

ODONATA (INSECTA) DIVERSITY OF SALIM ALI BIRD SANCTUARY AND ITS ADJACENT AREAS IN THATTEKKAD, KERALA, INDIA

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Odonata are valuable indicators of aquatic and terrestrial ecosystems. Out of 5952 species recorded globally, India possesses 474 species and subspecies of Odonata which belong to 142 genera and 18 families (Subramanian 2014). The Western Ghats, one of the hotspots of biodiversity in India, possesses 53 genera and 107 species of Anisoptera (dragonflies) and 29 genera and 67 species of Zygoptera (damselflies) (Subramanian et al. 2011). Out of the 174 odonata identified in Western Ghats, 31 Dragonflies and 25 Damselflies are endemic (Subramanian et al. 2011). Of this, 139 species belonging to 81 genera and 12 families are recorded from Kerala (Emiliyamma et al. 2012).

There are several studies which document the Odonata of Kerala (Fraser 1933–34; Rao & Lahiri 1982; Emiliyamma & Radhakrishnan 2000, 2002; Prasad & Kulkarni 2001; Radhakrishnan & Emiliyamma 2003; Palot & Sonia 2004; Palot et al. 2005; Emiliyamma et al. 2005, 2007, 2012; Emiliyamma 2005, 2008). However,

a certain lacuna in the occurrence of the Odonata fauna of Kerala still exists.

The Salim Ali Bird Sanctuary and its adjacent areas in Thattekkad, Kerala, India is well known for its low land forests and avifaunal diversity. It is part of a large contiguous forest belt south of the Palakkad gap on the western slope of the Western Ghats, falling within the latitude 10°N and longitude 76–77 °E. The elevation of the area ranges from about 30–523 m. The area is hot and humid being on the western slope of the Western Ghats. Rainfall is received during the southwest and northeast monsoon seasons. The average rainfall recorded is 4000mm. The temperature ranges from 16.1–37 °C. The major forest types occurring in the sanctuary are: tropical evergreen forest (10% of the total area), tropical semi-evergreen forest (10%), tropical moist deciduous forest (60%) and teak, rose wood and mahogany plantations (around 10%). There are patches of grasslands as well as stretches of riparian vegetation (10%) inside the sanctuary.

The sanctuary is bordered by river Periyar on the southwestern side and its tributary Pooyamkutty river on the northern side. A dam was constructed at Bhoothathankettu, 1.5km downstream of Thattekkad, in the Periyar river in 1964. It caused the submergence of all low lying forest and paddy fields. The resultant water bodies have a depth ranging from 5 to 50 feet beyond the river. These water bodies along with the streams and rivers adjacent to the sanctuary were also selected for the study.



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ज्ञान-विज्ञान विमुक्तये



Materials and Methods: Studies on odonate diversity were made by visiting various localities in the study area at weekly intervals from 2010 to 2012. Ovumkal and Urulanthanny forest streams and water bodies such as, Koottikkal, Marottichal, Ovumkal and Kolambay were the localities selected inside the protected area (10°07'48.5"N & 76°41'16.2"E). In addition, forest streams and rivers in neighbouring areas such as Pooyamkutty (10°09'47.1"N & 76°47'09.0"E), Pinavurkudy (10°06'24.4"N & 76°47'15.8"E), Neriamangalam (10°06'21.1"N & 76°47'11.1"E) and Karimanal (10°00'59.7"N & 76°51'15.1"E) and adjacent water bodies of the Bhoothathankettu reservoir were also selected (Fig. 1). Opportunistic observations were made for documenting the adults of Odonata. Species were photographed in the field. In certain cases, adults were collected and after recording morphological details, measurements and photographs, the individuals were freed. The specimens were identified by following Fraser (1933, 1934, 1936), Subramanian (2008, 2014) and Emiliyamma et al. (2005, 2007).

Results and Discussion: A total of 82 species belonging to 55 genera and 13 families were recorded

during the entire study (Table 1). Out of this, 51 species belong to (39 genera and 4 families) Anisoptera, and 31 species belong to (19 genera and 7 families) Zygoptera. Libullilidae family is represented by 28 genera and 38 species. Gomphidae (9 genera) and Coenagrionidae (5 genera) are represented by nine and 12 species, respectively. Platycnemididae (4 genera) family is represented by seven species. Aeshnidae (2 genera), Platystictidae (2 genera) Calopterygidae (2 genera) and Chlorocyphidae (2 genera) families are represented by three species each. Euphaeidae (2 genera) family is represented by two species. Macromiidae (1 genus) and Lestidae (1 genus) families are represented by a single species each.

