sInternational Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 23-11-2025, Accepted: 22-12-2025, Published: 06-01-2026
Volume 11, Issue 1, 2026, Page No. 22-25

Studies on species diversity of dragonflies and damselflies (*Odonata*: *Insecta*) in and around Gangau Wildlife Sanctuary, Madhya Pradesh, Central India

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Abstract
A detailed study on the species diversity of odonates has been conducted in and around Gangau Wildlife Sanctuary, Panna and Chhatarpur district of Madhya Pradesh India. The survey was conducted in order to explore the diversity of odonates during 2022-2024. The study revealed that about 54 species belong to 34 genera in 07 families and 6 superfamilies under 2 suborders *Anisoptera* (Dragonflies) and *Zygoptera* (Damselflies) of order *Odonata*. The dragonflies 35 species and 24 genera and damselflies 19 species and 10 genera were recorded from the study area.
The family *Libellulidae* was the most dominant family of order *Odonata*, represented by 26 (48.14%) species, followed by *Coenagrionidae* 11 (20.37%) species, *Gomphidae* 05 (9.25%) species, *Aeshnidae* and *Lestidae* 04 (7.40%) species each, *Platycnemididae* 03 (5.55%) species and *Chlorocyphidae* 01(1.85%) species. The *Orthetrum* genus was most abundant of all species. Among species *Orthetrum sabina* and *Lestes umbrinus* was the most abundant one in the study area.

Keywords: *Odonata*, diversity, Gangu Wildlife Sanctuary, Panna, Madhya Pradesh

Introduction

Odonates are one of the most common insects flying over forests, fields, meadows, ponds, and rivers. Odonates have a very remarkable image and are among the most well-known aquatic insects (Davies and Tobin, 1985; Subramanian and Babu, 2019) [1, 2]. They are an ancient insect order with origins in the Carboniferous era about 250 million years ago (Grimaldi and Engel 2005; Tiple *et al*, 2022; Paunikar and Talmale, 2024) [3, 4, 5]. The order *Odonata* under class *Insecta* consists of three suborders the *Zygoptera* (damselflies), *Anisoptera (*dragonflies) and Aniso *Zygoptera* (a relict group having characters of both damsel & dragonflies). They are amphibious hemi-matabolan insects having the aquatic egg and larval (nymph) stages, while the adults are terrestrial (Bulánková, 1997; Tiple *et al*., 2012) [6, 7].

Due to their amphibious habits and sensitivity to structural habitat quality (such as forest cover and water), dragonflies are ideally suited for assessing environmental changes both above and below the water surface in the short term and long term (Tennessen, 2009; Subramanian and Babu, 2020) [8, 9]. They are regarded as beneficial insects because they are carnivorous throughout their life, mostly feeding on smaller insects such as mosquitoes, termites, ants, mayflies, small moths etc. Many odonates species that live in forest and agro ecosystems act as biocontrol agents and are essential for regulating pest populations (Clark and Samways, 2009; Tiple *et al*., 2011; Paunikar, 2024a) [11, 12]. The presence of dragonflies and damselflies are good indicators of freshwater ecosystem because they dependent on both aquatic and terrestrial habitats to maintain viable populations (Boudot and Kalkman 2015) [13]. Many odonates species that live in forest and agro ecosystems act as biocontrol agents and are essential for regulating pest populations the presence of dragonflies and damselflies are good indicators of freshwater ecosystem because they dependent on both aquatic and terrestrial habitats to maintain viable populations (Nair, 2011; Paunikar, 2024b) [14, 15]. The dragonflies and damselflies diversity studying in the sanctuary will provide insights into the intricate food webs and ecological interactions within the region (Corbet and Brooks 2008) [16]. It will also highlight the importance of preserving these insects as part of the broader biodiversity of the study area.
Globally, 6392 extant species in 46 families are known (Paulson *et al*., 2022) and distributed globally except in the poles. In India a total 504 species belong to 157 genera, 17 families, 3 Genera and 3 suborders are known (Kalkman *et al*., 2020) [18].
In Madhya Pradesh 88 species of *Odonata* (damselflies and dragonflies) were compiled along with 11 species are endemic to state Subramanian and Babu, (2024) [19].
Perusal of literature reveals that no consolidated account is available on the *Odonata* fauna in and around Gangau Wildlife Sanctuary, Madhya Pradesh. Therefore, the present studies had made a modest attempt to explore the existing diversity of odonates in and around Gangau Wildlife Sanctuary, Panna and Chhatarpur district of Madhya Pradesh, Central India.
Gangau Wildlife Sanctuary (24^0.699751' N, 80^0. 0967927' E) is a protected area situated on the banks of the Ken River in Panna and Chhatarpur District of Madhya Pradesh, India. The Sanctuary was established in 1975 and covers an area of approximately 69 square kilometers. The sanctuary comprises the territorial forests of the present North and South Panna Forest Division. These forests shed their leaves during certain seasons, and the trees found here have adapted to the region's dry and arid climate. Teak (*Tectona grandis*) is a prominent tree species (*Madhuca longifolia*) is another common tree species found in the It produces edible flowers and seeds that are essential food sources for several wildlife species Bamboo (*Bambusa arundinacea*) thickets are found in certain areas of the Gangau Wildlife Sanctuary. These fast-growing plants are vital for the survival of many animal species. Sal (*Shorea robusta*) forests are also found in some parts of the Sanctuary. Sal trees are known for their dense foliage and provide important habitat for various animals. Gangau Wildlife Sanctuary has grasslands that provide crucial feeding and breeding grounds for various herbivores and support the park's ecosystem. The sanctuary's water bodies and riverbanks are home to diverse riparian vegetation, including aquatic plants and shrubs that

