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Taxonomic study of Odonata [Insecta] in Kolkata and surroundings, West Bengal, India

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ABSTRACT
The present study was conducted to study species richness of Odonata (Insecta) in Kolkata and Howrah, West Bengal. Results document eighty Odonate species including four new records viz., *Rhodothemis rufa* (Rambur, 1842), *Trithemis festiva* (Rambur, 1842), *Agriocnemis femina* (Brauer, 1868) and *Lestes malabarica* Fraser, 1929. One species under genus *Agriocnemis* does not fit the records and is awaiting description. The paper also discusses habitat wise species distribution of Odonata within the study area.

Keywords: Dragonflies, Damselflies, Howrah, Kolkata, Odonata

1. Introduction
Kolkata and Howrah, situated in the Gangetic Plain are well known to the World from the early Eighteenth century as Kolkata was the capital of British India. Taxonomic work for both animal and plant groups was initiated by British people. First taxonomic account of Odonata from Kolkata was published by Selys [1], and later several workers studied different aspects of Odonata from Kolkata. Mitra *et al.* [2] published the first list of 22 species of Odonates from Kolkata. Later 50 species were recorded by Ram *et al.* [3] from Kolkata and surroundings and Mitra [4] further listed 44 species of Odonata from Kolkata. Srivastava & Sinha [5] reported 178 Odonata species from West Bengal which included materials of 48 species from Kolkata and Howrah and later Gupta *et al.* [6] documented 58 species from Kolkata. Ultimately Mitra [7] reported a total 65 species from Kolkata and Howrah among which 3 species were added from literatures.
The main habitats for Odonates in Kolkata, Howrah and its surroundings are the rain fed canals, ponds, swamps, lowlands and lakes. In the monsoon season paddy fields and other grasslands are also used by Odonates as breeding grounds. Due to their carnivorous feeding habit, Odonates are an important insect group in biological control measure of insect pests in the Gangetic Plains where agriculture is a the chief source of livelihood [8]. The larval stages are equally important as potential bio-indicator [9] and to control mosquito larvae as well [10].
The present study was undertaken to point out the current status of Odonata diversity of this area. Attempt was also made to study some aquatic ecosystems in the study area that are facing serious threats for aquatic Odonata larvae as well as other aquatic insects.

2. Materials and Methods
The present study was conducted from July, 2010 to June, 2011. After general random visits 12 sites were selected for repeated sampling (Figure 1). Common species were identified and photographed in the field; some doubtful and important specimens were captured with the help of butterfly net. Damselflies were killed by gently pressing their thorax then kept dried in paper envelope or in 70% ethanol. Dragonfly specimens were kept in paper envelopes live for few days allowing them to defecate to reduce the chance of decaying, then preserved dried. Identification was done following the keys of Fraser [11, 12, 13] and Mitra [7] and the species names were listed following Subramanian [14]. Field photographs were taken using Sony Cyber-shot point and shoot camera. Collected specimens are deposited in National Zoological Collections, Zoological Survey of India and Entomology laboratory, Bidhannagar Govt. College, Govt. of West Bengal.

3. Results
During the study period 53 species were recorded (collected or observed) in the field. Among the Anisopterans a maximum of 29 species were recorded belonging to the family Libellulidae, and minimum 2 species belonged to family Gomphidae. In case of Zygoptera, family Coenagrionidae

predominated with 14 species where only one species was recorded from family Lestidae and two species from Platycnemididae (figure 2). This study finally led to listing of total 80 species of Odonates from the study area belonging to 43 genera and 7 families (Table 1). Among them 27 species were included from literatures and 4 species viz. *Rhodothemis rufa* (Rambur, 1842), *Trithimis festiva* (Rambur, 1842), *Agriocnemis femina* (Brauer, 1868), *Lestes malabarica* Fraser, 1929 were recorded for the first time from Kolkata and its surrounding area. One species of genus *Agriocnemis* was also recorded which does not fit with the records and is awaiting description.

Table 1: List of Odonata species reported so far from the study area (Kolkata and Howrah).

