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A PRELIMINARY STUDY ON THE AQUATIC INSECTS IN FRESHWATER WETLANDS OF NORTH EASTERN KOLKATA

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INTRODUCTION

Among various biological components of freshwaters, the aquatic insects play an important role not only in the trophic dynamics of the ecosystem but also in the indication of changes in the quality of water due to pollution or degradation because of their ability to respond, quickly to such changes. While most of the aquatic insect species constitute the food of many commercially important fishes, some others are predaceous, feeding upon spawn and frys or competing with them directly for natural food. Besides, several species, particularly of belostomatid Hemiptera are known to predate heavily upon the mosquito larvae and thereby limiting their population size.

A large number of species belonging to several orders have adapted to aquatic mode of life completely or partially. It is estimated that about 3% of the total insects are aquatic, spending atleast a part of their life cycles in the water, and these comprise about 25,000 to 30,000 species (Cheng, 1976). The highly diverse aquatic forms are spread over 10 orders viz. Collembola, Plecoptera, Ephemeroptera, Odonata, Hemiptera, Neuroptera, Trichoptera, Lepidoptera, Coleoptera and Diptera. Out of these, taxa belonging to only a few groups like Ephemeroptera, Odonata, Hemiptera, Coleoptera and Diptera constitute the dominant components of fauna of the freshwater wetlands of this region.

Some of the important contributions on taxonomy of aquatic insects are done mainly by Distant (1902, 1906, 1910), d'Orchymont (1928), Ochs (1930), Vazirani (1968, 1970). Srivastava and Sinha (1995) on Odonata; Bal and Basu (1994a, 1994b) on Hemiptera; Biswas *et al.*, (1995a, 1995b), Biswas and Mukhopadhyay (1995) on Coleoptera. Some taxo-ecological works are also done by Roy (1982), Roy and Sharma (1983), Roy *et al.*, (1988), De (Pal) and Sengupta (1993), Bhattacharya (2000), Pal *et al.*, (2000) & Khan and Ghosh (2001).

The areas which have been selected for detailed study are as follows :-

i. Two freshwater wetlands (Ponds) in Kestopur (Rabindrapally Pond and Majherpara Pond), N. 24 Parganas.

ii. One freshwater wetland (Pond) near Dumdum Park (Dumdum Park Pond), N. 24 Parganas and

iii. Sewage-fed wetland of Kestopur Canal, N. 24 Parganas.

All the materials under study were collected by the first author (R.Debnath) and the same are deposited in the collections of Vidyasagar College, Kolkata.

No consolidated account of Biodiversity of aquatic freshwaterbodies of North East Kolkata is available so far except a stray work on the occurrence of only aquatic Coleoptera in and around Kolkata (De and Sengupta, 1993). No study on seasonal abundance of the aquatic

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insects from the area under study is on record. This has prompted to take up the present project work as preliminary study in this field.

MATERIAL AND METHODS

The materials for the present study were collected during the period October, 2009 to April, 2010, in the freshwater wetlands of North eastern Kolkata as mentioned earlier.

The collection was made with the help of hand operated net by randomly netting different areas of the wetland. Aquatic forms of insects adults/nymphs/larvae were collected by water net which has a close meshed nylon net supported by metal ring and long handle.

After netting the accumulated materials were kept in a plastic tray. The aquatic weeds, stones, mud were removed and aquatic insects were collected. Later, the collected insects were preserved in 70% alcohol. After a few days the preserved aquatic insects were set, pinned and preserved into the insect box.

Specimens were identified with the help of available literature. Most of the identifications were later confirmed by Zoological Survey of India, Kolkata.

SYSTEMATIC LIST OF AQUATIC AND SEMI-AQUATIC SPECIES

A. Order HEMIPTERA

Family NEPIDAE

1. *Laccotrephes griseus* (Guerin)
2. *Ranatra sordidula* Dohrn.

Family NOTONECTIDAE

3. *Nychia marshalli* (Scott.)

Family GERRIDAE

4. *Limnogonus nitidus* (Mayr)
5. *Limnogonus fossorum* (Fabr.)
6. *Neogerris parvula* (Stal)

Family BELOSTOMATIDAE

7. *Diplonychus rusticus* (Fabr.)
8. *Diplonychus annulatum* (Fabr.)
9. *Lethocerus indicus* (Lep. & Serv.)

Family PLEIDAE

10. *Plea* sp.

Family MESOVELIIDAE

11. *Mesovelia* sp.

Family CORIXIDAE

12. *Micronecta* sp.

B. Order COLEOPTERA

Family HYDROPHILIDAE

13. *Amphiops pedestris* Sharp
14. *Berosus indicus* Mots
15. *Berosus fairmairei* Zaitzev
16. *Helochares anchoralis* Sharp
17. *Regimbertia attenuata* Fab.
18. *Sternolophus rufipes* (Fab.)

Family DYTISCIDAE

19. *Canthydrus laetabilis* (Walker)
20. *Canthydrus luctuosus* (Aube)
21. *Hydaticus* sp.
22. *Laccophilus anticatus anticatus* Sharp.
23. *Laccophilus parvulus parvulus* Aube
24. *Laccophilus basalis* Mots.
25. *Laccophilus flexuosus* Aube
26. *Laccophilus sharpi* Regimbart

Family CHRYSOMELIDAE

27. *Cassida* sp.
28. *Paridea* sp.
29. *Altica* sp.

Family CARABIDAE

30. *Tetragonoderus arcuatus* Dejean

Family GYRINIDAE

31. *Dineutus (Protodineutus) indicus* Aube

SYSTEMATIC ACCOUNT

Order HEMIPTERA

Hemiptera is one of the large groups of aquatic and semiaquatic insects. Mouthparts are piercing and sucking type beak-like structure,

inserted near the anterior end of the head. Leathery anterior pair of wings at the base and membranous apically and second pair completely membranous. Metamorphosis simple and gradual. The size-range is very vast, from minute to very large. The body shape varies greatly from long, cylindrical to oval and sometimes considerably flattened. The prothorax is large and free, meso and metathorax united, scutellum very prominent and antennae 4-5 segmented. There are generally 5 nymphal stages and the nymphs look like adults except they're comparatively of smaller sizes and sexual immaturity.

There are a series of aquatic and semiaquatic families that show a gradual transition of habitats from damp shores to subsurface waters (Pennak, 1978). Some remain confined to the shore, some venture further and abound the floating algal mats and other floating objects, and some skate rapidly over the surface of water. The true aquatic species are normally found below the surface. They are highly predaceous, feeding upon micro and macro invertebrates and sometimes on fish eggs and fry. For this, forelegs are highly modified for seizing and holding the prey while body fluids are sucked up through the mouthparts with the muscular pharynx (Pennak, 1978). The eggs are generally laid on the surface or within the tissue of submerged macrophytes.

Family NEPIDAE

The insects belonging to this family are commonly known as "Water Scorpions".The body is dorso-ventrally flattened or cylindrical with long slender legs, the anterior pair being raptorial with long and stout femur used mainly for capture of prey. 1- jointed tarsi and absence of ocelli are the characteristic feature of the family. Head set into prothorax, fore tarsi not fringed; hind coxae globular; antennae 3-jointed.

They are usually found in trash and mud or remain entangled with aquatic vegetation in the shallow littoral region of the wetlands. Highly predaceous insect species feed mainly on live insects and their nymphs. The prey is captured with the help of raptorial forelegs.

1. ***Laccotrephes griseus*** (Guerin)

1829. *Nepa greseus* Guerin, *Iconogr Regne Anim. Ins.*, : 352

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 38

2007. Thirumalai, G. *Rec. zool. Surv. India. Occ. Paper No.*, **273** : 1-84

Material examined : 1 ex., Rabindrapally pond, 11.X.2009; 1 ex., Kestopur Canal, 11.X.2009; 1 ex., Dumdum Park Pond, 17.I.2010; 1 ex., Rabindrapally Pond, 21.II.2010; 1 ex., Dumdum Park Pond, 21.III.2010; 1 ex., Dumdum Park Pond, 18.IV.2010.

