Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP5: 437-440

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(Special Issue- 5)
International Conference on
"Food Security through Agriculture & Allied Sciences"
(May 27-29, 2019)

Community structure of odonata naiads of a fish farming pond in costal area of West Bengal, India

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Abstract
Community structure of Odonata larvae was investigated in a fish farming pond at Tamluk located in the coastal belt of West Bengal, India. In total 12 species under 3 families and 2 suborder were recorded during study period. Suborders Anisoptera was the most dominant (76.16%) group. Family Gomphidae had the lowest abundance (1.93%) and Family libellulidae had highest abundance (76.66%). All the species were not found throughout the year. Some species such as *Pantala flavescens* (Fabricius, 1798) of family Libellulidae was found only in rainy months thus behaving as species associated with rains. Species diversity, dominance index, equitability index and evenness indices during study period, suggest a moderately stressed and disturbed environment.

Keywords: Odonata larvae, Libellulidae, Gomphidae, Species diversity

Introduction
The dragonfly & damselfly collectively known as Odonata constitute a small but well known, widely distributed group of insect order. The insect order Odonata is one of the most ancient and beautiful insects that ever roamed earth. Odonata being one of the most dominant and important groups, plays an important role in the functioning of water ecosystem worldwide [2]. The structure specificity, taxonomic stability pronounced there functionality in food web [15]. There are more than 6000 species globally and they are grouped in three sub orders, Anisoptera, Zygoptera and recently discovered Anisozygoptera. Out of 6256 species known all over the world, Odonata fauna of India is known by 3 sub orders, 18 families 152 genera, 487 species and 27 sub species (Subramanian, 2017) [16]. Odonata is one of the most important insect groups for ecological quality assessment, and the predatory aquatic larval stages act as an important part of aquatic food webs. As fresh water insects, Odonata is exceptionally vulnerable to urban and agricultural expansions which commonly entail the draining ponds and marshes (Corbet, 1980) [6]. Many studies have been carried out on adult Odonata, but the study on larvae have not been much yet. In India the study on Odonata larvae is very restricted. Very limited number of works have been done on diversity and abundance of Odonata larvae in India, but study on community structure is not really done so far. There is a major gap in research on taxonomy and ecology of larval Odonata. Hence we have tried to assess the community structure of Odonata larvae in a fresh water fish farming pond in coastal area of West Bengal. The surveys of Odonata larval communities have become a more and more important tool for the ecological assessment of aquatic system (Chovanecand Raab 1997) [4]. Odonates are used as "target species" in environmental protection and water management.

Materials and Methods
The present study was carried out in a manmade large fish culture pond (22019'52.56"N, 87056'16.72"E) near Tamluk Rajbari of East Midnapore district in coastal area of West Bengal. The area of the water body is 9.88 acre and average depthis of 4 meters. The pond is infested with few aquatic weeds named *Marsilea minuta* Lin, *Monochornia hastate* Solms, *Eichhornia crassipes* (Mart.) *Solms, Hydrilla vercillata* Casp, *Chara sp, Nitella sp, Pistia*

stratiotes L, *Lamna sp*, *Ipomea aquatic* Forsk, *Trapa sp*, *Jussia repens* L *Ceratophyllum demersum* L, *Polygonum sp*, *Alternanthera sp*. But these weeds were controlled manually by hand picking in a gap of 2 or 3 months by the fish farmers.

Larvae were collected at monthly interval from July 2017 to June 2018 between 8.00 A.M to 11 A.M. The collection was done by hauling of a dip net with a mesh size of 245 µm (Nylobolt PA, Deekay Nylobolt Industries Pvt. Ltd. Mumbai, India). The area of the circular net was 4208.0 cm^2. Samples were taken from eight sites of four sides of the pond and collected insects were preserved in 70% ethylalchol in specimen bottles. For identification, the larvae were placed under a binocular microscope (Magnus MS24) and upon observation of the characters and comparison byfollowing standard literature & references (Kumar 1970, 72, 73, 80, 83 and Theischinger 2007 [10, 11, 12, 13, 14 & 17]). The identification of aquatic vegetation was done by following N.K Chakraborty (Jalaja Gachpala, 2010) [5].

For analysis of community abundance, relative abundance, species diversity index and evenness index were determined [3]. Dominance status of various species was described on the basis of relative abundance following Engelmann's scale (Engelmann, 1973) as mentioned under Table 1. Species diversity index (H) was estimated by following Shannon and Winner (1963) and Evenness index was estimated by following Pielou (1975).

The data analysis is done by PAST version 3.24 (2019) [Natural History Museum, University of Oslo].