thrive in the wetter areas. Gangau Wildlife Sanctuary is home to a diverse range of fauna, including a variety of Arthropods (Insects, Spider, Scorpion, Crustacean), fishes, amphibians, reptiles, birds, mammals and other wildlife species.

Material and Method

The detailed study on odonates has been made in and around the Gangau Wildlife Sanctuary, India during 2022 to 2024. The extensive studies of odonates were made in different forest ranges of the sanctuary and observation on species diversity and reproductive behaviour of odonates was made in the field. 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 and 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) [20, 21, 22], Andrew *et al*. (2008) [23] and Subramanian (2009) [24]. Also studied the collection of odonates preserved in National Zoological Collections of Central Zone Regional Centre, Zoological Survey of India, Jabalpur.

Results and Discussion

During the study revealed that about 54 species belong to 34 genera in 07 families and 6 superfamilies under 2 suborders *Anisoptera* (Dragonflies) and *Zygoptera* (Damselflies) of order *Odonata*. The dragonflies 35 species and 24 genera and damselflies 19 species and 10 genera were recorded from the study area.

The family *Libellulidae* was the most dominant family of order *Odonata*, represented by 26 (48.14%) species, followed by *Coenagrionidae* 11 (20.37%) species, *Gomphidae* 05 (9.25%) species, *Aeshnidae* and *Lestidae* 04 (7.40%) species each, *Platycnemididae* 03 (5.55%) species and *Chlorocyphidae* 01(1.85%) species. The *Orthetrum* genus was most abundant of all species. Among species *Orthetrum sabina* and *Lestes umbrinus* was the most abundant one in the study area.

The highest number of Odonates were recorded belonging to the *Libellulidae* (24 species and 16 genera), followed by *Coenagrionidae* (10 species and 6 genera), *Gomphidae* (5 species and 5 genera), *Aeshnidae* (4 species, 2 genera), *Lestidae* (4 species and 1 genera), *Platycnemididae* (3 species and 2 genera) and *Chlorocyphidae* (01 species and 1 genera).The list of odonates along with their common name is provided in Table-1 and dominance of different families, genera and species in Table-2 and Figure -1.

The current study reveals that some dragonflies *Orthetrum sabina*, *Crocothemis servilia*, *Brachythemis contaminata*, *Trithemis festiva* and some damselflies, *Ceriagrion coromandelianum*, *Pseudagrion* and *Ischnura* species were the dominant species in the study area. The mass emergence of *Lestes* species and the migratory species *Pantala flavescens* was recorded in the monsoon months of July-September.

Libellulidae and *Coenagrionidae* are the most dominant families among the dragonflies and damselflies in the study area. Several studies indicated that these two families are most dominant and widespread across the India (Subramanian, *et al*., 2011; Sharma, 2019; Paunikar *et al*., 2024ab) [25, 26, 12, 15].

Several studies on *Odonata* fauna in different wildlife sanctuaries across the country are available but, very few studies are available in the wildlife sanctuaries of Madhya Pradesh.

The studied on the odonates faunal diversity from wildlife sanctuaries is limited as compare to national parks of Madhya Pradesh. Some reports are available on the odonates diversity of wildlife sanctuaries from Madhya Pradesh.

Talmale (2011) [27] had given preliminary list of 26 species from Singhori Wildlife Sanctuary.

Talmale, S.S. (2016a) [28] recorded 38 species belonging to 29 genera of 16 subfamilies and 7 families from Veerangana Durgawati Wildlife Sanctuary, District Damoh, Madhya Pradesh. Talmale, S.S. (2016b) [29] reported 40 species belonging to 31 genera of 15 subfamilies and 9 families from Singhori Wildlife Sanctuary Raisen district, Madhya Pradesh.

Talmale (2022) [30] documented 50 species belonging to 33 genera of 7 families of Odonates from Nauradehi Wildlife Sanctuary, Madhya Pradesh.