Diagonosis : Abdomen above with light bluish tinge; anterior area of prosternum provided with a strong acute spine-like structure; abdominal appendages distinctly shorter than body; the parameres are symmetrical and slightly hooked.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, Darjeeling), Pondicherry, Tamil Nadu; Elsewhere : Malaysia; Myanmar; Seychelles; SriLanka; Thailand.

Remarks : The species was recorded from Rabindrapally & Dumdum Park freshwater Pond & sewage-fed Kestopur Canal . This is a very sluggish species and very common in Peninsular India and occurs in permanent pond near the edges (Thirumalai 1994).

2. ***Ranatra sordidula*** Dohrn

1859. *Ranatra sordidula* Dohrn., *Stettin. Ent. Ztg.*, **21**: 409

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 40

Material examined : 3 exs., Rabindrapally Pond, 11.X.2009; 2 exs., Kestopur Canal, 11.X.2009; 1 ex., Majherpara Pond, 11.X.2009; 4 exs. Dumdum Park Pond, 15.XI.2009; 1 ex., Majherpara Pond, 20.XII.2009; 2 exs., Majherpara Pond, 17.I.2010; 1 ex., Rabindrapally Pond, 21.II.2010; 1 ex., Dumdum Park Pond, 21.II.2010; 1 ex., Majherpara Pond, 21.II.2010; 3 exs., Rabindrapally Pond, 21.III.2010; 8 exs., Majherpara Pond, 21.III.2010; 4 exs., Rabindrapally Pond, 18.IV.2010; 16 exs., Majherpara Pond, 18.IV.2010.

Diagnosis : Body elongated, 23-24 mm. Long, abdominal appendages approximately shorter

than body; inter ocular space slightly greater than diameter of an eye; pronotum provided with an indistinct ridge at the posterior angle on each side; metasternal process posteriorly projectile with lateral concavity on each side; anterior tibia shorter.

Distribution : India : West Bengal (Kolkata, Hooghly, North 24-Parganas); Orissa; Elsewhere : Malay Peninsula; Sri Lanka; Thailand.

Remarks : This spacies was recorded from Majherpara freshwater pond and Rabindrapally freshwater pond.

Family : NOTONECTIDAE

The members of this family are usually called as "backswimmers" because they have peculiar habit of swimming on their backs. At surface these can be seen resting with their dorsal sides downwards, body at an angle and the tip of abdomen in contact with air. They are strikingly coloured, sometimes multicoloured, on the dorsal surface of the head and thorax. Body long and slender, flat ventrally and convex dorsally; eyes are large, remiform; antennae short. Rostrum short. First two pairs of legs are adapted for grasping and the last is flattened and fringed, densely setose for swimming.

They are mainly carnivores. While adults feed on aquatic insects, other invertebrates and fish eggs and fry, the nymphal food mainly comprises microcrustaceans, zooplankton.

3. ***Nychia marshalli*** (Scott.)

1872. *Antipalocoris marshalli* Scott, *Entomologist's mon. Mag.*, **8**:245

1994. Bal, Animesh and Basu, R. C. Insecta : Hemiptera : Belostomatidae, Nepidae, Notonectidae and Pleidae. *Fauna of West Bengal, State Fauna Series 3* : Part **5**:550

Material examined: 1ex., Rabindrapally Pond, 11.X.2009; 2 exs., Rabindrapally Pond, 15.XI.2009; 1 ex., Majherpara Pond, 15.XI.2009; 3 exs., Rabindrapally Pond, 20.XII.2009; 1 ex., Majherpara Pond, 20.XII.2009; 7 exs., Rabindrapally Pond, 17.I.2010; 2 exs., Majherpara Pond, 17.I.2010; 12 exs., Rabindrapally Pond, 21.II.2010; 6 exs., Majherpara Pond, 21.II.2010; 38 exs., Rabindrapally Pond, 21.III.2010; 21 exs., Majherpara Pond, 21.III.2010; 63 exs., Rabindrapally Pond, 18.IV.2010; 10 exs., Majherpara Pond, 18.IV.2010;

Diagnosis: Male (5.2 mm) a little longer than female (4.8 mm). Head with vertex a little raised, postero leteral margin of eye "E"-shaped; pronotum short and transverse with punctate anterior angles; hemelytra without any clavus; posterior legs slender and longer than body; hemelytra fully cover the body in females while in males, last three abdominal segments remain uncovered.

Distribution : India : West Bengal (Birbhum, North 24-Parganas). Elsewhere : Africa, Europe, Sri Lanka.

Remarks : This species was collected from Majherpara freshwater pond and Rabindrapally freshwater pond in good number. It was absent in sewage-fed Kestopur canal and Dumdum Park freshwater pond.

Family : GERRIDAE

These insects are commonly known as "Water Striders" or "Pond Skaters". They are semiaquatic long-legged hemipterans. Body oval-shaped and covered with a hydrofuge hairpile. They are of black, grey or brown in colour, with light grey or yellow spots or lines on the dorsum. Antennae long, 4-segmented , ocelli absent. The forelegs are relatively short and raptorial, widely separated from the closely spaced and middle and hind legs. The middle legs longer than the others. Both winged and non-winged forms occur, but the latter are more common.

These insects are found skating or leaping about on the surface film of wetlands. They feed upon a number of microcrustaceans and insects.

4. ***Limnogonus nitidus*** (Mayr)

1865. *Hydrometra nitida* Mayr, *Verh. Zool. Bot. Ges. Wien*, **15**:443

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**:47

Material examined : 3 exs., Rabindrapally Pond, 11.X.2009; 3 exs., Rabindrapally Pond, 20.XII.2009;

Diagnosis : Body of moderate size (6-8 mm in length); antennae 4 - jointed, 2nd. and 3rd. joints shortest and nearly subequal in length; 4th antennal joint slightly smaller than the 1st joint or subequal; pronotum with the mid-longitudinal carination moderately prominent, posterior tip of pronotum remarkably angular; 7th abdominal segment with connexival spines.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Hooghly, Bankura, Birbhum, Purulia), Andaman Is. ,Andhra Pradesh, Assam, Bihar, Delhi, Karnataka, Kerala, Orissa, Rajasthan, Uttar Pradesh, Tamil Nadu, Tripura. Elsewhere : Bangladesh; Burma; Java; Malaya; Sri Lanka; Sumatra.

Remarks : The species was collected from Rabindrapally freshwater pond for the first time.

5. ***Limnogonus fossorum*** (Fabr.)

1775.*Cimex fossarum* Fabricius, *Systema Entomologiae* : 727

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 47

Material examined : 4 exs., Majherpara Pond, 11.X.2009; 1 ex., Rabindrapally Pond, 15.XI.2009; 2 exs., Dumdum Park Pond, 15.XI.2009;

Diagnosis : Body elongate, 9-10 mm. long; antennae 4-jointed, 1st. joint longest, 2nd. 3rd. and 4th. joints shortest and subequal in length; pronotum with mid-longitudinal carination conspicuous and prominently present all along the length; anterior part of pronotum with a pair of irregular patches.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Howrah, Darjeeling), Andaman & Nicobar Is., Andhra Pradesh, Assam, Bihar, Delhi, Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Pondicherry, Rajasthan, Tamil Nadu. Elsewhere : Australia; Burma; China; Formosa; Java; Malacca; Philippines; Sumatra.

Remarks : This species is reported to be very common in Rabindrapally freshwater pond, Dumdum Park freshwater pond and Majherpara freshwater pond.