Sl. No.	Name	Kolkata							Howrah				
		Central Park	Nalban fisheries	Victoria Memorial Garden	Bidhannagar College Field	Subhas Sarobar	Joka	Chintamani Kar Bird Sanctuary	Bosipota, Uttarpara	d Bali	Santragachi Jheel	Panchla	Botanical Garden, Howrah
Order Odonata													
Suborder Anisoptera													
Family Aeshnidae													
1	*Anaciaeschna jaspidea* (Burmeister, 1839)									1			
2	*Anax guttatus* (Burmeister, 1839)	1	1	1	1	1	1	1	1	1	1	1	1
3	*Anax sp.*							1					
4	*Gynacantha bainbriggei* Fraser, 1922*	(Mitra, 2002)											
5	*Gynacantha bayadera* Selys, 1891								1	1			
6	*Gynacantha dravida* Lieftinck, 1960				1			1	1	1			
7	*Gynacantha rammohani* Mitra & Lahiri, 1975*	(Srivastava & Sinha, 1993)											
8	*Hemianax ephippiger* (Burmeister, 1839)*	(Ram *et al.*, 1982)											
Family Gomphidae													
9	*Anisogomphus bivittatus* Selys, 1854*	(Ram *et al.*, 1982)											
10	*Ictionogomphus pertinax* (Selys, 1854)*	(Srivastava & Sinha, 1993)											
11	*Ictinogomphus angulosus* (Selys, 1854)*	(Ram *et al.*, 1982)											
12	*Ictinogomphus rapax* (Rambur, 1842)	1	1	1	1	1	1	1	1	1	1	1	1
13	*Macrogomphus montanus* Selys, 1869*	(Srivastava & Sinha, 1993)											
14	*Paragomphus lineatus* (Selys, 1850)	1	1							1			
15	*Phaenandrogomphus aureus* (Laidlaw,1922)*	(Srivastava & Sinha, 1993)											
Family Libellulidae													
16	*Acisoma panorpoides* Rambur, 1842	1	1	1	1		1	1	1	1	1	1	1
17	*Aethriamanta brevipennis* (Rambur, 1842)	1	1	1	1		1	1	1	1	1	1	1
18	*Brachydiplax chalybea* Brauer, 1868	1	1	1	1		1	1	1	1	1	1	1
19	*Brachydiplax farinosa* Kruger, 1902						1	1		1			1
20	*Brachydiplax sobrina* (Rambur, 1842)	1	1		1		1	1	1	1	1	1	1
21	*Brachythemis contaminata* (Fabricius, 1793)	1	1	1	1	1	1	1	1	1	1	1	1
22	*Bradinopyga geminata* (Rambur, 1842)	1	1	1		1	1	1	1	1	1	1	1
23	*Cratilla lineata* Foerster, 1903								1	1		1	
24	*Crocothemis erythraea* (Brullé, 1832)*	(Mitra, 2002)											
25	*Crocothemis servilia* (Drury, 1770)	1	1	1	1	1	1	1	1	1	1	1	1