Recently, Paunikar (2025) [31] reported 41species of *Odonata* from 25 genera and 6 families from Gandhisagar Wildlife Sanctuary, Neemach and Mandsaur district of Madhya Pradesh. Among these, 26 species and 17 genera were *Anisoptera* (dragonflies), and 15 and 8 genera were *Zygoptera* (damselflies).

The study showed that the diversity of dragonflies and damselflies in the different wildlife sanctuaries of the Madhya Pradesh very rich and diverse. It is also urgently needed to explore not only the odonates faunal diversity but also other precious faunal of the other wildlife sanctuaries of Madhya Pradesh.

Table 1: Odonates species recorded in different forest ranges of Gangu Wildlife Sanctuary, Madhya Pradesh

Sl. No.	Suborder	Superfamily /Family	Common Name	Scientific Name
1	*Zygoptera* (Damselflies)	*Coenagrionidea Coenagrionidae*	Pygmy dartlet	*Agriocnemis pygmaea* (Rambur, 1842)
2			Splendid dartlet	*Agriocnemis splendidissima* Laidlaw,1919
3			Azure dartlet	*Amphiallagma parvum* Selys, 1876
4			Coromandel marsh dart	*Ceriagrion coromandelianum* (Fabricius, 1798)
5			Golden dartlet	*Ischnura aurora* (Brauer, 1865)
6			Pixie dartlet	*Ischnura nursei* (Morton,1907)
7			Senegal golden dartlet	*Ischnura senegalensis* (Rambur, 1842)
8			Lavender Sprite	*Pseudagrion hypermelas* Selys, 1876
9			Three- line Sprite	*Pseudagrion decorum* (Rambur, 1842)
10			Blue Grass dartlet	*Pseudagrion microcephalum* (Rambur, 1842)
11			Saffron-faced Bluedart	*Pseudagrion rubriceps* Selys, 1876
12		*Platycnemididae*	Yellow bush dar	*Copera marginipes* (Rambur, 1842)
13			Blue bush dart	*Copera vitatta* (Selyes, 1863)
14			Black- wing Bombaootail	*Disparoneura quadrimaculata* (Rambur,1842)
15		*Lestoidea Lestidae*	Emerald Spreadwing	*Lestes elatus* Hagen in Selys, 1862
16			Brown Spreadwing	*Lestes umbrinus* Selys, 1891

17			Emerald Spreadwing	*Lestes thoracicus* Laindlaw, 1920
18			Emerald-striped Spreadwing	*Lestes viridulus* Rambur, 1842
19		*Calopterygoidea Chlorocyphidae*	River Heliodo	*Libellago lineata lineata* (Burmeister,1839)
20		*Aeshnoidea Aeshnidae*	Vagrant Emperor	*Anax ephippiger* (Burmeister, 1839)
21			Blue-Tailed Green Darner	*Anax guttatus* (Burmeister, 1839)
22			Magnificent Emperor	*Anax immaculifrons* Rambur, 1842
23			Parakeet Darner	*Gynacanth abayadera* Selys, 1891
24		*Gomphoidea Gomphidae*	Common Hooktail	*Anormogomphus heteropterus* Selys, 1854
25			club tail	*Cyclogomphus heterostylus* Selys,1854
26			Common club tail	*Ictinogomphus rapax* (Rambur, 1842)
27			Collared pygmy clubtail	*Microgomphus torquatus* (Selys)
28			Common Hooktail	*Paragomphus lineatus* (Selys,1850)
29		*Libelluloidea Libellulidae*	Trumpet Tail	*Acisoma panorpoides* Rambur, 1842
30			Ditch Jewel	*Brachythemis contaminate* (Fabricius, 1793)
31			Little Blue Marsh Hawk	Brachydiplax sobrina (Rambur, 1842)
32			Granite ghost	*Bradinopyga geminata* (Rambur, 1842)
33			Blacktipped Ground Skimmer	Diplacodes nebulosa (Fabricius, 1793)
34			Ground Skimmer	*Diplacodes trivialis* (Rambur, 1842)
35			Light-tipped Demon	*Indothemis carnatica* (Fabricius, 1798)
36			Ruddy marsh skimmer	*Crocothemis servila* (Drury, 1770)
37			Fulvous forest skimmer	*Neurothemis tullia* (Drury, 1773)
38			Blue Marsh Haw	*Orthetrum glaucaum* (Brauer, 1865)
39			Crimoson -Tailed Marsh Hawk	*Orthetrum pruinosum* (Rambur, 1842)
40			Tricolor Marsh Hawk	Orthetrum luzonicum (Brauer, 1868)
41			Slender Skimmer	*Orthetrum sabina* (Drury, 1770)
42			Small Skimmer	*Orthetrum taeniolatum* (Schneider, 1845)
43			Brown-backed Red Marsh Hawk	*Orthetrum Chrysis* (Selyes,1891)
44			Wandering Glider	*Pantala flavescens* (Fabricius, 1798)
45			Yellow-tailed Ashy Skimmer	*Potamarcha congener* (Rambur, 1842).
46			Blue tail Yellow Skimmer	*Palpopleura sexmaculata Fabricius, 1787*
47			Coral tailed Cloud wing	*Rhodothemis rufa* (Rambur, 1842)
48			Common Picture Wing	*Rhyothemis variegata* Linnaeus, 1763)
49			Coral tailed Cloud wing	*Tholymis tillarga* (Fabricius, 1798)
50			Red Marsh Trotter	*Tramea basilaris* Kirbyi, 1889
51			Crimson marsh Skimmer	*Trithemis aurora* (Burmeister, 1839)
52			Black Stream Skimmer	*Trithemis festiva* (Rambur, 1842)
53			Scarlet Roack Glider	Trithemis kirbyi Selys, 1891
54			Long -legged marsh glider	*Trithemis pallidinervis* (Kirby, 1889)

