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Cover: Life and death in one night - wolf hunting the hare. Mixed media—gouache, acrylics, pen & colour pencils. © Dupati Poojitha.

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COMMUNICATION

A preliminary study of odonate fauna in the high ranges of Munnar, southern Western Ghats, India

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Abstract: A study was conducted at Munnar Forest Division Idukki District, Kerala, the southern Western Ghats, to assess the diversity of odonates. Around 44 species of odonates, which include 29 species of Anisoptera (dragonflies) and 15 species of Zygoptera (damselflies). The odonate diversity of Munnar Forest Division accounted for 24.72 % of the odonates in Kerala and 22.45 % of the odonates of the Western Ghats. The study highlights the importance of biodiversity documentation at high altitudes in the Western Ghats.

Keywords: Anisoptera, biodiversity, ecosystem, endemic, Idukki District, Kerala, Odonata, pre-monsoon, Zygoptera.

Malayalam: പശ്ചിമഘട്ടമലനിരകളുടെ ഭാഗമായ ഇടുക്കി ജില്ലയിലെ മൂന്നാർ ഫോറസ്റ്റ് ഡിവിഷനിൽ തുമ്പികളുടെ വൈവിധ്യം വിലയിരുത്തുന്നതിനായി ഒരു പഠനം നടത്തുകയുണ്ടായി. 44 വിവിധയിനം തുമ്പികളെ ഈ പഠനത്തിന്റെ ഭാഗമായി കണ്ടെത്തുകയുണ്ടായി. അതിൽ 29 ഇനം കല്ലൻതുമ്പികളുടെ (അനിസോപ്റ്റെറ) വിഭാഗത്തിലും 15 ഇനം സൂചിത്തുമ്പികളുടെ (സൈഗോപ്റ്റെറ) വിഭാഗത്തിലും ഉൾപ്പെടുന്നു. മൂന്നാർ വനം ഡിവിഷനിൽ കേരളത്തിലെ മൊത്തം തുമ്പിവൈവിധ്യത്തിന്റെ 24.72%, പശ്ചിമഘട്ടത്തിലെ മൊത്തം തുമ്പിവൈവിധ്യത്തിന്റെ 22.45% കാണപ്പെടുന്നു. കേരളത്തിലെ തുമ്പികളുടെ സംരക്ഷണവുമായി ബന്ധപ്പെട്ടു പ്രാധാന്യമർഹിക്കുന്ന ഒരു മേഖലയാണ് മൂന്നാർ എന്ന് ഈ പഠനം സൂചിപ്പിക്കുന്നത്.

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Author contributions: TSK—fieldwork, analysis and manuscript preparation. NN—fieldwork and analysis. AR—fieldwork and analysis. PON—principal supervisor throughout the project work and guidance during manuscript preparation.

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INTRODUCTION

The order Odonata is one of the fascinating groups of winged insects which comprises both dragonflies and damselflies (Grimaldi & Engel 2005). They act as an important top predator at both larval and adult stages and hence form an important tool for various types of assessments and monitoring, such as measures of biodiversity, wetland health, integrity, and the biological impact of climate change. There are over 6,376 odonate species known worldwide (Paulson et al. 2022), 493 in India, 196 in the Western Ghats (Subramanian & Babu 2020), and 178 in Kerala (Chandran et al. 2022; Society for Odonate Studies 2022). The 178 species of odonates of Kerala belong to 87 genera in two suborders and 14 families (Chandran et al. 2022; Society for Odonate Studies 2022), and 68 species are endemic to the Western Ghats.

Studies on odonates of the Western Ghats are far and in between. These include the studies by Mathavan & Miller (1989) who reported 36 species of odonates from Periyar Tiger Reserve, Idukki District, Kerala; 29 species of odonates were recorded from Silent Valley and New Amarambalam Reserved Forests in Kerala by Rao & Lahiri (1982), Emiliyamma & Radhakrishnan (2000), recorded 25 species of odonates from Parambikulam Wildlife Sanctuary, Palakkad dt. Kerala, Adarsh et al. (2015) recorded 48 species of odonates from Chinnar Wildlife Sanctuary, Idukki District, Kerala and Sadasivan et al. (2022) recorded 116 species of odonates from Shendurney Wildlife Sanctuary, Kollam District, Kerala. The present paper summarises the findings of odonates from Munnar Forest Division conducted during the pre-monsoon months: February to May 2022.