6. ***Neogerris parvula*** (Stal)

1906. *Gerris parvula* Stal, *K. Svenska Eng. Zool.*, **4**: 265

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 48

Material examined : 1 ex., Majherpara Pond, 20.XII.2009;

Diagnosis : Body elongated 6.0 mm. long; posterior tip of pronotum more or less convex, anterior part of pronotum with yellow patches; 1st antennal segment, longest and as long as or a little longer than the 2nd and 3rd segments together, 4th antennal segment remarkably smaller than the 1st segment; anterior part of pronotum with a single roundish yellow patch which separates it from all other known species.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Darjeeling Jalpaiguri, Murshidabad, Purulia), Andhra Pradesh, Assam, Bihar, Kerala, Orissa, Pondicherry, Uttar Pradesh, Tamil Nadu. Elsewhere : Bangladesh; Burma; China; Iran; Japan; Java; Malay Peninsula; Myanmar;New Guuinea; Oman; Philippines; Pakistan; Singapore; Sri Lanka; Solomon Is.; Taiwan; Thailand; Vietnam.

Family : BELOSTOMATIDAE

The Belostomatids, are commonly called as "Giant Waterbugs" due to their large sizes (10-110mm in length). Body flat, oval, brown or dull greenish colour, antennae 4-segmented and concealed in the pockets beneath the head; eyes prominent. The strong and thick front legs are raptorial and used for grasping. Posterior tibiae flattened and fringed with hairs, fitted for swimming. The most characteristic feature in adult is the presence of retractile strap-like appendages at the abdominal apex which are used to obtain air.

They are generally found on the bottom in shallower littoral zones where emergent macrophytes are in abundance. The larger species live in deeper waters. They are highly predaceous and feed on all kinds of aquatic

organisms including fish eggs and fry. They secrete a toxic slivery substance that kills the prey within a short time.

7. *Diplonychus rusticus* (Fabr.)

1794. *Nepa rustica* Fabricius, *Ent. Syst.* **4** : 62

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 42

2007. Thirumalai, G. *Rec. zool. Surv. India. Occ. Paper No.*, **273** : 1-84

Material examined : 2 exs., Rabindrapally Pond, 11.X.2009; 8 exs. Kestopur Canal, 11.X.2009; 3 exs., Majherpara Pond, 11.X.2009; 2 exs., Rabindrapally Pond, 15.XI.2009; 9 exs., Kestopur Canal, 15.XI.2009; 5 exs., Majherpara Pond, 15.XI.2009; 6 exs., Rabindrapally Pond, 20.XII.2009; 4 exs., Kestopur Canal, 20.XII.2009; 9 exs., Majherpara Pond, 20.XII.2009; 10 exs., Rabindrapally Pond, 17.I.2010; 4 exs., Kestopur Canal, 17.I.2010; 4 exs., Majherpara Pond, 17.I.2010; 7 exs., Kestopur Canal, 21.II.2010; 5 exs., Majherpara Pond, 21.II.2010; 27 exs., Rabindrapally Pond, 21.III.2010; 26 exs., Kestopur Canal, 21.III.2010; 58 exs., Majherpara Pond, 21.III.2010; 80 exs., Rabindrapally Pond, 18.IV.2010; 17 exs., Kestopur Canal, 18.IV.2010; 43 exs., Majherpara Pond, 18.IV.2010;

Diagnosis : Head shorter than the inocular space; body 15-17 mm. long; lateral basal margins of pronotum and embolium pale; suboval shaped, greatest expanse of hemeelytra together is shorter than its length. Tarsi 1-jointed and with a smaller claw long, ventro lateral stripe of fine hairs on abdomen is narrower.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Hooghly, Bankura, Murshidabad), Bihar, J. & K. State, Orissa, Kerala, Maharashtra, Tamil Nadu,. Elsewhere : Austria; Burma; China; Formosa; Indonesia; Japan; Java; Malay Peninsula; New Zealand; Philippines; Sri Lanka; Sumatra; Thailand; New Guinea.

Remarks : This species was abundantly collected from Rabindrapally freshwater pond, sewage-fed Kestopur canal and Majherpara freshwater pond.

8. *Diplonychus annulatum* (Fabr.)

1803. *Nepa annulatum* Fabricius, *Systema Rhyngotorum : 106*

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 41

2007. Thirumalai, G. *Rec. zool. Surv. India. Occ. Paper No.*, **273** : 1-84

Material examined : 3 exs., Dumdum Park Pond, 11.X.2009; 6 exs., Dumdum Park Pond, 15.XI.2009; 5 exs., Dumdum Park Pond, 20.XII.2009; 5 exs., Dumdum Park Pond, 17.I.2010; 13 exs., Dumdum Park Pond, 21.II.2010; 18 exs., Dumdum Park Pond, 21.III.2010; 21 exs., Dumdum Park Pond, 18.IV.2010;

Diagnosis : Body broad and oval, maximum width of hemelytra together is almost equal to their length; head as long as the interocular space; anterior tarsus with two segments. Body more than 20 mm. long.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Bankura; Burdwan, Howrah, Hooghly, Murshidabad), Assam, Bihar, Orissa. Elsewhere : Bangladesh; Pakistan.

Remarks : This species was collected from only Dumdum Park freshwater pond.

9. *Lethocerus indicus* (Lep. & Serv.)

1825. *Belostoma indica* Lepeletier and Serville, *Encycl. Meth,* : 272

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 42

2007. Thirumalai, G. *Rec. zool. Surv. India. Occ. Paper No.*, **273** : 1-84

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Body dorsoventrally flattened with large size (70 mm.). Head between eyes with parallel sides; pronotum with a transverse fasciae at the basal end and a fine longitudinal carination in the middle; thick sets of swimming hairs on intermediate and posterior legs on the ventral side.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, Darjeeling, Purulia), Assam,

Bihar, Kerala, Maharashtra, Mizoram, Orissa, Uttar Pradesh. Elsewhere : Burma; Java; Malay Peninsula; Pakistan; Philippines; Sumatra.

Family : PLEIDAE

The members of this family, are commonly called as "Pigmy backswimmers". They are smallest aquatic Hemiptera with compact and strongly arched body. Head relatively large, rostrum short and 3-segmented; antennae short and concealed; legs subequal, tibiae and tarsi not flattened and ciliated along margins; anterior leg modified for grasping.

These insects prefer dense submerged macrophyte strands of *Ceratophyllum* and *Chara*. Where they remain attached or clinging on leaves and stems. They feed vigorously on a variety of micro-invertebrates. The eggs are inserted into macrophytes.

10. ***Plea*** sp.

Material examined : 3 exs., Rabindrapally Pond, 21.III.2010; 2 exs., Majherpara Pond, 21.III.2010; 1 ex., Rabindrapally Pond, 18.IV.2010; 2 exs., Majherpara Pond, 18.IV.2010;

Diagnosis : Body sub-ovate, sub-convexly raised, a bit laterally compressed dorsally; 3-segmented rostrum distinctly longer than broad; pronotum antero-medially scarcely convex; clavus of hemelytra very prominently present.

Family : MESOVELIIDAE

The members of Mesovelidae are known as "Water Treaders" or "Pond weed bugs". Body small, slender, semiaquatic, saw-like ovipositor; thorax divided into 3 simple segments; scutellum exposed.

These insects occupy almost all types of wetland and found near the edge of waterbodies among emergent or floating vegetation and other objects.They run rapidly on the water surface.They feed upon small living or dead insects falling upon the water surface.Females deposit the eggs in the tissue of emergent macrophytes.

11. ***Mesovelia*** sp.

Material examined : 1 ex., Dumdum Park Pond, 21.III.2010; 1 ex., Majherpara Pond, 21.III.2010; 1 ex., Rabindrapally Pond, 18.IV.2010;

Diagnosis : Body elongate with prominent head; eyes large and almost touching anterior margin of pronotum; pronotum with lateral angles tuberculously sub-prominent; 4th segment of antenna longer than 3rd segment.