Of the total Odonata, 21 species are endemic to the Western Ghats (Table 1). *Burmagomphus laidlawi* Fraser, 1924, *Davidioides martini* Fraser, 1924, *Gomphidia kodaguensis* Fraser, 1923, *Megalogomphus hanningtoni* (Fraser, 1923), *Merogomphus longistigma* (Fraser, 1922), *Microgomphus souteri* Fraser, 1924, *Onychogomphus striatus* Fraser, 1924, *Idionyx saffronata* Fraser, 1924, *Macromedia donaldi* (Fraser, 1924), *Macromia annimalaiensis* Fraser, 1931 and *Epithemis*



Figure 1. Localities selected for the study

mariae (Laidlaw, 1915) were the endemic dragonflies recorded from the area. *Agriocnemis keralaensis* Peters, 1981, *Pseudagrion indicum* Fraser, 1924, *Caconeura risi* (Fraser, 1931), *Esme longistyla* Fraser, 1931, *Esme mudiensis* Fraser, 1922, *Protosticta gravelyi* Laidlaw, 1915, *Protosticta sanguinostigma* Fraser, 1922, *Platysticta deccanensis* Laidlaw, 1915, *Calocypha laidlawi* (Fraser, 1924) and *Euphaea fraseri* (Laidlaw, 1920) are the endemic damselflies identified during the study.

Gomphidae had the most endemic species of all the families. Out of the nine species recorded, seven species are endemic. *O. striatus* Fraser, 1924 and *B. laidlawi* Fraser, 1924 were recorded for the first time from the state of Kerala. Several individuals of *B. laidlawi* Fraser, 1924 were observed along the forest streams of Neriamangalam. One male individual of *O. striatus* Fraser, 1924 was recorded from the Periyar river in Karimanal. *M. souteri* Fraser, 1924 had been reported for the first time from Kerala by Emiliyamma et al. (2012) from Aralam Wildlife Sanctuary, but this species was recorded from Neriamangalam during the study. *M. hanningtoni* (Fraser, 1923) was included in the nearly threatened (Subramanian et al. 2011). *M. longistigma* (Fraser, 1922) was found to be a common species along the forest streams. Rare species such as *D. martini* Fraser, 1924, and *G. kodaguensis* Fraser, 1923 were also seen along the forest streams of Pooyamkutty and Neriamangalam.

Endemic species such as *M. donaldi* (Fraser, 1924) and *M. annaimalaiensis* Fraser, 1931 were recorded only once in Neriamangalam. *I. saffronata* Fraser, 1924 was recorded from two localities. *E. mariae* (Laidlaw, 1915) was restricted to a forest swamp near Urulanthanny.

Species such as *C. risi* (Fraser, 1931), *E. longistyla* Fraser, 1931, *E. mudiensis* Fraser, 1931 were the endemic Platycnemididae damselflies recorded. *C. risi* (Fraser, 1931) was reported previously from Thamaracherry, Calicut district and Kottayam District alone (Emiliyamma 2005). The study recorded this species from three localities such as Pooyamkutty, Urulanthanny and Karimanal. *E. longistyla* Fraser, 1931 was previously reported from the north of the Palakkad Gap to Dakshina Kannada. But this species was also identified from Pooyamkutty and Neriamangalam. *E. mudiensis* Fraser, 1931 was recorded from the hill streams of Urulanthanny and Neriamangalam.

All the three species identified from the family Platystictidae are endemic. Vulnerable species such as *P. deccanensis* Laidlaw, 1915 and *P. sanguinostigma* Fraser, 1922 (Subramanian et al. 2011) were found to be

locality specific. Of these, *P. deccanensis* Laidlaw, 1915 had been previously reported from a few locations in Kodagu, Thrissur, Ernakulam and Thiruvananthapuram districts only (Subramanian et al. 2011). But this species was sighted in a hill stream in Pinavurkudy. *P. sanguinostigma* Fraser, 1922 has been reported from a few localities in southern Western Ghats (Subramanian et al. 2011) but a good number of individuals of this species were located in the Neriamangalam stream. *P. gravelyi* Laidlaw, 1915 another endemic species of the family was identified from six localities in the study area along the forest streams.