Study Area

The Munnar Forest Division is located in the high ranges of the southern Western Ghats. It consists of four ranges, namely Munnar Range, Devikulam Range, Adimaly Range, and Neriamangalam Range with a total area of 892.707 km². The study focused on the hilly regions (>1100 m) of the Munnar Forest Division, which majorly included the Munnar and Devikulam Ranges. The study area is located between 10.067–10.167 ^{0}N & 77.083–77.167 ^{0}E (Figure 1). The details of the study localities are given in Table 1.

The topography of the study area is hilly with undulating terrain. The altitude varies from 33 m near Palamattom on the bank of the river Periyar in the Neriamangalam Range to Anamudi (2,695 m) in the Munnar Range. The average annual rainfall of the region is about 3,000 mm, and it receives both southwestern and northeastern monsoons. Temperatures range 6–35 °C, and the climate is more or less temperate in high-altitude areas. The air is highly humid throughout the year, and the relative humidity is about 80 % and above (Kerala Forest and Wildlife Department 2011).

The Munnar Forest Division consists of different habitat types, which include, west coast tropical evergreen forest, west coast semi-evergreen forest, southern moist mixed deciduous forest, southern montane wet grasslands, the southern montane wet temperate forest along with tea plantations, eucalyptus plantations, cardamom hill reserves, and wattle plantations (Kerala Forest and Wildlife Department 2011).

METHODS

The study was carried out in the pre-monsoon months from February 2022 to May 2022 at selected high-altitude sites (above 1,100 m) in the Munnar Forest Division. The field was categorized into seven habitats, and three sites were randomly selected from each habitat for surveying (21 sites in total). The habitats include grassland, eucalyptus plantation, shola forest (southern montane wet temperate forest), wattle plantations, pond and riverine ecosystem, Cardamom Hill Reserve (evergreen), and tea plantation. A single field visit was made to each of the three sites in each of the seven habitats between 0900 and 1300 h when odonate activity was at its peak. The belt transect method (Kulkarni et al. 2013) was done to document odonates and a 500 m transect line having a width of 10 m was taken on each site. The transect and the coordinates were taken using a mobile application called 'Geotracker' (https://geo-tracker.org/).

Collection and killing were avoided for species identification. Observed odonates were photo-documented using a Nikon COOLPIX P900 and a Nikon D5600 DSLR camera with a 70–300 mm lens. Most of the species were identified on the spot by close observation and later confirmed using taxonomic monographs of Fraser (1933, 1934, 1936) and field guides (Subramanian 2009; Kiran & Raju 2013). The taxonomy and nomenclature that have been used are as per Kalkman et al. (2020). The odonates observed during the study period were categorized into five groups based on their relative abundance. Accordingly, those species which were sighted 80–100 % of the survey days were categorized as very common (VC), 60–79 % as common (C), 40–59 % as occasional (O), 20–39 % as rare (R), and