Family : CORIXIDAE

The Corixids are commonly called as "water boatmen" (usually 2-16mm in length). Body flattened; colour dark grayish with yellow or black markings. Wing membrane without veins. Head triangular; antennae short; concealed; consist of 3-4 segments; scutellum concealed. Front tarsus 1-jointed; flattened and scoop-like called "Pala" which is the characteristics of the family.

Corixids occur in both stagnant and running waters, generally at bottom near the littoral zone. The corixids are good flier and take off easily from the surface of water. They swim by their dorsum.

12. ***Micronecta*** sp.

Material examined : 2 exs., Majherpara Pond, 18.IV.2010;

Diagnosis : Antennae 3-segmented; scutellum exposed; in male 9th segment of abdomen and upper paramere not forming supports for the aedeagus; small species hardly over 4.5mm in length.

Order : COLEOPTERA

Coleoptera is one of the large group of mainly terrestrial but a few aquatic or semiaquatic insects. The aquatic coleopterans are commonly known as water beetles.They are minute to large (0.6-15 cm) in size and usually sclerotised insects. Front wings are much thickened, veinless and meeting in mid dorsal straight line, the hindwings are membranous. Mouthparts biting or chewing type. Antennae 9-11 segmented. Larvae worm-like, usually with 3 pairs of thoracic legs, which are 5 or 6, with 10 segments and sometimes with

prominent circi. The pupae are with appendages and do not form a puparium. The water beetles show wide diversity of colour, form and life pattern.

The aquatic coleopterans are also very diverse in their mode of life and behaviour. Some are very good swimmer and efficient diver and some others are whirling. The feeding habits vary from highly predaceous to scavenger.

Family : HYDROPHILIDAE

The members of this family are commonly termed as water scavenger beetles, are characterized by their short-clubbed antennae. Maxillary palps nearly always longer than the antennae of which the first 3-5 segments are glabrous, the next segment cup like, and the last ones form a strong pubescent club. Head usually with a Y-shaped impressed line on the front. Wings usually with cantharid venation. Habits truly aquatic. Antennal club hairy.

Adults are good fliers and some leave the water and crawl on land.They feed mainly on detritus, algae and decaying vegetative matter.

13. ***Amphiops pedestris*** Sharp

1890 *Amphiops pedestris* sharp, *Trans. Ent. Soc. Lond.*: 354

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 72

Material examined : 1 ex., Majherpara Pond, 17.I.2010; 3 exs., Dumdum Park Pond, 21.III.2010; 2 exs., Dumdum Park Pond, 18.IV.2010;

Diagnosis : Body rounded and punctate, about 3mm long; head reddish brown, eyes divided by a conspicuous and complete canthus reaching the vertex; prothorax concolourous with head, scutellum triangular; elytra yellowish brown; legs simple, armed with spines; posterior legs without swimming hairs. Ventral surface punctate and dark brown in colour.

Distribution : India : West Bengal (Kolkata, North 24-Parganas), Bihar, Pondicherry and Tamil Nadu.

Remarks : It was found only from Dumdum Park freashwater pond.

14. ***Berosus indicus*** Mots.

1861. *Berosus indicus* Motschulsky, *Bull. Soc. Imp. Nat. Moscou*, **34**: 110.

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 74.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Body elongate with brown to yellow colour and punctate; head markedy deflexed; eyes prominent; antennae 7 - segmented; prothorax brownish yellow, with dense punctures specially on disc of pronotum; scutellum long, triangle; elytra highly patterned, narrowed; legs with long swimming hairs; ventral surface punctate and dark brown in colour.

Distribution : India : West Bengal (Kolkata, North and South 24-Parganas, Murshidabad), Assam, Bihar and Maharashtra.

15. ***Berosus fairmairei*** Zaitzev

1908. *Berosus fairmairei* Zaitzev, *Horae Soc. Ent. Ross*, **38**: 355.

1995. *Berosus fairmairei*, Biswas and Mukhopadhyay, *zool. Surv. India, State Fauna Series* **3** : *Fauna of West Bengal*, Part 6 (A) : 162 - 163.

Material Examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Body elongate with brown to yellowish colour; eyes prominent; antennae segmented; prothorax brownish yellow; scutellum long; legs with long swimming hairs.

Distribution : India : Manipur; West Bengal; Bihar; Rajasthan; Delhi; Kerala; Andaman Is. Elsewhere : Indo - China, Formosa, Indonesia, Tonkin, Laos, Annam, Siam, F.M.S., Philippines, Nepal, Pakistan, Bangladesh, Myanmar, China, Hongkong, Japan, Taiwan, Thailand, Malaysia.

16. ***Helochares anchoralis*** Sharp

1980. *Helochares anchoralis* Sharp , *Trans.Ent.Soc.Lond.* : 35

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 69.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009; 1 ex., Rabindrapally Pond, 15.XI.2009; 1 ex., Kestopur Canal, 15.XI.2009; 2 exs.,

Rabindrapally Pond, 17.I.2010; 1 ex., Majherpara Pond, 17.I.2010; 1 ex., Rabindrapally Pond, 21.II.2010; 2 exs., Rabindrapally Pond, 18.IV.2010;

Diagnosis : Body elongate, about 6mm long, dark brown with blackish patches; head densely punctate, dark posteriorly and with Y-shaped frontal suture; antennae 9-segmented; prothorax densely punctate; scutellum small; elytra densely and evenly punctate; legs with distinct claws and spines; ventral surface dark brown.

Distribution : India : West Bengal (Kolkata, North & South 24-Parganas);

Elsewhere : Indochina, Indonesia and SriLanka.

Remarks : This species was found both from Rabindrapally freashwater pond, sewage-fed Kestopur canal and Majherpara freashwater pond.

17. ***Regimbertia attenuata*** (Fabricius)

1801. *Hydrophilus attenuate* Fabricius, Syst. Eleuth, **1** : 235.

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**:74.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Strongly convex, elongate, compressed on sides, deep and shinning black and punctate. Head rounded anteriorly; eyes large; antennae 8-segmented; elytra strongly narrowed posteriorly; scutellum elongate and triangled; legs with spines and swimming hairs, mid and hind tibiae with long swimming hairs on inner side. Body black ventrally.

Distribution : India : Bihar, Maharashtra, West Bengal (Kolkata, North 24-Parganas) :

Elsewhere : Sri Lanka, Indochina, China, Cambodia, Sumatra, Philippines, Formosa, Japan and Australia.

18. ***Sternolophus rufipes*** (Fab.)

1792. *Hydrophilus rufipes* Fabricus, *Entom. Syst.* **1** : 183.

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**:71.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009; 1 ex., Kestopur Canal, 17.I.2010;

Diagnosis: Body elongate, shinny black; head with Y-shaped frontal suture, maxillary palpi reddish brown; antennae 9-segmented, brownish black and pubescent; elytra punctured; scutellum triangular; legs at base with silky and dense pubescence; ventral surface black and pubescent.

Distribution : India : West Bengal (Kolkata, North and South 24 Parganas, Burdwan, Murshidabad, Purulia, and Medinipur), Bihar, Kashmir, Maharashtra, Punjab and South India;

Elsewhere : East Asia, Sunda Island.

Remarks : This species was found from Rabindrapally freashwater pond and sewage-fed Kestopur Canal.

Family : DYTISCIDAE

The members of this family of Coleoptera have adapted perfectly well to aquatic life. All adults and larvae are aquatic. These beetles generally occupy clean and fresh macrophytic leaves near the bottom along littoral zone. Some species are known to leave water and fly from one wetland to other. They are active swimmers and swift divers.

