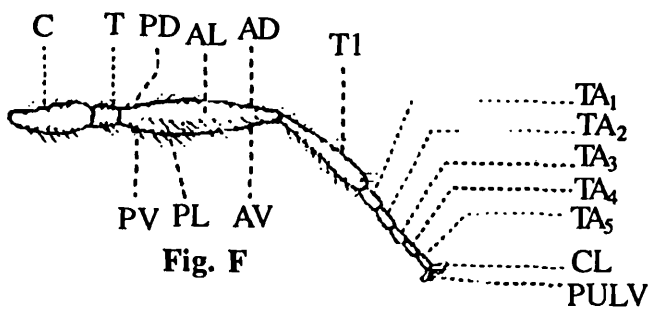
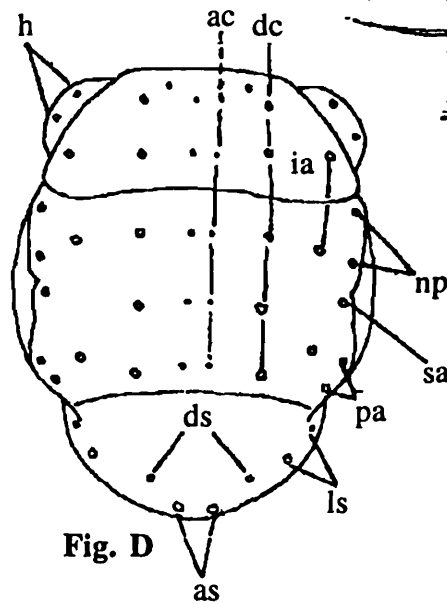
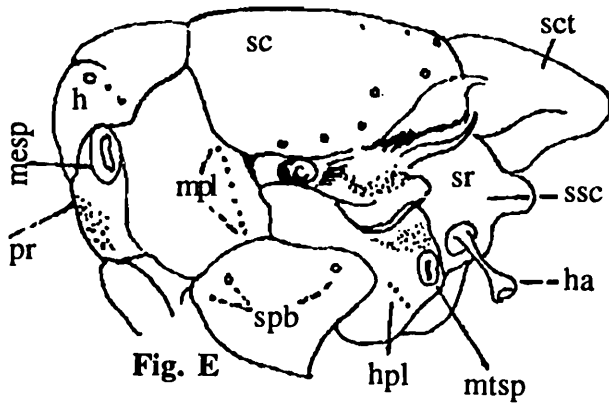
