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Research Article

DIVERSITY OF ODONATES (INSECTA: ODONATA) IN DIFFERENT HABITATS OF VELLORE DISTRICT, TAMIL NADU, INDIA IN EASTERN GHATS

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ABSTRACT

The objective of the preliminary study of Odonates is to explore the diversity of dragonflies and damselflies (Odonata) in different habitats are Amirthi streams, Mordhana dam and Pulliyanthangal Lake in Vellore district. Totally the 30 species of Odonates including 17 species under 2 families of sub order Anisoptera and 13 species under 2 families of Sub order Zygoptera were recorded from June 2017 to May 2018. The 26 species of Odonates were documented in habitats near Mordhana dam reservoir, 25 species from near Amirthi streams and 16 species were recorded from Pulliyanthangal Lake. 30 species were recorded in all the three different habitats. Among these species, Libelluidae and Coenagrionidae were the dominant families with maximum number of species abundance in the study area. The most abundant Anisopteran species in Amirthi falls are Diplacodes trivial is and Pantalaflavescens, and in Mordhana dam and Pulliyanthangal Lake were encompass with *Brachythemis contaminate*. Among the Zygopteran species the most abundant species are *Ceriagrion coromandelianumin* the all habitats. These data will be useful in future studies and conservation of biodiversity in the studied habitats.

INTRODUCTION

Dragonflies and Damselflies in the order Odonata are important group of insects in agro ecosystems, forest ecosystems and aquatic ecosystems. Odonata are classified into three suborders, namely Anisoptera (8 living families), Zygoptera (17 living families) and Anisozygoptera1. In India Odonate are represented by 474 species in 142 genera and 18 families (Subramanian, 2014). This group represents the second largest aquatic insect order in the animal kingdom. They are sensitive to environmental conditions makes odonates excellent biological indicators of environmental conditions (Brown 1991; Clark &Sam ways 1996; Sam ways, *et al.* 2010). They are potential bio-control agents of agricultural, horticulture and forest pests, and important components of aquatic food chain by either feeding on aquatic plants, protozoans, algae, fish fries, mosquito larvae, tad poles, and minute crustaceans (Bhatti *et al.*, 2014; Smith, 2005) or being fed by fishes, frogs, ducks and birds etc. (Rafi *et al.*, 2009; Din *et al.*, 2013). Among natural factors affected, salinity is a crucial factor that affects life of aquatic invertebrates directly as well as indirectly. The larva of Odonata naiads are directly affected by quality of water they are living in (Azam *et al.*, 2015). The Eastern Ghats are endowed with an extensively rich variety of biological species, geological formations and different ethnic tribes. In India there is no proper information available on the identification, diversity and the role of blatted in forest ecosystems. Hence, the broad objective of the present study is to identify and calculate the diversity indices of blatted species along with an elevation gradient within the different areas in Vellore district of Eastern Ghats, Tamil Nadu. Earlier surveys showed that there were no study has been carried out so far from this region of Vellore district; hence an attempt was made to study the Odonata fauna of different habitats. Dragonfly communities are increasingly threatened with habitat loss and degradation within the Mediterranean Region from factors such as the malfunctioning of agricultural practices (Riservato *et al.* 2009).

MATERIALS AND METHODS

Study area: All the sampling sites were broadly categorized into three habitat types i.e. Amirthi hill streams (**Zone 1**) Mordhana dam (**Zone 2**) and Pulliyanthangal Lake (**Zone 3**) in the Eastern Ghats of Vellore District (Fig 1). Species diversity from all these habitats was recorded and the significant difference of species diversity among the three types of water bodies was studied. Amirthi Zoological Park is

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situated 12.7322° N, 79.0566° E inside the Thellai Reserve Forest of Amirthi range with a semi-perennial falls nearby is the only Eco-tourism place present in Vellore Forest Division. Mordhana dam is about 25 kilometers from Gudiyatham. The dam is built (2000) between two hills that are covered with lush greenery and is 33 meters high and 220 meters long. Pulliyanthangal Lake in Ranipet town is located at 12.92º Northern latitude and 79.33º eastern longitude of Chennai. Ranipet was once glorified as fast developing industrial zone, but faced some repression. BHEL Ranipet Plant is manufacturing Boiler Auxiliary instruments such as, ESP, Fans, Gate & Dampers, FGD etc. to support Thermal Power Plan In 1995, a chromium factory in Tamil Nadu's Vellore district shut shop leaving behind a legacy of contaminated soil and water. As such habitat cast-off also serve as breeding sites for many species of Odonates.