Body covered with an adherent layer of grease, which holds dust particles or detritus. They are usually black or brownish black in colour, sometimes marked with dull yellow, orange or bronze shades. Hind coxae very large; hind legs flattened, elongated and hairy; antennae very long, threadlike 11-segmented. The spiracles open in subelytral chambers and help in oxygen supply. During submergence, these beetles utilize the oxygen of the tracheae and subelytral chambers. The beetles can remain in submerged condition only for a very short duration and come to surface for oxygen replacement at the interval of every few minutes. The contact of the terminal spiracles with atmosphere maintains the oxygen supply in elytra. In males of some genera the first three segments of anterior tarsi are greatly swollen to form an acetabulum, which helps in holding two individuals during copulation. The females generally deposit the eggs on floating macrophyte leaves near the shore.

These beetles are highly predaceous and feed vigorously upon almost all invertebrates and fish

eggs and fry. Because of their highly predatory nature, these are commonly known as 'predaceous diving beetles'.

19. ***Canthydrus laetabilis*** (Walker)

1859. *Hydroporus Lactabilis* Walker, *Ann. Mag. Nat. Hist.* **3(2)** : 205

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 56.

Material examined : 2 exs., Rabindrapally Pond, 21.II.2010; 1 ex., Rabindrapally Pond, 21.III.2010; 1 ex., Kestopur Canal, 21.III.2010; 2 exs., Majherpara Pond, 18.IV.2010;

Diagnosis : Body oblong-oval; head brownish yellow; eyes large; antennae brownish yellow, short and slender; prothorax with its front margin darker and with dark punctures; elytra streamlined, brownish black with two basal orange yellow spots; legs with front tibiae short and its apical spur curved, hind tarsi with swimming hairs, claws simple.

Distribution : India : West Bengal (Kolkata, North and South 24 Parganas), Andhra Pradesh, Assam, Bihar, Kerala, Orissa, Punjab, Rajasthan, Uttar Pradesh.

Remarks : This species occurs both in Rabindrapally and Majherpara freashwater pond, and sewage-fed Kestopur Canal.

20. ***Canthydrus luctuosus*** (Aube)

1838. *Hydrocanthus luctuosus* Aube, *in Dejean's species coleopteres,* Paris, **6** : 408

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 56.

Material examined : 1 ex., Kestopur Canal, 20.XII.2009; 3 exs., Kestopur Canal, 17.I.2010; 3 exs., Rabindrapally Pond, 21.II.2010; 5 exs., Kestopur Canal, 21.II.2010; 3 exs., Majherpara Pond, 21.II.2010; 21 exs., Kestopur Canal, 21.III.2010; 10 exs., Majherpara Pond, 21.III.2010; 27 exs., Kestopur Canal, 18.IV.2010; 1 ex., Majherpara Pond, 18.IV.2010;

Diagnosis: Body 3.0-3.25 mm. long; head brownish black with anterior portion yellowish; prothorax black merging into orange-yellow on sides; elytra black with orange-yellow markings and ventral surface deep brown.

Distribution : India : West Bengal (Kolkata, North 24-Parganas and South 24-Parganas), Andhra Pradesh, Bihar, Karnataka, Kerala, Maharashtra, Orissa, Tamil Nadu.

Remarks : This species was found from Rabindrapally and Majherpara freashwater pond and sewage-fed Kestopur Canal.

21. ***Hydaticus*** sp.

Material examined : 1 ex., Kestopur Canal, 21.III.2010;

Diagnosis: Suture between the metaepisternum and metasternal wing straight, apical spurs of the hind tibiae blunt; posterior claws unequal.

22. ***Laccophilus anticatus anticatus*** Sharp.

1890. *Laccophilus anticatus* Sharp, *Trans. Ent. Soc. London* :341

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 58.

Material examined : 1 ex., Majherpara Pond, 20.XII.2009; 1 ex., Majherpara Pond, 21.II.2010; 2 exs., Majherpara Pond, 21.III.2010;

Diagnosis: Body oval, 3.0-3.2 mm. Long; head brownish yellow, and often with faint brownish markings; eyes large; antennae brownish-yellow, long and narrow; prothorax transverse; elytra blackish, with yellow patches on anterior half and a pair of small patches on posterior half, punctures present; hind tarsi with swimming hairs and with a single straight claw.

Distribution : India : West Bengal (Kolkata, Hooghly, Murshidabad, North 24-Parganas), Assam, Bihar, Orissa and Manipur.

Remarks : It was recorded only from Majherpara freshwater pond.

23. ***Laccophilus parvulus parvulus*** Aube

1838. *Laccophilus parvulus* Aube, *in Dejean's species coleopteres, Paris, 6* : 429.

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* **No. 194**: 58.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Body elongate, about 3.6 mm. long; head brownish yellow; eyes large; antennae concolourous with head, long and narrow; prothorax transverse, also brownish yellow; elytra testaceous – reddish with zigzag double markings, generally thick and coalescent; hind tarsi with swimming hairs and single, straight claw.

Distribution : India : West Bengal (Medinipur, North 24-Parganas), Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Madhya Pradesh, Maharashtra, Manipur, Orissa, Rajasthan, Tamil Nadu. Elsewhere : West Pakistan, Indochina (Saigon),Thailand, Indonesia, Ceylon.

24. ***Laccophilus basalis*** Mots.

1858. *Laccophilus basalis Mots., Etud. Ent.*, **8** : 45.

Material examined : 1 ex., Rabindrapally Pond, 21.II.2010;

Diagnosis : Elytra testaceous, with irrotations well marked. In males penis very much narrowed in the anterior part.

Distribution : India : West Bengal (North 24-Parganas), Andaman Is.

25. ***Laccophilus flexuosus*** Aube

1838. *Laccophilus flexuosus Aube, in Dejean's species coleopteres,* **6** : 430.

Material examined : 1 ex., Rabindrapally Pond, 15.XI.2009;

Diagnosis : Elytra markings flexuosus, excessively irregular and covering the entire surface excepting the lateral margins.

Distribution: Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Karnataka, Orissa, Rajasthan, Gujarat, Uttar Pradesh, Himachal Pradesh, West Bengal (North 24-Parganas), Tamil Nadu.

26. ***Laccophilus sharpi*** Regimbart

1889. *Laccophilus sharpi Regimbart, Ann. Soc. ent. Fr.,* **9**:151.

Material examined : 4 exs., Rabindrapally Pond, 18.IV.2010;

Diagnosis : Elytra markings consisting of zigzag double lines, clear and thick but never coalesent; pronotum with transverse black markings, in the middle, along the anterior and posterior margines.

Distribution : Bihar, West Bengal (North 24-Parganas), Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Gujarat, Tamil Nadu, Uttar Pradesh, Andaman Is.

Remarks : This species was collected only from Rabindrapally freshwater pond.

Family : CHRYSOMELIDAE

Body oval, minute to small, convex brightly coloured and measure 3.5 to 12mm. long; antennae widely separated at base, not clubbed; head not produced, hypognathous; eyes not prominent; prothorax laterally margined; prosternum broad and pygidium not exposed beyond elytra. Elytra shining. The third tarsal segment is not bilobed and the forecoxae are transverse.

27. ***Cassida*** sp.

Material examined : 1 ex., Majherpara Pond, 11.X.2009;

Diagnosis : Head imbedded in a cavity under the explanate margin of the prothorax. The eyes are black, oblong and convex. The clypeus is elongate, generally broader near the labrum. The antennae in most cases just pass a little beyond the prothorax. Scutellum triangular, with the surface usually smooth and impunctate. Elytra equal to or a little or much broader than the prothorax at the base, convex, the highest point being posterior to the scutellum, and generally punctate – striate.

28. ***Paridea*** sp.

Material examined : 1 ex., Majherpara Pond, 21.III.2010; 3 exs., Majherpara Pond, 18.IV.2010.

