Aquatic Insect Biodiversity of Northern Region of Bangladesh

Md. Abdul Ahad[1], Saiful Islam Raja[2], Mst. Masuda Khatun[3] and M. Alamgir Hossain[4]

[1,3&4]Department of Entomology, Hajee Mohammad Danesh Science &Technology University, Dinajpur (5200), Bangladesh
[2]Karnaphuli Tea State, Photiksori, Chittagong, Bangladesh

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Correspondence to

E-mail: aahad_hstu@yahoo.com

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Abstract

The experiment was under taken to investigate the 'Aquatic Insect Biodiversity of Northern Region of Bangladesh' during January to December 2009. The aquatic insects were collected at 15 days interval by using an aquatic net with fairly fine mesh from the three lakes, one pond, canal and bill from Dinajpur district. In these ecosystems, insects of three orders were found and biodiversity of insects (both species and number) of the order Hemipteran were highest followed by Coleopteran and Odonata. Biodiversity of Hemipteran insects were Water boatmen (Corixidae), Backswimmers (Notonectidae), Creeping water bugs (Naucoridae), Water scorpion (Nepidae), Giant water bugs (Belostomatidae), Water striders (Gerrididae), Broad-shouldered water striders/Ripple bugs (Veliidae),Velvety shore bugs (rare, Ochteridae); biodiversity of Coleopteran insects were Water scavenger beetles (Hydrophilidae), Crawling water beetle (Haliplidae), Diving beetles (Dytiscidae), Whirligig beetles (Gyrinidae); and biodiversity of Odonata insects were Damselfly nymph (Coenagriidae) and Dragonfly nymph (Aeshnidae). Water strider, Back swimmer, Water boatmen, Creeping water bug, Water scorpion (*Ranatra* sp) and Damselfly nymph were most common in all water ecosystems and season. Abundance of these insect was more in rainy season. Diversified insect was found in a pond and Ramsager lake. All aquatic insect are beneficial but Backswimmers and Giant water bugs (especially adult Giant fish killer, *Lethocerus indica*) and Diving beetle feed on fishes therefore they are harmful to fish cultivation. However, from the ecological point of view all aquatic insects are important and useful to nature. Diversified insect was found in a pond and Ramsager lake as these two water reservoirs were less disturbed by human and were not commercially fish cultivated. Giant water bug and Scavenger beetle were not caught by the aquatic net; however, large number of Water scavenger beetle were found in the beginning of winter season below the light sources and data were taken from their but Giant water bug were not found below the light sources though it attracted to light.

1. Introduction

Biodiversity refers to the variety and variability among living organisms (number of different items/species and their relative frequency) in which they occur. During past twenty years or so biodiversity has attracted attention of numerous workers expediting fauna and flora of the world. This is considered as the basic science and has grown as an useful subject. Several softwares are developed to accommodate the data of faunal and floral biodiversity for the different regions of the globe (Kumer and Asija, 2005). Biodiversity helps to know whether living organisms is threaten or not and thus help to conserve them through consciousness of human.

The insects are primarily terrestrial and they have been secondarily adapted to aquatic life and less than 4% of the total number of species occur in or on water at some time during their life histories. Though small parts of the whole insect community are aquatic, the insects constitute the most conspicuous and interesting forms of life in ponds and streams and about 5,000 species of insects are found in fresh water habitats; of these, the aquatic bugs (Hemiptera) and beetles (Coleoptera) pass their entire life cycle in fresh water whereas the mayfly (Ephemeroptera), stonefly (Plecoptera), dragonfly and damselfly (Odonata), spend part of their lives in fresh water (Anonymous, 1980a).

The Hemipteran insect is a very successful aquatic group because of its adaptive nature in diverse ecological and geographical area and is especially economically important.

Some aquatic species live on the shore (semi-aquatic), some abate over the surface while others swim and dive deep into the water. The toad bugs are semi-aquatic, the marsh striders, pond skaters and water striders can run over the surface of water. The water scorpions and giant water bugs remain under aquatic vegetation and have special appendages to take atmospheric air. The water boatman and the back swimmers dive deep into the water and have adaptation to carry air with them (Comstock, 1984).