Fig 1 Study area of the Vellore District

Sample Colletion

Odonates exhibit an attractive response to temperature the time has chosen for survey during 10 p.m. to 2 p.m. as they expose more as temperature increases. Data collection and identification in diverse selected zones of the study area was surveyed during June 2017 to May 2018 by using line transect method. In this method 3 permanent 400 m line transects were setup in 3 zones. Through these transect walked once in a week in each zones to follow Pollard Walk method for recording the Odonates. A slow 180 degree visual sweep was performed during walking (Dwari, S., and Mondal, A.K. 2017). Photographs were taken using Nikon D5600 camera. Identification of species (Odonata) was done with the help of various literatures (Tiple, A.D. 2014, Baidya,S. 2017, Kalita, G.J., Ray, S.D. 2015, Subramanian, K.A. 2005 and Joshi, S., and Kunte, K. 2014). Collected specimens were then killed, sorted, pinned, labeled, dried and preserved following general entomological procedures. Identification was done following Fraser (Richards and Davies 1977) and Borror *et al.*, (1981). Encyclopedia of Flora and Fauna of Bangladesh also used species identification (Kabir *et al.* 2008).

RESULTS AND DISCUSSION

A total of 30 species were documented during the study period. The suborder Anisoptera is represented by 2 families and 17 species (Table-1) and the suborder Zygoptera by 2 families and 13 species (Table-2). The 26 species were recorded from habitats near Mordhana dam, 25 from Amirthi Streams and 16 species were recorded from Pulliyanthangal Lake. Mordhana dam are the most abundant habitat with 345 individuals (175 Anisopteran and 170 Zygopteran), followed by Amirthi Streams with 288 individuals (151 Anisopteran and 137 Zygopteran) and Pulliyanthangal lake with 184 (104Anisopteran and 80 Zygopteran) was the least abundant (Table-3). The family Libelullidae were dominant (40%) from the five families were identified in the Vellore areas, (Fig -2) followed by family Coenagrionidae (27%), Gomphidae (2%), Lestidae (3%) and only 28% of the family Platycnemididae. (Fig -3)

Nine species viz. *Brachythemis contaminate, Trithemis festiva, Crocothe misservilia, Orthetrum Sabina, Pantala flavescens, Bradinopyga geminate, Diplacode strivialis, Orthetrumpruino sum*and *Trithemis aurora* were found to be present in all habitats. Three species viz. *Neurothemis tullia, Neurothemis fulvia, Brachidiplax sobrina* were recorded from two different types of habitats. A total of three species viz., *Rhyothemis variegata, Brachidiplax chalybea and Palpopleurasexmaculata* were found only in one particular habitat type. The most abundant Anisopteran species in Amirthi streams was *Diplacodes trivialis* and *Pantala flavescens,* in Mordhana dam and Pulliyanthangal Lake was *Brachythemis contaminata* most abundant. Their ascendancy may be attributed to the presence of large marshy areas, shrubs and wetland.

However presence of significant number of *Brachythemis contaminates* suggests that the water quality of water bodies is bad and it can be also assumed that pollution from nearby Pulliyanthangal Lake. Study reports that *Brachythemis contaminata* dragonfly seen in polluted water and it abundantly seen in sewage discharged areas (Kulkarni AS, 2013).The Ranipet area is a chronic polluted area and one of the biggest exporting centers of tanned leather. Many small-scale tanneries are processing leather in the study area and discharging their effluents on the open land and surrounding water bodies (K. RiazAhamed, 2017). Ditch Jewel (*Brachythemis contaminata*) was frequently sighted in the polluted water bodies near human habitations, which is an indicator species of highly polluted water not suitable for human consumption (Nair MV 2011). The different environmental factors such as temperature, humidity, rainfall, vegetation and food sources directly affect the diversity and distribution of Odonate population, Morais *et al.*, (1999), Kittelson (2004), Bispo and Oliveira (2007) and Goldsmith (2007). Some zygopteran species *Coperaannulata, Agriocnemis pygmaea, Aciagrion pallidum, Ceriagrion cerinobellum, Ceriagrion coromandelianum, Ischnura aurora* and *Copera ciliate* were found to be present in all habitats.

