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RESEARCH

Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh

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ABSTRACT

Odonates play crucial role in ecosystem functioning and can be used as biological indicators of environmental quality. Although much work have been carried out regarding the abundance and distribution of insect orders in southern Andhra Pradesh, no sufficient effort has been made to study the diversity and distribution of Odonates. Thus, in the present study an attempt was taken to study the diversity and abundance of Odonates in Sri Lankamalleswara reserve forest, Eastern Ghats of southern Andhra Pradesh. A total number of 33 species of Odonates were recorded from the study area duringMarch 2013 to August 2014. The family Libellulidae with 21dragonfly species was the most dominant followed by Gomphidae (2 sp.) and Aeshnidae (1 sp.) from the sub order Anisoptera. 9 species of damselflies were recorded from the family Coenagrionidae of sub order Zygoptera. As the area housedwith 33 species of Odonates including 24 species of Anisoptera and 9 species of Zygoptera, were presumed to have a good diversity which may be attributed to the grasslands, shrubs and moist water bodies, moist green thick forests inside the study area.

Key words: Odonata, Dragonfly, Damselflies, Sri Lankamalleswara reserve forest, Eastern Ghats, Andhra Pradesh.

1. INTRODUCTION

Biodiversity conservation and management both are worldwide concern. Insects are the largest class in the animal world and they play an important role in nutrient cycle, organic matter decomposition, pollination and soil aeration in urban ecosystem.Odonates are an important amphibiotic insect group depending on freshwater ecosystems for most of their life span. Most of us would have noticed certain eye-catching insects with bulbous eyes, long slender colourful tails and two pairs of large veined wings, these are the most common insects which are flying over forest, rang land, meadows, corps,stream and rivers and one of the dominant groups of aquatic and terrestrial insects. The damselflies (Zygoptera) and dragonflies (Anisoptera) are amphibiotic insects, which belong to the order Odonata. They spend a major part of their life cycle in fresh water ecosystem. Odonata are divided into three groups, viz. Damselflies (Zygoptera), relict dragonflies (Anisozygoptera) and dragonflies (Anisoptera)(Fig: 1) the order Odonata was quite big with worldwide distribution of 5,952 species, of which 474 species in 142 genera and 18 families exist in India [Subramanian KA, 2014]. Numerous reports have been published in recent years regarding the taxonomic information on Odonata [Kulkarni PP et al.,1999; Prasad M et al., 2000; Prasad M 1996; Sharma RM et al., 2000, Kulkarni PP et al., 2002, Kulkarni PP et al ., 2002, Talmale SS et al.,2003; Kulkarni PP et al., 2005; Kulkarni PP et al., 2006; Kulkarni PP et al., 2006; Babu R et al.,2009; Prasad M et al.,1995; Kulkarni PP et al .,2008; Talmale DA et al .,2006; Koparde P et al., 2014; Rangnekar P et al., 2014; and Subramanian KA et al., 2011]. The adults are generally predacious insects, while the larvae are carnivorus and voracious. Even though the species are usually highly specific to a habitat, some have adapted to urbanization and use man-made water bodies. Being primarily aquatic, their life history is closely linked to specific aquatic habitats (Andrew, R.J et al., 2009).

Odonates are good indicators of environmental changes as they are sensitive to changes in the habitats, atmospheric temperature and the weather conditions. They are bio-control agents; many species of odonates inhabiting agro ecosystems play a crucial role in controlling pest populations (Tiple, A.D et al., 2008). Many species of Odonates were reported from north eastern part of India but documentation of abundance and distribution is still not known for most of the species in this part of the world.

Thus the present study aimed to explore the species richness and diversity of Odonates in different locations of Sri Lankamalleswara reserve forest which might be helpful to pave the way for future research and formulation of an effective strategy for conservation of this important group of insects.

2. MATERIAL AND METHODS

The present study was conducted at Sri Lankamalleswara reserve forest, Eastern Ghats of southern Andhra Pradesh duringMarch 2013 to August 2014 to assess the diversity of Odonates (Dragonflies & Damselflies).Collection sites were chosen randomly, geographical position and elevation of the collection sites were recorded with GPS (Global Positioning System). Only dead specimen sample of each species were collected and preserved in 70% alcohol. Specimens were identified using odonata identification keys [Fraser FC 1933; Fraser FC, 1934; Fraser FC, 1936]; and earlier species descriptions [Gunathilagaraj MA et al., 2012; Asahina S,1967; Mitra A et al.,2006]. All this specimens were deposited in the 'Entomology research Museum' inthe Department of Zoology, Yogi Vemana University, Kadapa(Fig: 1, 2).Quantitative estimation of species and individuals in study areas was made using data from survey. The abundance was studied by using Simpson's Diversity indices.

