

Studies on the Species Diversity of Damselflies and Dragonflies (Odonata: Insecta: Arthropoda) in and Around Asan Conservation Reserve and RAMSAR Site, Uttarakhand, India

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(Received: 19 October 2024; Revised: 02 December 2024; Accepted: 28 December 2024; Published online: 21 January 2025)
(Published by Research Trend)

DOI: <https://doi.org/10.65041/BiologicalForum.2025.17.1.19>

ABSTRACT: The studies on species diversity of Odonata (Damselflies and Dragonflies) was conducted in and around Asan Conservation Reserve and RAMSAR site, District Dehradun, Uttarakhand, India during 2021-24. In the present study recorded about 45 species belongs to 07 families under 2 suborders of order Odonata. The family Libellulidae was the most dominant family of order Odonata, represented by 25 species, followed by Coenagrionidae 11 species, Gomphidae 04 species, Aeshnidae 02 species, and Calopterygidae, Lestidae, Platycnemididae each having 01 species. The study recorded maximum number of 44 species in the study area selected Sector-II (in Wetland Vegetation area), followed by 20 species in Sector-IV (Vegetation around Yamuna river), 19 species in Sector-III (vegetation around Asan River) and least 15 species in Sector-I (Vegetation around Asan Barrage), which indicates that maximum species of odonates prefer Sector-II study area having Wetland vegetation as suitable habitat to complete their life cycle except one species *Neurobasis chinensis*, which prefer Sector-III vegetation around Asan river habitat. The mass emergence of the migratory species *Pantala flavescens* (Fabricius) was recorded in the months of June-September during all three years study period. The Odonates play crucial roles in freshwater ecosystems, their presence indicates good water quality and their diverse species contribute to ecosystem stability. This study helps in planning conservation efforts, habitat management and understanding ecological patterns in the study area.

Keywords: Odonata, diversity, Asan Conservation Reserve, Dehradun, Uttarakhand, India.

INTRODUCTION

Odonata, a group of ancient insects, have a rich evolutionary history dating back to the Paleozoic era and fossil records, including those from the Carboniferous period, provide evidence of their early existence. The Odonata are widely distributed across the globe, inhabiting various freshwater habitats and are found on every continent except Antarctica (Corbet, 1999). Globally, 6407 species under 693 genera of Odonates are known from the world (Paulson *et al.*, 2024) and from India 493 species of Odonates under 154 genera and 18 families are reported (Subramanian and Babu 2020). Odonata species exhibit diverse habitat preferences, with a strong association with freshwater ecosystems (Dijkstra *et al.*, 2013). They are commonly found in various aquatic habitats such as ponds, lakes, rivers, and streams, often preferring areas with abundant vegetation (Corbet, 1999). These giant insects are amphibious in the natural world, hemimetabolous with aquatic eggs and larval forms referred as nymphs or naiads (Sharma, 2020). The diversity of Odonates generally depend upon the type of habitat and its environment (Das *et al.*, 2012).

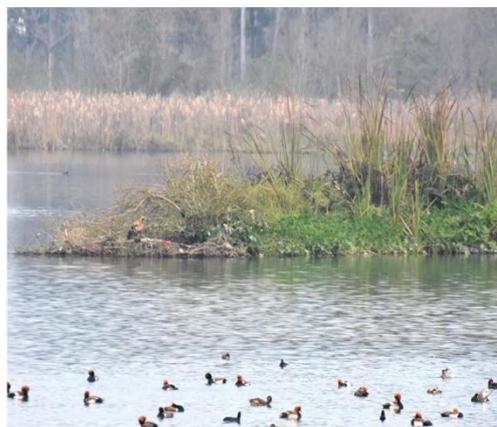
The population of dragonflies is very difficult to find in and around polluted water. Due to its feature as an ecological indicator species, dragonflies can be used as indicators of water quality (Pamungkas and Muhammad 2015). The population of Odonates can be found abundantly in and around clean unpolluted water, green patches, around rivers and wetlands, whereas highly industrialized area act as a refugee for them. The maximum abundance and species richness of Odonates is found in large perennial water bodies and near diverse aquatic vegetative areas (Saha and Gaikwad 2014). They thrive in a wide range of environments, from tropical rainforests to temperate woodlands, and even in arid deserts. The distribution and diversity of Odonata species are influenced by factors such as climate, habitat availability, and geographic isolation. Perusal of literature reveals that no consolidated account is available on the Odonata fauna in and around the Asan Conservation Reserve and RAMSAR site, District Dehradun, Uttarakhand, India. Therefore, the present studies had made a modest attempt to explore the existing diversity of odonates of Asan Conservation Reserve and RAMSAR site, District Dehradun, Uttarakhand, India.