Results and discussion

In total 1191 number Odonata larvae were collected during the sampling period. In this study site annual average density was 99.25/unit-month. In total 12 species belonging to 12 genera and 3 families were recorded (Table-1). Suborder Anisoptera was 76.66% and Zygoptera was 23.34%.Family Libellulidae (74.73%) was numerically most abundant group according to annual observations and it was followed by family Coenagrionidae (23.34%) and Gomphidae (1.93%) (Fig1 & Fig.2). Almost same pattern of abundance was found in monthly abundance.

Each species was not found in all months of the year. *Orthetrum sabiana* of family libellulidae was the most abundant species (18.89%) followed by *Pantala flavescens* (16.63%) during study period. Other pre-dominant species of this community were *Brachythemis contaminata* (12.34%), *Urothemis signata* (11.34%), *Zyxomma petiolatum* (10.92%) of family libellulidae and *Ceriagrion coromandelianum* (10.92%) of family Coenargrionidae. (Table-1)

*Ictinogomphus rapax*was the only representative of family Gomphidae and showed highest abundance in December. In the months of July, August, September and March-April *Pantala flavescens* was numerically most abundant and except these months it was found only in October.*Potamarcha congener* (2.35%), *Trithemis pallidinervis* (2.27%) and *Pseudagrion rubriceps* (3.86%) were not found during hot summer months like May and June. *Orthetrum sabiana*, *Urothemis signata* and *Ceriagrion coromandelianum* were most abundant in post-monsoon and winter months-November, December, January and February, but in pre-monsoon and summer months- March, April, May and June,*Zyxomma petiolatum* was 2nd most dominant (19.23%) after *Orthetrum sabiana* (28.85%).

Monthly fluctuation of larval Odonata community indices was clearly visible. The Shannon General Diversity Index (H) for the year was 2.25. But in June it dropped to 1.36. All the summer months it ranged in between 1.36 to 1.98. From July to September it gradually increased and in October it again dropped to 2.05. Total no of species was 12, but it fluctuated from month to month. It dropped to 10 in October and 8 in May, but in June it showed the lowest number 7. The fluctuation in monthly larval density was also seen. September was the most crowded month with 177 collected samples. Months October, February-March and May-June showed lowest collection of total sample. In June only 51 individuals of 7 species were recorded. (Table-2).

Ictinogomphus rapax of family Gomphidae were found in only one collecting station out of 8 collecting stations, and which was without aquatic macrophytes but shaded by trees. This is due to theburrowing nature of Family Gomphidae which prefers habitat without vegetation (A. Kumar, 1973) [10]. *Pantala flavescens* of family Libellulidae was found only in monsoon monthsJuly, August and very few in October thus behaving as monsoon species. [13]

The monthly numerical fluctuation of species found in the pond showed a particular pattern which indicated that there might be a seasonality and habitat partitioning (Crowley & Johnson, 1982; Johnson1991). [7, 9] Species with similar microhabitats might have temporal niche separation (Benke & Benke, 1975) [1] resulting from competitive and intra-guild predatory interactions (Wissinger, 1992) [19]. For example, *Orthetrum sabiana* dominated in November, December, January, February(post-monsoon and winter),but was replaced by *Brachythemis contaminata* in March,April,May andJune (spring and summer) and by *Pantala flavescens* in monsoon months July, August, September. (Fig-3)

In few months such asMay-June, October and February the number of larvae collection was very low, but in April, September and January the community showed highest collection of the corresponding seasons. Diversity and evenness also dropped in these months. Dominance and equitability also fluctuated in these months. (Table-2) This indicated a stressed environmental condition in water and succession of some species of the Odonata larval community.

Species diversity (H') and equitability (J) indices were found to 2.25 and 0.97 respectively (table-2). Since Shonnon diversity index was only 2.25 (less than three and higher than one), this land use type might be considered as moderately stressed and moderately polluted following the criteria of Wilhm & Doris (1968) [18]. According to Ghosh & Bhattacharya (2018) [8] dominance index and equitability index can determine the homogeneity of community structure and stress of the environment. Since the equitability index was 0.97 and dominance index was 0.09, it supports to the moderately stressed and moderately polluted environment. It may, therefore, be said that the community structure of odonata larvae have the potentiality to be used as an ecological indicator of the health of an environment since pollution.