$D= \Sigma (n/ N) 2$

n = total number of organisms of a particular species
N = total number of organisms of all species.
(The values will be between 0 and 1. If the values are near to 0, more diversity, if values are near to 1 then less diversity.)

Study Area

The present study was carried out at (Fig:4.A & B) Sri Lankamalleswara reserve forest (79^0 07' – 78^0 80'E) and Kadapa (14° 47' N and 78° 82' E) and it has an average elevation of 138 meters. Data collection was conducted between 06:00 am and 05:00 pm and even in the evenings when the Odonates were observed in the field and photographed. Identification was done by using available identification keys [Oertli B, 2008; Fraser FC,1933; Fraser FC,1933; and Barhaum KP et al.,1980-1981]. Photographs of the adults were taken either in field areas.

Survey Method

Surveys were conducted throughout the forest to cover all the habitats. Field notes, photographs (Camera: Olympus SLR) and observations were taken during the day light hours. The population trends were monitored during the study period using transects counting method [Fraser FC, 1933]. At each location the same route of inspection was followed each time to reduce the number of variables present and to avoid biasness all the counts were made by the same person.

Life Cycle: (**Fig. 4**)

Odonates were interesting and complex life-history with 3 stages: egg, larva and adult, of which the egg and larval stage are aquatic and the adult stage terrestrial.

Harinath et al.
Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Morphology of the Dragonflies & Damselflies: **(Fig: 5 & 6)**

The body of an Odonate is basically divided into three parts

1. Head which with biting mouthparts, large well developed compound eyes capable of excellent omnidirectional vision;
2. Thorax consisting of anterior pro-thorax bearing the front pair of legs, and a fused syn-thorax bearing the remaining two pairs of legs plus a pair of wings;
3. A long thin abdomen consisting of 10 segments. Based on their body structure, Odonata are divided into three groups, viz. damselflies (Zygoptera), relict dragonflies (Anisozygoptera) and dragonflies (Anisoptera).

Owl flies & Fish fly: **(Fig: 7**)

Four Owl flies are identified the moist residue forest region are dragonfly-like insects with large bulging eyes and strongly knobbed antennae. They are neuropterans in the family Ascalaphidae; they are only distantly related to the true flies, and even more distant from the dragonflies and damselflies. They are diurnal or crepuscular predators of other flying insects, and are typically 5 cm (2.0 in) long. Fish fly Fish flies are members of the subfamily Chauliodinae, belonging to the megalopteran family Corydalidae. They are most easily distinguished from their closest relatives, dobsonflies, by the jaws (mandibles) and antennae. One Palpares species of the Myrmeleonidae family was identified in the study area.

Identification

Individual images of Odonates were photo-documented and identified by cross-checking with standard references and photo guides [Fraser FC, 1934; Subramanian KA, 2009; Remsburg AJ et al., 2008]. The relative abundance or saystatus of individual species is categorized within the study area as VC-Very Common (> 25 sightings), C-Common (16- 25 sightings), O-Occasional (9–15 sightings), R-Rare (5–8 sightings) and VR-Very Rare (< 5 sightings) (Fig: 8).

3. RESULTS AND DISCUSSION

All over 33 species of Odonates including 24 species of Anisoptera (Dragonflies) and 9 species of Zygoptera (damselflies) were recorded from the Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, India (Table: 1),(Fig:16). The Libellulidae with 21 species was the most dominant family among the Anisoptera followed by Gomphidae (8%) (0.0036), (2sp.) and Aeshnidae(69%)(0.5184),(1species). Among the Zygoptera, the 9 species recorded belong to the family Coenagrionidae (23%)(0.0441)(Table: 2)(Fig:9, 10, 11, 12, 13, 14, 15). Odonates are predatory in nature, but also a good source of energy to different animals, especially for birds and other insects such as spiders. Being as indicators of environment odonates are sensitive towards their surroundings and changes in their ambience may lead to the changes in their status. Recent studies in the Eastern Ghats and Western Ghats of India have indicated that change in land use patterns leads to change in odonates community structure. Odonates are important indicators of water quality and pollution levels. They inhabit diversified habitats near water bodies ranging from stagnant pond water to flowing streams. Sri Lankamalleswara Reserve forest has a diversified habitat for odonates, due to gradual increase in human pressure in and around water bodies has adverse effects on the sustainability of these insects. Therefore, protection measures are necessary of these valuable creatures. But much more elaborated study is required to access the biodiversity of this unique natural creature.