MATERIALS AND METHODS

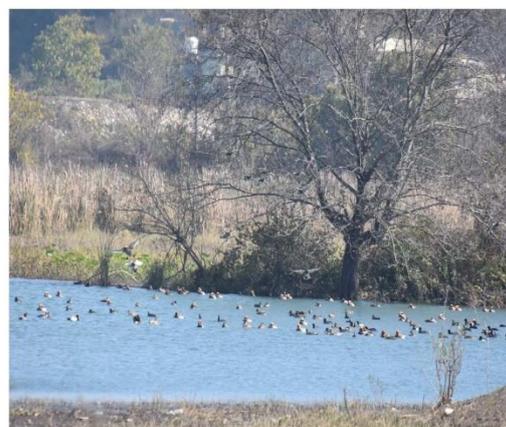
The detailed study on odonates has been made in and around the Asan Conservation Reserve and RAMSAR site, District Dehradun, Uttarakhand, India having coordinates 30°26'09"N, 77°39'56"E during September, 2021 to October, 2024. The Asan Wetland, Conservation Reserve or also known as Dhalipur Lake was constructed in 1967 at union of two rivers Asan and Yamuna, is small wetland of about 4 Km² and now also famous tourist attraction for observation of migratory waterbirds from October to March every year. A large number of animal and plant species are restricted only to wetlands, their survival depending totally on the existence of this habitats.

The extensive studies of odonates was made in the field by visiting in all the seasons in a year and continued for three years 2021-24 in the study area. To explore the species diversity the study area Asan

Conservation Reserve was divided into four Sectors *i.e.* Sector-I (around Vegetation near Asan Barrage); Sector-II (around Wetland Vegetation Opposite end Asan Barrage); Sector-III (around Vegetation near Asan river) and Sector-IV (around Vegetation near Yamuna river) (Fig. 1 a-d). The unidentified odonates were caught in the field by using Insect net and after taking photographs, observation and identification of the species, the live individuals were released. The very few selected unidentified individuals of odonates were collected, transferred into insect collection paper packs and were brought to the laboratory and identification of the collected specimens was carried out using identification keys provided by Fraser (1933, 1934 & 1936). Also studied the collection of odonates preserved in National Zoological Collections of Zoological Survey of India, Northern Regional Centre, Dehradun.



(a). Study Area Site: Sector-I



(b). Study Area Site: Sector-II



(c). Study Area Site: Sector-III



(d). Study Area Site: Sector-IV

Figs. 1 a-d. A glimpse of study area Asan Conservation Reserve, Uttarakhand.

RESULTS AND DISCUSSION

The studies on the Odonata fauna recorded about 45 species belongs to 07 families under 2 suborders in the study area Asan Conservation Reserve and RAMSAR site, District Dehradun, Uttarakhand, India during 2021-24 (Table 1). The family Libellulidae was the most dominant family of order Odonata, represented by 25 species, followed by Coenagrionidae 11 species, Gomphidae 04 species, Aeshnidae 02 species, and Calopterygidae, Lestidae, Platycnemididae each having

01 species. The study recorded maximum number of 44 species in the study area selected Sector-II (in Wetland Vegetation area), followed by 20 species in Sector-IV (Vegetation around Yamuna river), 19 species in Sector-III (vegetation around Asan River) and least 15 species in Sector-I (Vegetation around Asan Barrage), which indicates that maximum species of odonates prefer Sector-II study area having Wetland vegetation as suitable habitat to complete their life cycle except one species *Neurobasis chinensis*, which prefer Sector-III vegetation around Asan river habitat (Table 1).