C. laidlawi (Fraser, 1924) had been previously reported from Myristica swamps of Nilgiri-Wyanad-Kodagu region, north of the Palakkad Gap, and Kollam District only (Subramanian et al. 2011). This species was sighted at Mlavana in the Pooyamkutty River. *A. keralaensis* Peters, 1981 had been reported so far from Thiruvananthapuram, Kottayam and Kuttanad (Emiliyamma 2005, Raju 2007) but this was identified as a common species along the marshy areas. *P. indicum* Fraser, 1924 was a common species across the water bodies of Thattekkad. *E. fraseri* (Laidlaw, 1920) was recorded from the forest streams of Urulanthanny, Pooyamkutty and Neriamangalam.

The family Libellulidae is the most species-rich and widely distributed family. Out of the 38 species, 30 species were found across the water bodies selected for the study. However, families like Gomphidae, and Macromiidae were confined to the forest streams and rivers. Dragonflies such as *Neurothemis tullia* (Drury, 1773), *Orthetrum sabina* (Drury, 1770), *Pantala flavescens* (Fabricius, 1798), *Trithemis aurora* (Burmeister, 1839) and *Diplacodes trivialis* (Rambur, 1842) were the wide spread and common species. *Tetrathemis platyptera* Selys, 1878 and *Hylaeothemis indica* Fraser, 1946 were restricted to one or two habitats inside the forest. *Ictinogomphus rapax* (Rambur, 1842) was the commonest Gomphid species found across forest streams and water bodies.

Damselflies of the family Coenagrionidae were widely distributed in all the localities selected. The Platystictidae family was found only in streams running through the forest. Calopterygidae, Euphaeidae and Chlorocyphidae families were recorded from the rivers. *Pseudagrion microcephalum* (Rambur, 1842), *P. indicum* Fraser, 1924 and *Copera vittata* Selys, 1863 were recorded as the abundant species across the localities selected.

Species diversity varied across the localities selected for the study. High species diversity was observed in

Table 1. Checklist of Odonata of Thattekkad

	Suborder: Family	Species
1	Zygoptera: Lestidae	<i>Lestes praemorsus</i> Hagen in Selys, 1862
2	Zygoptera: Platystictidae	<i>Platysticta deccanensis</i> Laidlaw, 1915*
3	Zygoptera: Platystictidae	<i>Protosticta graveleyi</i> Laidlaw, 1915*
4	Zygoptera: Platystictidae	<i>Protosticta sanguinostigma</i> Fraser, 1922*
5	Zygoptera: Calopterygidae	<i>Neurobasis chinensis</i> (Linnaeus, 1758)
6	Zygoptera: Calopterygidae	<i>Vestalis apicalis</i> Selys, 1873
7	Zygoptera: Calopterygidae	<i>Vestalis gracilis</i> (Rambur, 1842)
8	Zygoptera: Chlorocyphidae	<i>Calocypha laidlawi</i> (Fraser, 1924) *
9	Zygoptera: Chlorocyphidae	<i>Heliocypha bisignata</i> Hagen in Selys, 1853
10	Zygoptera: Chlorocyphidae	<i>Libellago lineata</i> (Burmeister, 1839)
11	Zygoptera: Euphaeidae	<i>Dysphaea ethela</i> Fraser, 1924
12	Zygoptera: Euphaeidae	<i>Euphaea fraseri</i> (Laidlaw, 1920)*
13	Zygoptera: Platycnemididae	<i>Copera marginipes</i> (Rambur, 1842)
14	Zygoptera: Platycnemididae	<i>Copera vittata</i> Selys, 1863
15	Zygoptera: Platycnemididae	<i>Caconeura ramburi</i> (Fraser, 1922)
16	Zygoptera: Platycnemididae	<i>Caconeura risi</i> (Fraser, 1931)*
17	Zygoptera: Platycnemididae	<i>Esmé longistyla</i> Fraser, 1931*
18	Zygoptera: Platycnemididae	<i>Esmé mudiensis</i> Fraser, 1931*
19	Zygoptera: Platycnemididae	<i>Prodasineura verticalis</i> (Selys, 1860)
20	Zygoptera: Coenagrionidae	<i>Agriocnemis keralensis</i> Peters, 1981*
21	Zygoptera: Coenagrionidae	<i>Agriocnemis pieris</i> Laidlaw, 1919
22	Zygoptera: Coenagrionidae	<i>Agriocnemis pygmaea</i> (Rambur, 1842)
23	Zygoptera: Coenagrionidae	<i>Agriocnemis splendissima</i> Laidlaw, 1919
24	Zygoptera: Coenagrionidae	<i>Ceriagrion cerinorubellum</i> (Brauer, 1865)
25	Zygoptera: Coenagrionidae	<i>Ceriagrion coromandelianum</i> (Fabricius, 1798)
26	Zygoptera: Coenagrionidae	<i>Ceriagrion rubiae</i> Laidlaw, 1916
27	Zygoptera: Coenagrionidae	<i>Ischnura aurora</i> (Brauer, 1865)
28	Zygoptera: Coenagrionidae	<i>Mortonagrion varralli</i> Fraser, 1920
29	Zygoptera: Coenagrionidae	<i>Pseudagrion indicum</i> Fraser, 1924*
30	Zygoptera: Coenagrionidae	<i>Pseudagrion microcephalum</i> (Rambur, 1842)
31	Zygoptera: Coenagrionidae	<i>Pseudagrion rubriceps</i> Selys, 1876
32	Anisoptera: Aeshnidae	<i>Anax immaculifrons</i> Rambur, 1842
33	Anisoptera: Aeshnidae	<i>Gynacantha bayadera</i> Selys, 1891
34	Anisoptera: Aeshnidae	<i>Gynacantha dravida</i> Lieftinck, 1960
35	Anisoptera: Gomphidae	<i>Burmagomphus laidlawi</i> Fraser, 1924*
36	Anisoptera: Gomphidae	<i>Davidioides martini</i> Fraser, 1924*
37	Anisoptera: Gomphidae	<i>Gomphidia kodaguensis</i> Fraser, 1923*
38	Anisoptera: Gomphidae	<i>Ictinogomphus rapax</i> (Rambur, 1842)
39	Anisoptera: Gomphidae	<i>Megalogomphus hannyngroni</i> (Fraser, 1923)*
40	Anisoptera: Gomphidae	<i>Merogomphus longistigma</i> (Fraser, 1922) *
41	Anisoptera: Gomphidae	<i>Microgomphus souteri</i> Fraser, 1924*