Anisoptera (Dragonflies)

Table 2: Superfamily-wise species and genera richness in *Odonata* of the Gangau Wildlife Sanctuary of Madhya Pradesh

S. No.	Species and genera in suborder	Species and genera in Superfamilies	Species and genera in Families
1	*Zygoptera* (Damselflies) (19 and 10)	*Coenagrionidea* (14 and 7)	*Coenagrionidae (*11 and 5) *Platycnemididae (*3 and 2)
2		*Calopterygoidea* (1and 1)	*Chlorocyphidae* (1 and 1)
3		*Lestoidea* (4 and 2)	*Lestidae (*4 and 2)
4	*Ansioptera* (Dragonflies) (35 and 24)	*Aeshnoidea* (4 and 2)	*Aeshnidae* (4 and 2)
5		*Gomphoidea* (5 and 5)	*Gomphidae (*5 and 5)
6		*Libelluloidea* (26 and 17)	*Libellulidae* (26 and 17)

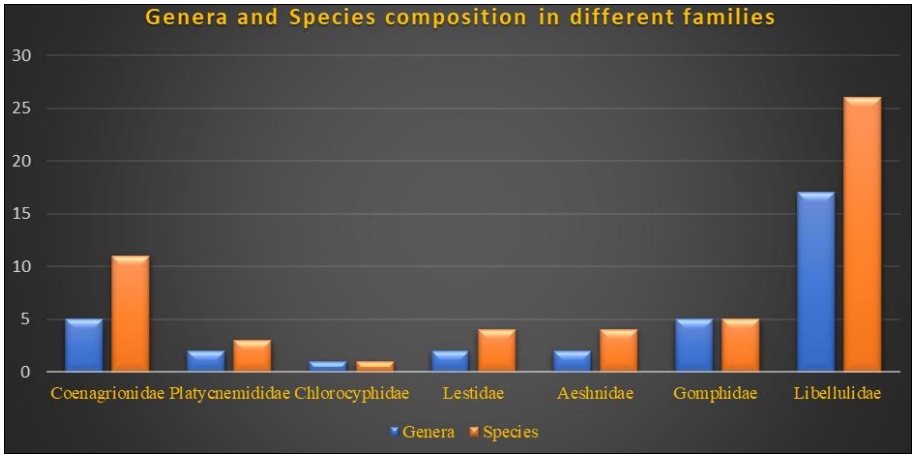

Fig 1: Graphical representation of identified genera and species of *Odonata* the Gangau Wildlife Sanctuary of Madhya Pradesh

Conclusion

The present study recorded a rich and diverse assemblage of *Anisoptera* (dragonflies) and damselflies (*Zygoptera*) belonging to order *Odonata* in the Gangau Wildlife Sanctuary, highlighting the ecological importance and habitat heterogeneity of the region. A total of 54 species 17

genera were documented that comprises 35 dragonflies (*Anisoptera)* and 19 damselflies (*Zygoptera*) across seven families and 6 superfamilies, with *Libellulidae* and *Coenagrionidae* emerging as the most dominant groups. The diversity of species observed suggests that the sanctuary supports a wide range of aquatic habitats, from stagnant and slow-moving water bodies (Ponds, lakes, dams) to fast-flowing ken river, forest streams and ephemeral pools. These findings validate the role of the Gangau Wildlife Sanctuary as a critical freshwater biodiversity hotspot in the Panna and Chhatarpur district of Madhya Pradesh.

Acknowledgment
The author would like to thank Dr. Dhriti Banerjee, Director, Zoological Survey of India, Kolkata and Officer-in-Charge, ZSI, CZRC, Jabalpur for the facilities and encouragement. Thanks are due to the Principal Chief Conservator of Forests, Bhopal for permission to survey of the areas and and also thanks to the DFO, Panna to provide facilities and accommodation during the survey.

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