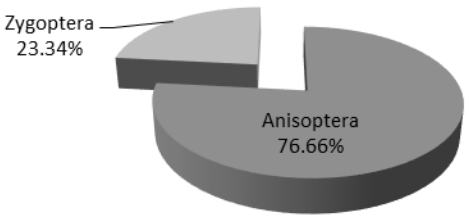

Fig 1: Relative abundance of different sub-orders of Odonata larvae in fish farming pond.

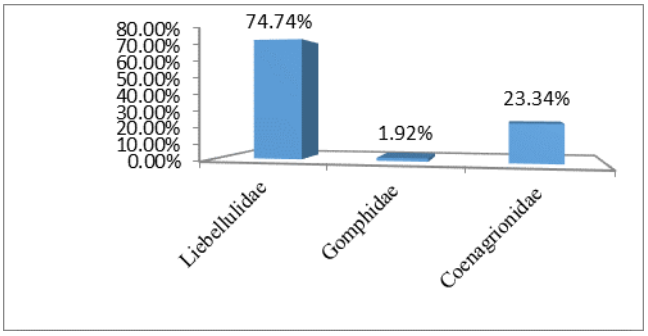

Fig 2: Relative abundance of different families of Odonata larvae in fish farming pond

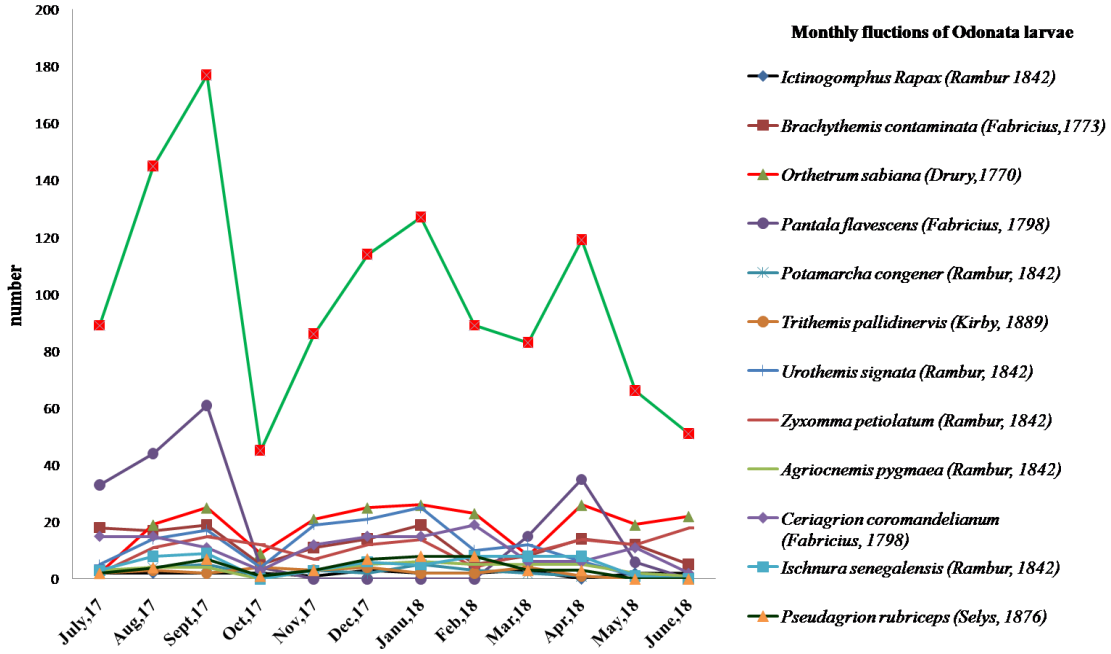

Fig 3: Monthly abundance of different species of Odonata larvae in a fish farming pond.

Table 1: Dominance status of different species of Odonata larvae in a fish farming pond in Purba Medinipur

	Number	Relative abundance (%)	Dominance status
Family-Gomphidae			
Ictinogomphus Rapax (Rambur 1842)	23	1.93	Recedent
family-Liebellulidae			
Brachythemis contaminata (Fabricius,1773)	147	12.34	Dominant
Orthetrum sabiana (Drury,1770)	225	18.89	Dominant
Pantala flavescens (Fabricius, 1798)	198	16.63	Dominant
Potamarcha congener (Rambur, 1842)	28	2.35	Recedent
Trithemis pallidinervis (Kirby, 1889)	27	2.27	Recedent
Urothemis signata (Rambur, 1842)	135	11.34	Dominant
Zyxomma petiolatum (Rambur, 1842)	130	10.92	Dominant
Family-Coenagrionidae			
Agriocnemis pygmaea (Rambur, 1842)	43	3.61	Subdominant
Ceriagrion coromandelianum (Fabricius, 1798)	130	10.92	Dominant
Ischnura senegalensis (Rambur, 1842)	59	4.95	Subdominant
Pseudagrion rubriceps (Selys, 1876)	46	3.86	Subdominant

RA, 1=Subrecedent, 1.1-3.1=Recedent, 3.2-10=Subdominant, 10.1-31.6=Dominant and. 31.7% =Eudominant (Engelmann, 1973)

Table 2: Number of taxa, number of individualsand diversity indeces of Odonata larvae in a fish farming pond.