	Suborder: Family	Species
42	Anisoptera: Gomphidae	<i>Onychogomphus striatus</i> Fraser, 1924*
43	Anisoptera: Gomphidae	<i>Paragomphus lineatus</i> (Selys, 1850)
44	Anisoptera: Macromiidae	<i>Macromia annaimalaiensis</i> Fraser, 1931*
45	Anisoptera: Libellulidae	<i>Acisoma panorpoides</i> Rambur, 1842
46	Anisoptera: Libellulidae	<i>Aethriamanta brevipennis</i> (Rambur, 1842)
47	Anisoptera: Libellulidae	<i>Brachydiplax chalybea</i> Brauer, 1868
48	Anisoptera: Libellulidae	<i>Brachydiplax sobrina</i> (Rambur, 1842)
49	Anisoptera: Libellulidae	<i>Brachythemis contaminata</i> (Fabricius, 1793)
50	Anisoptera: Libellulidae	<i>Bradinyopyga geminata</i> (Rambur, 1842)
51	Anisoptera: Libellulidae	<i>Cratilla lineata</i> Foerster, 1903
52	Anisoptera: Libellulidae	<i>Crocothemis servilia</i> (Drury, 1770)
53	Anisoptera: Libellulidae	<i>Diplacodes nebulosa</i> (Fabricius, 1793)
54	Anisoptera: Libellulidae	<i>Diplacodes trivialis</i> (Rambur, 1842)
55	Anisoptera: Libellulidae	<i>Epithemis mariae</i> (Laidlaw, 1915)*
56	Anisoptera: Libellulidae	<i>Hydrobasileus croceus</i> (Brauer, 1867)
57	Anisoptera: Libellulidae	<i>Hylaeothemis indica</i> Fraser, 1946
58	Anisoptera: Libellulidae	<i>Lathrecista asiatica</i> (Fabricius, 1798)
59	Anisoptera: Libellulidae	<i>Neurothemis fulvia</i> (Drury, 1773)
60	Anisoptera: Libellulidae	<i>Neurothemis tullia</i> (Drury, 1773)
61	Anisoptera: Libellulidae	<i>Onychothemis testacea</i> Laidlaw, 1902
62	Anisoptera: Libellulidae	<i>Orthetrum chrysis</i> (Selys, 1891)
63	Anisoptera: Libellulidae	<i>Orthetrum glaucum</i> (Brauer, 1865)
64	Anisoptera: Libellulidae	<i>Orthetrum luzonicum</i> (Brauer, 1868)
65	Anisoptera: Libellulidae	<i>Orthetrum pruinosum</i> (Burmeister, 1839)
66	Anisoptera: Libellulidae	<i>Orthetrum sabina</i> (Drury, 1770)
67	Anisoptera: Libellulidae	<i>Orthetrum triangulare</i> (Selys, 1878)
68	Anisoptera: Libellulidae	<i>Pantala flavescens</i> (Fabricius, 1798)
69	Anisoptera: Libellulidae	<i>Potamarcha congener</i> (Rambur, 1842)
70	Anisoptera: Libellulidae	<i>Rhodothemis rufa</i> (Rambur, 1842)
71	Anisoptera: Libellulidae	<i>Rhyothemis variegata</i> (Linnaeus, 1763)
72	Anisoptera: Libellulidae	<i>Tetrathemis platyptera</i> Selys, 1878
73	Anisoptera: Libellulidae	<i>Thalymis tillagra</i> (Fabricius, 1798)
74	Anisoptera: Libellulidae	<i>Tramea limbata</i> (Desjardins, 1832)
75	Anisoptera: Libellulidae	<i>Trithemis aurora</i> (Burmeister, 1839)
76	Anisoptera: Libellulidae	<i>Trithemis festiva</i> (Rambur, 1842)
77	Anisoptera: Libellulidae	<i>Trithemis pallidinervis</i> (Kirby, 1889)
78	Anisoptera: Libellulidae	<i>Urothemis signata</i> (Rambur, 1842)
79	Anisoptera: Libellulidae	<i>Zygonyx iris</i> Selys, 1869
80	Anisoptera: Libellulidae	<i>Zyxomma petiolatum</i> Rambur, 1842
81	Anisoptera: Insertae sedis	<i>Idionyx saffronata</i> Fraser, 1924 *
82	Anisoptera: Insertae sedis	<i>Macromedia donaldi</i> (Fraser, 1924)*