The aquatic Hemiptera contain 14 families. Three lives on the shore, 5 stride over the water surface or floating vegetation, they are known as semi-aquatic, whereas the other 6 lives beneath the surface and are known as truly aquatic (Anonymous, 1980a). Dragonflies and damselflies (Order-Odonata) are very common insects in the surrounding area of stream, ponds, and lakes; they are well known to all who frequently visit such place (Comstock, 1984). Aquatic insect typically have broad sampling seasons or index periods (Fend et al. 2005).

The beetles are an enormous group of insects containing a few families which are entirely aquatic (i.e. Dytiscidae, Gyrinidae and Hydrophilidae) but there are also some aquatic genera among families are mainly land dwelling species and some of these later spent only part of their live in water (Anonymous, 1980b).

Adult aquatic insects are important energy subsidies for terrestrial predators (Paetzold and Tockner, 2009) and its population counts can be a good indicator of the health, or water quality of rivers and streams (Thomas, 2009). Thus the use of aquatic Coleopterans insects as an index to stream pollution is of great help in the science of conservation of natural resources. Moreover, aquatic insects are the most widely used organisms in freshwater biomonitoring of human impact. Because of the high monetary investment in freshwater management, decisions are often based on biomonitoring results, and a critical and comparative review of different approaches is required (Núria et al,, 2006). This type of insects helps to keep water clear at the same time some aquatic insects feeds on spawn, fish fry, fish larvae, small fishes and some aquatic flora.

Moreover, the adults and the eggs of corixid are used as food by the birds as well as by the people in Egypt and Mexico. Hemiptera serves as a natural foot for fish and therefore, they are of considerable economic importance (Anonymous, 1980a). In addition, some of the aquatic beetles are also taken as food by the Chinese such as *Eretes strictus* Linn. (Coleoptera: Dytiscidae) both larvae and adult are used as food such as *Cybister* (Coleoptera: Dytiscidae) is also used by the Chinese both as food and for medicinal purposes. Dried specimens can be purchased in the Chinese stores in San Francisco (Essig, 1942). Apart from their importance in food chain and as food stuffs the aesthetic value of the beetles also cannot be denied. Not only they are most beautiful but they are most stable specimens that can be collected only (Anonymous, 1980b).

Aquatic entomology is an interesting as well as a complex subject as the control of mosquitoes a concern of aquatic entomologist is very important in connection with public health. The role of insect in the farm ponds is of important concern to fishery hydrologist. Insects are an important element in the food of pond fishes. On the other hand, some large beetles and giant water bugs feed variously on fish fry. *Anisops pouvirl* (Notonectidae) was found to feed voraciously on fish fry.

It is seen from review and literature that very little work has been done on the aquatic insect in Bangladesh. So, extensive work is needed regarding aquatic insects diversity especially in Northern region of Bangladesh. Therefore, the work has been taken with the objectives of preparing a list of aquatic insects of northern region, to know the abundance and seasonal fluctuation of aquatic insects iii) to identify the harmful and beneficial aquatic insects of northern region.

2. Materials and Methods

The aquatic insects were collected at 15 days interval by using an aquatic net with fairly fine mesh. Ten sweeps were taken from different portion of the aquatic ecosystems such as lake, pond, bill and canal. After collecting the aquatic insect, it was identified by using taxonomic key and also by comparing the collected specimen with internet-photo of the specific insect. The number of different species was counted to know the abundances and fluctuations of each species. However, giant water bug, water scavenger beetle and diving water beetle were not found in sweeping net as they live in deep water. But water scavenger beetle and diving water beetle attracted to light and count daily at morning to observe their abundance. Giant water bug also attracted to light but during 2009 it was not found beneath the light sources. So, data were collected on 20.05.09 to 29.06.09 from fifty (50) commercial fishermen. Pre-tested interview schedules containing direct questions were used for collection of data**.** Data were converted into % and compiled in tables. A colour photograph (laminated) of giant water bug was prepared and was showed to the commercial fishermen and asked them how many giant water bug caught net^{-1} in the pond during the last year.