Fig 4 Photographs of some odonates recorded during the study period

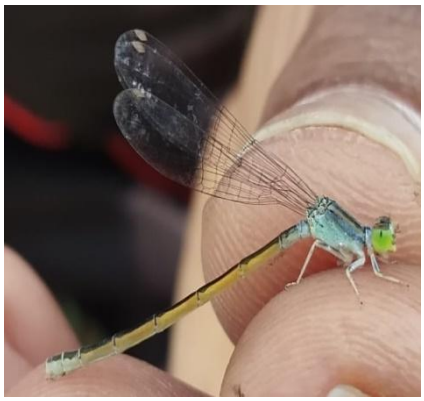
Brachythemis contaminate (Ditch jewel) Male

Diplacodes trivialis (ground skimmer)

Crocothemis servilia (adult male)

Crocothemisservilia (juvenile male)

Ischnura aurora (Golden dartlet)



Pseudagrionrubriceps (saffron-faced blue dart)

Pantalaflavescens (globe skimmer)

Ceriagrionrubiae (orange marsh dart)

Crocothemisservilia (scarlet skimmer)

*Ceriagrion coromandelianum*is a species confined to Mordhana dam and Pulliyanthangal Lake frequently sits on water plants and overhanging bushes, so during the study period this species was commonly found near river and also seen rarely near Amirthi streams and in Pulliyanthangal Lake. *Ceriagriono livaceum*an in habitant of marshy areas was found in all the habitats sand *Agriocnemis lacteola* and *Coperavittata* which prefers weedy habitats was recorded in weed covered areas of Mordhana dam. *Agriocnemis femina Agriocnemis lacteola, Copera vittata* and *Lesteselatu s*all are absent in Pulliyanthangal Lake. (Fig -4)

The results also indicate the habitat of Amirthifallsen compasses with all the Anisopteran species excluding the species *Acisoma panorpoides* and *Brachidiplax chalybea* of family Libellulidae.

This species is however hardly ever found along Mordhana dam. The abundance of Libellulidae in the present study was, due to their short life cycle and wide spread distribution (Norma-Rashid *et al.,* 2001). The Mordhana dam are the habitats which seems to be most preferred by the zygopterans since all the species encountered here, whereas one zygopteran species were not found in Mordhana dam and six were deficient in Pulliyanthangal Lake. It may perhaps live for the fact that damselflies prefer shallow water with emergent vegetation into which they oviposit endophytic all.

For the period of the present study, the rich diversity of Odonates at Amirthi falls and Mordhana dam was attributed to the favorable habitat formed by the presence of aquatic vascular plants (Ameilia, 2006; Arulprakash and Gunathilagaraj, 2010) while the least diversity of Odonates at

Pulliyanthangal Lake was due to no or limited shade cover and less availability of food sources (Arulprakash and Gunathilagaraj, 2010), discharge of sewage water (Che Slamah *et al.*, 1998) and presence of insectivorous fishes (Blaustein, 1992). The anthropogenic activities observed near the Lake were also found accountable for disturbing the habitats of Odonates consequently destitute diversity was recorded in Puliyanthagal Lake at Ranipet of Vellore. The diminutive diversity of Odonates recorded in the present survey was due to the removal of riparian vegetation and discharge of industries transmitting high nutrient loads to the stream water which affected the food availability and disturbed the habitats of the Odonates as reasoned by Adams and Fitch (1998) and Hornung and Rice (2003).