26	*Diplacodes nebulosa* (Fabricius, 1793)				1		1	1	1				
27	*Diplacodes trivialis* (Rambur, 1842)	1	1	1	1	1	1	1	1	1	1	1	1
28	*Lathrecista asiatica* (Fabricius, 1798)						1	1					
29	*Macrodiplax cora* (Brauer, 1867)		1		1		1	1		1	1		
30	*Neurothemis fulvia* (Drury, 1773)	1	1		1		1	1	1	1	1	1	1
31	*Neurothemis intermedia* (Rambur, 1842)*	(Ram *et al.*, 1982)											
32	*Neurothemis tullia* (Drury, 1773)	1	1		1		1	1	1	1	1	1	1
33	*Orthetrum glaucum* (Brauer, 1865)*	(Ram *et al.*, 1982)											
34	*Orthetrum pruinosum* (Burmeister, 1839)						1	1	1		1		
35	*Orthetrum sabina* (Drury, 1770)	1	1	1	1	1	1	1	1	1	1	1	1
36	*Orthetrum triangulare* (Selys, 1878)*	(Srivastava & Sinha, 1993)											
37	*Palpopleura sexmaculata* (Fabricius, 1787)		1						1	1			
38	*Pantala flavescens* (Fabricius, 1798)	1	1	1	1	1	1	1	1	1	1	1	1
39	*Potamarcha congener* (Rambur, 1842)	1	1		1		1	1	1	1	1	1	
40	*Rhodothemis rufa* (Rambur, 1842)**	1	1				1	1	1	1	1	1	1
41	*Rhyothemis variegata* (Linnaeus, 1763)	1	1	1	1	1	1	1	1	1	1	1	1
42	*Sympetrum hypomelas* (Selys)*	(Srivastava & Sinha, 1993)											
43	*Tholymis tillarga* (Fabricius, 1798)	1	1	1	1		1	1	1	1	1	1	1
44	*Tramea basilaris* (Palisot de Beauvois, 1805)	1					1	1	1	1			1
45	*Tramea limbata* (Desjardins, 1832)	1					1	1	1			1	
46	*Trithemis aurora* (Burmeister, 1839)*	(Srivastava & Sinha, 1993)											
47	*Trithemis festiva* (Rambur, 1842)**									1			
48	*Trithemis pallidinervis* (Kirby, 1889)	1			1		1	1	1	1	1	1	1
49	*Urothemis signata* (Rambur, 1842)	1	1				1	1	1	1	1	1	1
50	*Zyxomma petiolatum* Rambur, 1842	1	1		1		1	1	1	1	1		
Family Macromiidae													
51	*Epophthalmia vittata* Burmeister, 1839*	(Srivastava & Sinha, 1993)											
Suborder Zygoptera													
Family Coenagrionidae													
52	*Agriocnemis dabreui* Fraser, 1919*	(Mitra, 1983)											
53	*Agriocnemis femina* (Brauer, 1868)**								1				
54	*Agriocnemis lacteola* Selys, 1877	1	1				1		1	1	1	1	1
55	*Agriocnemis pieris* Laidlaw, 1919*	(Mitra, 1983)											
56	*Agriocnemis pygmaea* (Rambur, 1842)	1	1	1	1	1	1	1	1	1	1	1	1
57	*Agriocnemis splendidissima* Laidlaw, 1919*	(Srivastava & Sinha, 1993)											
58	*Agriocnemis sp.***	1	1				1	1	1	1		1	1
59	*Argiocnemis rubescens* Selys, 1877*	(Srivastava & Sinha, 1993)											
60	*Ceriagrion cerinorubellum (Brauer, 1865)*	1	1				1	1	1	1	1	1	1
61	*Ceriagrion coromandelianum* (Fabricius, 1798)	1	1	1	1	1	1	1	1	1	1	1	1
62	*Ceriagrion olivaceum* Laidlaw, 1914*	(Mitra, 1983)											
63	*Enallagma parvum* Selys, 1876		1				1		1		1	1	
64	*Ischnura aurora* (Brauer, 1865)	1	1	1	1	1	1	1	1	1	1	1	1
65	*Ischnura elegans* (Vander Linden, 1823)*	(Mitra, 1983)											

66	*Ischnura forcipata* Morton, 1907*	(Srivastava & Sinha, 1993)										
67	*Ischnura rufostigma* Selys, 1876*	(Srivastava & Sinha, 1993)										
68	*Ischnura senegalensis* (Rambur, 1842)	1	1	1	1		1	1	1	1	1	1	1
69	*Paracercion malayanum* (Selys, 1876)						1			1		1	
70	*Onychargia atrocyana* (Selys, 1865)		1	1	1	1	1	1	1	1	1	1	1
71	*Pseudagrion australasiae* Selys, 1876*	(Mitra, 2002)											
72	*Pseudagrion decorum* (Rambur, 1842)	1	1				1	1	1	1	1	1	
73	*Pseudagrion malabaricum* Fraser, 1924*	(Mitra, 1983)											
74	*Pseudagrion microcephalum* (Rambur, 1842)	1	1				1		1	1	1	1	1
75	*Pseudagrion rubiceps* (Selys, 1876)	1	1				1	1	1	1	1	1	1
76	*Pseudagrion spencei* Fraser, 1922*	(Ram *et al.*, 1982)											
Family Lestidae													
77	*Lestes malabarica* Fraser, 1929**									1			
78	*Lestes platystylus* Rambur, 1842*	(Srivastava & Sinha, 1993)											
Family Platycnemididae													
79	*Copera ciliata* (Selys, 1863)								1	1		1	1
80	*Copera marginipes* (Rambur, 1842)								1	1		1	1
	TOTAL	**34**	**35**	**18**	**26**	**13**	**41**	**39**	**44**	**46**	**34**	**37**	**33**