Species Dominance

Among the Anisoptera, Brachythemis contaminate, Diplacodes trivialis, Neurothemis fulvia and Orthetrum Sabina were the dominant species (Fig:10.A & B), whereas among the Zygoptera, Agriocnemis lacteola was the most dominant species encountered Odonates are among the ideal taxon for investigation of the impact of environmental warming and climate change due to its tropical evolutionary history and adaptations to temperate climates [Nair, M V,2011; Hassall C et al 2008]. Despite the high importance of Odonates in environmental monitoring, still there was a lack of significanteffort to explore the diversity and abundance of this insect order in study during the study, it was found that the institution campus full fills most of the criteria important forOdonates as it are rich in grassland, shrubs and small water bodies. This study strongly encourages the use of institutional estates in providing habitat facility not only to the Odonates but also to other wildlife as a whole. The data recorded in the present study may prove valuable as a reference for assessing the changes in environmental tools in the locality, in near future.

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Table 1

List of Odonates recorded in Sri Lankamalleswara reserve forest in the Eastern Ghats of Southern Andhra Pradesh, India(**Fig: 16**)

S.NO	Common Name	Scientific Name	IUCN status [Moore NW,1997]	Abundance
	Ansioptera (Dragonflies)			
	Family: Gomphidae (Clubtails)			
1	Common Clubtail	*Ictinogomphus rapax*	LC	O
2	Common Hooktail	*Paragomphus lineatus*	LC	O
	Family: Aeshnidae (Darners)			
3	Ruddy Marsh Skimmer	*Crocothemis servilia*	LC	R
4	Black-tipped Ground Skimmer	*Diplacodes nebulosa*	LC	C
5	Ground Skimmer	*Diplacodes trivialis*	LC	C
6	Fulvous Forest Skimmer	*Neurothemis fulvia*	LC	C
7	Ruddy Meadow Skimmer	*Neurothemis intermedia*	LC	C
8	Blue-Tailed Forest Hawk	*Orthetrum triangulare*	LC	C
9	Blue Marsh Hawk	*Orthetrum glaucum*	LC	C
10	Brown Darner	*Gynacantha dravida*	DD	VR
11	Trumpet Tail	*Acisoma panorpoides*	LC	C
12	Scarlet Marsh Hawk	*Aethriamanta brevipennis*	LC	C
13	Rufous-backed Marsh Hawk	*Brachydiplax chalybea*	LC	C
14	Little Blue Marsh Hawk	*Brachydiplax sobrina*	LC	C
15	Ditch Jewel	*Brachythemis contaminate*	LC	VC
16	Emerald-Banded Skimmer	*Cratilla lineata*	LC	VC
17	Crimson-Tailed Marsh Hawk	*Orthetrum pruinosum*	LC	C
18	Green Marsh Hawk	*Orthetrum sabina*	LC	VC
19	Blue-Tailed Yellow Skimmer	*Palpopleura sexmaculata*	LC	C
20	Wandering Glider	*Pantala flavescens*	LC	C
21	Yellow Tailed Ashy Skimmer	*Potamarcha congener*	LC	C
22	Rufous Marsh Glider	*Rhodothemis rufa*	LC	C
23	Picture Wing	*Rhyothemis variegata*	LC	C
24	Long-Legged Marsh Glider	*Trithemis pallidinervis*	LC	C
25	Red Faced Skimmer	*Orthetrum chrysis*	LC	C
26	Green Marsh Hawk	*Orthetrum sabina*	LC	C
	Zygoptera (Damselflies)			
	Family: Coenagrionidae (Marsh Dart)			
27	Coromandel Marsh Dart	*Ceriagrion coromandelianum*	LC	C
28	Black Marsh Dart	*Onychargia atrocyana*	LC	O
29	Golden Dartlet	*Ischnura aurora*	LC	C
30	Orange-tailed Marsh Dart	*Ceriagrion cerinorubellum*	LC	O
31	Green-Striped Slender Dartlet	*Aciagrion occidentale*	LC	O
32	Milky Dartlet	*Agriocnemis lacteola*	LC	C
33	Stream glory	*Neurobasis chinensis*	LC	O

