



A study on the diversity of odonates in Dheer Beel, Chakrashila wildlife sanctuary, Kokrajhar, BTR, Assam, India

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Abstract

Dragonflies and damselflies, the ancient groups of insects belonging to the order Odonata, were among the first to develop wings and take to the air. The presence of odonates can serve as an indicator of ecosystem quality and a variety of microhabitats. They are important indicators of water quality and population levels, inhabiting diverse habitats near water bodies, from stagnant ponds to flowing streams. This study was conducted within a specific region of Chakrashila Wildlife Sanctuary, located about 6 km from Kokrajhar town in Kokrajhar district, Bodoland Territorial Region (BTR), Assam, India. The research focused on Dheer Beel, an area with healthy ecological quality where various species of odonates can be easily observed. The main objective was to document the diversity of dragonfly species in Dheer Beel and to identify and study their morphological characteristics. A total of 12 dragonfly species from 3 families were recorded in the study area, with the Libellulidae family being the most dominant and abundant.

Keywords: Chakrashila wildlife sanctuary, odonata, dragonflies, Dheer Beel, Kokrajhar, libellulidae

Introduction

Dragonflies and damselflies, belonging to the ancient insect order Odonata, are among the most captivating insects. They were among the first to develop wings and take to the air, with fossil evidence indicating their origin dates back to the Permian period, around 250 million years ago. The life history of odonates is closely tied to water bodies, and their species are highly specific to particular aquatic habitats, significantly influencing their distribution and ecology (Subramanian, 2014)^[11]. This habitat specificity highlights their integral role in wetland ecosystems and their reliability as indicators of ecosystem health. Adult odonates are terrestrial, while their larvae are aquatic. Adults feed on mosquitoes, black flies, and other blood-sucking insects, serving as important biological control agents for these harmful pests.

Odonates excel in their flying capabilities compared to other insect groups. Unlike moths, butterflies, wasps, and bees, they have uncoupled wings, meaning their fore and hind wings are not connected and can beat independently. Their strong thoracic muscles allow for sustained flight and impressive maneuverability. Odonates can hover, perform 180-degree turns mid-flight, and even fly backward (Subramanian, 2005)^[12].

Globally, there are 5,952 species of odonates across 652 genera. In India, there are 474 species and 50 subspecies distributed among 142 genera and 18 families (Subramanian, 2014)^[11]. Extant odonates are classified into three suborders: Anisozygoptera, Zygoptera (damselflies), and Anisoptera (dragonflies). The Anisozygoptera, with four relict species, was once considered a separate suborder. This group, a living fossil, includes two species, one of which, *Epiophlebia laidlawi*, is found in Darjeeling. However, recent studies often group Anisozygoptera with Anisoptera, or some authors classify them together under the new name *Epirocta* (Trueman, 1996; Rehn, 2003; Kalkman *et al.*, 2008).

Libellulidae, commonly known as skimmers, are the most diverse group of odonates. These insects are typically large

to medium in size and display bright colors. Their eyes are broadly confluent and vary in size, shape, width, and coloration. This family has a global distribution and includes 1,139 species. They can breed in domestic storage tanks and aquaria. In India, there are 65 known species, with 37 species found in peninsular India (Subramanian, 2008).

All dragonflies are carnivorous during both their larval and adult stages. They primarily feed on mosquitoes, midges, and other small insects such as flies, bees, and butterflies, capturing their prey while in flight. Their ability to maneuver in multiple directions allows them to outfly their prey. Additionally, dragonflies possess excellent eyesight; each of their two compound eyes comprises thousands of six-sided units, enabling them to detect even the slightest movements. With large optic brain lobes, 80% of their mental processes are dedicated to vision, allowing them to detect color, ultraviolet light, and polarization.

Morphological characterization and identification of different insect species is challenging and time-consuming. Due to the immense diversity of insects, traditional taxonomy based on morphological characteristics is highly complex. Modern taxonomy increasingly relies on DNA barcoding, where species are identified using gene sequences (Narzary, 2015).

The order Odonata, encompassing dragonflies and damselflies, is divided into two suborders: Anisoptera (dragonflies) with 12 families and Zygoptera (damselflies) with 24 families. The previously recognized third suborder, Anisozygoptera, has been integrated into Anisoptera in recent taxonomic revisions (Bybee *et al.*, 2008; Dumont *et al.*, 2010).

The complex life cycle of odonates—comprising an aquatic larval stage and terrestrial adults—along with their specific habitat requirements, makes them excellent indicators of biodiversity and wetland health. Their habitat specificity underscores their integral role in wetland ecosystems and their reliability as indicators of ecosystem health (Corbett, 1999; Stokes *et al.*, 2005; Hadrys *et al.*, 2006; Groenveld *et al.*, 2007)^[7, 10].

Odonates serve as valuable indicators of ecosystem quality and microhabitat diversity (Rutherford & Mallow, 1994). Mitra (2002)^[8] noted their ecological importance as both predators and prey. Odonates do not sting or bite and are generally harmless. Their larvae, or naiads, prey on small invertebrates such as mosquito larvae, as well as smaller vertebrates like frogs and fish. This predation helps control mosquito populations and mitigate the spread of diseases like malaria, dengue, and filariasis.

