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Odonate (Insecta: Odonata) diversity of West Bengal State University Campus; a checklist and pictorial catalogue

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Abstract
Dragonflies and damselflies, in the ancient order odonata, are amongst the most attractive creatures on earth, first to have conquered the aerial domain. Yet we know little of their diversity in India and detailed ecology and habitat preferences of many species are poorly documented. Although much work have been carried out regarding the abundance and distribution of insect orders, no sufficient effort has been made to study the diversity and distribution of Odonates. Thus, in the present study an attempt has been taken to study the diversity and abundance of Odonates in West Bengal State University (WBSU) campus, West Bengal, India. A total of 32 species of Odonates were recorded from the study area from July to September, 2017. The family Libellulidae with 18 species was the most dominant among the Anisoptera (dragonflies) followed by Gomphidae (1sp.) and family Aeshnidae (1 sp.). Among the Zygoptera (damselflies), the 11 species recorded belong to the family Coenagrionidae and 1 species of family platycnemididae. As the area houses 32 species of Odonates including 20 species of Anisoptera and 12 species of Zygoptera, it can be presumed to have a good diversity which may be attributed to the grasslands, shrubs and small water bodies inside the campus.

Keywords: Odonates, diversity, WBSU, West Bengal, India

1. Introduction
Dragonflies and damselflies collectively called Odonates, are one of the most common insects flying over forest, fields, meadows, ponds and rivers. Among the most ancient order of insects, and possibly the first to master the art of flying, Odonates first made their appearance during the Carboniferous era, about 250 million years ago. However, modern families of these insects date from the upper Jurassic and Cretaceous periods (150-60 million years ago) [1]. Silsby [2] described about 6000 species of dragonflies in all over the world.

Based on their body structure, Odonata are divided into three groups, viz. damselflies (Zygoptera), relict dragonflies (Anisozygoptera) and dragonflies (Anisoptera). Odonates have a very interesting and complex life-history with 3 stages: egg, larva and adult, of which the egg and larval stage are aquatic and the adult stage terrestrial. Thus the free flying dragonfly or damselfly that we see around constitutes only one brief stage of its life; the other, often much longer part, is played out underwater, away from the eyes of us humans.

Dragonflies and damselflies of the Indian sub region (India, Sri Lanka, Pakistan, Nepal, Bhutan, Bangladesh and Myanmar) are well documented with over 600 species. Regional checklists are available for many areas. In India, 470 species of Odonates are recorded belonging to 139 genera and 19 families; [3]. The eastern India is one of the globally rich areas of odonates and the forest streams and rivers of this region are habitat for many endemics and habitat specialists. The Odonate fauna of Eastern India has attracted the attention of various workers in the past [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14]. Many species of odonates were reported from eastern part of India, but documentation of abundance and distribution is still not known for most of the species and detailed ecology and habitat preferences of many species are poorly documented.

Being supreme predators both during their adult and larval stages, Odonates play crucial role in ecosystem functioning and serve to keep other insects including those harmful to humans (like mosquitoes, blood-sucking flies, etc.) under control. Apart from functioning as predators in the ecosystem, their value as indicators of habitat quality has also been widely appreciated in recent times. Thus the present study aimed to explore the species richness and diversity of Odonates in WBSU campus which might be helpful to pave the way for future research and formulation of an effective strategy for conservation of this important group of insects.

2. Materials and methods
The present study was conducted in West Bengal State University (WBSU), Barasat, Kolkata, West Bengal, India from July to September, 2017 to assess the diversity of Odonates. WBSU Campus is located in between 88° 25′ E longitudes and 44°46′ N latitude in the state of West Bengal, India (Fig. 1).

Surveys were conducted throughout the campus to cover all the habitats. Photographs and observations were taken during the day light hours. Individual images of Odonates were photo-documented and identified by cross-checking with standard references and photo guides [15, 16, 17].

