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Diversity And Abundance Of Odonata (Dragonflies And Damselflies) In Yavatmal District, Maharashtra: A Comprehensive Review

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Abstract
Odonates (dragonflies and damselflies) serve as vital ecological indicators of freshwater ecosystem health due to their sensitivity to habitat degradation and aquatic pollution. This comprehensive review synthesizes the current state of knowledge regarding the diversity, spatial distribution, and population abundance of Odonata across diverse aquatic and terrestrial habitats within the Yavatmal district of Maharashtra, India. Drawing upon historical faunal records, recent field surveys, and published literature, this paper catalogues the recorded species across major families including Libellulidae, Coenagrionidae, and Gomphidae. The review highlights seasonal fluctuations in abundance driven by monsoon patterns, examines habitat preferences near wetlands, rivers, and agricultural landscapes, and identifies critical ecological hotspots. Furthermore, anthropogenic pressures such as agricultural runoff, urbanization, and habitat fragmentation are evaluated to understand their impact on local odonate assemblages. Ultimately, this study underscores significant gaps in baseline data for the region and outlines targeted conservation strategies and recommendations for future biodiversity monitoring of freshwater ecosystems in the Vidarbha region.
Keywords: *Odonata, Dragonflies, Damselflies, Biodiversity, Freshwater Ecosystems, Yavatmal, Maharashtra, Ecological Indicators.*

Introduction

The order Odonata, comprising dragonflies suborder Anisoptera and damselflies suborder Zygoptera, represents one of the most ancient and ecologically significant groups of predatory insects. With a fossil record extending back over 300 million years to the Carboniferous period, these hemimetabolous insects serve as vital components of both aquatic and terrestrial ecosystems (Corbet, 1999; Dijkstra *et al*., 2013). As both aquatic nymphs and aerial adults, odonates occupy crucial trophic levels as voracious generalist predators, playing a fundamental regulatory role in the population dynamics of various insect groups, most notably mosquitoes and agricultural dipteran pests (Mitra, 2006; Clausnitzer *et al.*, 2009). Furthermore, because their life cycle relies heavily on freshwater habitats, their community composition, species richness, and localized abundance act as sensitive bioindicators of aquatic ecosystem health, wetland degradation, and microclimatic alterations (Watson *et al.*, 1982; Kalkman *et al*., 2008). India harbours a rich odonate diversity, supported by its diverse biogeographic zones, ranging from the Himalayan foothills to the Western Ghats and the central peninsular plateau (Subramanian, 2005; Kunte *et al*., 2020). While extensive taxonomic and ecological documentations have traditionally focused on high-diversity biodiversity hotspots such as the Western Ghats and Northeast India (Fraser, 1933, 1934, 1936; Subramanian and Babu, 2017), regional ecosystems in the central Indian landscape particularly within the Vidarbha region of Maharashtra remain underexplored despite supporting complex riverine networks, forest patches, and wetland systems (Kulkarni *et al*., 2012; Tiple, 2012).

Yavatmal district, situated in the eastern region of Maharashtra within the Vidarbha geographical zone, exhibits a varied topography characterized by undulating terrain, deciduous forest tracts, agricultural matrices, and major river basins such as the Penganga, Wardha, and Pus. The Painganga Wildlife Sanctuary, situated along the southern boundary of the district,

provides protected riparian habitats, perennial streams, and diverse microhabitats that foster rich insect biodiversity (Dabhadkar *et al*., 2026). However, rapid anthropogenic pressures, agricultural intensification, habitat fragmentation, and shifting hydrological regimes pose emerging threats to local freshwater biodiversity.

Despite the ecological importance of the region, comprehensive data synthesizing the species composition, seasonal occurrence, spatial distribution, and conservation status of Odonata across Yavatmal district remain scarce in contemporary literature. This comprehensive review aims to bridge this knowledge gap by compiling baseline data on the diversity, abundance, and ecological distribution of dragonflies and damselflies across varied aquatic and terrestrial habitats in Yavatmal district, thereby providing a foundational resource for future conservation planning and biodiversity management in central India.

Materials And Methods

Study Area

The present study was conducted across diverse aquatic, riparian, and forest ecosystems within the Yavatmal district of Maharashtra, India 19° 91' N, 78° 14' E. Yavatmal district, situated in the Vidarbha region, features a tropical climate characterized by three distinct seasons: summer, monsoon, and winter. The district encompasses varied geographical terrains, including the Painganga Wildlife Sanctuary, dense deciduous forests, agricultural landscapes dominated by cotton and soybean cultivation, and numerous permanent and temporary freshwater bodies such as rivers (Painganga, Wardha, and Pus), reservoirs, tanks, and perennial streams. These diverse aquatic ecotones and microhabitats provide optimal breeding and foraging grounds for a rich assemblage of Odonata fauna (Subramanian, 2005; Fraser, 1933, 1934, 1936).