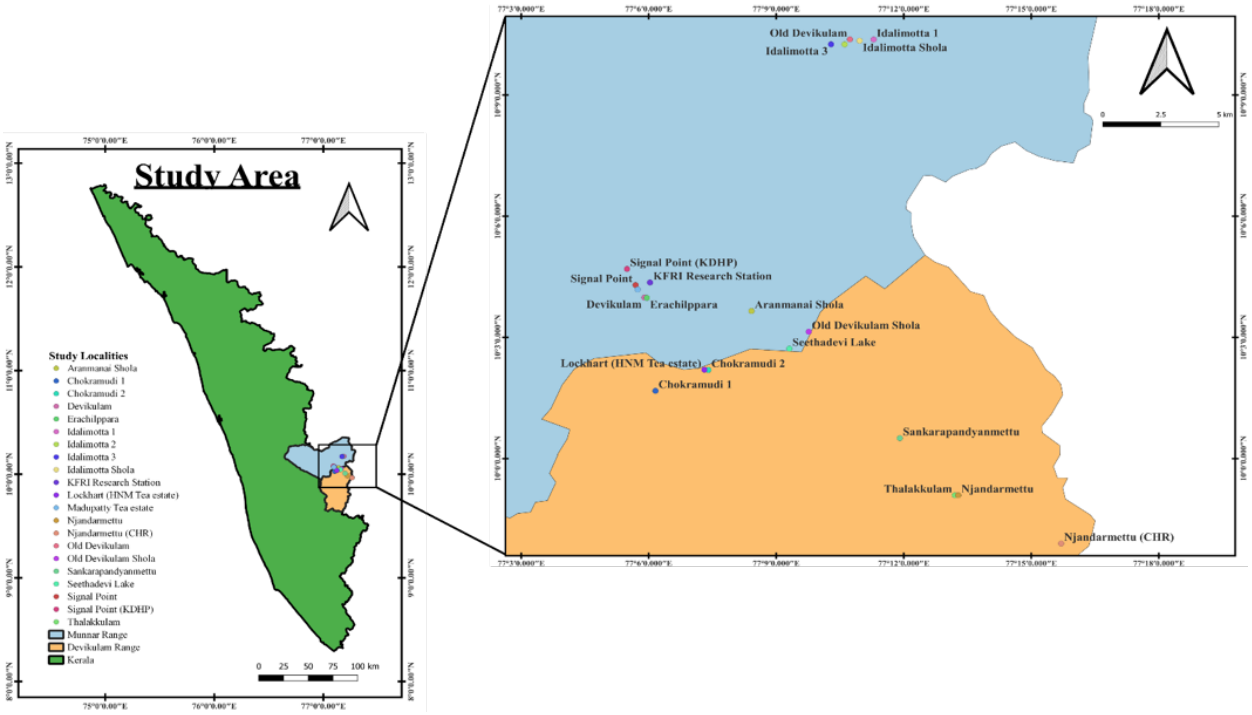

Figure 1. Study locations from the present survey.
HNM Tea estate—Harrisons Malayalam Tea estate | CHR—Cardamom Hill Reserve | KDHP—Kannan Devan Hills Plantation.

very rare (VR) for those that were sighted less than 20% of the field days. The species richness and abundance were recorded and Simpson & Shannon diversity indices and evenness values were also calculated using PAST software.

RESULTS AND DISCUSSION

The study has encompassed 44 species of odonates, which include 29 species of Anisoptera (Dragonflies) and 15 species of Zygoptera (Damselflies) spread across eight families (Table 2). The family Libellulidae was the most dominant in Anisoptera with 24 species, followed by Aeshnidae (3), Macromiidae (1), and Gomphidae (1). Among Zygoptera, Coenagrionidae (9) was the dominant family, followed by Lestidae (3), Platycnemididae (2), and Chlorocyphidae (1). Family-wise species richness of odonates (both Anisoptera and Zygoptera) along with their relative abundance is given in Figure 2.

The distribution of odonates in the study area was classified into seven different habitat types. Habitat-wise distribution and species diversity of odonates in the Munnar Forest Division are given in Table 3. Maximum species richness was observed in the pond and riverine ecosystem (26 species), followed by eucalyptus plantation (17 species), Cardamom Hill Reserve (11 species), wattle infested areas (8), grassland (6 species), shola forest (6 species), and tea plantation (5). The species abundance was maximum in the pond and riverine ecosystem and minimum in the shola forest.

The Simpson & Shannon diversity indices and evenness values of the seven habitats were calculated (Table 4). In this study, the value of the Gini Simpson's index ranged 0.794–0.932 in different habitats. The Simpson index showed the maximum value for the pond and riverine ecosystem (0.932) and the minimum value for grassland (0.794). Hence, species diversity is high in pond and riverine ecosystem habitats. The value of the Shannon Weiner index for different habitats range 1.47–2.87, with the maximum value shown by pond and riverine ecosystem and the minimum by tea plantation. As a result, pond and riverine ecosystems have the highest species richness and evenness.

Out of the 44 species recorded, four of the odonate species are endemic, two to the Western Ghats, one to peninsular India, and one to India. *Esme cyaneovittata* and *Esme mudiensis* are endemic to the Western Ghats, *Heliocypha bisignata* is endemic to peninsular India and *Hylaeothemis apicalis* is endemic to India. There are 196 species of odonates in the Western Ghats and 178 species of odonates in Kerala. Considering the total

Table 1. Details of the study localities at Munnar Forest Division.