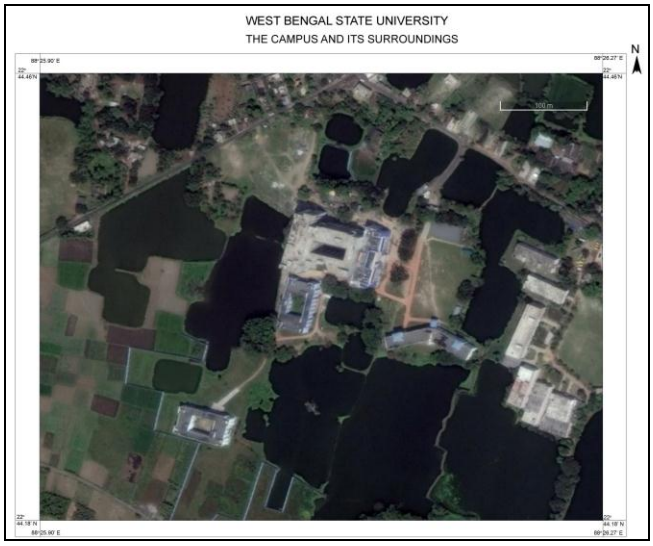
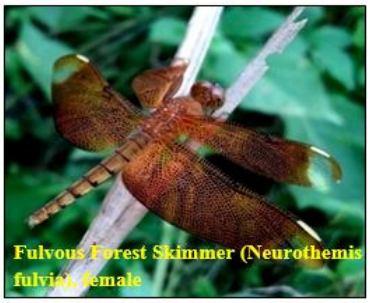


Fig 1: Location of the study


Fulvous Forest Skimmer (Neurothemis fulvia), male


Fulvous Forest Skimmer (Neurothemis fulvia), female


Pied Paddy Skimmer (Neurothemis tullia, male)


Pied Paddy Skimmer (Neurothemis tullia, female)


Common Picture Wing (Rhyothemis variegata), male


Common Picture Wing (Rhyothemis variegata), female


Green Marsh Hawk (Orthetrum sabina)


Crimson-tailed Marsh Hawk (Orthetrum pruinosum)


Wandering Glider (Pantala flavescens)


Yellow-tailed Ashy Skimmer (Potamarcha congener, male)


Yellow-tailed Ashy Skimmer (Potamarcha congener, female)


Coral-tailed Cloud Wing (Tholymis tillarga)


Blue Marsh Hawk (Orthetrum glaucaum)


Greater Crimson Glider (Urothemis signata), male)


Greater Crimson Glider (Urothemis signata), female


Long-legged marsh glider (*Trithemis pallidinervis*)


