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An observation on the Odonata diversity in and around Sarojini Naidu College campus, Kolkata, West Bengal, India

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Abstract
Odonates play vital role in environmental monitoring and can be used as biological indicators of ecological health. The present investigation was undertaken as a pilot study to study the diversity and abundance of dragonflies and damselflies (Odonata) in Sarojini Naidu College campus, Kolkata, West Bengal, India. A combination of direct search and opportunistic sighting methods were applied to record 23 different Odonata species (18 dragonflies and 5 damselflies) from the study area during May, 2015 to April, 2016. In spite of the college campus being located in an industrial urban area, the present study revealed a striking diversity of Odonates. A suitable geographic location, favourable climatic conditions, appropriate vegetation provided a comfortable shelter for Odonata species to flourish in this area. This study is aimed towards contributing to the plan of biodiversity restoration in our campus and development of management strategies for conservation of this important group of insects.

Keywords: odonata, dragonfly, damselfly, sarojini naidu college, diversity, conservation

1. Introduction
Odonata comprising the dragonflies (Anisoptera) and damselflies (Zygoptera) constitute a small and highly specialized order of insects that are widely distributed all over the world [1]. Approximately 6000 species and subspecies to 630 genera in 28 families are known from all over the world [2], out of which 474 species in 142 genera and 18 families are known from India [3]. Being predators both at larval and adult stages, Odonates play significant role as important food chain components especially for spiders and birds and serve to keep harmful insects (like mosquitoes, blood-sucking flies, bees, ants, wasps etc.) under control [4]. Moreover, Odonate taxa are ideal models for the investigation of the impact of environmental warming and climate change due to their tropical evolutionary history and adaptations to temperate climates [5]. Studies have shown that they are good indicators of ecosystem health [6] and have strong association with water because of their aquatic larvae [7]. Even though most species of odonates are highly specific to a habitat, some have adapted to urban areas and exploit man-made water bodies [8]. Anecdotal observations suggest that some Odonates are so habitat sensitive that even minor changes can lead to their disappearance [4]. In the recent past, researchers have studied Odonates from some of the urban and sub-urban areas of Kolkata [9-12]. Institutional campuses with undisturbed natural vegetation provide potential habitat for Odonate population as they are devoid of any developmental activities and pollution.
Sarojini Naidu College for Women (SNCW), Dum Dum, (22°37´12´´ N and 88°25´12´´ E) is located in a sub-urban belt having a well-wooded campus amidst a mosaic of concrete buildings (Fig 1). The campus is spread over an area of 3.5 acres with lush green vegetation having large trees, bushy shrubs and long grasses. The College campus is surrounded by residential apartments, hospital, office buildings and large and small scale industries. The campus is flanked by roads with continuous vehicular movements. There are also ponds and water bodies with rich aquatic vegetation in the vicinity of the college. The study area experiences a sub-tropical climate with hot summers from late March to early June (Temperature range: 25℃-40℃), the humid monsoon season from mid June to late September and a cool dry winter from late November to early February (Temperature range: 12℃-25℃). Humidity is generally very high during summer and the area receives an average rainfall of 170 mm. The present survey is focused not only on preparing the checklist of odonates, but also to create awareness for their conservation.

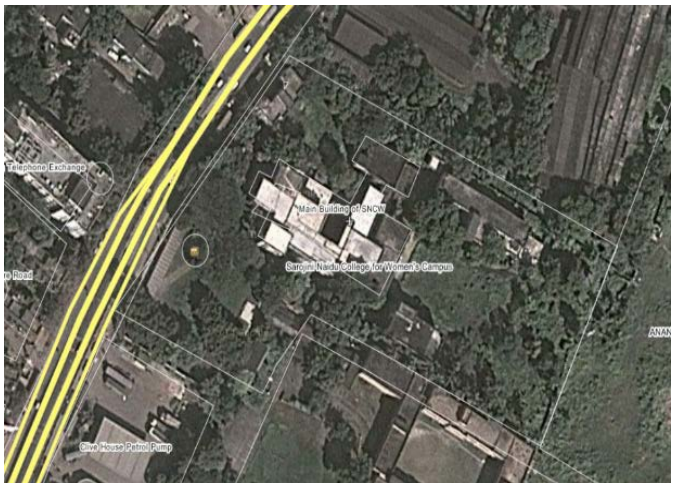

Fig 1: Satellite overview map of study locality

2. Materials and Methods
The present study was carried out between the months of May 2015 to April 2016. Visual surveys were done randomly in the morning, noon and evening times and the Odonates were identified up to the species level. All the specimens were identified with the aid of a Bushnell Binocular (8X40) and photographed with Canon PowerShot SX 510 HS in their natural habitats. In case of difficulties, unidentified ones were collected using a butterfly net and identified in the laboratory

