



## Odonate ecology and diversity- A review

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### Abstract

One of the most prevalent insects flying over forests, fields, meadows, lakes, and streams are dragonflies and damselflies, which are collectively known to as odonates. The number of living species worldwide is about 6,000. With more over 500 species currently known, India is very diversified. One of the oldest groups of insects is the odonata. It first originated along with mayflies during the Carboniferous era, some 250 million years ago (Ephemeroptera). Monsters include up the Odonata group from the Carboniferous period; for instance, *Meganeuropsis americana* from that time had wingspan of 71 cm, which is almost as long as a pigeon. Ancient insect species like dragonflies and mayflies were some of the first to acquire wings and take to the air. Dragonflies have perfected the art of flight and are still skilled acrobats. The order Odonata is divided into three categories depending on morphology: the Anisozygoptera, the Zygoptera, and the dragonflies (Anisoptera). *Epiophlebia laidlawi*, one of the two species mostly in suborder Anisozygoptera, is documented from Darjeeling. In the field, dragonflies and damselflies are easily distinguished. Although their morphologies are very different, they have similar overall life histories.

**Keywords:** odonates, anisozygoptera, zygoptera, and the dragonflies

### Introduction

Nearly one million of the 1.9 million species already catalogued in the globe are insects. Taxonomists believe that there are anywhere from three and 100 million species worldwide. This taxonomic-based estimate of diversity differs from estimates are based on macroecological patterns and biodiversity ratios. Depending on the host range of guilds in beetle samples and subsequently hierarchical ratio extrapolations, Erwin (1982) <sup>[1]</sup> predicted 30 million species of arthropods. This estimate was hotly contested, and up until the early nineties, it was believed that there were two to three times as many species as there were described (i.e. 2–3 million species) <sup>[2-4]</sup>.

Among the insects that hovers over forests, farms, meadows, ponds, and rivers most frequently is an odonate, which includes dragonflies and damselflies. There are over 6,000 species that are still alive today. India is indeed a fairly diverse nation with around 500 identified species. First it appeared alongside mayflies during the Carboniferous epoch, about 250 million years ago (Ephemeroptera). The Odonata of the Carboniferous period featured giants. Ancient insect species like dragonflies as well as mayflies were some of the first to develop wings and the capability of flying. According to morphology, the order Odonata is divided into the groups of damselflies (Zygoptera), anisozygoptera, and dragonflies (Anisoptera). Dragonflies and damselflies can be easily differentiated in the wild. Although they have different morphologies, they have comparable overall life cycles. More people are realising the use of dragonflies and damselflies as environmental aspects. There is additional research being done on dragonflies. Identify what they can reveal about India's biodiversity and habitat.

With origins in the Permian era, dragonflies are one of the oldest species of insects. The Order Odonata is currently divided into three suborders: Anisoptera (subequal wings); Zygoptera (equal wings); and Anisozygoptera. There are

just four species of Anisozygoptera found in Asia. Along with the 6,000 Odonate species that have previously been identified worldwide. 150 more species have been identified since 2011 in addition <sup>[5-7]</sup>. Because of their wide range of ecological activities and capacity as bioindicators in evaluating aquatic habitats, odonates are rapidly being utilized in both fundamental and practical research with reasonable ease. Odonates, for example, continue to serve as model animals to test critical hypotheses about sexual selection, complicated life cycles, the development of flying, and community ecology. These also are employed as management tools for preservation and environmental health <sup>[8-9]</sup>. Odonates have demonstrated to be superior indicators for evaluating aquatic environments. They have been utilized to focus and evaluate efforts to control and conserve aquatic resources. Odonate spectrum extension analyses by latitude imply that they may offer insight into climate change. Odonates are a perfect taxon to study the effects of environmental deterioration and climate change because of a number of reasons. These include 1) temperature-related distribution restrictions, 2) Odonate activity seasonal regulation, 3) relative high analysis revealed the presence of some species, which make field perform encompassing ecological random samples not just to feasible but also manageable, 4) a lengthy background of science investigation into all of their ecology and behaviour, and 5) comprehensive amateur recording, which results in an extensive history databases of sightings <sup>[10-13]</sup>. Odonate diversity and distribution in the temperate zone have been widely studied, however it is known that the tropics have a higher level of richness. Their potential richness and relationships with their habitats in the tropics are not well understood. There have been few ecological analyses on Odonate in the context of India <sup>[14-18]</sup>. In this overview, studies on dragonflies in general and a few particular species that really are related to diversity and habitat are highlighted.