Mitra (2002)^[8] documented 23 species and subspecies of odonates from 18 genera and 10 families in Trashigong District, Eastern Bhutan, adding 18 new records to the country's list. Ware & Bellare (2011)^[15] highlighted that, among insects, dragonflies and damselflies are particularly admired for their vibrant colors and are extensively studied.

In the riparian zone of the Meenachial River Basin in Kottayam District, Kerala, 36 species of odonates were recorded, including 24 dragonfly species from 3 families and 12 damselfly species from 5 families. The most numerous families were Libellulidae (10.71%), Gomphidae (8.33%), and Platycnemididae (5.56%).

Dragonflies are typically found near various freshwater habitats, including rivers, streams, marshes, lakes, small pools, and rice fields. They are sensitive to environmental changes and serve as bioindicators of habitat alterations, atmospheric temperature, and weather conditions. Additionally, many odonate species in agro-ecosystems play a crucial role in controlling pest populations (Tiple *et al.*, 2008)^[13].

As key predators in both their larval and adult stages, dragonflies exhibit specific habitat preferences and terrestrial behaviors. Their presence provides valuable insights into ecosystem health (Neog & Rajkhowa, 2016)^[9]. Northeast India, known for its species richness and diversity, includes 151 odonate species across 79 genera and 14 families in Meghalaya—about one-third of the total species in India (Acharjee & Karzee, 2016)^[11].

At Bodoland University, 34 odonate species, including 26 dragonfly species from 3 families, were recorded between May 2013 and November 2014 (Basumatary *et al.*, 2015)^[2]. Dragonflies are among the most ancient insects, capable of flying both forward and backward. Their reproduction involves indirect sperm transfer from testes to secondary copulatory organs located at the base of the abdomen (Dorji).

The primary objective of this study was to document the

diversity of dragonfly species in Dheer Beel, Chakrashila Wildlife Sanctuary, Kokrajhar, BTR, Assam and to identify and analyze the morphological characteristics of these species.

Study area

The study was conducted within a specific region of Chakrashila Wildlife Sanctuary, located approximately 24 km from Kokrajhar town in the Kokrajhar district, BTR, Assam, India. The sanctuary spans an area of 45.568 km² and primarily consists of a hilly terrain extending north to south. It features two lakes, Dheer Beel and Diplai Beel, which are crucial to the sanctuary's ecosystem. The sanctuary is renowned for its population of Golden Langur and serves as the second protected habitat for this species in India.

The research focused mainly on Dheer Beel due to its high ecological quality and the easy visibility of various odonate species. The lake is surrounded by local paddy fields, creating a favorable habitat for odonates.

Method and Methodology

The study was conducted from February 2024 to June 2024, between 9:00 am and 1:00 pm on sunny days at Dheer Beel in Chakrashila Wildlife Sanctuary, Kokrajhar district, Assam, India. During the study, time, temperature, and humidity were recorded using mobile location data and online temperature-humidity measurement applications on a smartphone.

Photographs of the odonates were taken and submitted to the Indian Biodiversity Portal for identification and systematic classification. Specimens were carefully collected, studied morphologically, and then released alive. Preliminary morphological studies focused on body division, eyes, legs, wings, body length, body color, and tail. A table was prepared to document these observations. Photographs were captured using a DSLR camera, and specimens were identified with reference to the literature by Subramanian (2005)^[12] and Basumatary *et al.* (2014).

Results

A total of 12 dragonfly species from 3 families were recorded in the study area. The Libellulidae family was the most dominant and abundant among them. The recorded species are listed in Table 1 below.

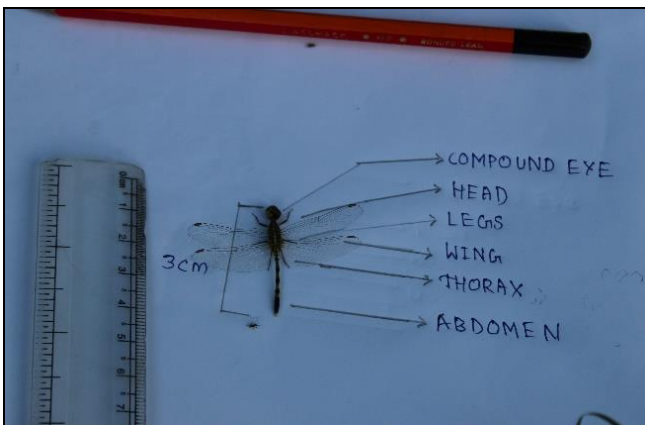
Table 1: Dragonfly species found in Dheer Beel, Chakrashila Wildlife Sanctuary, Kokrajhar, Assam, India