The dominance of family Libellulidae was reported by many earlier workers as Kumar and Mitra (1998) recorded 42 species from Sahstradhara, Dehradun, out of which 18 species represented family Libellulidae; Prasad (2002) recorded 162 species from Western Himalaya, out of which 42 species represented family Libellulidae; Kumar (2002) recorded 109 species in Jharkhand state, out of which 40 species represented family Libellulidae; Vashishth *et al.* (2002) recorded 17 species in Rajaji National Park, out of which 9 species represented family Libellulidae; Kandibane *et al.* (2005) recorded 12 species of odonates in an irrigated rice field of Madurai, out of which 7 species represented family Libellulidae; Emiliyamma *et al.* (2005) recorded 137 species of odonates from Kerala, out of which 56 species represented family Libellulidae; Sharma (2019) recorded 22 species of odonata in the four selected localities of Districts Solan

and Sirmaur, Himachal Pradesh, in that 16 species represented family Libellulidae; Verma and Arya (2020) recorded 11 species of Odonates from Pancheshwar dam, district Champawat, Uttarakhand; Sharma (2020) recorded 23 species of odonates in and around the tributary of tons river, Dehradun, Uttarakhand, in that the family Libellulidae was the most dominant family of order Odonata, represented by 15 species, followed by Coenagrionidae four species, Gomphidae two species and Aeshnidae, Chlorocyphidae each having one species. De *et al.* (2021) prepared a checklist of 97 species of Odonates from Doon valley, Uttarakhand, in that 60 species belongs to suborder Anisoptera (dragonflies) and 37 species to suborder Zygoptera (damselflies). Arya *et al.* (2023) recorded 22 Odonata species from various habitat of Nandhour Landscape, Uttarakhand, India.

Table 1: List of Odonata Species recorded from Asan Conservation Reserve and RAMSAR site, Uttarakhand, India.

| Sr. No. | Family | Odonata Species | Sector-I (around Vegetation near Asan Barrage) | Sector-II (around Vegetation Opposite Asan Barrage) | Sector-III (around Vegetation near Asan river) | Sector-IV (around Vegetation near Yamuna river) |
|---------|-----------------|--|--|--|--|---|
| 1. | Coenagrionidae | <i>Agriocnemis clauseni</i> Fraser, 1922 | - | + | - | - |
| 2. | | <i>Agriocnemis pygmaea</i> (Rambur, 1842) | - | + | - | - |
| 3. | | <i>Amphiallagma parvum</i> (Selys, 1876) | - | + | - | - |
| 4. | | <i>Ceriagrion cerinorubellum</i> (Brauer, 1865) | - | + | - | - |
| 5. | | <i>Ceriagrion coromandelianum</i> (Fabricius, 1798) | + | + | + | + |
| 6. | | <i>Ischnura aurora</i> (Brauer, 1865) | - | + | + | + |
| 7. | | <i>Ischnura forcipata</i> Morton, 1908 | - | + | - | - |
| 8. | | <i>Ischnura nursei</i> Morton, 1907 | - | + | - | + |
| 9. | | <i>Paracercion calamorum</i> (Ris, 1916) | - | + | - | - |
| 10. | | <i>Pseudagrion decorum</i> (Rambur, 1842) | - | + | - | - |
| 11. | | <i>Pseudagrion rubriceps</i> Selys, 1876 | - | + | - | - |
| 12. | Platycnemididae | <i>Calicnemia eximia</i> Selys, 1863 | - | + | - | - |
| 13. | Lestidae | <i>Lestes praemorsus</i> (Selys, 1862) | - | + | - | - |
| 14. | Calopterygidae | <i>Neurobasis chinensis</i> (Linnaeus, 1758) | - | - | + | - |
| 15. | Gomphidae | <i>Burmagomphus sivalikensis</i> Laidlaw, 1922 | - | + | - | - |
| 16. | | <i>Ictinogomphus rapax</i> (Rambur, 1842) | + | + | + | + |
| 17. | | <i>Onychogomphus duaricus</i> (Fraser, 1924) | - | + | - | - |
| 18. | | <i>Paragomphus lineatus</i> (Selys, 1850) | - | + | + | + |