### Biology of Odonates

Since they have existed since the Permian epoch, odonates are the oldest kind of winged insects. They are amphibiotic, with a larval stage that is entirely aquatic and an adult stage that is terrestrial. In the insect kingdom, odonates are carnivorous; both their adult and larval stages exhibit predatory behaviour. Due to the following traits, dragonflies are regarded as special insects: a mouthpart that enables Odonates to be fierce predators; rectal gills that allow dragonfly nymphs to breathe underwater; nonstop flight muscles to every wing that enable all four wings to act freely; secondary genitalia; and males' distinctive territorial behaviour [19]. Tillyard (1917) [20], Corbet (1962) [21], and Corbet (1980) [22] all recorded different facets of the biology of the Odonata, with Corbet (1980) focusing on the following elements: 1) habitat choices and oviposition, 2) the egg phase, 3) the larval phase, 4) the growth stage, 5) the overall feeding and reproductive success of adults, and 6) distribution. Both sexes must establish habitat selection that is focused on mating in the case of males and mating and egg laying in the case of females. The choice of the oviposition site is essential to the life history of odonates because females must locate an environment that will promote the survival and growth of the larvae. The type of flora in waterbodies and the degree of darkness or brightness affect the Odonates' choice of location for oviposition.

Odonates' endophytic or exophytic egg-laying behaviour differs from species to species. *Lestes macrostigma*, which chose to lay eggs in *Bolboschoneus maritimus*, was the subject of a study by Matushkina and Lambret (2011) [23] on the ovipositor shape and behaviour. The stems of *B. maritimus* and *Juncus maritimus* produce eggs. Odonates typically have aquatic habitats for their larvae. However, some species' larvae live in the water-filled tree holes or the bases of leaves. In aquatic settings, larvae choose their habitats mainly for resources partitioning [24].

### Odonata documentation in India

Earlier, during the British era, amateurs who conducted faunal surveys in various regions and examined the results or forwarded them to specialists in Europe began documenting the insect flora of India. The 'Fauna of British India' book series contains descriptions of the described insects. Different orders of the class insecta have been examined by entomologists in Central India. In the area of insect identification, Kailash Chandra alone has made significant contributions. He also wrote a brief overview in the book "Fauna of Pachmari Biosphere Reserve."

### Odonata documentation by Indian workers

6,000 Odonata species were described by Srivastava and Prasad [25] in 1997 under 630 genera and 28 families of a three suborders Zygoptera, Anisoptera, and Anisozygoptera of the planet. Mishra (2007) [26] investigated nine groups and 70 species of odonates from Pench and Satpura National Parks. Andrew *et al.* (2008) [27] reported identification traits and spatial distributions of dragonflies and damselflies. According to Kulkarni and Talmale (2008) [28], Odonates can be found at the Lonar Wildlife Sanctuary.

### Distribution of Odonates: influencing factors

It is well recognised that a wide range of environmental conditions affect odonates. Voltinism, synchronisation, and

other life history traits like phenology have an impact on a region's population structure. Odonates and plants have a good relationship. Water quality typically has the greatest impact on odonate dispersion in pristine areas with little to no disturbance. The high diversity of water habitats in tropical forests is at least partially responsible for the diversity of tropical Odonates [29-34].

### Conclusion

The most of the rare or endangered dragonfly species found in India are poorly understood. Species-specific knowledge of habitat needs differs significantly. Numerous locations contain dragonflies. Some people inhabit bogs, streams, and still ponds. The main threat including almost all dragonfly species researched is habitat alteration. Some of the dangers include damming/rerouting of streams and rivers, clear-cutting of surrounding woodlots, road runoff, and other issues. In order to keep populations of these invertebrates stable, habitats must be preserved. Damselflies and dragonflies are great indicators of both the health of an ecosystem.

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