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Diversity and Habitat Use of Odonates in Cauvery Basin, Tamil Nadu, India

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ABSTRACT

Dragonflies and damselflies are commonly called odonates and are one of the most common insects flying and soaring over forest, cultivated fields, meadows, ponds and rivers. They are increasingly being look upon as excellent indicators of ecosystem health. The odonates were collected by hand, sweep net and random field sampling method. A total of 20 species of dragonflies were recorded during the period of study. Maximum of 17 species falls under family Libellulidae and one each under Gomphidae, Aeshnidae and Cordulidae respectively. Similarly 8 species of damselflies were recorded of which 6 species were falls under the family Coenagrionidae and one each of under the family Protoneuridae and Lestidae respectively. The results of habitat usage of dragonflies and damselflies shows that they mainly used the wetlands of pond ecosystem and agricultural fields than that of the riverside and shrub land. Future work should explore the biogeography of lesser studied Anisoptera and Zygopteran groups from Cauvery basin.

Keywords: *Diversity, Dragonfly, Damselfly, Odonate, Habitat*

INTRODUCTION

Dragonflies and damselflies are commonly called odonates and are one of the most common insects flying and soaring over forest, cultivated fields, meadows, ponds and rivers. They often termed as the bio-indicators of the aquatic ecosystem. They are one of the flagship species of insect communities which indirectly influence the tropic level of an ecosystem. Globally the distribution of odonates indicated that 5,740 species are known, of this 470 species in 139 genera and 19 families exist in India (Subramanian, 2009). The importance and appropriateness of invertebrate taxa as an ecological indicators in monitoring ecosystem health are well recognized (Merritt *et al*. 2008; Majumder *et al*. 2013), and Odonata, popularly known as dragonflies (Anisoptera) and damselflies (Zygoptera), are one such insect group (Corbet 1999; Foote and Rice 2005; Samways *et al*. 2010). Odonate insects are among the most primitive of winged insects dating back to the Permian (Grimaldi and Engel, 2005) and are very striking and attractive among the flying insects. They occur worldwide in varied ecological niches extending from sea shore to over 3600m altitude and from brackish, marshy area, mangroves to semi-arid areas (Kalkman *et al*. 2008). Odonates are amphibious with the adults being terrestrial and the larvae in aquatic. Majority of the known species are highly specific to their habitats and are highly sensitive to changes in habitat quality (Smith *et al*. 2007; Silva *et al*. 2010). Diversity in particular area or habitat has the potential to serve as a reliable indicator of stability, health, and integrity of aquatic (Foote and Rice, 2005; Osborn, 2005) as well as terrestrial ecosystems (Brown, 1991; Clausnitzer, 2003), and can be used as the predictor of other taxa present in the studied habitats (Oliver and Beattie, 1993; Wilson, 1997). Besides, these insect fauna is also play an important role in prey-predator dynamics of natural ecosystems (Das *et al.* 2012). Dragonflies are used as food and medicinal resources at a local scale (Kalkman *et al*. 2008; Shantibala *et al.* 2012). Dragonflies and Damselflies are excellent indicators of ecosystem health. There is not much known about specific habitat requirements for many rare or endangered species of dragonflies and damselflies, and studies are being conducted worldwide to try and determine what dragonflies need to survive.

There is not much studies on Odonates have been carried out so far in the Cauvery basin especially in Kumbakonam region where paddy and other crops mainly cultivated depends on Cauvery water. It is believed to be that due to irrigation of cultivated lands with Cauvery river, the availability of wet lands such as river, rivulets, ponds, tanks, channels are abundant. Hence the present study has been chosen to study on the presence of odonate fauna with the following Objectives**.**

- To study the density and diversity of dragonflies and damselflies in and around Kumbakonam region.
- To make a checklist and its diversity indices of odonates species.
- To recommend with suitable strategies for the conservation of these useful predatory arthropods.

MATERIALS AND METHODS

The **Kaveri** (or **Cauvery** in English) is one of the largest Indian river. The northern branch of the river is called the Kollidam and the southern branch retains the name Kaveri and then goes directly eastwards into Thanjavur District. Kumbakonam is located at the basin of Cauvery at 10.97°N 79.42°E. The present study was conducted in the agriculture areas and water bodies of the villages adjacent to Kumbakonam town *viz*. Kumbakonam (Government Arts College Ground & Pond), Sannapuram (Agriculture Land & Pond), Tirunageswaram,

Tiruvidaimarudur, Thepperumanallur, Tiruvisanallur, Swamimalai, Pattiswaram and banks of Arasalaru river.