using taxonomic literature and field identification guides [13-19] and again released in the environment. Species name were listed following Subramanian (2014) [3]. The Odonates were categorized into four groups (VC-very common, C-common, R-rare, VR-very rare) on the basis of their frequency of sightings in our college campus.

3. Results

A total of 23 species of Odonata representing 19 genera from 5 families was recorded from Sarojini Naidu College campus and its vicinity (Table 1&2). The photographs of some of the observed Odonates are given in Fig 4. Among the dragonflies (suborder Anisoptera), the most diverse and abundant family was Libellulidae, represented by 15 species (65.21%) followed by Aeshnidae (2 species) and Gomphidae (1 species) while among damselflies (suborder Zygoptera), Coenagrionidae was the most dominant family represented by 4 species (17.39%) followed by Platycenemididae representing 1 species (4.34%) only (Figure 2). *Orthetrum pruinosum* was the most abundant species recorded in the study area. Out of 23 species found in the study area, 13.04% species were very common, 52.17% were common, 30.43% were rare and 4.34% were very rare (Figure 3). Most of the Odonates belonged to the Least Concerned (LC) category according to the IUCN Red Data List.

Table 1: Checklist of dragonflies (sub order- Anisoptera) of Sarojini Naidu College for Women, Kolkata

Sl.no	Family	Common Name	Scientific Name	Local Status
1	*Aeshnidae*	Blue-tailed Green Darner	*Anax guttatus* (Burmeister, 1839)	Rare
2		Brown Darner	*Gynacantha dravida* Lieftinck, 1960	Rare
3	*Gomphidae*	Common Club Tail	*Ictinogomphus rapax* (Rambur, 1842)	Common
4	*Libellulidae*	Scarlet Marsh Hawk	*Aethriamanta brevipennis* (Rambur, 1842)	Rare
5		Rufous Marsh Glider	*Rhodothemis rufa* (Rambur, 1842)	Rare
6		Ditch Jewel	*Brachythemis contaminata* (Fabricius,1793)	Common
7		Ruddy Marsh Skimmer	*Crocothemis servilia* (Drury, 1770)	Common
8		Black-tipped Ground Skimmer	*Diplacodes nebulosa* (Fabricius,1793)	Common
9		Ground Skimmer	*Diplacodes trivialis* (Rambur, 1842)	Very Common
10		Fulvous Forest Skimmer	*Neurothemis fulvia* (Drury, 1773)	Very Common
11		Pied Paddy Skimmer	*Neurothemis tullia* (Drury, 1773)	Common
12		Blue Marsh Hawk	*Orthetrum glaucum* (Brauer,1865)	Rare
13		Crimson-tailed Marsh Hawk	*Orthetrum pruinosum* (Burmeister, 1839)	Very Common
14		Green Marsh Hawk	*Orthetrum sabina* (Drury, 1770)	Common
15		Wandering Glider	*Pantala flavescens* (Fabricius,1798)	Common
16		Common Picture Wing	*Rhyothemis variegata* (Linnaeus, 1763)	Common
17		Crimson Marsh Glider	*Trithemis aurora* (Burmeister, 1839)	Rare
18		Rufous-backed Marsh Hawk	*Brachydiplax chalybea* Brauer, 1868	Common

Table 2: Checklist of damselflies (sub order- Zygoptera) of Sarojini Naidu College for Women, Kolkata