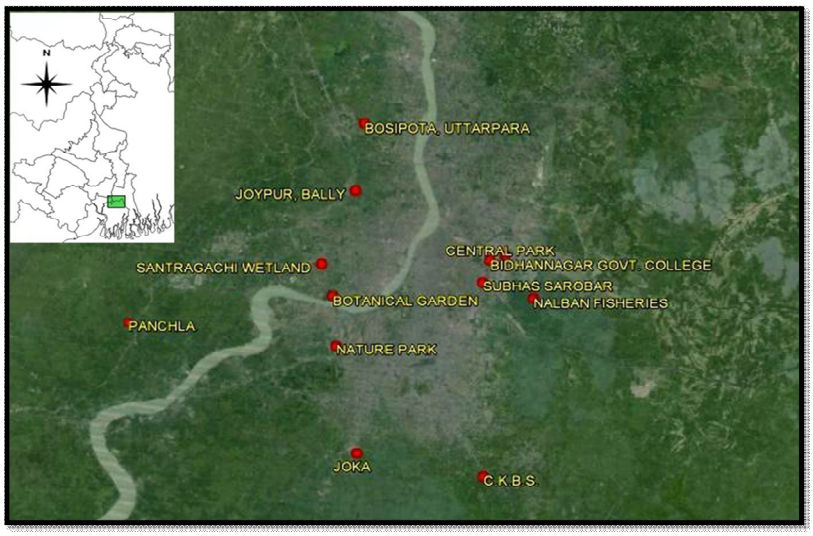

Fig 1: Map showing the Study Area [Inset: Map of West Bengal with study area marked with green].

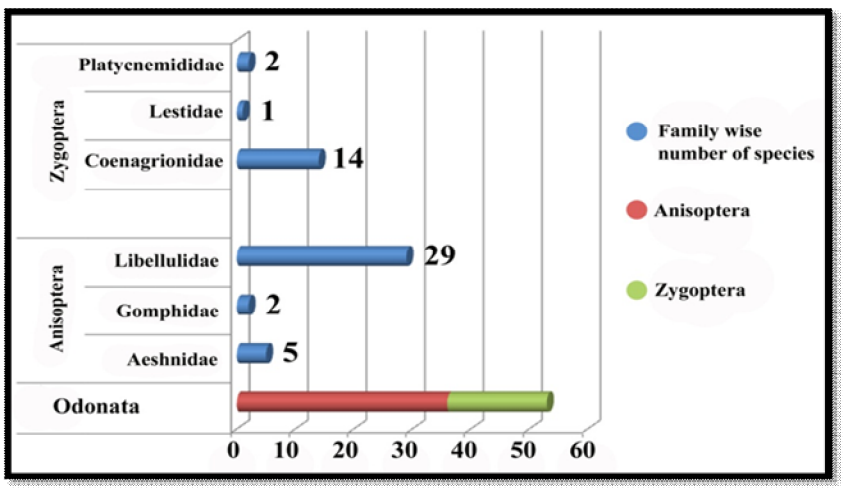

Fig 2: Species recorded from different families during the study.