The study was carried out in the above mentioned study sites from December 2016 to March 2017, considered to be favourable for the occurrence of adult odonates (Das *et al.* 2013). Data were collected by direct search technique (Sutherland, 1996) at the potential habitats of odonates. For this purpose, 10–15 min halts were made at each search point chosen at random. Dragonflies were collected by hand, sweep net and random field sampling method to cover entire study area and photographs were documented by using Cannon camera. Identification was done by observing wing venation, colour pattern and genetalia, described in available keys/identification guides by Fraser, 1957 and Subramanian, (2005, 2009), Emiliyamma (2005) and Nair (2011). Opportunistic sightings were also made to record maximum species richness and data was analysed using the statistical softwares such as MINITAB and PAST.

RESULT

A total of 20 species of dragonflies were recorded during the period of study (Table 1). Maximum of 17 species falls under family Libellulidae and one each under Gomphidae, Aeshnidae and Cordulidae respectively (Fig. 1).

Table1. *List of dragonflies recorded in the study area*

Sl. No.	Family	Species	Common Name
1	GOMPHIDAE	*Gomphusvulgatissimus*	COMMON CLUBTAIL
2	AESHNIDAE	*Gynacanthasubinterrupta*	DINGY DUSKHAWKER
3	CORDULIDAE	*Macromiaellisoni*	COORG TORRENT HAWK
4	LIBELLULIDAE	*Acisomapanorpoides*	TRUMPET TAIL
5		*Brachythemis contaminate*	DITCH JEWEL
6		***Bradinopyga geminate***	GRANITE GHOST
7		*Cratilla lineate*	EMERALD-BANDED SKIMMER
8		*Crocothemisservilia*	RUDDY MARSH SKIMMER
9		*Diplacodesnebulosa*	BLACKTIPPED GROUND SKIMMER
10		*Diplacodestrivialis*	GROUND SKIMMER
11		*Hydrobasileuscroceus*	AMBERWINGED MARSH GLIDER
12		*Hylaeothemisfrohstoreeri*	BLUE HAWKLET
13		*Orthetrumchrysis*	BROWNBACKED RED MARSH HAWK
14		*Onychothemistestacea*	STELLATE RIVER HAWK
15		*Orthetrumsabina*	GREEN MARSH HAWK
16		*Pantalaflavescens*	WANDERING GLIDER
17		*Tetrathemisplatyptera*	PIGMY SKIMMER
18		*Tholymistillarga*	CORAL-TAILED CLOUD WING
19		*Urothemissignata*	GREATER CRIMSON GLIDER
20		*Zyxommapetiolatum*	BROWN DUSK HAWK

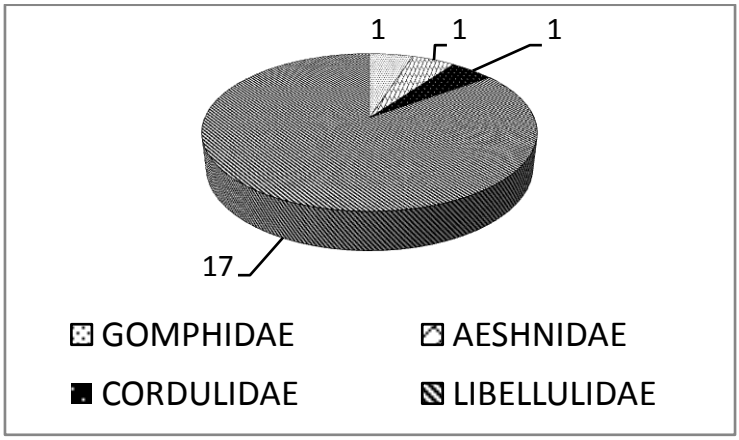

Fig1. *Family wise dragonflies recorded in the study area*

Similarly 8 species of damselflies were recorded of which 6 species were falls under the family Coenagrionidae and one each of under the family Protoneuridae and Lestidae respectively (Table 2. & Fig. 2).

Table2. *List of damselflies recorded in the study area*

Sl. No.	Family	Species	Common Name
1	COENAGRIONIDAE	*AgriocnemisPygmaea*)	PIGMY DARTLET
2		Agriocnemissplendidissima	SPLENDID DARTLET
3		*Ceriagrioncoromandelianum*	COROMANDEL MARSH DART
4		*Ceriagrionrubiae*	ORANGE MARSH DART
5		*Ischnura aurora*	GOLDEN DARTLET
6		*Ischnurasenegalensis*	SENEGAL GOLDEN DARTLET
7	PROTONEURIDAE	*Caconeuraramburi*	COORG BAMBOOTAIL
8	LESTIDAE	*Lesteselatus*	EMERALD SPREADWING