Diagnosis : Body oblong, broadened posteriorly. General colour usually brown with black spots and patches on the elytra. Head together with the eyes narrower than the prothorax, somewhat narrowed in front. Eyes convex but not large. Antenna long, slender, extending nearly to the apical area of elytron.

Prothorax quadrate or slightly broader than long. Scutellum small, triangular, surface somewhat convex, smooth, impunctate. Elytra much broader at base than the prothorax; slightly constricted behind the shoulders.

29. *Altica* sp.

Material examined : 1 ex., Majherpara Pond, 18.IV.2010.

Diagnosis : The form is generally oblong, the species are always winged, the colour is blue or greenish-blue. They are moreover characterized by having distinct frontal tubercles and a sharp frontal ridge on the head. The second and third antennal segments are of equal thickness, and the third fourth are almost equal in length. The pronotum is furnished, at the base with a relatively deep transverse depression, which is not bounded by a longitudinal fold on each side. The elytra are confusedly punctate. The anterior coxal cavities are open behind.

Family : CARABIDAE

Body oval, broad and somewhat flattened; antennae filiform, conspicuous and project anteriorly; legs adapted for running or burrowing; clypus not extending laterally in front of base of antennae; lacinia without a movable lobe. Majority of Carabidae carnivorous in their larval and adult stage.

30. *Tetragonoderus arcuatus* Dejean

1829. *Tetragonoderus arcuatus Dejean,* Spec. gen. col. IV : 495.

1930. *Tetragonoderus arcuatus,* Trans. Ent. Soc. Lond., L XXVIII : 9.

Material examined : 1 ex., Dumdum Park Pond, 15.XI.2009;

Diagnosis : Supraorbital seta present. Crescent shape marking on elytra. Elytra not completely covering the abdomen. Elytra slightly dilated just before apex. Medial line of prothorax nearly reaching both extremity. Labrum, clypeus emarginate.

Distribution : India : West Bengal (North 24-Parganas).

Elsewhere : Aegypten, Sudan, Mesopotamien, Brit. Indien, Birma, Laos.

Family : GYRINIDAE

The Gyrinids or whirling beetles occur in the groups of a few to thousands on the surface of wetlands. They are generally found in almost all types of ponds, lakes, floodplain, and natural wetlands, river pools etc. in the margin areas. They glide about each other in rapid irregular curves near the shore. When undisturbed for longer duration, they float quietly on water surface. When disturbed they fly quickly in all direction.

Beetles are shinny black in colour; oval in shape with some what depressed body, abdomen extending beyond elytra. Compound eyes divided into dorsal and ventral parts; antennae short and thick. The middle and hind legs are greatly flattened paddle-like and fringed, which help in rapid locomotion.

The air supply is being carried under the elytra when submerged. They are reported to be scavengers, feeding upon dead animal matter and vegetation. Gyrinids are found to breed throughout the year in the wetlands of this region. Eggs are laid on submerged macrophyte.

31. *Dineutus (Protodineutus) indicus* Aube

1938. *Dineutus indicus* Aube, *Species coleopteres,* **6** : 772 (India - Orient).

1977. *Dineutus (Protodineutus) indicus* : Vazirani, *Newsl. zool. Surv. India,* **3 (5)** : 251, 279.

Material examined : 2 exs., Kestopur Canal, 11.X.2009;

Diagnosis: Body elongate, black, 6-7 mm. long; antennae very short; prothorax black; elytra without pubescene, elytral straiae indistinct or obsolete; pronotum without pubescenece; scutellum invisible.

Distribution : India : Kashmir, Punjab, Himachal Pradesh, Rajasthan, Gujarat, Uttar Pradesh, Bihar, West Bengal (North 24-Parganas), Orissa, Karnataka, Andhra Pradesh, Tamil Nadu.

Remarks : This species was found only from sewage-fed Kestopur Canal.

RESULT

The present contribution is the result of the studies on aquatic insects carried out during 7 months (October, 2009 – April, 2010) of Wetlands of North East Kolkata.

In Rabindrapally freshwater pond of Kestopur, high organic load due to disposal of kitchen refused and other matters. Sparsely infested with submerged as well as floating macrophytes. Not organised fishing but used extensively for bathing, washing, and other domestic purposes. 9 species belonging to the 6 families of Hemiptera where 2 species of Nepidae, 2 species of Gerridae, 2 species of Belostomatidae, 1 species of Notonectidae, Pleidae and Mesoveliidae are collected. 11 species belonging to 2 families of Coleoptera are observed. Here 6 species of Dytiscidae, 5 species of Hydrophilidae are recorded.

In sewage-fed wetlands of Kestopur canal, high organic load due to input of sewage, dense littoral strands of macrophytes *Eichhornea* sp. 3 species belonging to 2 families of Hemiptera are collected. Here, 2 species of Nepidae, 1 species of Belostomatidae are collected. 6 species belonging to 3 families of Coleoptera are observed. Of these, 3 species of Dytiscidae, 1 species of Gyrinidae and Hydrophilidae are identified.

In Dumdum Park freshwater pond, high organic load due to disposal of kitchen refused and other matters. Moderately infested with macrophytes. Seasonal sport fishing and used extensively for bathing, washing and other domestic purposes. 5 species belonging to the 4 families of Hemiptera are observed. Of these, 2 species belong to Nepidae, 1 species each belongs to Belostomatidae, Gerridae and Mesoveliidae. 2 species under 2 families of Coleoptera are noted. Of these, 1 species of Carabidae and 1 species of Hydrophilidae are recorded.

In Majherpara freshwater pond of Kestopur, high organic load due to disposal of kitchen refused and other matters. Sparsely infested with submerged as well as floating macrophytes. Emergent vegetation moderate. Not organised fishing but used extensively for bathing, washing, and other domestic purposes. 8 species belonging to 7 families of Hemiptera are observed. Of these, 2 species of Gerridae, 1 species each of Nepidae, Notonectidae, Belostomatidae, Pleidae, Mesoveliidae and Corixidae are recorded. 9 species belonging to 4 families of Coleoptera are noted. Here, 3 species of Chrysomelidae and Dytiscidae, 2 species of Hydrophilidae are recorded.

Regarding water parameter of the collection media pH value of water was estimated as about 7.5.

DISCUSSION

The species diversity of Hemiptera is maximum in Rabindrapally freshwater pond and minimum in sewage-fed wetland of Kestopur canal. The species diversity of Coleoptera is maximum also in Rabindrapally freshwater pond and minimum in Dumdum Park freshwater pond. The hemipteran population is profusely abundant in Rabindrapally freshwater pond and minimum in sewage-fed Kestopur Canal. The coleopteran population is richly abundant in sewage-fed Kestopur Canal, and minimum in Dumdum Park freshwater pond.

The total number of species of sewage-fed wetland of Kestopur canal is significantly fewer than Rabindrapally freshwater pond and Majherpara freshwater pond of Kestopur, but greater than Dumdum park freshwater pond.

Hemipteran and coleopteran entomofauna contributed moderately and steadily in all wetlands, showing their comparatively lower sensitivity to organic enrichment but their distribution and abundance were heavily dependent of macrophytes. Their quicker movements and tendency to remain on surface films or macrophytes provided them protection from being extensively grazed by fishes.

SUMMARY

The result obtained from the study on diversity of aquatic insects in freshwater wetlands of North Eastern Kolkata during October, 2009 to April, 2010 in 4 different wetlands, two freshwater ponds of Kestopur, 1 freshwater pond near Dumdum park and sewage-fed wetland of Kestopur canal is incorporated in the present work. It deals with 12 species of Hemiptera belonging to the 10 genera and 7 families. Coleoptera is represented by 20 species belonging to 14 genera and 6 families. The fluctuation of population of insect community in 4 different freshwater bodies and the month-wise collection data are shown in charts.