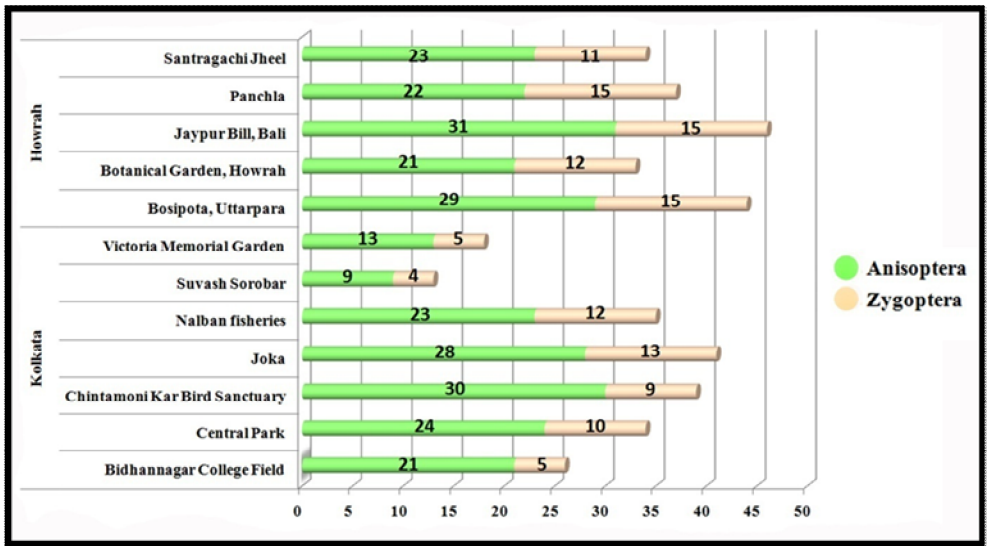

Fig 3: Number of Odonata species recorded from different sites of the study area

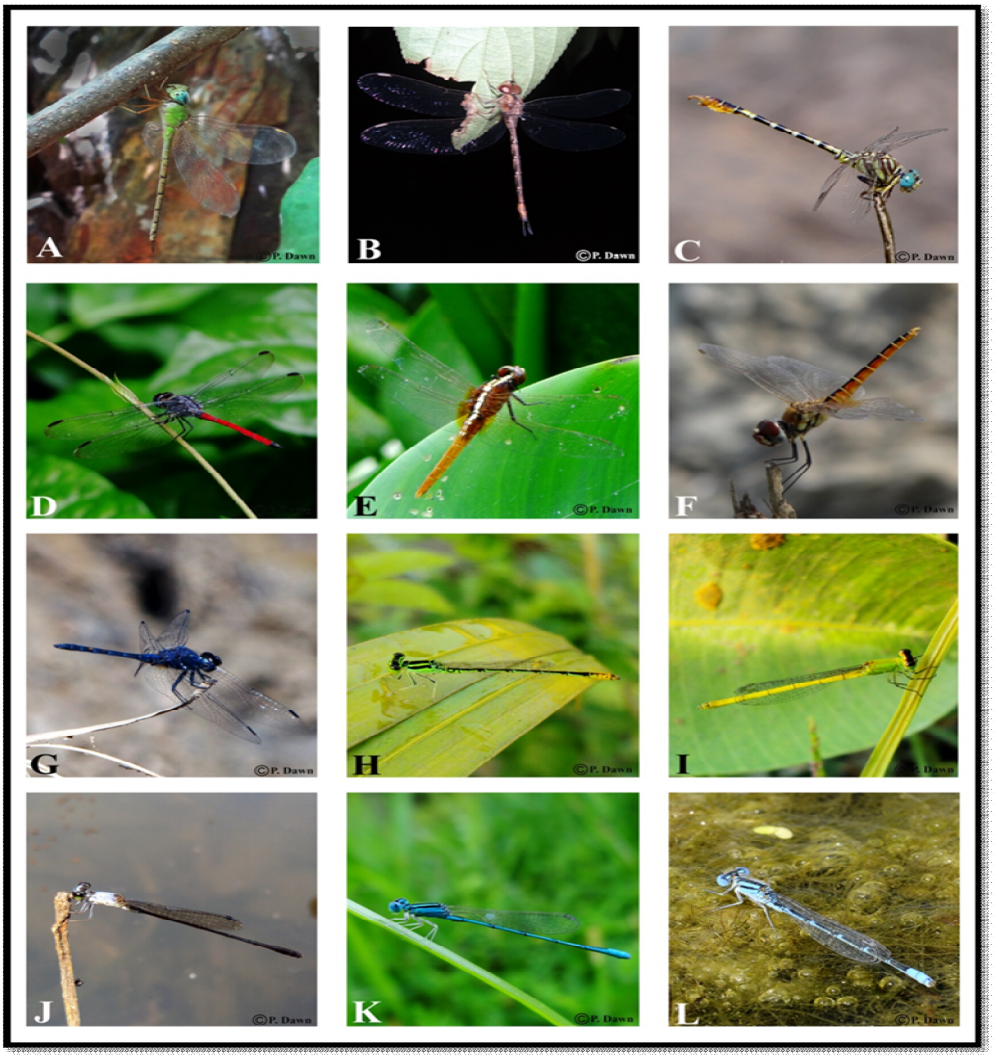

Fig 4: Some Odonates photographed during the study; A. *Gynacantha bayadera* Selys; B. *Gynacantha dravida* Lieftinck; C. *Paragomphus lineatus* (Selys); D. *Lathrecista asiatica* (Fabricius); E. *Rhodothemis rufa* (Rambur); F. *Macrodiplax cora* (Brauer); G. *Trithemis festiva* (Rambur); H. *Agriocnemis* sp. [Male]; I. *Agriocnemis* sp. [Female]; J. *Agriocnemis femina* (Brauer); K. *Enallagma parvum* Selys; L. *Paracercion malayanum* (Selys)

4. Discussion

Continuous study of the behaviour and habitat preference for different species was done throughout the study period. Urban ponds or lakes where aquatic vegetation is very less or regularly been cleared, showed presence of limited number of species. Due to occasional lack of aquatic vegetation some dragonfly species such as *Brachythemis contaminata* (Fabricius, 1793) were seen to emerge by perching on concrete side walls of urban ponds.