Rufous Marsh Glider (*Rhodothemis rufa*), female


Rufous Marsh Glider (*Rhodothemis* rufa), male

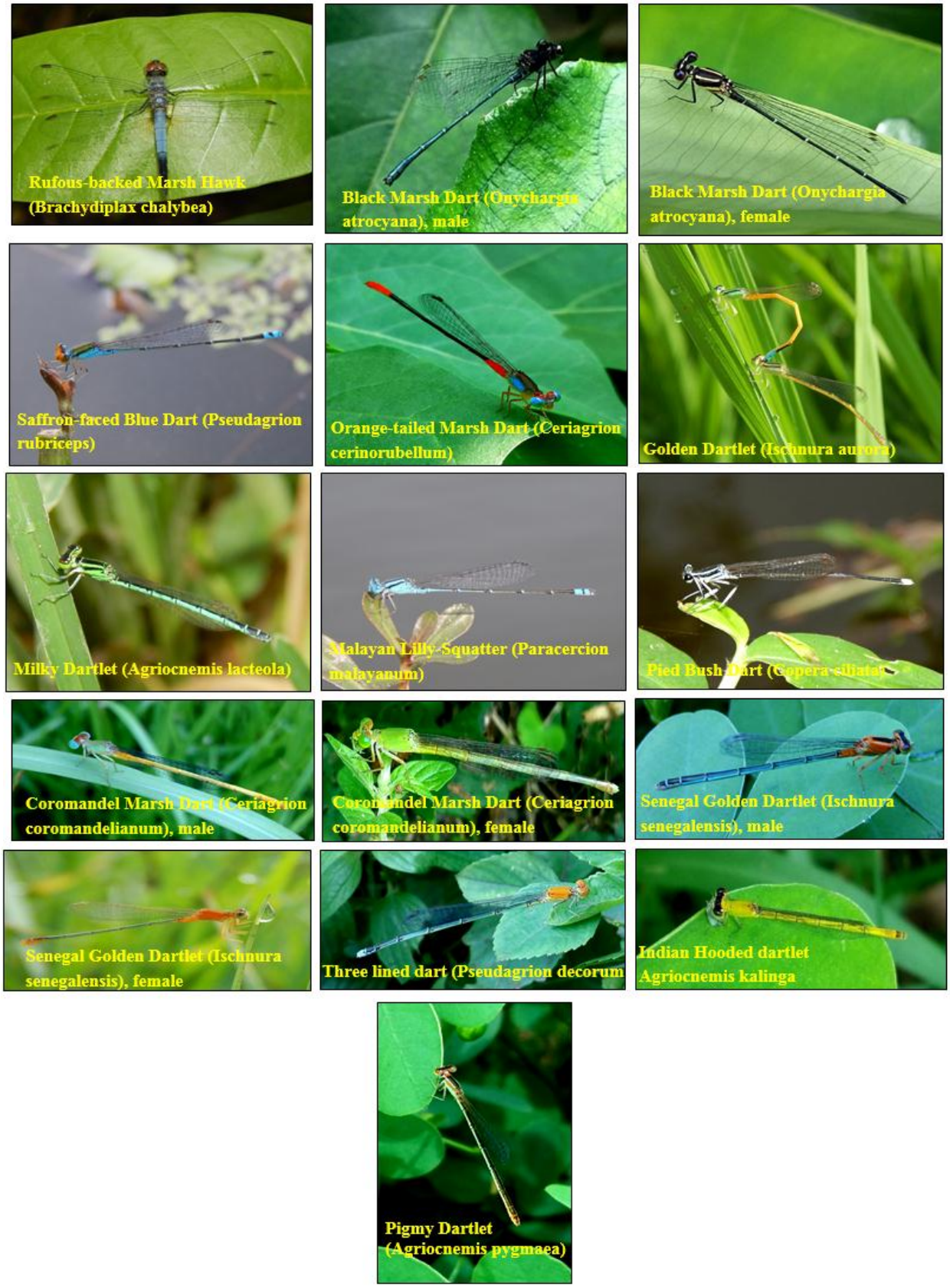


Fig 2: Photographs of some Dragonflies and Damselflies recorded during the study.

3. Results & Discussion

A total of 32 species of Odonates including 20 species of Anisoptera (Dragonflies) and 12 species of Zygoptera (damselflies) were recorded from the WBSU campus, Kolkata (both male and females), India (Table 1). The Libellulidae with 18 species was the most dominant family among the Anisoptera followed by Gomphidae (1 sp.) family Aeshnidae (1 sp.). Among the Zygoptera, the 11 species recorded belong to the family Coenagrionidae and 1 species of family: platycnemididae (Fig. 2). Among the Anisoptera, Brachythemis contaminata, Diplacodes trivialis, Neurothemis fulvia, Neurothemis tullia and Urothemis signata were the dominant species, whereas among the Zygoptera, Ceriagrion coromandelianum and Onychargia atrocyana was the most dominant species encountered in the campus area.

Table 1- List of Dragonfly and Damselfly and their status [19]

Sl. No.	Common name	Scientific Name	Status
	Family: Gomphidae		
1	Common Clubtail	*Ictinogomphus rapax*	Common
	Family: Aeshnidae		
1	The shadow darner	*Aeshna umbrosa*	Unknown
	Family: Libellulidae		
1	Trumpet Tail	*Acisoma panorpoides*	Common.
2	Scarlet Marsh Hawk	*Aethriamanta brevipennis*	Locally common
3	Ditch Jewel	*Brachythemis contaminata*	common
4	Ruddy Marsh Skimmer	*Crocothemis servilia*	Locally Common
5	Ground Skimmer	*Diplocodes trivialis*	Very common.
6	Fulvous Forest Skimmer	*Neurothemis fulvia*	Locally common.
7	Pied Paddy Skimmer	*Neurothemis tullia*	Locally common.
8	Common Picture Wing	*Rhyothemis variegata*	Very common.
9	Green Marsh Hawk	*Orthetrum sabina*	Very common
10	Crimson-tailed Marsh Hawk	*Orthetrum pruinosum*	Common.
11	Wandering Glider	*Pantala flavescens*	Very common
12	Yellow-tailed Ashy Skimmer	*Potamarcha congener*	Common
13	Coral-tailed Cloud Wing	*Tholymis tillarga*	Common
14	Blue Marsh Hawk	*Orthetrum glaucaum*	Locally common
15	Greater Crimson Glider	*Urothemis signata*	Common.
16	Long-legged marsh glider	*Trithemis pallidinervis*	Common.
17	Rufous Marsh Glider	*Rhodothemis rufa*	Uncommon
18	Rufous-backed Marsh Hawk	*Brachydiplax chalybea*	Common.
	Family: Coenagrionidae		
1	Coromandel Marsh Dart	*Ceriagrion coromandelianum*	Very common
2	Black Marsh Dart	*Onychargia atrocyana*	Locally common
3	Senegal Golden Dartlet	*Ischnura senegalensis*	Very common
4	Saffron-faced Blue Dart	*Pseudagrion rubriceps*	Common
5	Orange-tailed Marsh Dart	*Ceriagrion cerinorubellum*	Locally common.
6	Pigmy Dartlet	*Agriocnemis pygmaea*	Very common
7	Golden Dartlet	*Ischnura aurora*	Very common
8	Malayan Lilly-Squatter	*Paracercion malayanum*	Unknown
9	Three lined dart	*Pseudagrion decorum*	Locally common.
10	Indian Hooded dartlet	*Agriocnemis kalinga*	Locally common
11	Milky Dartlet	Agriocnemis lacteola	Uncommon.
	Family: Platycnemididae		
1	Pied Bush Dart	*Copera ciliata*	Uncommon.