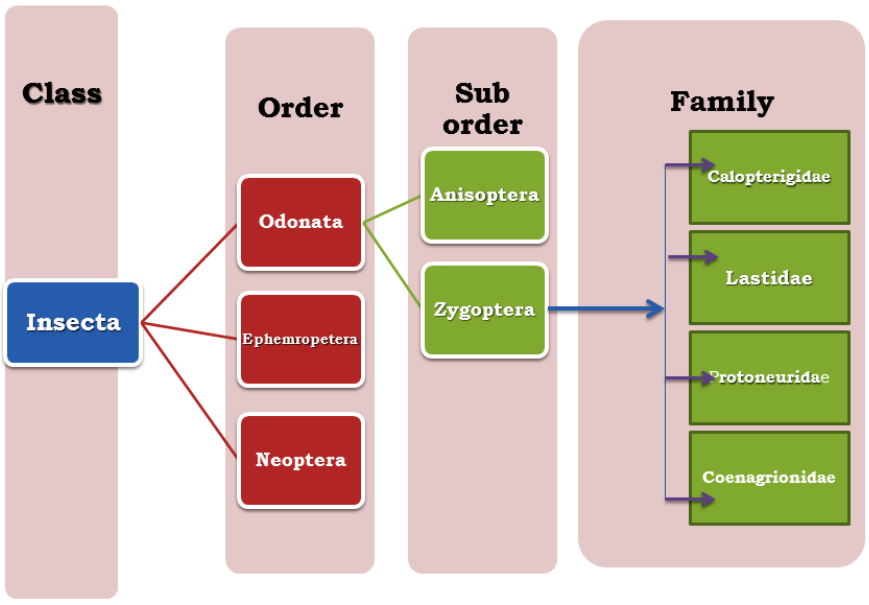
Table 2

Distribution of genera and species from different families of dragonflies and damselflies in Sri Lankamalleswara reserve forest, Kadapa. Where: **C**- Common, **O** – Occasional, **V.C**-Very Common, **R** – Rare. **V.R**-Very Rare

Family	Genera	Species	% of species	Diversity indicesD= Σ (n/ N) 2	Status				
					C	O	V.C	R	V.R
Gomphidae (Clubtails)	O2	02	08 %	0.0036	0	02	0	0	0
Aeshnidae (Darners)	18	24	69%	0.5184	19	1	03	01	01
Coenagrionidae (Marsh Dart)	06	07	23%	0.044	03	04	0	0	0

Figure 1

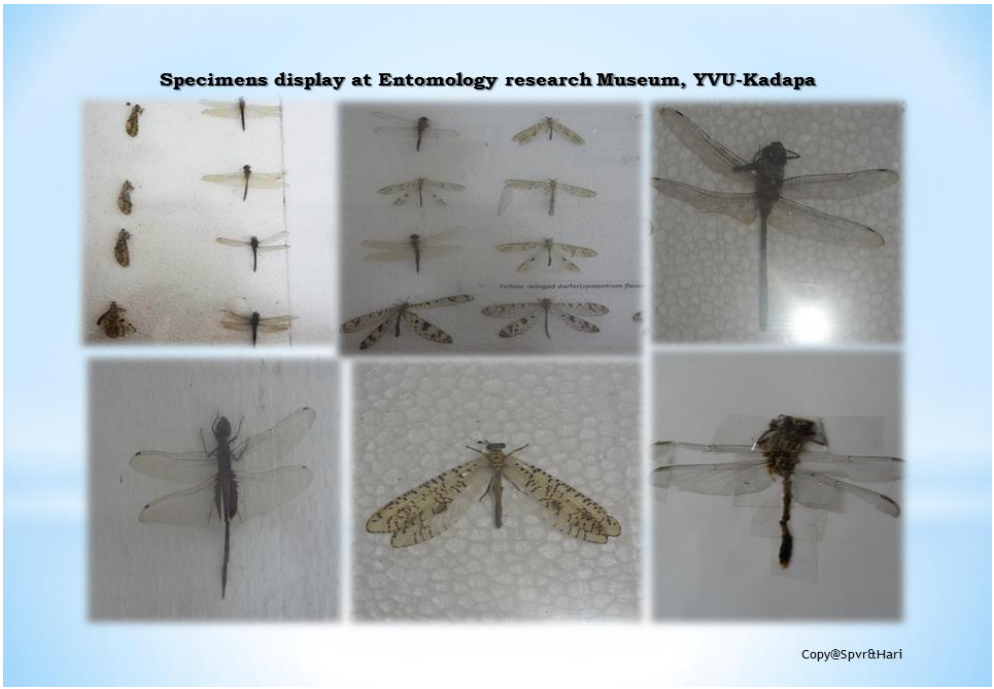
Odonata Classification



Harinath et al.
Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Figure 2

Figure 3



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Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Figure 4A
Study area