Libellulidae was the overriding family in the study area represented by 16 species and similar reports have been documented from Odisha (Debata S, *et al.*, 2013 and Kalita GJ, *et al* 2014). Among all habitats, primary number of species assemblage was recorded from the Amirthi falls and Mordhana dam. In Vellore district, greater part of the hill streams are away from human activities and are less disturbed which may be the reason for high species richness of Odonates in these habitats and low diversity in Pulliyanthangal Lake may be due to deprivation of water quality. Dragonflies have been proposed as indicators for assessing the ecosystem health of freshwater wetlands. In biodiversity conservation, Odonates serve as an umbrella species and represent specific biotic wetland assemblages. According to El-Moursy *et al.* (2001), there is light doubt that conditions like humidity, moisture, temperature etc. might affect insect distribution. The Odonates are ideal model insects for the examination of the impact of the environmental warming and climate change due to its trophical evolutionary history and adaptations to temperate climate. On the starting point of present study, it is clear that availability of Odonate species was not only dependent on seasonal fluctuation, but also on ecological and environmental conditions.

CONCLUSION

In the current study altogether 30 species of dragonflies and damselflies were reported from the three study sites of the Vellore district's Odonate diversity. The maximum species of Odonates were found in Amirthi falls and Mordhana dam than Pulliyanthangal Lake of Ranipet areas. The checklist of Odonatespecies shows remarkable dragonfly diversity and distribution in the Vellore district of TamilNadu. However, further studies are required to be undertaken for a longer period to understand the community structure, behaviour and impact of urbanization and habitat modification on Odonate diversity, distribution and thus be protected from anthropogenic threats in Pulliyanthangal Lake of Ranipet areas. The present study proves that the malfunctioning and other activities results the degradation of Odonate species in particular zones, To overcome this problem, the people were advised not to use such highly polluted things in agriculture fields and requisition may send to all small scale industry people to avoid pollution in particular area. By these activities we can hold the environmental conditions in the locality.

Table 1 Shows the number of Dragonfly species along with their families observed in three survey areas of Vellore district.

	Order: Anisoptera (Dragonflies)				
	Libellulidae Family				
S. NO	**Scientific name**	**Common name**	**Z 1**	**Z 2**	**Z 3**
1	*Rhyothemisvariegata* (Linnaeus, 1763)	Common Picturewing	+	-	-
2	*Neurothemistullia* (Drury, 1773)	Pied-paddy Skimmer	+	+	-
3	*Neurothemisfulvia* (Drury, 1773)	Fulvous Forest Skimmer	+	+	-
4	*Brachythemis contaminata* (Fabricius, 1793)	Ditch Jewel	+	+	+
5	*Brachidiplaxsobrina* (Rambur, 1842)	Little Blue Marsh Hawk	+	+	-
6	*Brachidiplaxchalybea* (Brauer, 1868)	Rufous-backed Marsh Hawk	-	-	+
7	*Acisomapanorpoides* (Rambur, 1842)	Trumpet Tail	-	+	-
8	*Trithemisfestiva* (Rambur, 1842)	Black Marsh Glider	+	+	+
9	*Crocothemisservilia* (Drury, 1773)	Scarlet Skimmer	+	+	+
10	*Palpopleurasexmaculata (Fabricius, 1935)*	Blue-tailed Yellow Skimmer	+	-	-
11	*Orthetrumsabina* (Drury, 1770)	Green Marsh Hawk	+	+	+
12	*Pantalaflavescens* (Fabricius, 1798)	Wandering Glider	+	+	+
13	*Trithemis aurora* (Burmeister, 1839)	Crimson Marsh Glider	+	+	+
14	*Bradinopyga geminate* (Rambur, 1842)	Granite Ghost	+	+	+
15	*Diplacodestrivialis* (Rambur, 1842)	Ground Skimmer	+	+	+
16	*Orthetrumpruinosum* (Burmeister1839)	Crimson-tailed marsh	+	+	+
	Gomphidae: Family				
17	*Ictinogomphusrapax* (Rambur, 1842)	Common Clubtail	+	+	-

(+ and - denotes presence and absence respectively)
Zone 1 Amirthi falls, Zone 2 Mordhana dam Zone 3 Pulliyanthangal Lake