| | | | | | | |
|-----|--------------|---|-----------|-----------|-----------|-----------|
| 19. | Aeshnidae | <i>Anax guttatus</i> (Burmeister, 1839) | + | + | - | - |
| 20. | | <i>Anax parthenope</i> (Selys, 1839) | - | + | - | - |
| 21. | Libellulidae | <i>Acisoma panorpoides</i> Rambur, 1842 | - | + | - | - |
| 22. | | <i>Brachydiplax sobrina</i> (Rambur, 1842) | - | + | - | - |
| 23. | | <i>Brachythemis contaminata</i> (Fabricius, 1793) | + | + | + | + |
| 24. | | <i>Bradinyoga geminata</i> (Rambur, 1842) | + | + | + | + |
| 25. | | <i>Crocothemis servilia</i> (Drury, 1773) | + | + | + | + |
| 26. | | <i>Diplacodes lefebvrii</i> (Rambur, 1842) | - | + | - | - |
| 27. | | <i>Diplacodes nebulosa</i> (Fabricius, 1793) | - | + | - | - |
| 28. | | <i>Diplacodes trivialis</i> Rambur, 1842 | + | + | + | + |
| 29. | | <i>Neurothemis fulvia</i> (Drury, 1773) | - | + | - | - |
| 30. | | <i>Neurothemis tullia</i> (Drury, 1773) | + | + | + | + |
| 31. | | <i>Orthetrum glaucum</i> Brauer, 1865 | - | + | + | + |
| 32. | | <i>Orthetrum luzonicum</i> (Brauer, 1868) | - | + | - | - |
| 33. | | <i>Orthetrum pruinosum neglectum</i> (Burmeister, 1839) | + | + | + | + |
| 34. | | <i>Orthetrum sabina sabina</i> (Drury, 1770) | + | + | + | + |
| 35. | | <i>Orthetrum taeniolatum</i> (Schneider, 1845) | + | + | + | + |
| 36. | | <i>Orthetrum triangulare triangulare</i> (Selys, 1878) | + | + | + | + |
| 37. | | <i>Palpopleura sexmaculata</i> (Fabricius, 1787) | - | + | - | - |
| 38. | | <i>Pantala flavescens</i> (Fabricius, 1798) | + | + | + | + |
| 39. | | <i>Rhyothemis variegata variegata</i> (Linnaeus, 1763) | - | + | - | - |
| 40. | | <i>Tholymis tillarga</i> (Fabricius, 1798) | - | + | - | - |
| 41. | | <i>Tamea virginia</i> (Rambur, 1842) | - | + | - | - |
| 42. | | <i>Trithemis aurora</i> (Burmeister, 1839) | + | + | + | + |
| 43. | | <i>Trithemis festiva</i> (Rambur, 1842) | + | + | + | + |
| 44. | | <i>Trithemis pallidinervis</i> (Kirby, 1889) | - | + | + | + |
| 45. | | <i>Urothemis signata</i> (Rambur, 1842) | - | + | - | + |
| | | Total | 15 | 44 | 19 | 20 |

Note: + = species present; - = species absent.

The study reveals that *Brachythemis contaminata* (Fabricius), *Ceriagrion coromandelianum* (Fabricius), *Crocothemis servilia* (Drury), *Orthetrum sabina* (Drury), *Orthetrum pruinosum* (Burmeister, 1839), *Orthetrum triangulare* (Selys, 1878), *Palpopleura sexmaculata* (Fabricius, 1787), *Trithemis aurora*

(Burmeister, 1839) and *Trithemis festiva* (Rambur) were the dominant species in the study area (Fig. 1 e-l). The mass emergence of the migratory species *Pantala flavescens* (Fabricius) was recorded in the months of June-September during all three years study period.



(e). *Ceriagrion coromandelianum* (Fabr., 1798)



(f). *Neurobasis chinensis* (Linn., 1758)



(g). *Orthetrum triangulare* (Selys, 1878)



(h). *Brachythemis contaminata* (Fabr., 1793)



(i). *Trithemis aurora* (Burmeister, 1839)



(j). *Trithemis festiva* (Rambur, 1842)



(k). *Crocothemis servilia* (Drury, 1773)



(l). *Pantala flavescens* (Fabr., 1798)

Fig. 1. e-l. A glimpse of some of the dominant species of Odonates in the study area Asan Conservation Reserve.

The present study reveals that the study area the Asan Conservation Reserve and RAMSAR site, District Dehradun, Uttarakhand, India is rich in Odonata fauna and provide a suitable natural habitat for their survival. The Odonates play crucial roles in freshwater ecosystems, their presence indicates good water quality and their diverse species contribute to ecosystem stability. This study helps in planning conservation efforts, habitat management and understanding ecological patterns in the study area.

Acknowledgement. The author is grateful to The Director, Zoological Survey of India, Kolkata for the necessary facilities and equipment's provided to conduct this study.

Conflict of Interest. None.

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How to cite this article: Manoj Kumar Meena and Gaurav Sharma (2025). Studies on the Species Diversity of Damselflies and Dragonflies (Odonata: Insecta: Arthropoda) in and Around Asan Conservation Reserve and RAMSAR Site, Uttarakhand, India. *Biological Forum – An International Journal*, 17(1): 113-118.