Sl. No	Family	Common name	Scientific name
1.	Aeshnidae	Blue tailed green darner	<i>Anax guttatus</i>
2.	Aeshnidae	Blue darner	<i>Anax immaculiformes</i>
3.	Gomphidae	Common club tail	<i>Ictinogomphus rapax</i>
4.	Gomphidae	Common hooktail	<i>Paragomphus lineatus</i>
5.	Libellulidae	Blacktipped grand skimmer	<i>Diplacodes nebulosa</i>
6.	Libellulidae	Ground skimmer	<i>Diplacodes trivialis</i>
7.	Libellulidae	Amber winged marsh glider	<i>Hyrobasileus croceus</i>
8.	Libellulidae	Fulvous forest skimmer	<i>Nensothemis fulvia</i>
9.	Libellulidae	Green marsh hawk	<i>Orthetrum sabina</i>
10.	Libellulidae	Wandering glider	<i>Pantatala flavescens</i>
11.	Libellulidae	Greater crimson glider	<i>Urothemis signanta</i>
12.	Libellulidae	Crimson tailed marsh hawk	<i>Orthetrum pruinosum</i>

Table 2: Morphological Characteristics of the Recorded Dragonfly Species at Dheer Beel, Chakrashila Wildlife Sanctuary, Kokrajhar, Assam, India.

Sl. No	Scientific name	Morphology					
		Body Division	Eye	Legs	Wings	Body Length (cm)	Body Color
1.	<i>Anax guttatus</i>	Head, Thorax & Abdomen	Compound eye, light green Color	3 pairs	2 pairs, Transparent, membranous Yellowishgreen	8	Green
2.	<i>Anax immaculiformes</i>	Head, Thorax & Abdomen	Compound eye, blue color	3 pairs	2 pairs, transparent, membranous	6.6-7	Bright blue, Brownish black
3.	<i>Ictinogomphus rapax</i>	Head, Thorax & Abdomen	Compound eye, bluish gray Color	3 pairs	2 pairs, Transparent, membranous	4.5-5.5	Black, Yellow
4.	<i>Paragomphus lineatus</i>	Head, Thorax & Abdomen	Compound eye, bluishgray Color	3 pairs	2 pairs, Transparent, membranous, Blackish	3.2-4	Black, Yellow
5.	<i>Diplacodes nebulosa</i>	Head, Thorax & Abdomen	Compound eye, Blackcolor	3 pairs	2 pairs, Transparent, membranous, Blackish	2.5-3	Bluish gray
6.	<i>Diplacodes trivialis</i>	Head, Thorax & Abdomen	Compound eye, dark gray, Black color	3 pairs	2 pairs, Transparent, Membranous	3-3.4	Light Greenish, Yellow
7.	<i>Hyrobasileus croceus</i>	Head, Thorax & Abdomen	Compound eye, brown color	3 pairs	2 pairs, Transparent, membranous	4.6-5.1	Reddish brown
8.	<i>Nenothemisfulvifera</i>	Head, Thorax & Abdomen	Compound eye, dark reddish brown color	3 pairs	2 pairs, Transparent, membranous	3.2-3.9	Light greenish, Yellow
9.	<i>Orthetrum sabina</i>	Head, Thorax & Abdomen	Compound eye, Greenish Color	3 pairs	2 pairs, transparent, membranous.	4.7-5.2	Greenish yellow, Black
10.	<i>Pantatata flavescens</i>	Head, Thorax & Abdomen	Compound eye, red color	3 pairs	2pairs, transparent, membranous	4.5	Yellow
11.	<i>Urothemis signata</i>	Head, Thorax & Abdomen	Compound eye, red color	3 pairs	2 pairs, Transparent, membranous	3.1-4	Red, Yellow, Black
12.	<i>Orthetrum pruinosum</i>	Head, Thorax & Abdomen	Compound eye, brown color	3 pairs	2 pairs, Transparent, membranous	4.1	Reddish blue, yellow

Photographs of conducting survey





Fig(s): Photographs taken during Field Survey

Conclusion

This study on the dragonfly species of Dheer Beel, located in Chakrashila Wildlife Sanctuary, Kokrajhar, Assam, has provided valuable insights into the diversity and morphological characteristics of these ancient insects. Conducted from February to June 2024, the research documented a total of 12 dragonfly species across three families, with Libellulidae emerging as the most dominant and abundant family in the area.

The findings underscore the ecological significance of Dheer Beel as a habitat for odonates, reflecting its high ecological quality and suitability for these insects. The detailed morphological characteristics of each recorded species reveal a range of adaptations that contribute to their survival and ecological roles. For instance, the variation in eye color, body length, and wing morphology among the species highlights their diverse adaptations to different microhabitats within the wetland ecosystem.

The presence of a variety of dragonfly species at Dheer Beel indicates a healthy and stable aquatic environment, further supported by the significant role odonates play as indicators of water quality and ecosystem health. Their larval and adult stages contribute to the biological control of mosquito populations, underscoring their importance in pest management and disease control.

Overall, this study not only enriches the understanding of odonate diversity in Northeast India but also emphasizes the importance of preserving such habitats for maintaining ecological balance. The comprehensive documentation of dragonfly species and their morphological traits provides a baseline for future research and conservation efforts, highlighting the need for continued monitoring and protection of wetland ecosystems. Therefore, protection measures are necessary for these creatures. Much more elaborate study is required to access the biodiversity of this unique creature.

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Conflict of Interest

The author declares no conflict of interest.

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