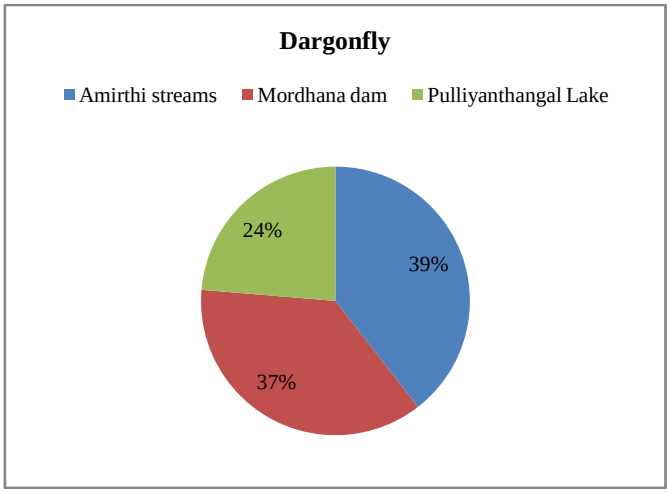


Fig 2 Percentage of Dragonfly species from each habitat

Table 2 Shows the number of Damselflies species along with their families observed in in different areas of Vellore district.

Order: Zygoptera (Damselflies)					
Coenagrionidae Family					
S.NO	**Scientific name**	**Common name**	**Z 1**	**Z 2**	**Z 3**
1	*Agriocnemispygmaea* (Rambur, s1842)	Pygmy Dartlet	+	+	+
2	*Agriocnemisfemina* (Brauer, 1868)	PruinosedDartlet	+	+	-
3	*Agriocnemislacteola* (Seyls, 1877)	Milky Dartlet	-	+	-
4	*Ceriagrion cerinobellum* (Brauer, 1865)	Orange-tailed Marsh Dart	+	+	+
5	*Ceriagrion coromandelianum* (*Fabricius,1798*)	Coromandel Marsh Dart	+	+	+
6	*Ceriagrionfallax* (Ris, 1914)	Black-tailed Marsh Dart	+	-	-
7	*Ischnura aurora* (Brauer, 1865)	Golden Dartlet	+	+	+
8	*Mortonagrionaborense* (Laidlaw, 1914)	Not available	-	+	+
9	*Coperaannulata* (Selys, 1863)	Narrow-winged Damselfly	+	+	+
10	*Ischnurasenegalensis (Rambur, 1842)*	Senegal Golden Dartlet	+	+	-
11	*Coperaciliata* (Seyls, 1863)	Black-kneed Feather legs	+	+	+
Platycnemididae: Family					
12	*Coperavittata* (Selys, 1863)	Blue Bush Dart	-	+	-
Lestidae: Family					
13	*Lesteselatus* (Selys, 1862)	Emerald Spreadwing	+	+	-

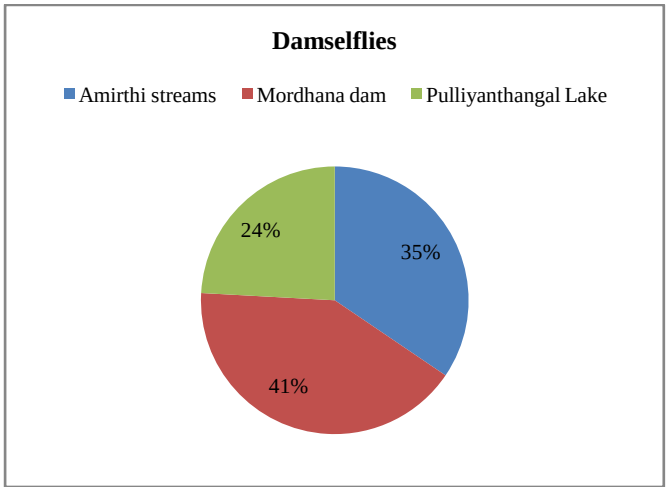


Fig 3 Percentage of damselfly species from each habitat

Table 3 Total number of Odonates species in different habitats

S.NO	Odonate	Zone 1	Zone 2	Zone 3	Total
1	Dragonfly	15	14	9	38
2	Damselflies	10	12	7	29

Zone 1 Amirthi Streams, **Zone 2** Mordhana Damand **Zone 3** Pulliyanthangal Lake

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