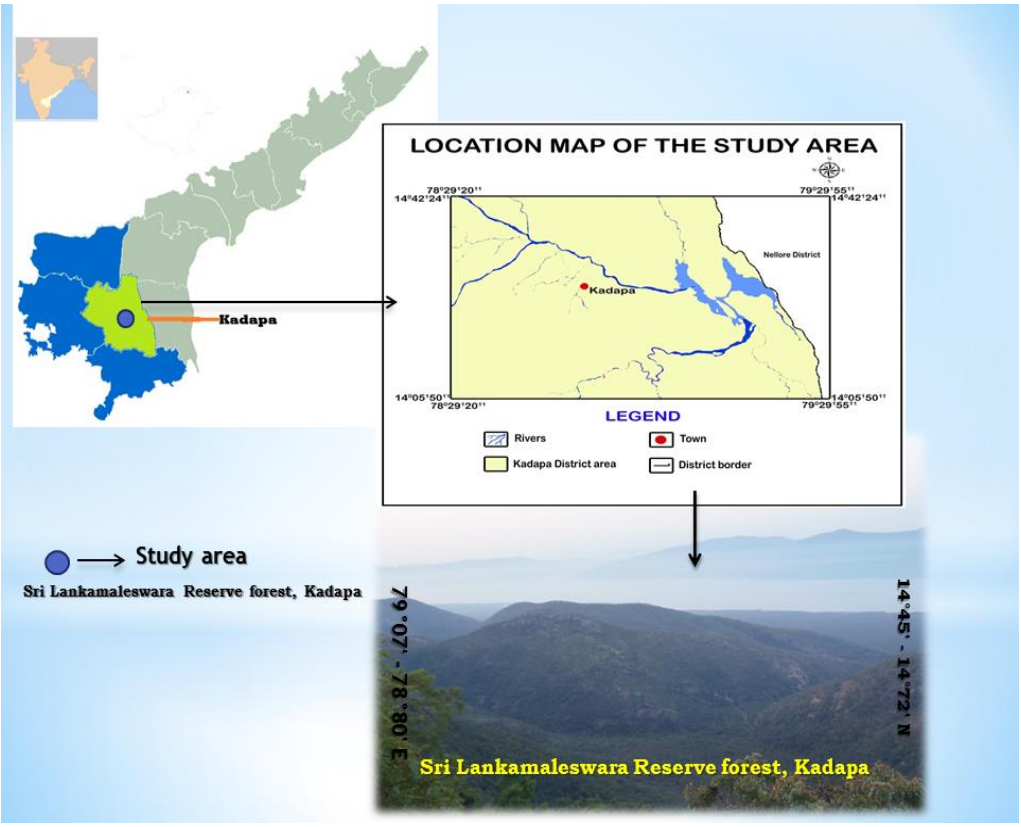


Figure 4B

Harinath et al.
Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Figure 5
Odanata Life cycle