Sl. no.	Family	Common name	Scientific name	Local Status
1	*Coenagrionidae*	Pigmy Dartlet	*Agriocnemis pygmaea* (Rambur, 1842)	Rare
2		Coromandel Marsh Dart	*Ceriagrion coromandelianum* (Fabricius, 1798)	Common
3		Golden Dartlet	*Ischnura aurora* (Brauer,1865)	Common
4		Saffron-faced Blue Dart	*Pseudagrion rubriceps* Selys, 1876	Very rare
5	*Platycnemididae*	Yellow Bush Dart	*Copera marginipes* (Rambur, 1842)	Common

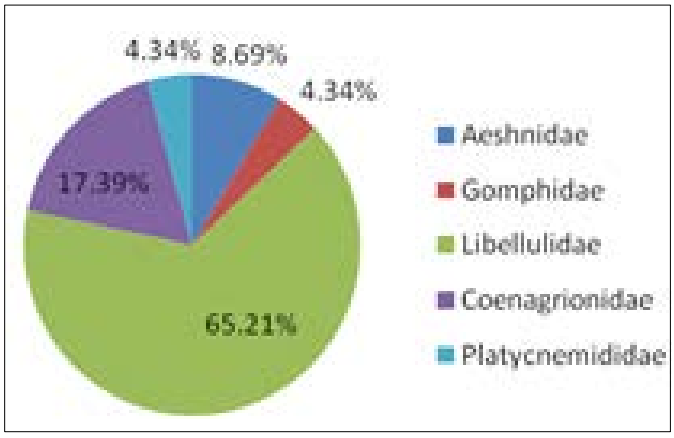

Fig 2: Percentage composition of Odonata species in different families at SNCW campus, Kolkata