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Table 1: DETAILS OF WETLANDS STUDIED

Month	Wetland	Order	Family	Genus	Species	Ex(s)
October	RabindraPally Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	3
				Laccotrephes	*griseus* (Guerin)	1
			Notonectidae	*Nychia*	*marshalli* (Scott.)	1
			Gerridae	*Limnogonus*	*nitidus* (Mayr)	3
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	2
				Lethocerus	*indicus* (Lep & Serv.)	1
		Coleoptera	Dytiscidae	*Laccophilus*	*parvulus parvulus* Aube	1
			Hydrophilidae	*Berosus*	*indicus* Mots	1
				Berosus	*fairmairei* Zaitzev	1
				Helochares	*anchoralis* Sharp	1
				Regimbertia	*attenuata* Fab.	1
				Sternolophus	*rufipes* (Fab.)	1
	Kestopur Canal	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	2
				Laccotrephes	*griseus* (Guerin)	1
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	8
		Coleoptera	Gyrinidae	*Dineutus (Protodineutus)*	*indicus* Aube	2
	Dumdum Park Pond	Hemiptera	Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	3
	Majherpara Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	1
			Gerridae	*Limnogonus*	*fossorum* (Fabr.)	4
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	3
		Coleoptera	Chrysomelidae	*Cassida*	sp.	1
November	RabindraPally Pond	Hemiptera	Notonectidae	*Nychia*	*marshalli* (Scott.)	2
			Gerridae	*Limnogonus*	*fossorum (Fabr.)*	1
			Belostomatidae	*Diplonychus*	*rusticus (Fabr.)*	2
		Coleoptera	Dytiscidae	*Laccophilus*	*flexuosus* (Aube)	1
			Hydrophilidae	*Helochares*	sp.	1
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	9
		Coleoptera	Hydrophilidae	*Helochares*	*anchoralis* Sharp	1
	Dumdum Park Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	4
			Belostomatidae	*Diplonychus*	*annulatum (Fabr.)*	6
			Gerridae	*Limnogonus*	*fossorum* (Fabr.)	2
		Coleoptera	Carabidae	*Tetragonoderus*	*arcuatus* Dejean	1
	Majherpara Pond	Hemiptera	Notonectidae	*Nychia*	*marshalli* (Scott.)	1
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	5
December	RabindraPally Pond	Hemiptera	Notonectidae	*Nychia*	*marshalli* (Scott.)	3
			Gerridae	*Limnogonus*	*nitidus* (Mayr)	3

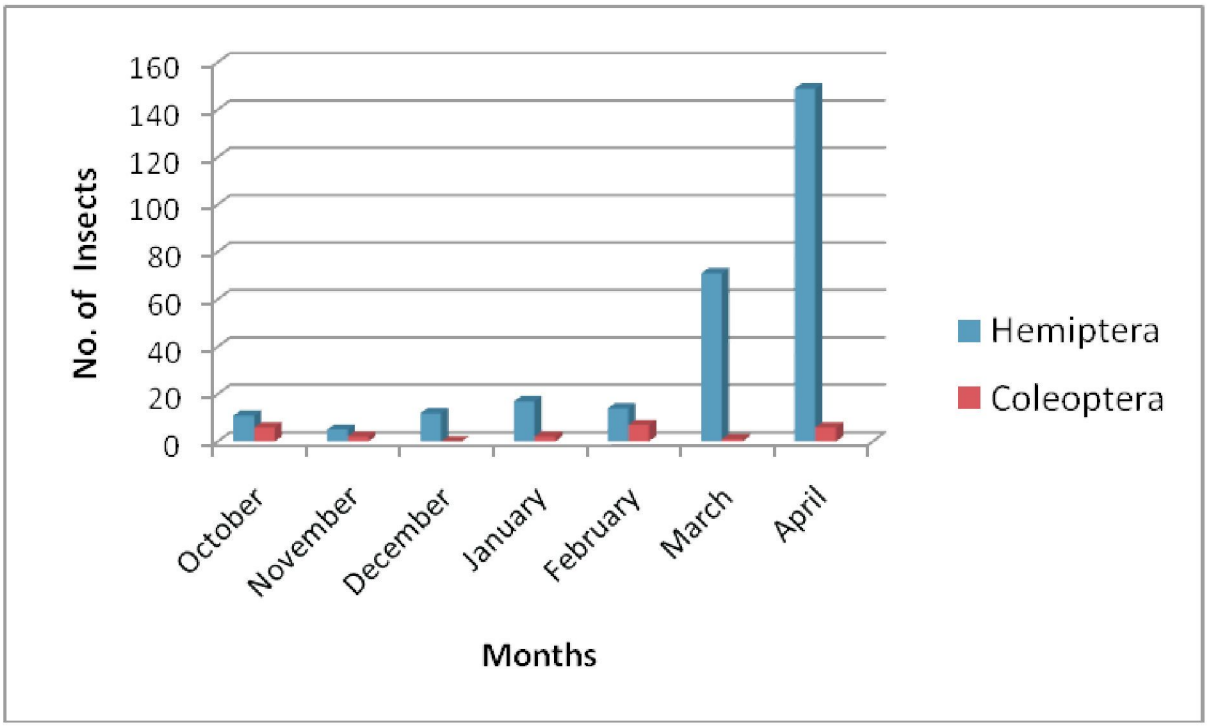
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	6
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	4
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	1
	Dumdum Park Pond	Hemiptera	Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	5
	Majherpara Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	1
			Notonectidae	*Nychia*	*marshalli* (scott.)	1
			Gerridae	*Neogerris*	*parvula* (Stal)	1
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	9
		Coleoptera	Dytiscidae	*Laccophilus*	*anticatus* *anticatus* Sharp	1
January	Rabindra Pally Pond	Hemiptera	Notonectidae	*Nychia*	*marshalli* (Scott.)	7
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	10
		Coleoptera	Hydrophilidae	*Helochares*	*anchoralis* Sharp	2
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	4
		Coleoptera	Hydrophilidae	*Sternolophus*	*rufipes* (Fab.)	1
			Dytiscidae	*Canthydus*	*luctuosus* (Aube)	3
	Dumdum Park Pond	Hemiptera	Nepidae	*Laccotrephes*	*griseus* (Guerin)	1
	Majherpara Pond	Hemiptera	Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	5
			Notonectidae	*Nychia*	*marshalli* (Scott.)	2
			Nepidae	*Ranatra*	*sordidula* Dohrn	2
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	4
		Coleoptera	Hydrophilidae	*Amphiops*	*pedestris* Sharp	1
February	RabindraPally Pond	Hemiptera	Nepidae	*Helochares*	*anchoralis* Sharp	1
				Ranatra	*sordidula* Dohrn	1
				Laccotrephes	*griseus* (Guerin)	1
			Notonectidae	*Nychia*	*marshalli* (Scott.)	12
		Coleoptera	Hydrophilidae	*Helochares*	*anchoralis* Sharp	1
			Dytiscidae	*Canthydrus* *Canthydrus* *Laccophilus*	*laetabilis* (Walker) *luctuosus* (Aube) *basalis* Mots.	2 3 1
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	7
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	5
	Dumdum Park Road	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	1
			Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	13
	Majherpara Pond	Hemiptera	Nepidae Notonectidae	*Ranatra* *Nyehia*	*sordidula* Dohrn *marshalli* (Scott.)	1 6