	Habitat	Coordinates	Altitude (m)	Weather	Temperature (°C)	Humidity (%)
1	**Grassland**					
	a) Chokramudi 1	10.028 °N & 77.102 °E	1,736	Sunny	25	48
	b) Old Devikulam 2	10.173 °N & 77.179 °E	1,788	Sunny	23	47
	c) Chokramudi 2	10.036 °N & 77.123 °E	1,736	Sunny	25	48
2	**Eucalyptus plantation**					
	a) Devikulam	10.067 °N & 77.098 °E	1,615	Cloudy	24	68
	b) KFRI Research Station	10.072 °N & 77.100 °E	1,594	Partly Cloudy	22	63
	c) Signal Point	10.071 °N & 77.095 °E	1,522	Sunny	24	47
3	**Shola forest**					
	a) Aranmanai Shola	10.061 °N & 77.140 °E	1,676	Sunny	22	51
	b) Old Devikulam Shola	10.052 °N & 77.163 °E	1,801	Sunny	23	47
	c) Idalimotta Shola	10.172 °N & 77.183 °E	2,239	Cloudy	19	68
4	**Wattle infested area**					
	a) Idalimotta 1	10.173 °N & 77.188 °E	2,190	Cloudy	17	95
	b) Idalimotta 2	10.171 °N & 77.177 °E	2,372	Cloudy	17	95
	c) Idalimotta 3	10.171 °N & 77.171 °E	2,387	Cloudy	17	95
5	**Pond and riverine ecosystem**					
	a) Erachilppara	10.066 °N & 77.099 °E	1,615	Partly cloudy	21	72
	b) Seethadevi Lake	10.045 °N & 77.155 °E	1,762	Sunny	24	42
	c) Njandarmettu (CHR)	9.965 °N & 77.261 °E	1,143	Cloudy	22	81
6	**Cardamom Hill Reserve**					
	a)Thalakkulam	9.985 °N & 77.220 °E	1,254	Cloudy	22	81
	b)Njandarmettu	9.985 °N & 77.221 °E	1,143	Cloudy	24	75
	c)Sankarapandyanmettu	10.008 °N & 77.199 °E	1,249	Cloudy	23	75
7	**Tea plantation**					
	a) Signal Point (KDHP)	10.078 °N & 77.091 °E	1,537	Partly Cloudy	23	63
	b) Lockhart (HNM Tea estate)	10.036 °N & 77.122 °E	1,518	Sunny	22	66
	c) Madupatty Tea estate	10.069 °N & 77.096 °E	1,630	Cloudy	24	68