Behavioural study shows most of the Aeshnids to be crepuscular during daytime. They were seen to perch in dense forested areas

and often came to light in the evening. *Anax guttatus* (Burmeister, 1839) has been seen to be active throughout the day, flying continuously over water and seldom perching on twigs. *Ictinogomphus rapax* (Rambur, 1842) were found beside large pond or lakes, often perched on sticks beside water.

Libellulids are most abundant and diverse group in any habitat. Dragonfly species like *Aethriamanta brevipennis* (Rambur, 1842), *Brachydiplax farinosa* Kruger, 1902, *Brachydiplax sobrina* (Rambur 1842), *Lathrecista asiatica* (Fabricius, 1798), *Neurothemis fulvia* (Drury, 1773), were generally found inside well shaded forested areas, sometimes away from water, while *Urothemis signata* (Rambur, 1842), *Rhodothemis rufa* (Rambur, 1842), *Crocothemis servilia* (Drury, 1770), *Brachydiplax chalybea* Brauer, 1868 were very common near open water bodies. *Pantala flavescens* (Fabricius, 1798), *Rhyothemis variegata* (Linnaeus, 1763), *Tramea basilaris* (Palisot de Beauvois, 1805) were sometimes seen flying in swarm to a considerable height but Odonates with weak flight such as *Acisoma panorpoides* Rambur, 1842, *Neurothemis tullia* (Drury, 1773), *Diplacodes nebulosa* (Fabricius, 1793) etc. were seen residing in grasslands with long grasses associated with water bodies. *Bradinopyga geminata* (Rambur, 1842) was always found near man made water reservoir or seen perched on dirty wall; *Orthetrum sabina* (Drury, 1770), *Orthetrum pruinosum* (Burmeister, 1839), *Diplacodes trivialis* (Rambur, 1842) used to sit on ground or on twigs very close to ground. On the other hand *Potamarcha congener* (Rambur, 1842) and *Cratilla lineata* Foerster, 1903 were mostly found perched on electric wares. Some dragonflies such as *Zyxomma petiolatum* Rambur, 1842, *Macrodiplax cora* (Brauer, 1867), *Tholymis tillarga* (Fabricius, 1798) frequently visited light at night.

Damselflies such as *Agriocnemis pygmoea* (Rambur, 1842), *Agriocnemis lacteola* Selys, 1877, *Ischnura aurora* (Brauer, 1865) were common in fields with small grasses; species like *Copera ciliata* (Selys, 1863), *Copera marginipes* (Rambur, 1842) were found to be restricted in some shaded bushes or ponds. *Ceriagrion coromandelianum* (Fabricius, 1798), *Onychargia atrocyana* (Selys, 1865), *Ischnura senegalensis* (Rambur, 1842) were sometimes seen visiting forests or gardens away from water, but *Pseudagrion decorum, Pseudagrion microcephalum* (Rambur, 1842), *Pseudagrion rubiceps* (Selys, 1876), *Paracercion malayanum* (Selys, 1876) etc. were typically confined near water bodies. These damselflies were seen flying over more or less clear water with few water lily or other submerged vegetation and often seen perched on twigs, flowers or floating leaves of these plants. But few species viz. *Ceriagrion cerinorubellum* (Brauer, 1865), *Agriocnemis femina* (Brauer, 1868) were mainly found near the ponds covered with water hyacinths.

5. Conclusion

Along the coasts of Ganges River and its distributaries Kolkata and its surrounding area is supplied with water through small canals, reservoirs and good number of ponds and lakes. These water bodies serve as good breeding grounds for aquatic and semi-aquatic insects including Odonata. This study shows clear difference in the distribution of the Odonata species in different type of habitats within the study area. It is clear that a number of species earlier reported from this region were not recorded during the study, and some species were only once seen throughout the study period. The aquatic ecosystems used for pisciculture showed a clear drop in Odonata diversity due to anthropogenic activity like clearing of aquatic vegetation, use of pesticides etc. Direct use of pesticides in submerged crop fields to kill crabs etc. and insecticide effluent from crop fields to adjacent water bodies is going to be a serious problem for the aquatic fauna throughout the region. Further taxonomic and Ecological studies on Odonata of this region may reveal some more interesting information.

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