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Odonate Diversity of Manjeera Wildlife Sanctuary with notes on Female Polymorphism of *Neurothemis tullia* (Drury, 1773) (Odonata: Libellulidae) and Some Species Hitherto Unreported From Andhra Pradesh, India

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ABSTRACT

A total of 28 species of odonates, including 18 species of dragonflies (Suborder Anisoptera) belonging to 3 families and 10 species of damselflies (Suborder Zygoptera) belonging to two families were recorded from the Manjeera Wildlife Sanctuary between December 2010 to October 2012. The highest diversity of odonates was that of family Libellulidae (50%), followed by Coenagrionidae (32.14%), Aeshnidae (10.71%), Gomphidae (3.57%) and Platycnemididae (3.57%). Four taxa, namely - *Anaciaeschna jaspidea* (Burmeister, 1839), *Coenagrion dyeri* (Fraser, 1924), *Pseudagrion decorum* (Rambur, 1842) and *Rhodischnura nursei* (Morton, 1907) are reported for the first time from Andhra Pradesh. We are also reporting for the first time the female polymorphism of *Neurothemis tullia* (Drury, 1773) (Anisoptera; Libellulidae) from the Manjeera Wildlife Sanctuary, Medak District, Andhra Pradesh.

Keywords: Manjeera Wildlife Sanctuary, odonates, andromorphic female, Medak District, Andhra Pradesh, India.

1. Introduction

Odonates are an important amphibiotic invertebrate group depending on freshwater ecosystems for most of their life processes. They have been around from the Carboniferous era [1]. Order Odonata, comprising the damselflies (suborder Zygoptera) and dragonflies (suborder Anisoptera), are one of the dominant groups of aquatic and terrestrial insects. Odonates, being predators both at larval and adult stages, play a significant role in the wetland ecosystem. The life cycle of Odonates is closely linked to water bodies as they prefer both lentic and lotic waters and can be considered as indicators to water quality and environment health. They use a wide range of flowing and stagnant water bodies. Even though most species of odonates are highly specific to a habitat, some have adapted to urban areas and exploit man-made water bodies [2].

Odonate taxa are ideal models for the investigation of the impact of environmental warming and climate change due to their tropical evolutionary history and adaptations to temperate climates [3]. About 5,000 species of odonates are found throughout the world. In India about 500 species and subspecies are reported and of this, about 200 species are found in the peninsular India [4].

In Andhra Pradesh, no significant work was carried out other than that of Srinivasulu and Srinivasulu [5] who reported 30 species of odonates belonging to 6 families and 22 genera from the urban and semi-urban conglomerate of Hyderabad. Through this paper we report the diversity and distribution of odonate fauna of Manjeera Wildlife Sanctuary, Medak District, Andhra Pradesh, India with comments on the observation of female polymorphism in *Neurothemis tullia* (Drury, 1773).

2. Materials and Methods

2.1 Study Area

The Manjeera Wildlife Sanctuary is located (17°57'52" N, 78°02'22" E) in Medak District, Andhra Pradesh spanning about 36km along the course of river Manjeera (Fig. 1). This sanctuary is dotted with small islands with extensive marshy fringes providing good nesting sites for water birds. The Manjeera reservoir supports submerging and emergent vegetation. A narrow margin of *Typha* sp., *Ipomoea* sp. and *Acacia* sp. fringe the waterline. Agriculture lands surround the reservoir and are present all along the river. The forest tracts are a typical tropical scrub forest type [6] with *Acacia* sp., *Prosopis juliflora*, *Pithecelobium dulce*, *Tamarindus indicus*, *Butea monosperma* and *Azadirachta indica* as the major species. The sanctuary experiences a tropical climate with temperatures ranging between 42 °C in the summers to 15 °C in the winters and receives about 1000-1100mm of rainfall annually.

2.2 Data Collection

Surveys were conducted along pre-determined transects, from December 2010 to October 2012. During the course of the survey, photographic records of adult individuals of different odonate species were maintained using a 14.5 mega pixels digital camera (Canon Power Shot 35X) and all photo-vouchers have been deposited in the photo-vouchers collection of the Natural History Museum of Osmania University. The odonates were categorized on the basis of their abundance in the sanctuary, VC-Very Common (> 100 sightings), C-Common (50–100 sightings), NR-Not Rare (15–50 sightings), R-Rare (2–15 sightings), VR-Very Rare (< 2 sightings) [7]. Species identification was done using standard literature including Fraser [8, 9, 10], Subramanian [1] and Mitra [11].