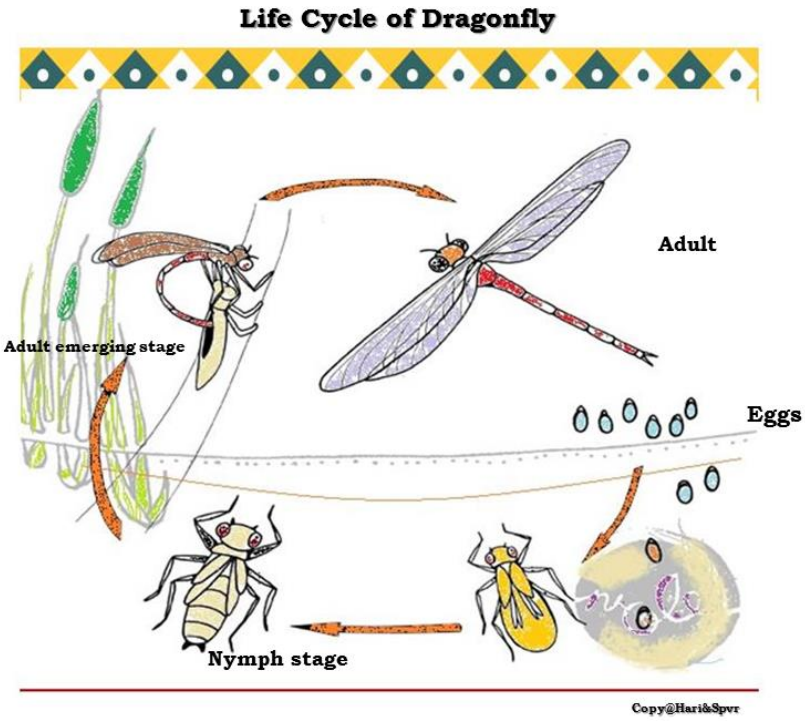
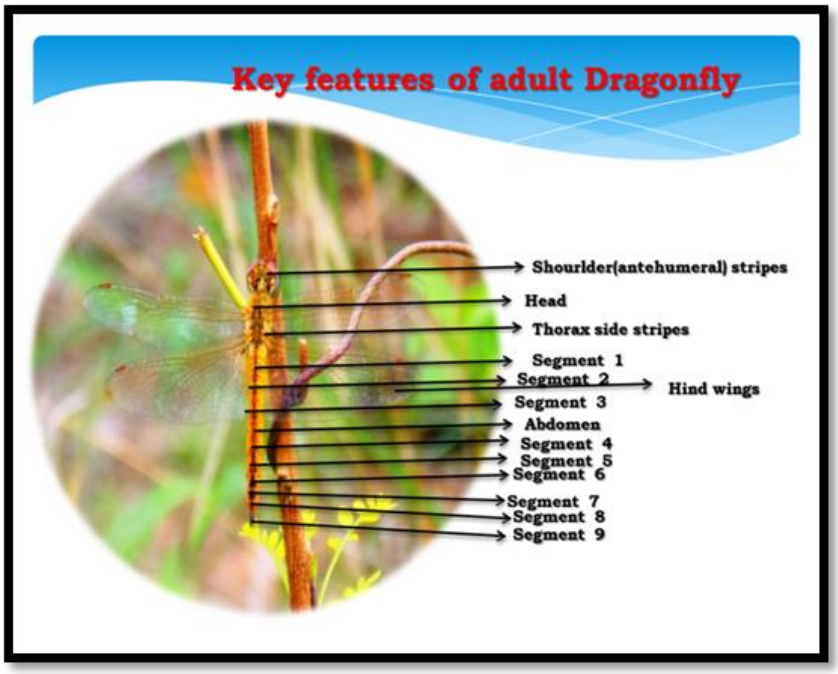
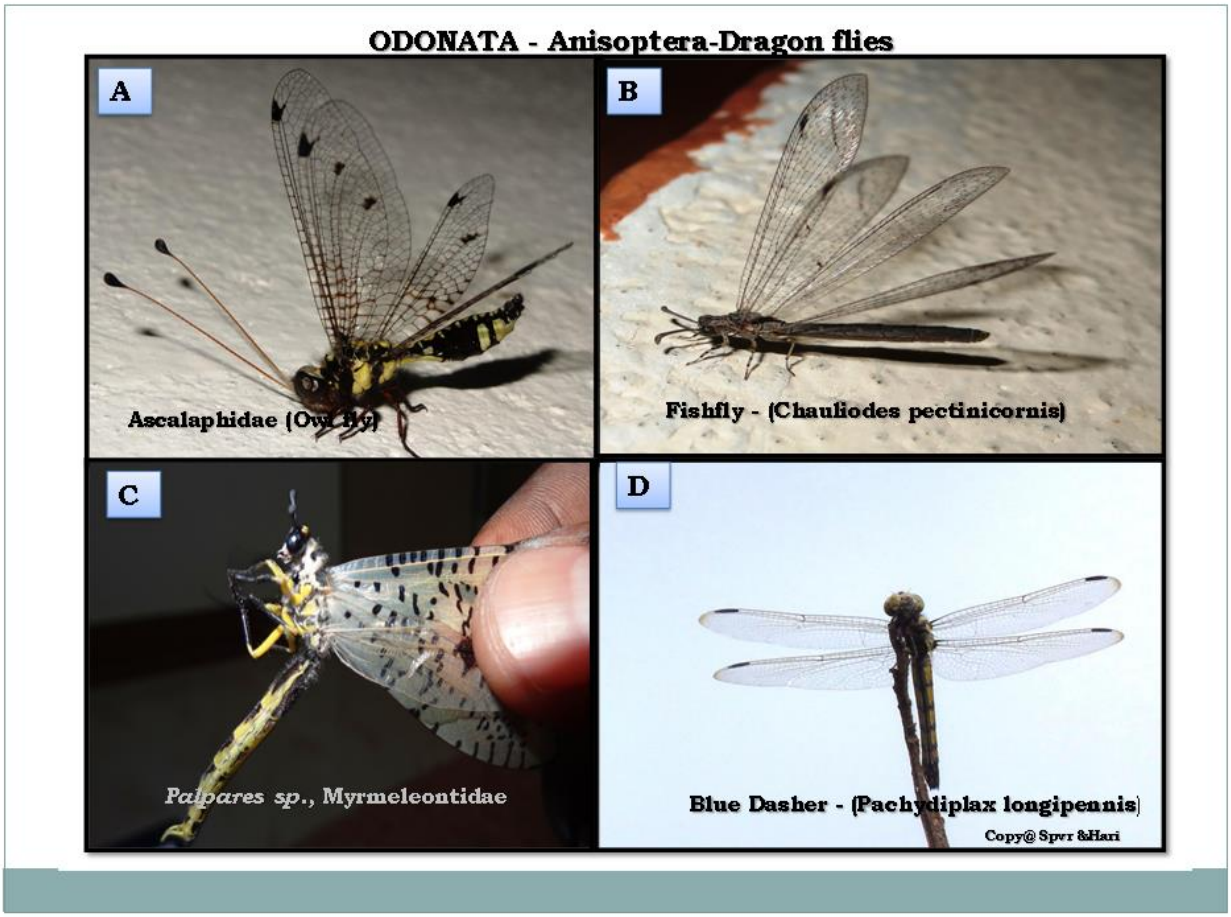


Figure 6 & 7
Body morphology of the Dragonflies & Damselflies (Odanata)