Months → Parameters ↓	Jul,17	Aug, 17	Sep, 17	Oct, 17	Nov, 17	Dec, 17	Jan, 18	Feb, 18	Mar, 18	Apr, 18	May, 18	Jun, 18	Year
Taxa_S	12	12	12	10	11	11	11	11	12	11	8	7	12
Individuals	89	145	177	45	86	114	127	89	83	119	66	51	1191
Dominance_D	0.21	0.15	0.2	0.15	0.15	0.13	0.13	0.15	0.11	0.17	0.18	0.32	0.12
Shannon_H	1.89	2.13	2.1	2.05	2.1	2.15	2.12	2.1	2.34	1.98	1.83	1.36	2.25
Evenness_e^H/S	0.55	0.7	0.7	0.77	0.71	0.78	0.76	0.74	0.86	0.7	0.69	0.56	0.93
Equitability_J	0.76	0.85	0.8	0.89	0.85	0.89	0.88	0.87	0.94	0.82	0.83	0.7	0.97

References

1. Benke AC, Benke SS. Comparative dynamics and life histories of coexisting dragonfly populations. Ecology. 1975; 56:302-317.
2. Bharamal DL, Koli YJ, Korgonkar DS, Bhawane GP. Odonata fauna of Sindhudurg district, Maharastra, India; Int. J Curr. Microbial. App. Sci. 2014; 3(9):98-104.
3. Chave J. Neutral theory and community ecology. Ecol Lett, 2004; 7:241-253.
4. Chovanec A, Rab R. Dragonflies (Odonata, Insecta) and the ecological status of newly created wetlands-exemples for long-term bioindication programmes. Limnologica. 1997; 27(34):381-392.
5. Chakraborty NK. Jalaja Gachpala, 2010.
6. Corbet PS, Annu. Rev. Entomol. 1980; 25:189-21.
7. Crowley PH, Johnson DM. Habitat and seasonality as niche axes in an odonate community. Ecology. 1982; 63/:1064-1077
8. Ghosh S, Bhattacharya T. A short-term survey on the post-winter avian diversity in Corbett National Park and associated areas, Uttarakhand, India. Journal of Threatened Taxa. 2018; 10(1):11185-11191.
9. Johnson DM. Behavioural ecology of larval dragonfly and damselfly. Trends Ecol. Evol. 1991; 6:8-13
10. Kumar A, Sangal SK. Studies on the taxonomy of larvae of Doon Valley Odonata II. J nat Hist. 1970; 4:306-313.
11. Kumar A. Studies on the life history of Trithemis festiva (Rambur) (Odonata: Libellulidae). Odonatologica 1972; 1(2):103-111.
12. Kumar A. Description of the last instar larvae of Odonata from the Dehra Dun Valley (India), with notes on Biology: II (Suborder Anisoptera). Oriental Insect 1973; 7(2):291-331.
13. Kumar A. Studies on the life history of Indian dragonflies, Pantala flavescens (Fab.) (Libellulidae: Odonata). Ann Entomol. 1984; 2(1):43-50.
14. Kumar A. Studies on the life history of Indian dragonflies, Anax immaculifrons (Rambur) (Aeshnidae: Odonata). Entomon. 1984; 9(2):127-133.
15. Ross Thompson M, Ulrich Brose, Jennifer Dunne A, Robert O Hall Jr, Sally Hladyz, Roger Kitching L *et al*. Tylianakis, Food webs: reconciling the structure and function of biodiversity; Trends in Ecology and Evolution 2012, 27(12).
16. Subramanin KA, Babu R. Checklist of Odonata (Insecta) of India. 2017, Version 3.0. www.zsi.govt.in.
17. Theischinger G. Identification Guide to Australian Odonata, Department of Enviornment, Climate Change and Water NSW, 2009.
18. Wilhm JR, Dorris CT. Biological parameters for water quality criteria. Bioscience. 1968; 18(6):477-481.
19. Wissinger SA. Niche overlap and potential for competition and intraguild predation between size-structured populations. Ecology. 1992; 73(4):1431-1444.