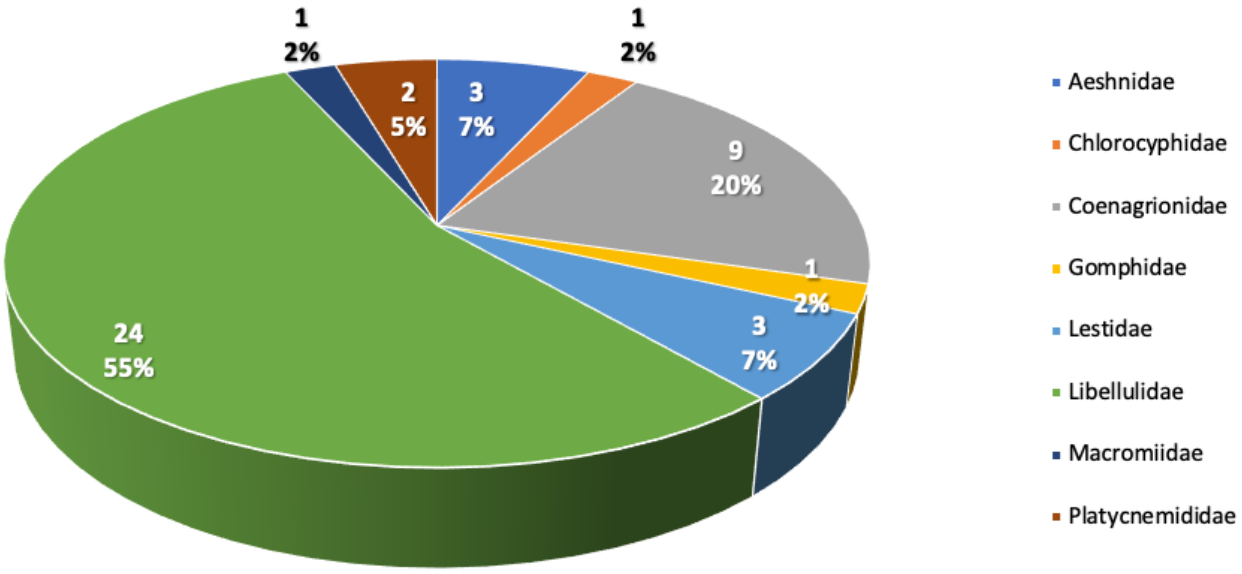

Figure 2. Family-wise species richness and relative abundance of odonates in Munnar Forest Division.

number of species of Odonates in Kerala, the present study accounted for 24.72 % of the odonates in Kerala and 22.45 % of the odonates of the Western Ghats. None of the odonate species from the region is protected under the Indian Wildlife Protection Act (WPA) of 1972. According to the IUCN Red List 2022, one species is staged under the 'Not Evaluated' category, four species under the 'Data Deficient' category, and the remaining 39 species are staged under the 'Least Concern' category, which implies that none of the species from the present study is listed as a threatened species.

Due to their amphibious life history, relatively short generation time, high trophic position, and diversity, the order Odonata is considered an important component

Table 2. Checklist of odonates recorded from the study habitats of Munnar Forest Division, Idukki, Kerala, southern Western Ghats.

	Family/Scientific name	Endemicity	IUCN status	Abundance	Study habitats
A.	**Zygoptera (Damselflies)**				
	Coenagrionidae				
1	*Aciagrion approximans krishna* Fraser, 1921		LC	R	P, C
2	*Aciagrion occidentale* Laidlaw, 1919		LC	O	E, P, C
3	*Agriocnemis pieris* Laidlaw, 1919		LC	R	E, W
4	*Agriocnemis pygmaea* (Rambur, 1842)		LC	VR	P
5	*Ceriagrion coromandelianum* (Fabricius, 1798)		LC	VR	P
6	*Ischnura rubilio* Selys, 1876		NE	VR	P
7	*Ischnura senegalensis* (Rambur, 1842)		LC	R	G, P
8	*Pseudagrion microcephalum* (Rambur, 1842)		LC	VR	P
9	*Pseudagrion rubriceps* Selys, 1876		LC	VR	P
	Platycnemididae				
10	*Esme cyaneovittata* Fraser, 1922	EN WG	DD	VR	S
11	*Esme mudiensis* Fraser, 1931	EN WG	DD	VR	S
	Chlorocyphidae				
12	*Heliocypha bisignata* (Hagen in Selys, 1853)	EN P	LC	VR	S
	Lestidae				
13	*Indolestes gracilis davenporti* (Fraser, 1930)		LC	VC	G, E, W, P, C, T
14	*Lestes dorothea* Fraser, 1924		LC	VR	P
15	*Lestes elatus* Hagen in Selys, 1862		LC	VR	P
B.	**Anisoptera (Dragonflies)**				
	Aeshnidae				
16	*Anaciaeschna martini* (Selys, 1897)		LC	VR	P
17	*Anax immaculifrons* Rambur, 1842		LC	VR	P
18	*Gynacantha dravida* Lieftinck, 1960		DD	VR	E
	Libellulidae				
19	*Acisoma panorpoides* Rambur, 1842		LC	R	E, T
20	*Brachydiplax chalybea* Brauer, 1868		LC	VR	P
21	*Brachydiplax sobrina* (Rambur, 1842)		LC	O	E, S, W, P
22	*Brachythemis contaminata* (Fabricius, 1793)		LC	R	E, P
23	*Bradinopyga geminata* (Rambur, 1842)		LC	O	G, E, T
24	*Crocothemis servilia* (Drury, 1770)		LC	O	G, E, W, C
25	*Diplacodes trivialis* (Rambur, 1842)		LC	O	E, W, T
26	*Hylaeothemis apicalis* Fraser, 1924	EN I	DD	R	P, C
27	*Orthetrum chrysis* (Selys, 1892)		LC	O	E, W, P, C
28	*Orthetrum glaucum (Brauer, 1865)*		LC	VR	C
29	*Orthetrum luzonicum* (Brauer,1868)		LC	R	G, C
30	*Orthetrum pruinosum* (Burmeister, 1839)		LC	O	E, P, T
31	*Orthetrum sabina* (Drury, 1770)		LC	VR	P
32	*Orthetrum triangulare* (Selys, 1878)		LC	R	W, C
33	*Palpopleura sexmaculata* (Fabricius, 1787)		LC	VR	E
34	*Pantala flavescens* (Fabricius, 1798)		LC	R	G, W
35	*Rhodothemis rufa* (Rambur, 1842)		LC	VR	P
36	*Sympetrum fonscolombii* (Selys, 1840)		LC	VR	S