* - endemic species



Image 1. *Macromedia donaldi*



Image 2. *Burmagomphus laidlawi*



Image 3. *Davidioides martini*



Image 4. *Gomphidia kodaguensis*



Image 5. *Megalogomphus hannyingtoni*



Image 6. *Merogomphus longistigma*

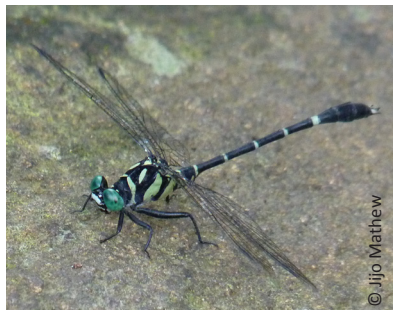


Image 7. *Microgomphus souteri*



Image 8. *Onychogomphus striatus*



Image 9. *Epithemis mariae*



Image 10. *Macromia annaimalaiensis*



Image 11. *Calocypha laidlawi*



Image 12. *Agriocnemis keralensis*



Image 13. *Pseudagrion indicum*



Image 14. *Euphaea fraseri*



Image 15. *Platysticta deccanensis*



Image 16. *Caconeura risi*



Image 17. *Protosticta sanguinostigma*



Image 18. *Protosticta gaveli*



Image 19. *Esme longistyla*



Image 20. *Esme mudiensis*

the water bodies of the Bhoothathankettu dam. But most of the endemic species observed were found only in streams and rivers running through the forests. The streams and rivers outside the forest area had low species diversity and endemism.

It was observed that the water bodies were drained out during June to November which created a number of problems for the aquatic habitat of the area. The

study clearly indicated that the water bodies support the aquatic flora and fauna only for a period of six months from December to May. An abundance of Odonata were also observed during these months in the water bodies. More studies and management efforts are required to maintain a stable population of Odonata in Salim Ali Bird Sanctuary, Thattakkad, Kerala.

Conclusion: The study results in the identification of

82 species of Odonata out of which 51 species belong to dragonflies and 31 belong to damselflies. Twenty-one species are endemic to the Western Ghats (Images 1–21). The occurrence of IUCN categorized near threatened species like *M. hanningtoni* (Fraser, 1923) and vulnerable species like *P. deccanensis* Laidlaw, 1915 and *P. sanguinostigma* Fraser, 1922 were remarkable. The area was found to be rich in odonate diversity. More studies are needed to understand the population dynamics and seasonal patterns of Odonata in this particular geographical area.

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