3. Results and Discussions

The aquatic insects were collected at 15 days interval by using an aquatic net from different ecosystem. Each aquatic net sample consists of 10 separate sweeps done continuously, one after another and this was considered as one sample. Abundance (total number) of different aquatic insect in different ecosystem

of 12 months is presented in Table1.

3.1. Abundances (total no.) of different insect in different ecosystem

3.1.1. Hemipteran insect

3.1.1.1. Backswimmers

Abundances of total number of Backswimmers in Ramsagar lake, Anandasagar lake, Matasagar lake, pond, Bill and Canal were175, 207, 86, 204, 60 and 135, respectively. Highest number of Backswimmers was found in Anandasagar lake (207) followed by pond (204) and lowest no. were in Bill (60) (Table 1).

3.1.1.2. Water boatmen

Abundances of total number of Water boatmen in Ramsagar lake, Anandasagar lake, Matasagar lake, HTSU pond, Bill and Canal were 82, 142, 27, 118, 700 and 307, respectively. Highest number of Water boatmen were found in Bill (700) followed by Canal (307) and lowest no. were in Matasagar lake (77) (Table 1).

3.1.1.3. Creeping water bugs

Abundances of total number of Creeping water bugs in Ramsagar lake, Anandasagar lake, Matasagar lake, HTSU pond, Bill and Canal were 06, 00, 00, 144, 60 and 21, respectively. Highest number of Creeping water bugs were found in HTSU pond (144) followed by Bill (60) and lowest number were in Anandasagar lake and Matasagar lake was absent (Table1).

3.1.1.4. Water striders

Water striders were found on the water surface of Ramsagar Lake, Anandasagar Lake, Matasagar lake, HTSU pond and were impossible to collect by swiping net. It was found all over season it was not in the bill. They remain scattered throughout the water surface but sometimes they form swarm and there were about 400-5000 insect in a swarm (Table1).

3.1.1.5. Broad shoulder water striders

Broad shoulder water strider was found in the in Ramsagar lake, Anandasagar lake, Matasagar lake, and Hajee Mohammad Danesh Science and Technology University pond 3-4 swarms. There were 200-300 broad shoulder water strider insects in each swarm. However, this insect was not found in the bill and canal.

3.1.1.6. Water scorpion, Ranatra sp

Water scopion, *Ranatra* sp. were found in Ramsagar lake, Anandasagar lake, Matasagar lake, HTSU pond, Bill and Canal. Abundances of total number of Water scopion *Ranatra* sp. in Ramsagar lake, Anandasagar lake, Matasagar lake, HTSU pond, Bill and Canal were 12, 25, 10, 32, 18 and 7, respectively. Highest number of Water scopion *Ranatra* sp. were found in HTSU pond (32) followed by Anandasagar lake (25) and lowest number were in canal (7) (Table 1).

Water scorpions, Nepa sp

These were found in Ramsagar Lake, Matasagar Lake, HTSU pond, and Canal. Abundances of total number of Water scorpion, *Nepa* in Ramsagar Lake, Matasagar lake, HTSU pond and Canal were 01, 03, 01 and 2, respectively (Table 1).

3.1.1.7. Giant water bugs

Giant water bugs were not found by the aquatic net. So, data were collected through interview of pond fishermen about Giant water bug caught in Ber net^{-1}. 40% farmers were opined that 1-2 Giant waters bug were caught Ber net^{-1}; 30% farmers were opined 3-5 Giant water bug caught Ber net^{-1} and rest 30% farmers opined no Giant water bug caught in their Ber net. Regarding when it was found 45% farmers were opined that it was found during May; 35% farmers were opined that it was found during May and June; 6% farmers were opined that it found during April to May and 4% farmers were opined that it was found all over the season (Table 4).

3.1.1.8. Velvety shore bugs

Velvety shore bugs were found in Ramsager lake and pond and it was absent in other ecosystems. Abundances of total number of velvety shore bugs in Ramsager lake and pond were 9 and 19, respectively (Table 1).