	Family/Scientific name	Endemicity	IUCN status	Abundance	Study habitats
37	*Tetrathemis platyptera* Selys, 1878		LC	O	E, P, C
38	*Tramea limbata* (Rambur, 1842)		LC	VR	P
39	*Trithemis aurora* (Burmeister, 1839)		LC	VR	E
40	*Trithemis festiva* (Rambur, 1842)		LC	VR	E
41	*Urothemis signata* (Rambur, 1842)		LC	VR	P
42	*Zyxomma petiolatum* Rambur, 184		LC	R	E, P
	Macromiidae				
43	*Epophthalmia vittata* Burmeister, 1839		LC	VR	C
	Gomphidae				
44	*Ictinogomphus rapax* (Rambur,1842)		LC	R	S, P

Legend: EN W—Endemic to Western Ghats | EN P—Endemic to Peninsular India | EN I—Endemic to India.
LC—Least Concern | DD—Data Deficient | NE—Not Evaluated.
G—Grassland | E—Eucalyptus Plantation | S—Shola Forest | W—Wattle Plantation | P—Pond and Riverine Ecosystem | C—Cardamom Hill Reserve | T—Tea Plantation.

Table 3. Habitat-wise distribution of odonates at Munnar Forest Division.

Habitat	Aeshnidae	Chlorocyphidae	Coenagrionidae	Gomphidae	Lestidae	Libellulidae	Macromiidae	Platycnemididae
Grassland	0	0	2	0	7	8	0	0
Eucalyptus Plantation	1	0	6	0	7	23	0	0
Shola Forest	0	2	0	1	0	2	0	3
Wattle Plantation	0	0	2	0	5	9	0	0
Pond and Riverine Ecosystem	2	0	25	1	17	25	0	0
Cardamom Hill Reserve	0	0	7	0	4	15	1	0
Tea Plantation	0	0	0	0	4	7	0	0

Table 4. Species richness and diversity of odonates in high ranges of Munnar Forest division.

Habitats	Grassland	Eucalyptus plantation	Shola forest	Wattle plantation	Pond and riverine Ecosystem	Cardamom Hill Reserve	Tea plantation
Species richness	6	17	6	8	26	11	5
Abundance	17	37	8	16	70	27	11
Species relative abundance	0.14	0.39	0.14	0.18	0.59	0.25	0.11
Shannon's diversity index (H')	1.56	2.53	1.73	1.89	2.87	2.07	1.47
Simpson's diversity index (D)	0.21	0.08	0.07	0.12	0.07	0.131	0.182
Inverse Simpson's diversity index (1/D)	4.86	12.81	14.00	8.00	14.64	7.63	5.50
Gini Simpson's index (1-D)	0.79	0.92	0.93	0.88	0.93	0.87	0.82

of freshwater ecosystems as well as a good indicator of ecosystem health (Corbet 1993). This reiterates the fact that more systematic exploration of biodiversity should be carried out in unexplored regions of the Western Ghats, especially in light of increasing anthropogenic influences and habitat transformations. The present study highlights the existing diversity of unexplored odonate fauna in the high ranges of the Munnar Territorial Division. Major changes in the degradation quality of available habitats could also result in a loss of regional odonate diversity, especially for endemic species. These changes could also have a cascading effect on terrestrial biodiversity.

A previous study on odonates from Chinnar Wildlife Sanctuary (Adarsh et al. 2015), a component of Munnar Wildlife Division, has recorded a total of 48 species of

Image 1–7. Habitat photos: 1—Aranmanai Shola (Shola forest) | 2—Idalimotta (Wattle infested area) | 3—KFRI Research Station (Eucalyptus plantation) | 4—Sankarapandyanmettu (Cardamom hill reserve) | 5—Signal Point (Tea plantation) | 6—Chokramudi (Grassland) | 7—Seethadevi Lake (Pond and riverine ecosystem).