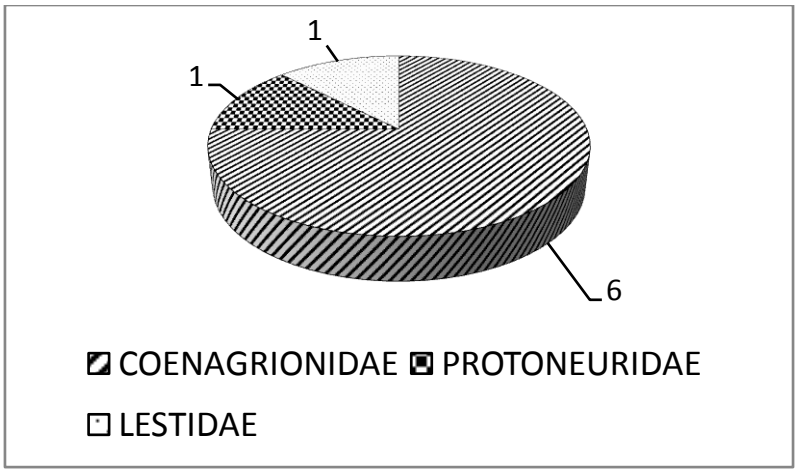

Fig2. *Family wise damselflies recorded in the study area*

Diversity indices

The species diversity indices of dragonflies show that there is a slight variation in the dominance except during the month of March. Similarly the Simpson and Shannon index also had minor variation during December to February except during March (Table 3).

Table3. *Species diversity index of dragonflies*

	Dec.16	Jan.17	Feb.17	Mar.17
Individuals	31	29	52	20
Dominance_D	0.6649	0.6457	0.6945	0.455
Simpson_1-D	0.3351	0.3543	0.3055	0.545
Shannon_H	0.61871	0.7191	0.6443	0.9673
Evenness_e^H/S	0.497	0.5131	0.4762	0.6577

In the case of damselflies also has the same result. There are slight variation during the months of December to February and has much variation in March for dominance, Simpson and Shannon indices (Table 4).

Table4. *Species diversity index of damselflies*

	Dec.16	Jan.17	Feb.17	Mar.17
Individuals	15	14	13	10
Dominance_D	0.3956	0.3367	0.3609	0.44
Simpson_1-D	0.6044	0.6633	0.6391	0.56
Shannon_H	1.01	1.093	1.058	0.9503
Evenness_e^H/S	0.9148	0.9948	0.9601	0.8621

Habitat Use

The results of habitat usage of dragonflies and damselflies shows that they mainly used the wet lands of pond ecosystem and agricultural fields than that of the riverside and shrub land (Fig. 3).

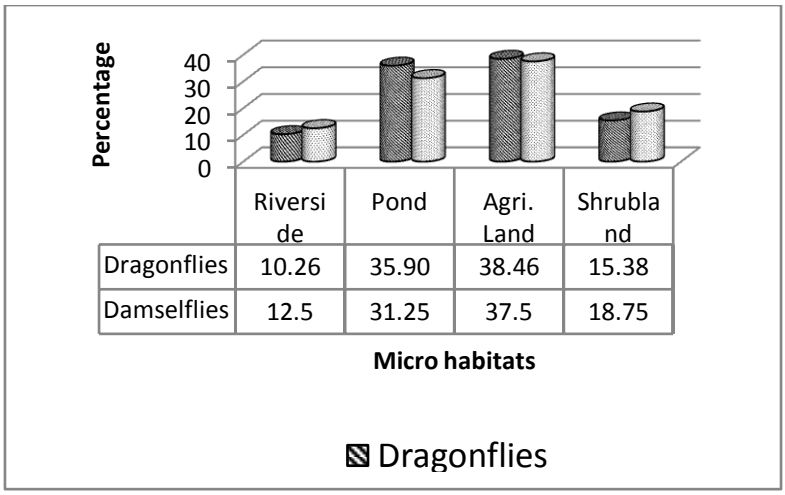

Fig3. *Habitat usages of Odonates*

Discussion

The present study of Odonates in Cauvery basin areas in and around Kumbakonam shows that there are 20 species of dragonflies were recorded under four families and 8 species of damselflies under 3 families. This shows that this is one of the maximum species of odonates were recorded within a short period of study. Similarly, Kandibane *et al*., (2005) recorded 12 species in irrigated rice fields of Madurai. Gunathilagaraj *et al.* (1999) reported 16 species of Odonates in rice fields of Coimbatore, whereas, a recent study by Arulprakash and Gunathilagaraj *et al*., (2010) revealed twenty-one species of Odonata (14 species of Anisoptera and seven species of Zygoptera) belonging to 17 genera under four families were recorded from 13 temporary water bodies of Coimbatore and Salem districts in Tamil Nadu. Whereas a maximum of 367 species of Odanata from six eco-regions of the Eastern Himalaya including two eco-regions viz., the Ganga Delta and Plain freshwater and the Chin Hills-Arakan Coast that extended to Tripura Mitra *et al.* (2010).