3.1.2. Odonatan insect

3.1.2.1. Damselflies nymph

Damselflies nymphs were found in all ecosystems (Tables 1 to 6). Abundances of total number of Damselflies nymphs in Ramsagar lake, Anandasagar lake, Matasagar lake, HTSU pond, Bill and Canal were 50, 32, 10, 86, 104 and 85, respectively. Highest number of Damselflies nymphs were found in Bill (104) followed by pond (86) and lowest number were in Matasagar lake (10) (Table 1).

3.1.2.2. Dragonflies nymph

Dragonflies nymphs were also found in all ecosystems. Abundances of total number of Dragonflies nymphs in Ramsagar lake, Anandasagar lake, Matasagar lake, HTSU pond, Bill and Canal were 03, 12, 03, 04, 08 and 07, respectively. Highest number of Dragonflies nymphs were found in Anandasagar lake (104) followed by Bill (8) and lowest no. were in Ramsagar and Matasagar lake (3) (Table 1).

3.1.3. Coleopteran insect

3.1.3.1. Crawling water beetle

Crawling Water Beetle were also found in all ecosystems. Abundances of total number of Crawling Water Beetle in Ramsagar lake, Anandasagar lake, Matasagar lake, pond, bill

and Canal were 10, 11, 28, 30, 18 and 28, respectively. Highest number of Crawling Water Beetle were found in pond (30) followed by Matasagar lake and Bill (28) and lowest number were in Ramsagar lake (10), Anandasagar lake (11) (Table 1).

3.1.3.2. Water scavenger beetles and Diving beetles

These two insects were not found in the aquatic net; as they were deep water insect. However, 1 (one) Water Scavenger Beetle was first time attracted to the search light (of Library) at 22th July of 2009. Moreover, 17, 13, 37, 3, and 10 Water Scavenger Beetles were attracted to the search light (of Library) at 21st , 22nd, 23rd, 24th, 25th October of 2009, respectively but only 1 (one) Diving beetles attracted at 21st (October of 2009) (Table 2).

It was interesting that Water scavenger beetles were also attracted to an electric bulb light in the Academic building (which is closed by wall) in the, Dinajpur. Only 1, 1 and 2 Water scavenger beetles were found at Ist, 18th and 25th (October 2009), respectively. Whereas, 1 and 1 Diving beetles were found at 18th and 28th October 2009, respectively (Table 3).

3.1.3.3. Whirligig beetles

Whirligig Beetles were found in Ramsager Lake and pond. They first appear in the month of July 2009 and about 13-20

Table 1: Abundances (Total No.) of different aquatic insect in different ecosystem

Name of insect, family and order	No. of different aquatic insect in different ecosystems					
Order Hemiptera	Ramsagar lake (total no. of insects in 12 months)	Anandasagar lake (total no. of insects in 12 months)	Matasagar lake (total no. of insects in 12 months)	HTSU pond (total insects in 12 months)	Bill (total no. of insects in 12 months)	Canal (total no. of insects in 12 months)
Backswimmers (Notonectidae)	175	207	86	204	60	135
Water boatmen (Corixidae)	82	142	77	118	700	307
Creeping water bugs (Naucoridae)	6	0	0	144	60	21
Waterscopions (Nepidae) *Ranatra* sp.	12	25	10	32	18	7
Water scorpions (Nepidae) *Nepa* Sp.	1	0	3	1	0	2
Water striders (Gerridae)	Present in swarm	Present in swarm	Present in swarm	Present in swarm	0	0
Ripple bugs (Veliidae)	0	Present in swarm	Present in swarm	Present in swarm	0	0
Velvety shore bugs (ochteridae	9	0	0	19	0	0
Order Odonata						
Damselfly Nymph	50	32	10	86	104	85
Dragonfly Nymph	3	12	3	4	8	7
Order Coleoptera						
Crawling water beetle (Haliplidae)	10	11	28	30	18	28
Whirligig beetles (Gyrinidae)	Present in swarm	0	0	Present in swarm (sometimes about 400-5000)	0	0