			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	5
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	3
				Laccophilus	*anticatus* *anticatus* Sharp	1
March	RabindraPally Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	3
			Notonectidae	*Nychia*	*marshalli* (Scott.)	38
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	27
			Pleidae	*Plea*	sp.	3
		Coleoptera	Dytiscidae	*Canthydrus*	*laetabilis* (walker)	1
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	rusticus (Fabr.)	26
		Coleoptera	Dytiscidae	*Canthydrus*	laetabilis (Walker)	1
				Canthydrus	luctuosus (Aube)	21
				Hydaticus	sp.	1
	Dumdum Park Pond	Hemiptera	Nepidae	*Laccotrephes*	*griseus* (Guerin)	1
			Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	18
			Mesoveliidae	*Mesovelia*	sp.	1
			Hydrophilidae	*Amphiops*	*pedestreis* Sharp	3
		Coleoptera				
	Majherpara Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	8
			Notonectidae	*Nychia*	*marshalli* (Scott.)	21
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	58
			Pleidae	*Plea*	sp.	2
			Mesoveliidae	*Mesovelia*	sp.	1
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	10
				Laccophilus	*anticatus* *anticatus* Sharp	2
			Chrysomelidae	*Paridea*	sp.	1
April	RabindraPally Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	4
			Notonectidae	*Nychia*	*marshalli* (Scott.)	63
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	80
			Pleidae	*Plea*	sp.	1
			Mesoveliidae	*Mesovelia*	sp.	1
		Coleoptera	Hydrophilidae	*Helochares*	*anchoralis* Sharp	2
			Dytiscidae	*Laccophilus*	*sharpi* Regimbart	4
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	17

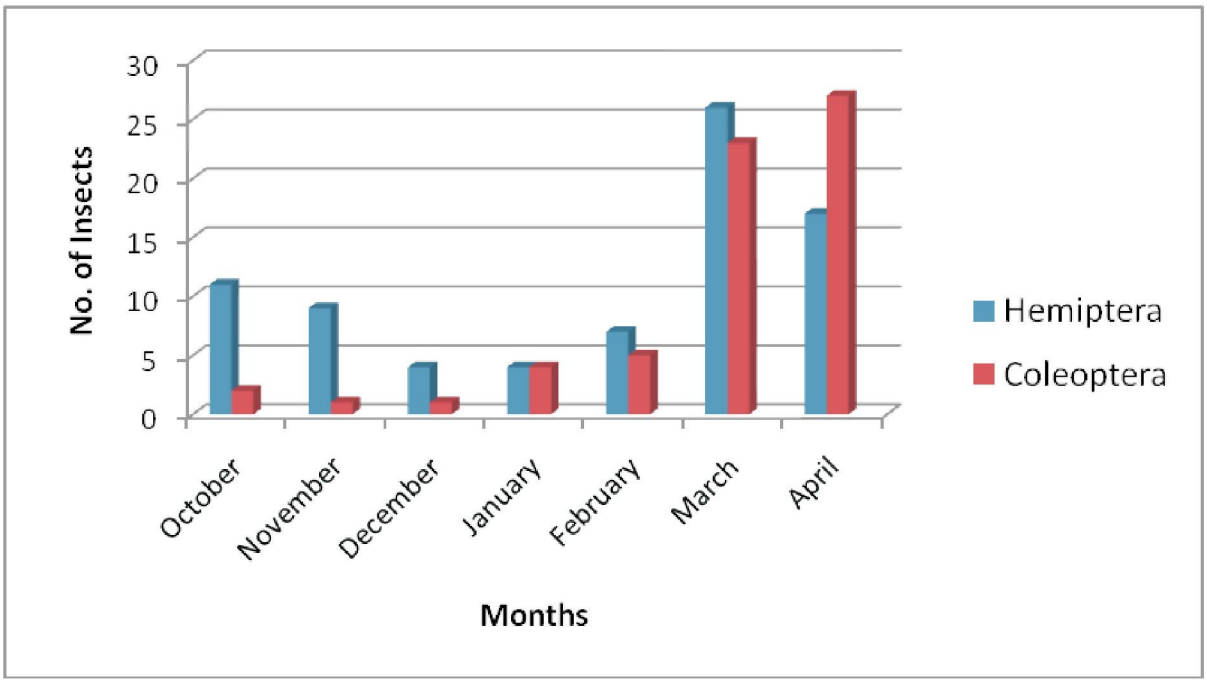
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	27
	Dumdum Park Pond	Hemiptera	Nepidae	*Laccotrephes*	griseus (Guerin)	1
			Belostomatidae	*Diplonychus*	annulatum (Fabr.)	21
		Coleoptera	Hydrophilidae	*Amphiops*	*pedestris* Sharp	2
	Majherpara Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	16
			Notonectidae	*Nychia*	*marshalli* (Scott.)	10
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	43
			Pleidae	*Plea*	sp.	2
			Corixidae	*Micronecta*	sp.	2
		Coleoptera	Dytiscidae	*Canthydrus*	*laetabilis* (Walker)	2
				Canthydrus	luctuosus (Aube)	1
			Chrysomelidae	*Paridea*	sp.	3
				Altica	sp.	1

BAR DIAGRAMS SHOWING INSECT DIVERSITY IN DIFFERENT FRESHWATER WETLANDS

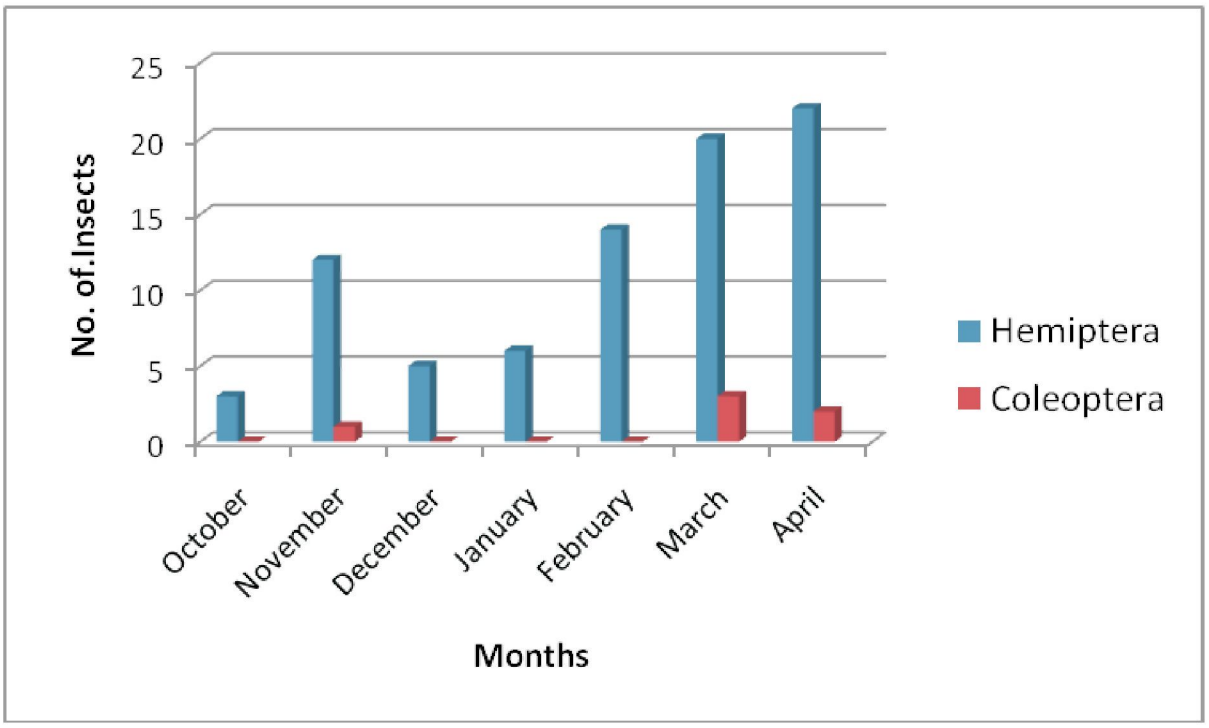
Rabindrapally Pond



Kestopur Canal



Dumdum Park Pond



Majherpara Pond