3. Results and Discussion

A total of 28 species of Odonates, including 18 species of dragonflies (Suborder Anisoptera) belonging to 3 families and 10 species of damselflies (Suborder Zygoptera) belonging to 2 families were recorded from Manjeera Wildlife Sanctuary (Table 1; Fig. 2; Fig. 3a-u). Among these, four species namely, *Anaciaeschna jaspidea* (Burmeister, 1839), *Coenagrion dyeri* (Fraser, 1924), *Pseudagrion decorum* (Rambur, 1842) and *Rhodischnura nursei* (Morton, 1907) were recorded for the first time from Medak District, Andhra Pradesh.

Eighteen species of suborder Anisoptera were recorded belonging to three families namely Gomphidae (one species), Aeshnidae (three species including the new record of *Anaciaeschna jaspidea*) and Libellulidae (14 species). While ten species of the suborder Zygoptera belonging to two families namely family Coenagrionidae (nine species including the three new records of *Coenagrion dyeri*, *Pseudagrion decorum* and *Rhodischnura nursei*) and family Platycnemididae (one species) were recorded. The highest diversity of Odonates were recorded belonging to the family Libellulidae (50%), followed by Coenagrionidae (32.14%), Aeshnidae (10.71%), Gomphidae (3.57%) and Platycnemididae (3.57%). Of the total 28 species, 36% of the species were very common, 18% were common, 29% were not rare, 14% were rare and 3% were very rare (Fig. 2). All the odonate species recorded from the Manjeera Wildlife Sanctuary are the 'Least Concern' species [12] excepting *Coenagrion dyeri* which has not been evaluated.

3.1 Observation on Female Polymorphism of *Neurothemis tullia* (Drury, 1773)

Most adult odonates exhibit sexual dimorphism and it has an important role in the courtship behavior and is restricted to certain geographical area [4]. In the females, two or more clearly different phenotypes exist in the same population of a species namely polymorphism and it is based on colour not on morphology [13]. Female polymorphism is common in the families Calopterygidae and Polythoridae of Zygoptera whereas very rare in Anisoptera wherein, it has been noticed in the family Libellulidae [14]. In a small number of odonate species, a part of the female population has a colour pattern that mimics the male coloration. Some Anisopteran Libellulids especially certain genera such as *Crocothemis*, *Neurothemis* and *Sympetrum* show different colour patterns on their wings which mimics the male coloration called as andromorphs (also known as androchromotypics or homeochromes) and the 'typical females' are named as gynochromotypics (also known as heteromorphs or heterochromes) [13, 15, 16]. Andromorphs are male-like coloured females or male-mimic females and they are commonly found in 54% genera of European zygopterans whereas very rarely in Libellulid Anisoptera [17]. *Neurothemis tullia* (Drury, 1773) is an andromorphic Libellulid commonly found in ponds, marshes, paddy fields, swamps and tanks.

On 23rd March 2011, we noticed in the paddy fields (17°43'18"N, 77°58'28"E) surrounding the Manjeera Wildlife Sanctuary, a typical male and female of *Neurothemis tullia* having an unusual wing pattern. The male had a black face and the eyes were blackish-brown above and olive green below. The thorax black in colour. The basal half of the wings opaque blue black which is bordered by a milky white patch towards the tip. The wing tips were transparent and the wing spot dull brown. The abdomen and legs were black. Female was found to differ significantly from the male in body marking, colouration and wing spots. The face is olive green while the eyes are pale brown above and pale olive green towards the sides and below. The thorax is greenish-yellow with a bright yellow mid dorsal stripe which is bordered with a black stripe. The wing base is amber yellow while the front edge is blackish-brown which forms a very large brown black spot. In the hind wing, this spot is irregular and sickle shaped. The wing tips are broadly blackish-brown. The abdomen is bright yellow with a broad black band above and underside is black. Another dragonfly was similar to male but we didn't identify as a female of *Neurothemis* at that time. Later we found that dragonfly was an andromorphic female. It had a black face and the eyes were dark brown above olive green below. The thorax was blackish-brown with a mid-dorsal cream stripe. Wings were with basal half opaque brownish black and a white broad border towards the tip. The wing tips were transparent and wing spot dull brown. The abdomen was dark brown with a broad mid-dorsal creamy white strip on the upper side, but a thin strip of olive green along the lateral margins of the first four abdominal segments (Fig. 4a-c).