The odonates mainly seen in the pond ecosystem and agriculture lands. Where as it is less in riverside and shrublands. This is because of the availability of food is higher in the surface of water bodies mainly in the standing waters. There may be chances of more species sighting is possible if the Cauvery would have flown more during the study period. Unfortunately due to low rainfall during the study period availability of water logging is less. Destruction of forested areas, pollution of aquatic habitats and filling of increasing numbers of ponds in urban and rural areas are considered to be the important threats to diversity of animals and plants including odonates in Tripura (Bhattacharjee *et al.* 2013). Studies were shown that forest cover and water quality have a positive influence on odonate diversity (Dolny *et al*. 2011).

However, it is difficult to mention whether a species is genuinely rare or merely overlooked until adequately sampled and assessed. Evaluating the status of naturally rare species is highly important from a conservation point. Occurrence of a high degree of endemism in the

recorded species of Odonata from this study is a definite indicator of greater species richness and diversity of these insects in South-east Asia in general and in the study area, in particular.

CONCLUSION

Dragonflies (Anisoptera) damselflies (Zygoptera) and Anisozygoptera comprise the three suborders of Odonata ("toothed ones"), often referred to as odonates. They are invaluable models for studies in ecology, behavior, evolutionary biology and biogeography and, along with may flies (Ephemeroptera), make up the Palaeoptera, the basal-most group of winged insects. Furthermore, few other insect groups possess as strong a fossil record as the Odonata and its precursors, the Protodonata, with numerous crown and stem group fossils from deposits worldwide.

Conspicuous behavior, striking colors and relatively small number of these species (compared to other insect orders) has encouraged odonatological study. These odonates are important predators during both their larval (nymph) and adult stages. They are often the top predators in freshwater ecosystems, such as ponds, rivers and lakes. One of their most remarkable traits, however, is their reproductive behavior, which takes place in a tandem position with the male and female engaging in a "copulatory wheel". Future work should explore the biogeography of lesser-studied Anisopteran andZygopteran groups from Cauvery basin, and expand understanding of species rich groups like the Libelluloidea and Gomphidae. Dragonflies and damselflies have been heralded as model indicators for climate change, due in part to their great dispersal capabilities, and earlier emergence has been documented in our warming climate. The future biogeographical distribution of Odonata undoubtedly will be influenced directly and indirectly by anthropogenically altered climate.

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Plates: *Dragonflies recorded during the study period*

COMMON CLUBTAIL

(*Gomphusvulgatissimus*)

TRUMPET TAIL

(*Acisomapanorpoides*)

DINGY DUSKHAWKER

(Gynacanthasubinterrupta)

DITCH JEWEL

(*Brachythemis contaminate*)

COORG TORRENT HAWK

(*Macromiaellisoni*)

GRANITE GHOST

(Bradinopyga geminate)

EMERALD-BANDED SKIMMER (*Cratilla lineate*)

GROUND SKIMMER (*Diplacodestrivialis*)

BLACKTIPPED GROUND SKIMMER (*Diplacodesnebulosa*)

BLUE HAWKLET (*Hylaeothemisfrohstoreeri*)

AMBERWINGED MARSH GLIDER (*Hydrobasileuscroceus*)

BROWNBACKED RED MARSH HAWK (*Orthetrumchrysis*)

RUDDY MARSH SKIMMER (Crocothemisservilia) (female)

GREEN MARSH HAWK (*Orthetrumsabina*)

PIGMY SKIMMER

(*Tetrathemisplatyptera*)

WANDERING GLIDER

(*Pantalaflavescens*)

STELLATE RIVER HAWK

(*Onychothemistestacea*)

GREATER CRIMSON GLIDER

(*Urothemissignata*)

Plates: *Damselflies recorded during the study period*

PIGMY DARTLET

(*AgriocnemisPygmaea*)

GOLDEN DARTLET

(*Ischnura aurora*)

COROMANDEL MARSH DART

(Ceriagrioncoromandelianum)

COORG BAMBOOTAIL

(*Caconeuraramburi*)

SPLENDID DARTLET

(Agriocnemissplendidissima)

SENEGAL GOLDEN DARTLET

(*Ischnurasenegalensis*)

ORANGE MARSH DART

(*Ceriagrionrubiae*)

EMERALD SPREADWING

(*Lesteselatus*)

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