Harinath et al.
Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Figure 8



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Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Figure 9

Relative abundance of Odonates during the study area

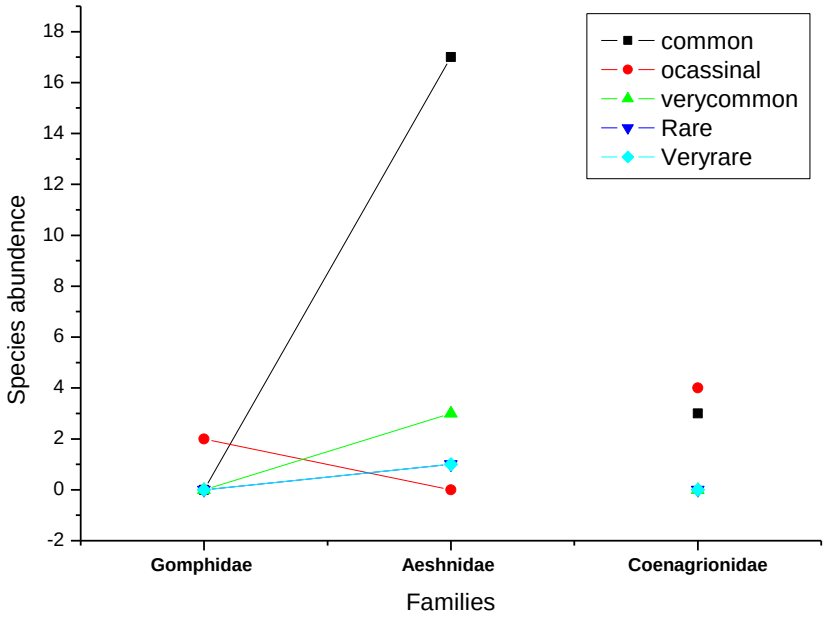
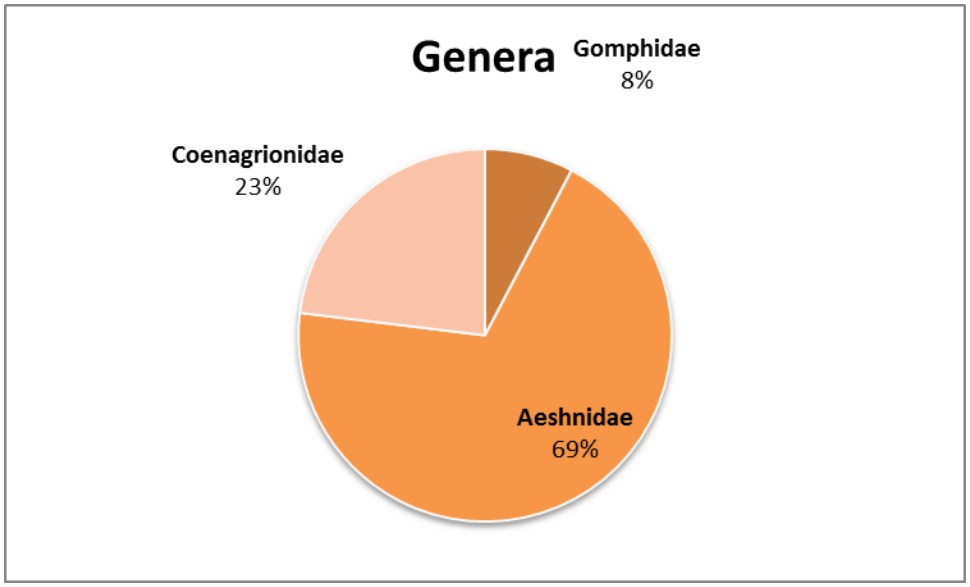


Figure 10A

Percentile distribution of families of dragonflies and damselflies in Sri Lankamalleswara Reserve forest, Kadapa