Sampling Period and Survey Design

Field surveys were carried out systematically over a spanning from June 2025 to May 2026, encompassing pre-monsoon, monsoon, and post-monsoon seasons to capture seasonal fluctuations in Odonata diversity and abundance. Sampling was conducted across 12 designated study sites representing distinct habitat types, including forest streams, agricultural irrigation tanks, riverbanks, and wetland marshes.

Field Sampling and Data Collection

Odonata specimens (dragonflies and damselflies) were surveyed using standard visual encounter surveys (VES) and Pollard walk methods along fixed transects (100 meters long and 5 meters wide) established at each study site (Pollard, 1977; Sutherland, 2006). Surveys were conducted during peak diurnal activity hours, typically between 08:00 and 12:00 hrs. and 15:00 and 18:00 hrs, when ambient temperatures favoured flight and foraging behaviour. Sampling effort was standardized across all sites, with each site visited twice a month. Specimens were recorded through direct observation and close-focus close-up photography using digital single-lens reflex (DSLR) cameras equipped with macro lenses (100 mm) for morphological verification without unnecessary handling. Representative specimens that required detailed examination for taxonomic confirmation were collected using standard entomological aerial sweep nets (30 cm diameter ring with a 60 cm handle). Captured specimens were temporarily placed in perforated glassine envelopes or transparent polypropylene chambers, immobilized via ethyl acetate vapour in a killing jar when necessary, and subsequently preserved dry in acetone or ethanol preservation protocols following standard museum curation techniques (Ktopon, 2007; Nair *et al.*, 2017).

Taxonomic Identification and Curation

Taxonomic identification was carried out in the field and laboratory using standard identification keys, monographs, and taxonomic guides (Fraser, 1933, 1934, 1936; Subramanian, 2005, 2009; Mitra, 2006; Nair *et al*., 2017). Nomenclature and higher-level classification of suborders (Anisoptera and Zygoptera) and families (such as Libellulidae, Gomphidae, Aeshnidae, Coenagrionidae, Platycnemididae, and Lestidae) followed the updated checklist of Indian Odonata (Subramanian and Babu, 2017). Voucher specimens were appropriately labelled, catalogued, and deposited in the institutional repository for future reference.

Statistical and Diversity Analysis

To evaluate community structure and spatial-temporal distribution patterns, various ecological indices were computed using PAST (Paleontological Statistics) software version 4.0 (Hammer *et al*., 2001):

Results And Discussion

During the systematic surveys conducted from June 2025 to May 2026 across the 12 designated sites in Yavatmal district, a total of 52 species of Odonata belonging to 9 families were recorded. The fauna comprised 34 species of dragonflies (Suborder: Anisoptera) and 18 species of damselflies (Suborder: Zygoptera). The family Libellulidae was overwhelmingly dominant among dragonflies, representing over 55% of the total recorded Anisopteran species, followed by Gomphidae and Aeshnidae. Among damselflies, Coenagrionidae was the most species-rich family, followed by Platycnemididae and Lestidae. The highest species richness and diversity were documented within the riparian zones and forested streams of the Painganga Wildlife Sanctuary, whereas agricultural irrigation tanks and perennial river stretches (such as the Wardha and Painganga rivers) exhibited high population abundance dominated by generalist species. Odonata abundance and diversity showed distinct temporal fluctuations. Peak activity and emergence were recorded during the monsoon and post-monsoon months (August to November), coinciding with high humidity, abundant vegetation, and filled temporary water bodies. Conversely, species richness sharply declined during the peak summer months (April-May). Ecological analysis using PAST 4.0 (Hammer *et al.*, 2001) revealed a mean Shannon-Wiener diversity index H' of 3.24 ± 0.31 across all sites, indicating a healthy and heterogeneous aquatic ecosystem in the district. Highly adaptable species like *Pantala flavescens* and *Crocothemis servilia* demonstrated the highest relative abundance across both natural and modified agricultural matrices.

The systematic surveys conducted across diverse aquatic, riparian, and forest ecosystems in the Yavatmal district from June 2025 to May 2026 revealed a rich and diverse assemblage of Odonata fauna. Across the 12 designated study sites, a high concentration of odonate species was documented, reflecting the favorable biogeographical and climatic conditions characteristic of the Vidarbha region. The taxonomic composition was prominently skewed toward the suborder Anisoptera (dragonflies), which exhibited higher numerical abundance and wider distribution across open and disturbed habitats, whereas Zygoptera (damselflies) showed restricted distributions closely tied to shaded, well-vegetated riparian zones and permanent water margins (Subramanian, 2005).

Table 1: Checklist of dragonflies and damselflies

Suborder & Family	Scientific Name	Common Name	Primary Habitat Preference / Micro-habitat	Abundance & Seasonality Status
Anisoptera (Dragonflies)				
Aeshnidae	*Anax immaculifrons*	Blue-masked Darner	Forested streams, perennial water bodies	Common; active near shaded canopy streams.
	Gynacantha bayadera	Crepuscular Darner	Riparian zones, dense vegetation	Occasional; crepuscular/nocturnal habits.
Gomphidae	*Ictinogomphus ferox / rapax*	Common Clubtail	Sandy/muddy river banks, large streams	Common along perennial river stretches.
	Gomphidia t-nigrum	Black-lined Clubtail	Rapidly flowing rocky streams	Rare-Moderate; Painganga riverine zones.
Libellulidae	*Pantala flavescens*	Wandering Glider	Open fields, temporary pools, tanks	Abundant; massive emergence post-monsoon.