A few andromorphic females were reported by Corbet [15] in the Libellulids; so far andromorphic females of *Neurothemis tullia* have been reported from the northeastern states of India [18, 19, 20, 21] and from central India [16, 22]. We are reporting for the first time the observation of an andromorphic female of *Neurothemis tullia* from Manjeera Wildlife Sanctuary, Medak District, Andhra Pradesh. Most of the hypotheses are

suggesting that andromorphic females have the advantages that they are not recognized by mate searching males and avoiding unnecessary and long copulations therefore, after first mating they can avoid additional unnecessary mating dedicating this time to feeding and egg maturation while the disadvantage of the andromorphic females are to suffer greater mortality by predation because of they are more noticeable [23].

Study of odonates becomes important in order to understand the ecosystem health. In wetland habitat the odonates function as efficient indicators of environment health. In agro-ecosystems they are important bio-control agents helping in controlling insect pest population. However, odonates and their

habitats are under threat due to large scale habitat fragmentation and loss, irreversible damage to their breeding habitats by draining of the swamps, habitat alterations such as construction of dams, sand mining, pollution and eutrophication of the waterbodies. The present study gives valuable information about odonate fauna of Manjeera Wildlife sanctuary as a baseline data for assessing the changes due to the environmental conditions in the area, thereby helping in formulating future conservation measures to preserve the wetland habitats and maintain the ecosystem health.