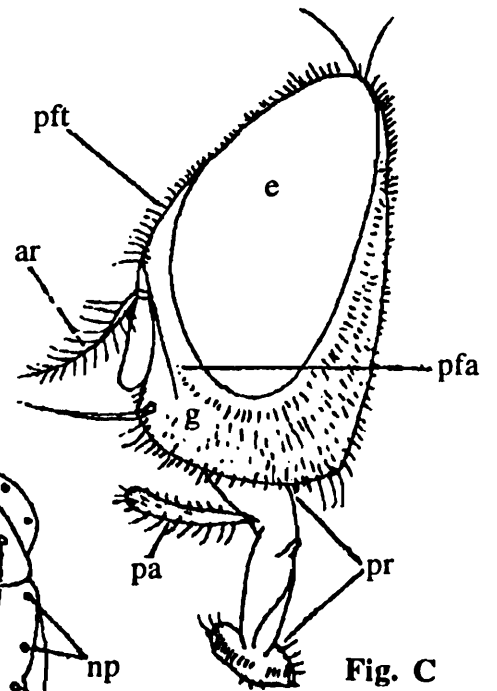
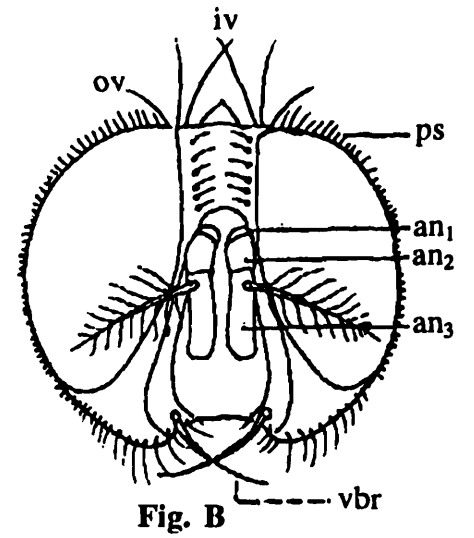
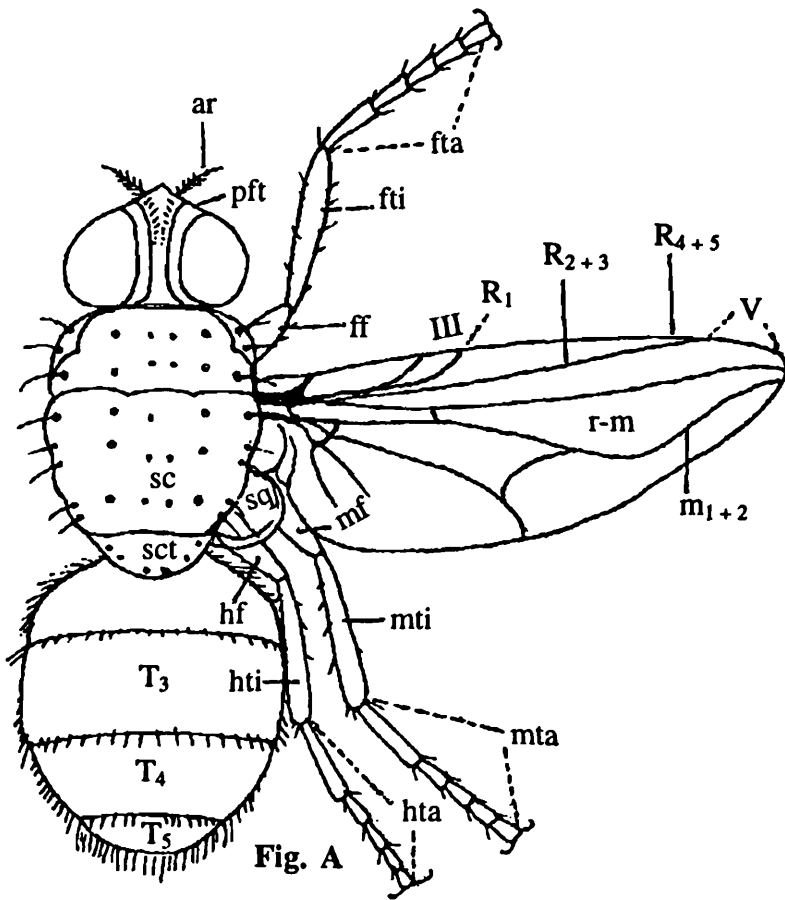