Dragonflies are a predaceous, hemi-metabolous and amphibiotic insect, which inhabits all kinds of freshwater habitats either permanent or temporary [2]. Subramanian [3] reported 11 dragonfliy families, of which Libellulidae (972) and Gomphidae (958) are major families containing maximum species throughout the world followed by Aeshnidae (436), Corduliidae (249) and Macromiidae (123). In India, out of 7 families, Libellulidae and Gomphidae are major families consisting of 85 species each. These are followed by Aeshnidae (45), Macromiidae (17), and Corduliidae (16). A very least number of species are reported in family-Chlorogomphidae (10) and Cordulegastridae (9). Sharma *et al*. [18] collected 147 species of dragonflies belongs to 5 families in Indian Agricultural Research Institute, New Delhi, India; of which 74, 36, 19, 16 and only 2 species are belongs to family-Libellulidae, Gomphidae, Aeshnidae, Corduliidae and Cordulegastridae respectively. In Orissa and Eastern India, Nair [19] recorded 45, 9, 8 and 3 species belongs to family-Libellulidae, Gomphidae, Aeshnidae and Cordulegastridae. Manwar *et al*. [20] in Chatri Lake Region, in Pohara–Malkhed Reserve Forest, Amravati, Maharashtra (India) recorded 22 species of dragonflies and damselflies of 4 families and 17 genera; of which 50% species are of family Libellulidae followed by Coenogrionidae (36%), Gomphidae (9%) and

Platycenemididae (5%). In Western Ghats, the Anisoptera has 53 genera, 107 species with 31 endemics. The families Libellulidae (49 species), Gomphidae (26 species) and Corduliidae (22 species) are the most species-rich, followed by Aeshnidae (8 species) Cordulegastridae and (2 species) [21]. Tijare & Patil [22] were observed 21 species of dragonflies in and around Gorewada National Park, Nagpur; of which 15 species belonging to Family- Libellulidae, 4 species from Aeshnidae and 2 species from Gomphidae. The above observations are similar to the present observations where family- Libellulidae is the largest family carrying maximum number of species and dragonflies.

Dragonflies and damselflies complete their life cycle in wetlands and its riparian landscape. Species are highly habitat specific in larval and adult stages. They are sensitive to the changes in habitat quality and reliably indicate ecosystem health. Thus they are valuable as indicator of aquatic and terrestrial ecosystem health [23]. Odonata are an easy to study group and are useful for monitor the overall biodiversity of aquatic habitats and had been identified as good indicators of environmental quality [24].

Despite the high importance of Odonates in environmental monitoring, still there is lack of significant effort to explore the diversity and abundance of this insect order in West Bengal. During the study, it has been found that the University campus fulfills most of the criteria important for Odonates as it is rich in grassland, shrubs and small water bodies. This study strongly encourages the use of institutional estates in providing habitat facility not only to the Odonates but also to other wildlife as a whole. The data recorded in the present study may prove valuable as a reference for assessing the changes in environmental tools in the locality, in near future.

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