Table 2: Different aquatic insect attracted to a search light placed on the roof of Library building at the Hajee Mohammad Danesh Science &Technology University, Dinajpur 5200, Bangladesh

Date	Name and number of the insect	
	Water Scavenger Beetles (Hydrophilidae)	Diving beetles (Dytiscidae)
22-07-09	1 (First found)	-
21-10-09	17	1
22-10-09	13	Not found
23-10-09	37	Not found -
24-10-09	3	Not found -
25-10-09	10	Not found
28-10-09 to 14-11-09	Not found	Not found
15-11-09	Not found	Not found
16-11-09 to 31-11-09	Not found	Not found

insect in a swarm and gregarious swarm was found in November to February and about1000-1500 insect in a swarm (Table 1).

3.2. Seasonal fluctuation of aquatic insects

All aquatic insects are available and breed in the rainy season but Water boatmen breed in the rainy season and faster in the winter season (Tables 1 to 6). Whirligig beetles first found in July but available in swarm forms in winter seasons; velvety shore bugs were available in spring. Water striders (Gerrididae) were found above the water surface in all season but numerous in rainy seasons but after heavy rainfall with windy weather its number reduces.

Damselflies nymphs were available and breed in all seasons but it breeds very fast in rainy season especially in bills. Its nymphs were available in all season and in all ecosystems (Table 1 to 6). Dragonflies nymphs were also available and breed in all seasons but its nymph was less available in sweep net in all ecosystems, but its causes were unknown.

3.3. Harmful and beneficial aquatic insects of northern region

3.3.1. Hemiptera

3.3.1.1. Water boatmen

Water boatmen feed on algae and other minute aquatic organism. The adult water boatmen are used as human food in Mexico Egypt (Richards and Davies, 1997). The very numerous eggs of *Aretocorixa* Sp. (water boatmen) are used as human food in Mexico (Mani, 1994).

3.3.1.2. Backswimmers

Backswimmers are predaceous, feeding on other insects and occasionally on tadpoles and small fishes.

3.3.1.3. Giant water bugs

Lethocerus indica species of Giant Water bugs kill Giant fish. It is rapacious creatures, feeding on other insects, snails, tadpoles and even small fishes (Comstock, 1984 and Mani, 1994)". The adult Giant fish killer, *Lethocerus indica* species is a popular food of the people of China and Australia.

3.3.1.4. Creeping water bugs

Creeping water bugs feed on various small aquatic animals.

3.3.1.5. Water striders

Water Striders are predator or scavenger and feed on insects that fall onto water.

3.3.1.6. Ripple bugs

Ripple bugs on insects and other aquatic animals.

3.3.1.7. Velvety shore bugs

Velvety shore bugs are also predaceous of small aquatic animal.

3.3.2. Coleoptera

3.3.2.1. Whirligig beetles

Whirligig beetles both larvae and adult are predaceous (Mani, 1994). The adult feed on chiefly insects that fall onto water, the larvae feed on variety of aquatic animals.

3.3.2.2. Water scavenger beetle

Water scavenger beetles are scavenger and rarely predator (Mani, 1994), but its larvae are very voracious and feed on all sorts of aquatic animals.

3.3.2.3. Diving beetle

The adult Diving beetle destroys insects, small fishes and other small animals. The larvae are extremely voracious and preys upon various aquatic animals including mollusk, worms, insect, tadpoles and prey small fishes (Richards and Davies, 1997).