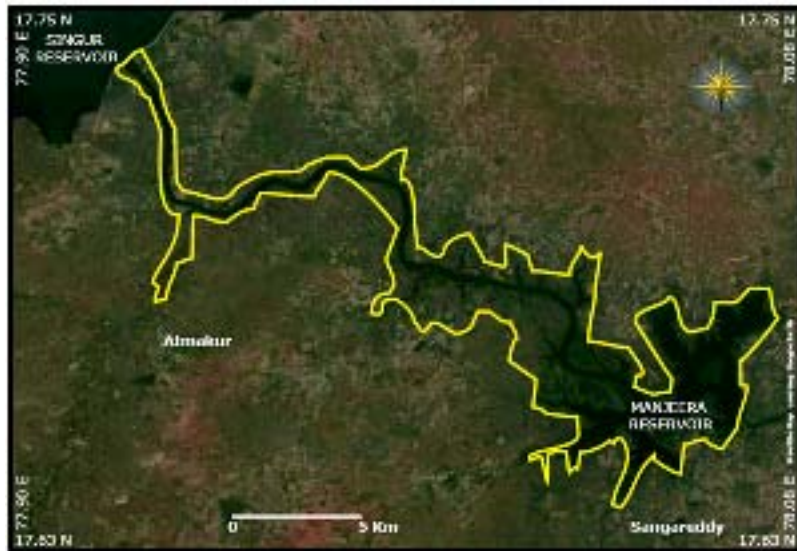


Fig 1: Map of Manjeera Wildlife Sanctuary, Medak District, Andhra Pradesh

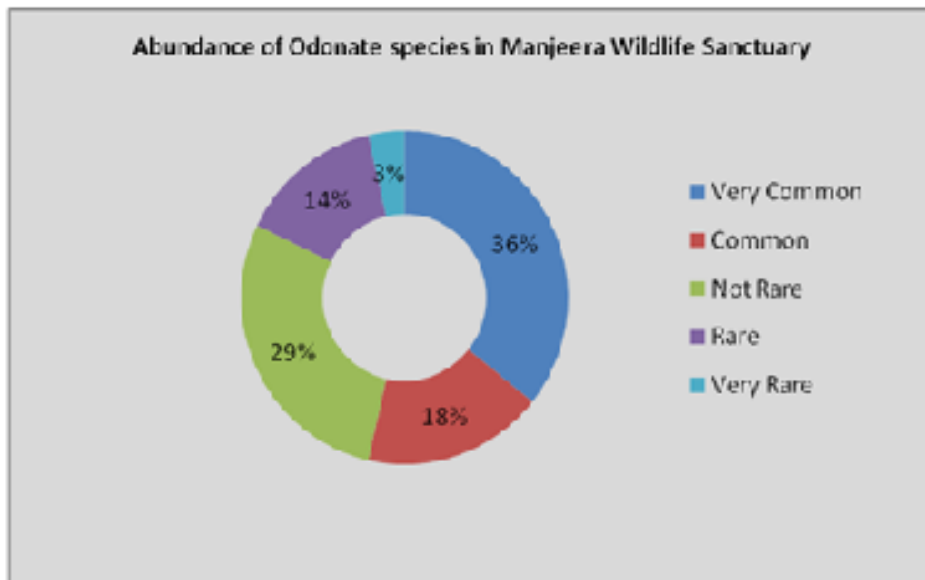


Fig 2: Abundance of odonate species in Manjeera Wildlife Sanctuary



Fig 3: Odonates (selected species) of Manjeera Wildlife Sanctuary, Andhra Pradesh, India

Key: A - *Anax immaculifrons*, B - *Anax guttatus*, C - *Ictinogomphus rapax*, D - *Acisoma panorpoides*, E - *Brachydiplax sobrina*, F - *Brachythemis contaminata*, G - *Bradinopyga geminata*, H - *Crocothemis servilia*, I - *Diplacodes trivialis*, J - *Neurothemis tullia*, K - *Orthetrum pruinatum*, L - *Orthetrum sabina*, M - *Pantala flavescens*, N - *Rhyothemis variegata*, O - *Trithemis aurora*, P - *Coenagrion dyeri*, Q - *Copera vittata*, R - *Ceriagrion coromandelianum*, S - *Ischnura aurora*, T - *Rhodischnura nursei*, U - *Pseudagrion decorum*



Fig 4: Polymorphism in *Neurothemis tullia* – A) male, B) andromorphic female, C) female from Manjeera Wildlife Sanctuary, Andhra Pradesh, India

Table 1: Odonates of Manjeera Wildlife Sanctuary, Medak District, Andhra Pradesh, India

S.No	Family	Common Name	Scientific Name	Status
1	Aeshnidae	Rusty darner	<i>Anaciaeschna jaspidea*</i>	C
2		Blue-tailed green darner	<i>Anax guttatus</i>	NR
3		Blue darner	<i>Anax immaculifrons</i>	NR
4	Gomphidae	Common clubtail	<i>Ictinogomphus rapax</i>	VC
5	Libellulidae	Trumpet tail	<i>Acisoma panorpoides</i>	NR
6		Little blue marsh hawk	<i>Brachydiplax sobrina</i>	NR
7		Ditch jewel	<i>Brachythemis contaminata</i>	VC
8		Granite ghost	<i>Bradinyopyga geminata</i>	VC
9		Ruddy marsh skimmer	<i>Crocothemis servilia</i>	C
10		Ground skimmer	<i>Diplacodes trivialis</i>	VC
11		Pied paddy skimmer	<i>Neurothemis tullia</i>	NR
12		Blue marsh hawk	<i>Orthetrum glaucum</i>	NR
13		Crimson-tailed marsh hawk	<i>Orthetrum prunosum</i>	NR
14		Green marsh hawk	<i>Orthetrum sabina</i>	VC
15		Wandering glider	<i>Pantala flavescens</i>	C
16		Common picture wing	<i>Rhyothemis variegata</i>	VC
17		Crimson marsh glider	<i>Trithemis aurora</i>	C
18		Long-legged marsh glider	<i>Trithemis pallidinervis</i>	VC
19	Coenagrionidae	Pigmy dartlet	<i>Agriocnemis pygmaea</i>	NR
20		Coromandel marsh dart	<i>Ceriagrion coromandelianum</i>	VC
21		Rusty marsh dart	<i>Ceriagrion olivaceum</i>	C
22		Unknown	<i>Coenagrion dyeri*</i>	R
23		Golden dartlet	<i>Ischnura aurora</i>	VC
24		Senegal golden dartlet	<i>Ischnura senegalensis</i>	VC
25		Elegant sprite	<i>Pseudagrion decorum*</i>	R
26		Blue grass dartlet	<i>Pseudagrion microcephalum</i>	C
27		Pixie dartlet	<i>Rhodischnura nursei*</i>	VR
28	Platynemididae	Blue bush dart	<i>Copera vittata</i>	R

Key: VC-Very Common, C-Common, NR-Not Rare, R-Rare, VR-Very Rare; *New report for Andhra Pradesh; Unknown: Common name unknown.

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