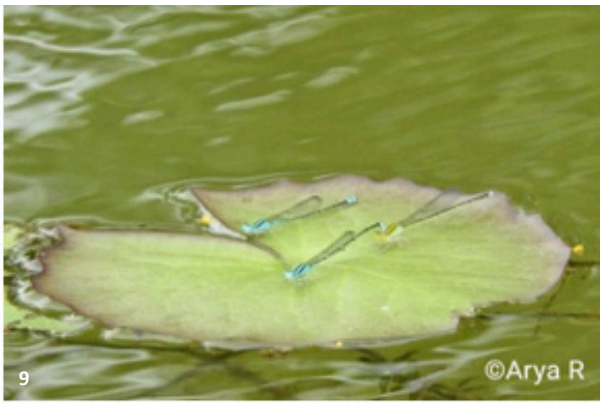

Image 8–15. Odonates photos: 8—*Agriocnemis pygmae* | 9—*Pseudagrion microcephalum* | 10—*Brachidiplax chalybea* | 11—*Orthetrum triangulare* | 12—*Hylaeothemis apicalis* | 13—*Orthetrum glaucum* | 14—*Epophthalmia vittata* | 15—*Diplacodes trivialis*.

Image 16–23. Odonates photos: 16—*Trithemis festiva* | 17—*Sympetrum fonscolombii* | 18—*Orthetrum sabina* | 19—*Palpopleura sexmaculata* | 20—*Anaciaeschna martini* | 21—*Gynacantha dravida* | 22—*Acisoma panorpoides* | 23—*Anax immaculifrons*.

Image 24–31. Odonates photos: 24—*Orthetrum luzonicum* | 25—*Crocothemis servilia* | 26—*Orthetrum chrysis* | 27—*Orthetrum pruinosum* | 28—*Pantala flavescens* | 29—*Brachydiplax sobrina* | 30—*Urothemis signata* | 31—*Rhodothemis rufa*.

odonates, which includes 31 species of dragonflies and 17 species of damselflies. The present study has recorded 14 new records of odonates, which include nine species of dragonflies and five species of damselflies.

The study also highlights the sighting of Martin's Duskhawker *Anaciaeschna martini* (Selys 1897) from wattle-infested areas of Idalimotta (above 2000m), which was previously recorded as a rediscovery from Nilgiris in September 2014 and later from the Munnar region in the Anamalais landscape of the Western Ghats in June 2019 (Sadasivan et al. 2021). The observed individual was a female ovipositing on emergent vegetation and no males were observed guarding or nearby the female. The species was identified by the typical female morphological characteristics of a brownish body with yellowish-green markings on the thorax and a brownish-yellow abdomen, as well as a dark band along the leading edge of the wings. Disturbed habitats such as wattle-infested areas may provide suitable breeding sites and hunting grounds for species like Martin's Duskhawker, which may explain the presence of this locally 'not common' species.

Even though there have been frequent surveys and few published papers (Adarsh et al. 2015; Sadasivan et al. 2021) in the wildlife division of Munnar, currently there are no published papers in Munnar territorial division as far as odonates are concerned. Under the circumstance that no previous research papers have been published under the Munnar territorial division, the present study comes into the light, providing far-reaching information regarding the diversity, distribution, and habitat preference of the recorded odonate species during the pre-monsoon period. The short-term study also acts as a preliminary report on odonates and forms a trail for further studies during the monsoon and post-monsoon months, where a peak in species richness can be expected due to the southwest monsoon.

REFERENCES

Adarsh, C.K., R. Arunraj & P.O. Nameer (2015). Odonata (Insecta) diversity of Chinnar Wildlife Sanctuary, the southern Western Ghats, India. *Journal of Threatened Taxa* 7(2): 6910–6919. https://doi.org/10.11609/JoTT.o3771.6910-9

Chandran, A.V. & K.M. Sherif (2022). Comments on "The Dragonflies and Damselflies (Odonata) of Kerala–Status and Distribution". *Journal of Threatened Taxa* 14(6): 21282–21284. https://doi.org/10.11609/jott.7989.14.6.21282-21284

Corbet, P.S. (1993). Are Odonata useful as bioindicators. *Libellula* 12(3/4): 91–102.