3.3.2.4. Crawling water beetle

Crawling water beetle adult feed on algae and other plant

Table 3: Different aquatic insect attracted to a bulb light in the Academic building at the Hajee Mohammad Danesh Science & Technology University, Dinajpur 5200, Bangladesh

Date	Name and No. of the insect	
	Water Scavenger Beetles (Hydrophilidae)	Diving water beetle (Dytiscidae)
01-09-09	1	Not found
18-10-09	1	1
25-10-09	2	0
28-10-09 to 07-01-10	Not found	1

Table 4: Comments of fishermen about Giant water bugs caught in Ber net^{-1} in the pond

Comments	Giant Water bugs (Belostomatidae) caught in Ber net^{-1} in the pond	% Farmers comments
Giant Water bugs (Belostomatidae) caught in Ber net^{-1}	1-2	40
Giant Water bugs (Belostomatidae) caught in Ber net^{-1}	3-5	30
Giant Water bugs (Belostomatidae) caught in Ber net^{-1}	Not found	30
Months	Found	
May (Chaittra)	,,	45
May (Chaittra) and June (Baishakh)	,,	35
April to June	,,	6
Always	,,	4

materials, larvae are predaceous.

3.3.2.5. Odonata

All stages of Dragonfly and Damselfly are predaceous and feed on various insect and other organisms.

So, all aquatic insect are beneficial to man but Backswimmers and Giant Water bugs (especially adult Giant fish killer, *Lethocerus indica*) and Diving beetle feed on fishes therefore they are harmful to fish cultivation. However, from the ecological point of view all aquatic insect are important and useful to nature.

In this research insect of 8 (eight) families of Hemiptera order are collected such as Water boatmen (Corixidae), Backswimmers (Notonectidae), Creeping water bugs (Naucoridae) Water scorpion (Nepidae), Giant water bugs (Belostomatidae), Water striders (Gerrididae), Broad-shouldered water striders/Ripple bugs (Veliidae),Velvety shore bugs (Ochteridae). Anonymous (1980a) took an experiment on 'Aquatic Hemiptera and Ephemeroptera in Dhaka City' and collected 7 (seven families) of insect such as Water boatmen (Corixidae), Backswimmers (Notonectidae), Waterscopion (Nepidae), Giant Water bugs (Belostomatidae), Water Striders (Gerrididae), Pleid water bugs (Pleidae), Water Measurers (Hydrometridae) from the ponds and lake of Dhaka city.

Besides this, Anonymous (1980a) took an experiment 'Aquatic Hemiptera and Ephemeroptera in Dhaka City' and collected insect 7(seven) families such as Water boatmen (Corixidae), Backswimmers (Notonectidae), Water scorpion (Nepidae), Giant water bugs (Belostomatidae), Water striders (Gerridae), Pleid Water bugs (Pleidae), Water measurers (Hydrometridae) from the ponds and lake of Dhaka city.

Collection and identification of Water measurers (Hydrometridae) by Anonymous (1980a) probably wrong as they identified Water scorpion (Nepidae) *Ranatra* species as Water measurers (Hydrometridae). Water scorpion (Nepidae) *Ranatra* species widely distributed all over the country.

Anonymous (1980b) took an experiment on 'Aquatic Coleoptera in Dhaka City and collected 3 (three families) of insect such as Water scavenger beetles (Hydrophilidae), Diving beetles (Dytiscidae), and Whirligig beetles (Gyrinidae). In this research 4 (four) families of insect of Coleoptera order are collected such as Water cavenger beetles (Hydrophilidae), Crawling water beetle (Haliplidae), Diving beetles (Dytsicidae) and Whirligig beetles (Gyrinidae). It is pointed out that aquatic insect populations vary greatly over an annual cycle (Fend et al., 2005). Consequently, previous works are also more or less similar and support the result of present experiment.

4. Conclusion

Diversified insects were found in the rainy season in pond and in Ramsagar lake as these two aquatic ecosystem water was always present there as well as commercial cultivation of fish are not done. So, application of toxic chemical such as Phostoxcin tablets was not applied for killing of voracious predatory fish such as sheat fish, striped snakehead fish etc. Consequently, this toxic poison has no effect on insect of these two ecosystems. Matasager and Anandasagar were polluted due to application of toxic chemical as these two were under leased for commercial cultivation of fish. Diversified insect was not found in bill and canal, as it is dry in dry season. So, survival of insect is difficult in dry season. It is also seem that Water scorpion *Nepa* sp., Giant water bugs and whirligig beetle were endangered aquatic insects.

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