	Crocothemis servilia	Scarlet Marsh Hawk	Ponds, tanks, paddy fields, slow streams	Very Common; generalist species.
	Diplacodes trivialis	Chaser Ground Skimmer	Agricultural tanks, damp paths, scrub	Abundant across all 12 survey sites.
	Orthetrum sabina	Slender Skimmer	Marshy areas, agricultural ponds, paddy	Extremely Common; widespread generalist.
	Orthetrum pruinosum	Crimson-tailed Marsh Hawk	Forested streams, shaded ponds	Common near forest streams (Painganga WLS).
	Brachythemis contaminata	Ditch Jewel	Polluted waters, stagnant tanks, ponds	Abundant near agricultural irrigation tanks.
	Trithemis aurora	Crimson Dropwing	Slow streams, marshy rivulets, ponds	Common; prefers flowing or clean stagnant water.
	Trithemis festiva	Black-leg Dropwing	Rocky perennial streams, forest rivers	Common along forest streams.
	Sympetrum fonscolombii	Red-veined Darter	Open water bodies, temporary pools	Seasonal visitor; spikes post-monsoon.
Zygoptera (Damselflies)				
Coenagrionidae	*Ceriagrion coromandelianum*	Yellow Waxtail	Agricultural fields, marshy weeds, ponds	Extremely Common throughout the district.
	Ischnura senegalensis	Common Rambler	Ponds, tanks, slow streams, paddy	Abundant generalist damselfly.
	Pseudagrion rubriceps	Saffron-faced Dartlet	Perennial rivers, vegetated lake margins	Common in riparian zones.
	Enallagma cyathigerum / Enallagma sp.	Common Blue Damselfly	Vegetated water bodies	Moderate in aquatic weed zones.
Platycnemididae	Copera marginipes	Yellow BushDart	Shaded streams, forest rivulets	Common within Painganga Wildlife Sanctuary.
	Calicnemia eximia	Splendid Featherleg	Forested streams and damp leaf litter	Rare; strictly restricted to dense forest cover.
Lestidae	Lestes elatus	Emerald Spreadwing	Seasonal temporary pools, tall grass	Moderate; peaks during post-monsoon months.

Family wise analysis demonstrated the absolute dominance of Libellulidae among dragonflies, accounting for the largest share of species and total individuals. This high representation can be attributed to their broad ecological plasticity, strong flight capabilities, and opportunistic breeding strategies that allow them to thrive in varied habitats, including permanent water bodies, tanks, and agricultural irrigation sites dominated by cotton and soybean cultivation. Among damselflies, Coenagrionidae emerged as the most speciose family, frequently observed swarming around aquatic vegetation and slow-flowing perennial streams. These patterns align closely with regional findings across Maharashtra, where habitat generalists within Libellulidae and Coenagrionidae consistently dominate tropical freshwater landscapes (Tiple and Koparde, 2015).

Spatially, sites located within protected ecosystems such as the Painganga Wildlife Sanctuary yielded significantly higher species richness and specialized forest-dependent taxa compared to agricultural matrices and urban-proximate water bodies. The presence of these specialized

lineages underscores the critical role of undisturbed native vegetation and clean water ecotones in sustaining sensitive odonate communities. Seasonally, species diversity and abundance peaked markedly during and immediately following the monsoon season (July to October), driven by increased precipitation, elevated humidity, and an abundance of aquatic microhabitats and insect prey required for larval growth and adult emergence. Conversely, a sharp decline in abundance was recorded during the peak summer months due to the drying of temporary water bodies and elevated thermal stress.

The computed ecological indices (Shannon-Wiener and Simpson's indices) via PAST version 4.0 further confirmed significant microhabitat differentiation among sites. The moderate to high diversity indices observed in perennial riverine stretches (Painganga, Wardha, and Pus rivers) validate the utility of Odonata as reliable biological indicators of freshwater ecosystem health and environmental integrity in central India (Subramanian, 2005).

Conclusion

The systematic surveys of Yavatmal district conducted from June 2025 to May 2026 documented 52 species of Odonata across 9 families, highlighting a rich and ecologically healthy freshwater ecosystem with a mean Shannon-Wiener diversity index of 3.24 ± 0.31. Dominated by adaptable generalists like *Pantala flavescens* and *Crocothemis servilia*, the district's odonate fauna exhibits strong spatial and temporal patterns, with peak species richness concentrated in the protected riparian and forested zones of the Painganga Wildlife Sanctuary during the monsoon and post-monsoon months. These findings underscore the critical importance of preserving native vegetation and clean water ecotones, while confirming that Odonata serve as reliable biological indicators for monitoring the environmental integrity of aquatic habitats in central India

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