Emiliyamma, K.G. & C. Radhakrishnan (2000). Odonata (Insecta) of Parambikulam Wildlife Sanctuary, Kerala, India. *Records of the Zoological Survey of India* 98(1): 157–167.

Fraser, F.C. (1933). *The Fauna of Britsh-India Including Ceylon and Burma, Odonata. Vol. I*. Taylor and Francis Ltd., London, 436 pp.

Fraser, F.C. (1934). *The Fauna of Britsh-India Including Ceylon and Burma, Odonata. Vol. II*. Taylor and Francis Ltd., London, 442 pp.

Fraser, F.C. (1936). *The Fauna of Britsh-India Including Ceylon and Burma, Odonata. Vol. III*. Taylor and Francis Ltd., London, 461 pp.

Grimaldi, D. & M.S. Engel (2005). *Evolution of the Insects*. Cambridge University Press, New York, 733 pp.

Kalkman, V.J., R. Babu, M. Bedjanič, K. Conniff, T. Gyeltshen, M.K. Khan & A.G. Orr (2020). Checklist of the dragonflies and damselflies (Insecta: Odonata) of Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka. *Zootaxa* 4849(1): 1– 84. https://doi.org/10.11646/zootaxa.4849.1.1

Kerala Forest and Wildlife Department. (2011). Working Plan of Munnar Forest Division. Part I Chapter I, 1–8. http://old.forest.kerala.gov.in/images/wpmunnar/1_tract_wp_mnr.pdf

Kiran, C.G. & D.V. Raju (2013). *Dragonflies and Damselflies of Kerala (Keralathile Thumbikal)*. Tropical Institute of Ecological Sciences, 156 pp.

Kulkarni, A.S. & K.A. Subramanian (2013). Habitat and seasonal distribution of Odonata (Insecta) of Mula and Mutha river basins, Maharashtra, India. *Journal of Threatened Taxa* 5(7): 4084–4095. https://doi.org/10.11609/JoTT.o3253.4084-95

Mathavan, S. & P. L. Miller (1989). A collection of dragonflies (Odonata) made in the Periyar National Park, Kerala, south India, in January, 1988. *Rapid Communications* 10(1): 1–10.

Paulson, D., M. Schorr & C. Deliry (2022). World Odonata List. https://www.pugetsound.edu/academics/academicresources/slater–museum/biodiversity–resources/dragonflies/worldodonata–list2/. Accessed on 20 August 2022.

Rao, R.K. & A.R. Lahiri (1982). First records of odonates (Arthropoda: Insecta) from the Silent Valley and New Amarambalam reserved forests. *Journal of the Bombay Natural History Society* 79(3): 557–562.

Sadasivan, K., M. Sethumadhavan S. Jeevith & B. Kochunarayanan (2021). Rediscovery of Martin's Duskhawker anaciaeschna martini (Selys, 1897) (Odonata: Aeshnidae) from Western Ghats, peninsular India, with notes on its current distribution and oviposition behavior. *Journal of Threatened Taxa* 13(1): 17543–17547. https://doi.org/10.11609/jott.6301.13.1.17543-17547

Sadasivan, K., V.P. Nair & K.A. Samuel (2022). The dragonflies and damselflies (Insecta: Odonata) of Shendurney Wildlife Sanctuary, southern Western Ghats, India. *Journal of Threatened Taxa* 14(6): 21213–21226. https://doi.org/10.11609/jott.7885.14.6.21213-21226

Society for Odonate Studies. (2022). List of odonates of Kerala. https://odonatesociety.org/list-of-odonates-of-kerala/. Accessed on 20 August 2022.

Subramanian, K.A. & R. Babu (2020). Dragonflies and Damselflies (Insecta: Odonata) of India, pp. 29–45. In: Ramani, S., P. Mohanraj & H.M. Yeshwanth (eds.). *Indian Insects: Diversity and Science*. CRC Press, Taylor & Francis Group, London, 450 pp.

Subramanian, K.A. (2009). *Dragonflies and Damselflies of Peninsular India — A Field Guide*. Vigyan Prasar, Noida, India, 168 pp.

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