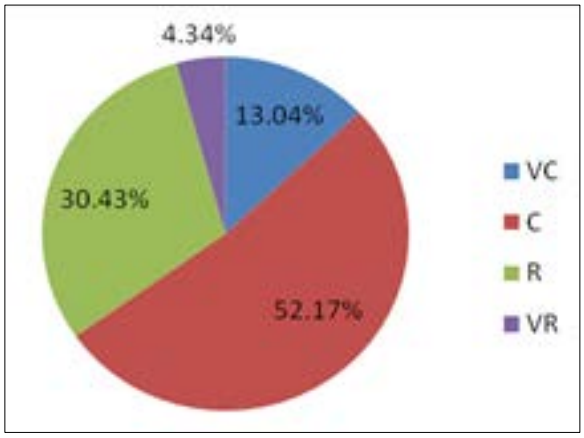

Fig 3: Abundance of Odonata species in SNCW campus, Kolkata

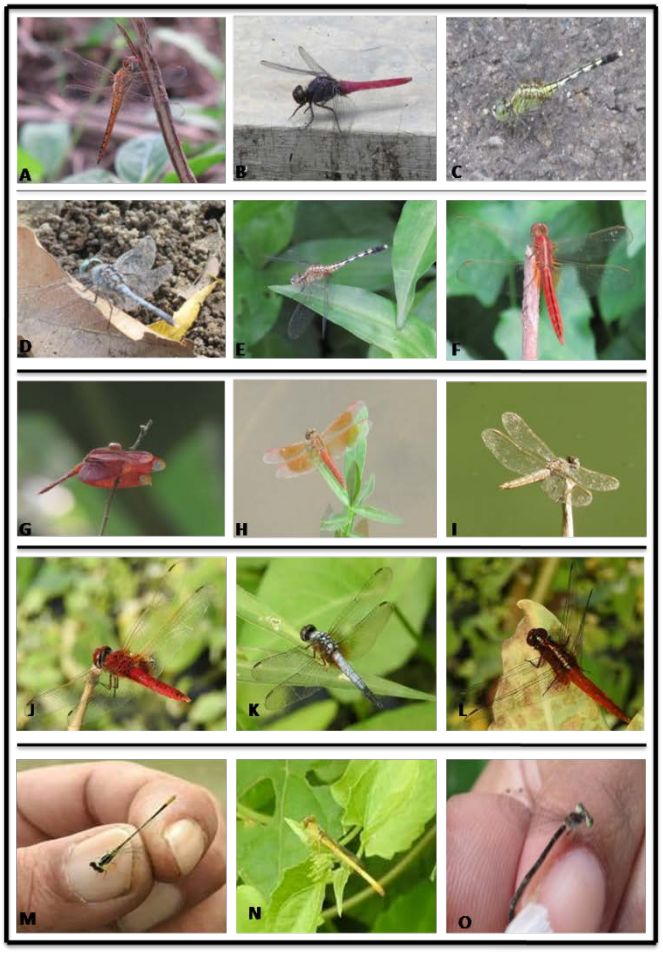

Fig 4: Photographs of some of the Odonata species observed in and around SNCW campus.
(A) *Pantala flavescens* (Fabricius, 1798), **(B)** *Orthetrum pruinosum* (Burmeister, 1839), **(C)** *Ictinogomphus rapax* (Rambur, 1842), **(D)** *Diplacodes trivialis* (Rambur, 1842) Male, **(E)** *Diplacodes trivialis* (Rambur, 1842) Female, **(F)** *Crocothemis servilia* (Drury, 1770), **(G)** *Neurothemis fulvia* (Drury, 1773), **(H)** *Brachythemis contaminata* (Fabricius, 1793) Male, **(I)** *Brachythemis contaminata* (Fabricius, 1793) Female, **(J)** *Trithemis aurora* (Burmeister, 1839), **(K)** *Brachydiplax chalybea* Brauer, 1868, **(L)** *Rhodothemis rufa* (Rambur, 1842), **(M)** *Agriocnemis pygmaea* (Rambur, 1842), **(N)** *Ceriagrion coromandelianum* (Fabricius, 1793), **(O)** *Copera marginipes* (Rambur, 1842).

4. Discussion

Dragonflies have been extensively used as indicators of biological health of aquatic habitats [20]. They are considered key organisms of the food web as the larvae and adults are predatory and very important bio-control agents for insect pests [21]. Since they are sensitive to fluctuations in their ecosystem, they can be used as determiners of ecological health. Thus, they also serve as model organisms to assess the effects of global climate change. Odonates neither sting nor bite, and they are harmless in nature. Naiads serve as food for growing freshwater fish and the soft bodies of the adults are eaten by songbirds as tasty snacks [22].

Our observation emphasizes the importance of urban green spaces in conserving regional Odonata fauna. As the area houses 23 species of Odonates, it can be presumed that the institution campus fulfils an environment favourable for Odonate diversity. Such high diversity and abundance in urban areas may be attributed to the grasslands, shrubs and small water bodies in and around the campus with minimal disturbance. Although the Odonata species recorded in this study is consistent with earlier studies [12], slight variations in the total species richness is evident possibly due to differences in the size or habitat conditions within the sampling area. Such habitats are not only home for Odonates but also for other flora and fauna. Previously, 49 species of butterflies, and 45 species of birds have been recorded from Sarojini Naidu College campus [23, 24]. Such green patches in the highly industrialized and polluted landscape of Kolkata indicate the potentiality of the habitat to support a substantial amount of biodiversity. Similar habitation need to be identified in other urban centres in West Bengal as well as India and long term protection and management are required for conserving regional biodiversity.

With the pressing needs of the growing human population in India, natural greeneries are being clear-felled giving way to urbanization, pollution and overgrazing. Loss of prime habitat is the major threat to all wildlife including birds, butterflies, dragonflies and damselflies. Although we cannot completely nullify the ill effects of urbanization and development, we can at least try to reduce them by planting endemic trees and plants supporting the local wildlife. This will make sure that by no means the common species will go on to the verge of extinction [23, 24].

Thus, the present study, aimed to explore the species diversity and abundance of Odonates in Sarojini Naidu College campus might be helpful to pave the way for future research and formulation of an effective strategy for sustainability of these insects.

5. Conclusion

The findings of the present work underline the importance of institutional campuses as a preferred habitat for dragonflies and damselflies. The findings also points to the need of conservation of a wide range of indigenous dragonfly species in an area. Further, human interference and developmental activities should not increase in the area over a period of time to maintain diverse species composition. This is the first effort in exploring the Odonata wealth of SNCW. The present list of Odonata species is not conclusive and exhaustive and future exploration will be continued to update this checklist.

6. Acknowledgement

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7. Conflict of interest

The authors declare that there is no conflict of interest.

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