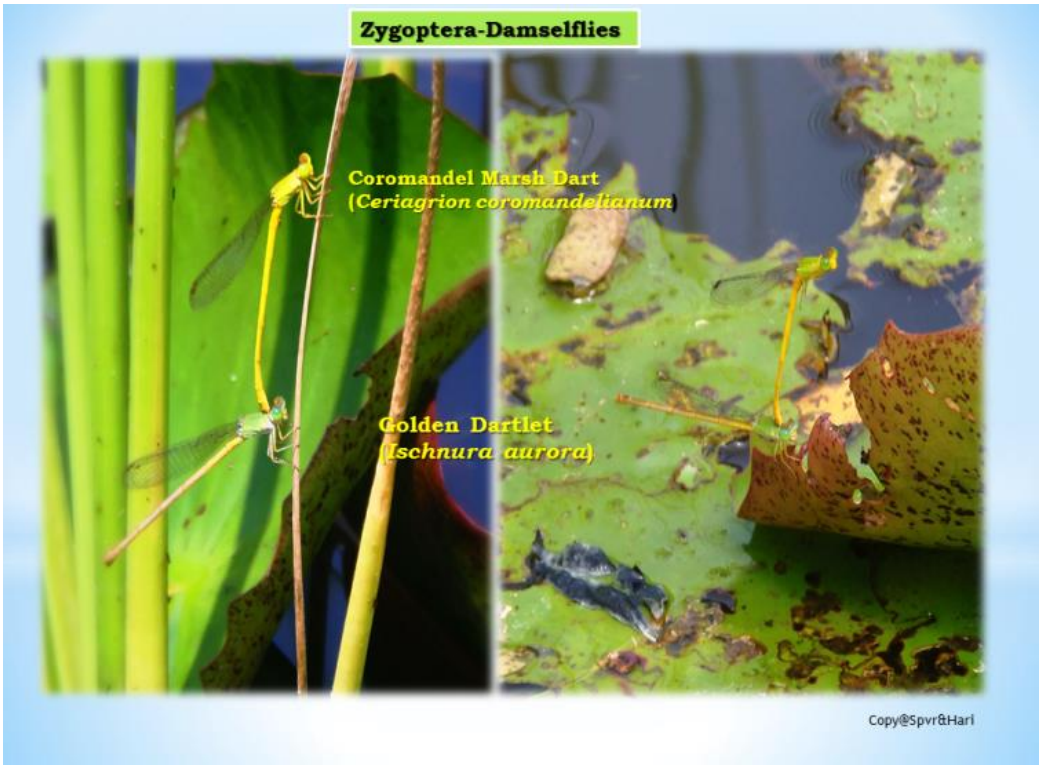
Harinath et al.
Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Figure 10B

Figure 11

Harinath et al.
Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Figure 12



Harinath et al.
Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Figure 13

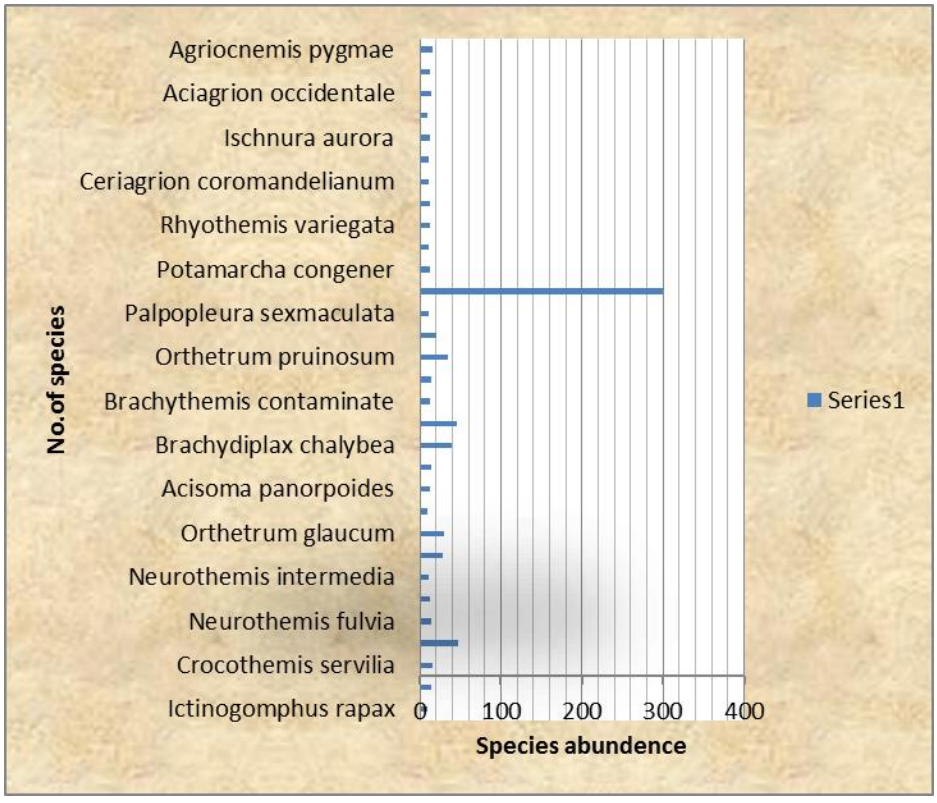
Figure 14

Harinath et al.
Diversity and Abundance of Odonates (Dragonflies & Damselflies) at Sri Lankamalleswara reserve forest in the Eastern Ghats of southern Andhra Pradesh, Species, 2015, 12(34), 52-66,

Figure 15

Figure 16

Number of Odonata Species recorded from different sites of the study area



Harinath et al.
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