Fig. G

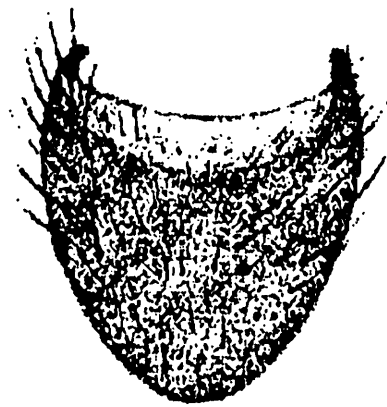


Fig. I

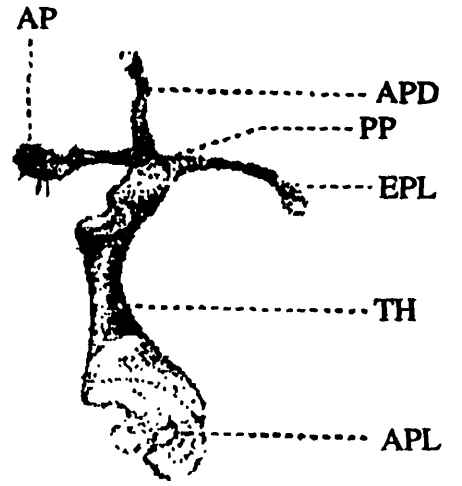


Fig. K

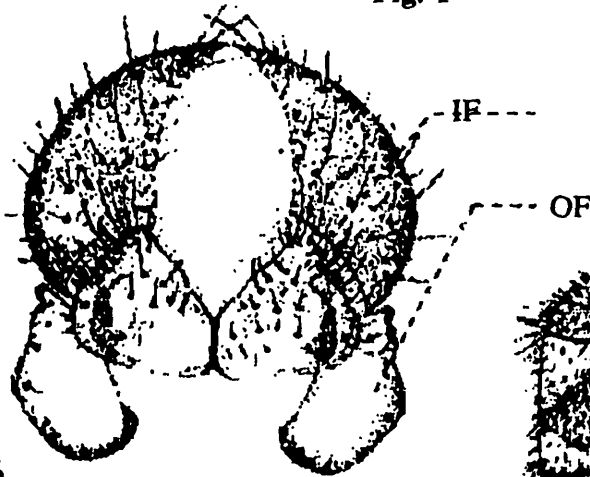


Fig. J

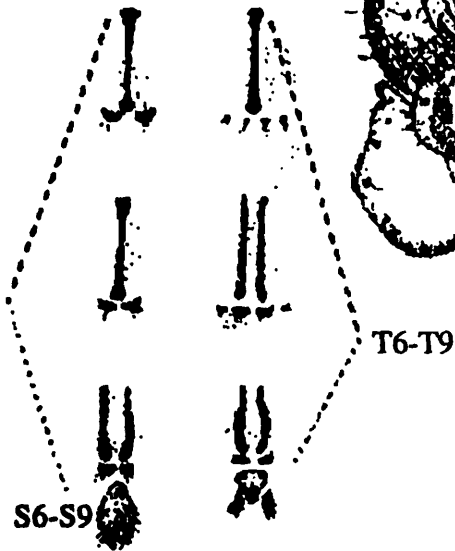


Fig. L

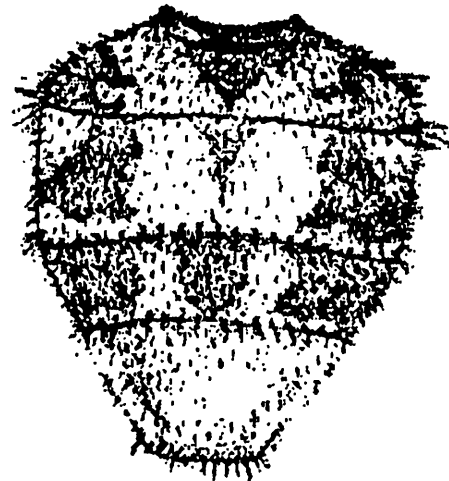
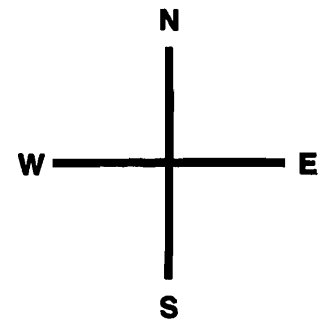
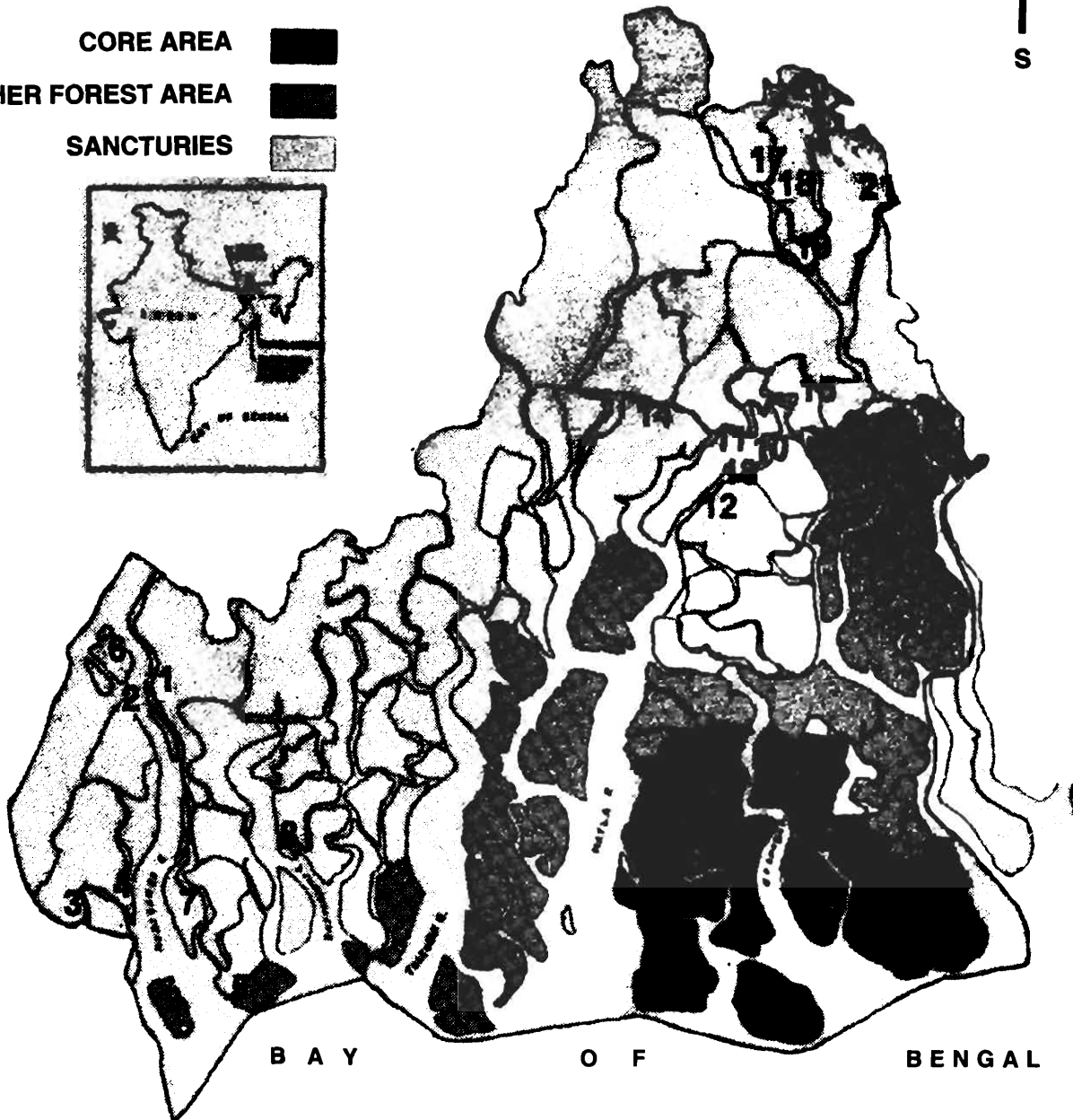


Fig. H

**COLLECTION SPOTS  
SUNDARBANS BIOSPHERE RESERVE**



**CORE AREA** [Solid black box]  
**OTHER FOREST AREA** [Dark grey box]  
**SANCTUARIES** [Light grey box]



**COLLECTIONS SPOTS**

- 1. KAKDWIP 2. KACHUBERIA 3. GANGA SAGAR 4. BANIJUNGLE 5. BAKKHALI
- 6. GHORAMARA ISLAND 7. MOHISANI ISLAND 8. BHAGABAT PUR 9. JAMBU ISLAND
- 10. RANGABELLIA 11. GOSABA 12. SAJNEKHALI 13. SUNDANYAKHALI 14. BASANTI
- 15. MOLLAKHALI 16. JHARKHALI 17. NAYAJAT 18. KALINAGAR 19. SANDESHKHALI
- 20. HASNABAD 21. HINGALGANJ