

OPEN ACCESS



The Journal of Threatened Taxa is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use of articles in any medium, reproduction, and distribution by providing adequate credit to the authors and the source of publication.

Journal of Threatened Taxa

Building evidence for conservation globally

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

COMMUNICATION

ODONATA (INSECTA) DIVERSITY OF KULDIHA WILDLIFE SANCTUARY AND ITS ADJOINING AREAS, ODISHA, EASTERN INDIA

Subrat Debata & Kedar Kumar Swain

26 December 2018 | Vol. 10 | No. 15 | Pages: 12969–12978

10.11609/jott.3463.10.15.12969-12978



For Focus, Scope, Aims, Policies and Guidelines visit <https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-0>

For Article Submission Guidelines visit <https://threatenedtaxa.org/index.php/JoTT/about/submissions#onlineSubmissions>

For Policies against Scientific Misconduct visit <https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-2>

For reprints contact info@threatenedtaxa.org

Partners



المحمد بن زايد
للمحافظة على
الكائنات الحية
The Mohamed bin Zayed
SPECIES CONSERVATION FUND



Member



Publisher & Host





ODONATA (INSECTA) DIVERSITY OF KULDIHA WILDLIFE SANCTUARY AND ITS ADJOINING AREAS, ODISHA, EASTERN INDIA

Subrat Debata¹  & Kedar Kumar Swain² 

¹Aranya Foundation, Plot No-625/12, Mars Villa, Panchasakha Nagar, Dumduma, Bhubaneswar, Odisha 751019, India

²Office of the Divisional Forest Officer, Chandaka Wildlife Division, Gaja Vihar, Bhubaneswar, Odisha 751003, India

¹subrat.debata007@gmail.com (corresponding author), ²kedarswain28@gmail.com

ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

OPEN ACCESS



Abstract: A study was carried out to assess the Odonata fauna of Kuldiha Wildlife Sanctuary, Odisha, eastern India from November 2012 to October 2013. During the study a total of 54 species of odonates including 37 species of dragonflies (Anisoptera) and 17 species of damselflies (Zygoptera) were recorded. Among the dragonflies, the family Libellulidae was well represented with 30 species whereas among the damselflies, Coenagrionidae was well represented with seven species. Overall, the odonate fauna of Kuldiha Wildlife Sanctuary accounted for 49.09% of the odonate species known from Odisha and 10.73% of India. Therefore, further long-term studies on these lesser-known insect fauna in Kuldiha Wildlife Sanctuary will be useful in understanding their status over time.

Keywords: Anisoptera, Coenagrionidae, damselflies, dragonflies, Libellulidae, Zygoptera.

DOI: <https://doi.org/10.11609/jott.3463.10.15.12969-12978> | **ZooBank:** urn:lsid:zoobank.org:pub:57B7ABD1-A0FA-4BAF-A7D4-24121B224CC6

Editor: K.A. Subramanian, Zoological Survey of India, Chennai, India.

Date of publication: 26 December 2018 (online & print)

Manuscript details: Ms # 3463 | Received 24 March 2017 | Final received 13 December 2018 | Finally accepted 16 December 2018

Citation: Debata, S. & K.K. Swain (2018). Odonata (Insecta) diversity of Kuldiha Wildlife Sanctuary and its adjoining areas, Odisha, eastern India. *Journal of Threatened Taxa* 10(15): 12969–12978; <https://doi.org/10.11609/jott.3463.10.15.12969-12978>

Copyright: © Debata & Swain 2018. Creative Commons Attribution 4.0 International License. JoTT allows unrestricted use of this article in any medium, reproduction and distribution by providing adequate credit to the authors and the source of publication.

Funding: None.

Competing interests: The authors declare no competing interests.

Author Details: SUBRAT DEBATA is a wildlife researcher and naturalist with special interest on small mammals and waterbirds. KEDAR KUMAR SWAIN is presently working as Divisional Forest Officer in Chandaka Wildlife Division, Forest and Environment Department, Government of Odisha.

Author Contribution: Both the authors contributed equally in field work. SD designed and wrote the paper.

Acknowledgements: We are thankful to the Forest Range Officers of Kuldiha Wildlife Range and Soro Wildlife Range of Balasore Wildlife Division for the logistics and other field support during the study. We are thankful to Udit Pratap Das and Arajush Payra for allowing us to use some of their photographs.



INTRODUCTION

The order Odonata comprising both dragonflies and damselflies are believed to have evolved some 250 million years ago (Subramanian 2005). These aquatic insects being predators in both larval and adult stages are an important and widespread component of freshwater ecosystems (Adarsh et al. 2015) as well as valuable indicators of water quality and landscape disturbance (Watson et al. 1982; Castella 1987; Varghese et al. 2014). Globally around 5,952 species of odonates have been described; of which 503 species have been reported within the geographic limits of India so far (Joshi et al. 2017).

Odisha is one of the eastern coastal states of India and being situated along the amalgamation zone of Chhotanagpur Plateau, Eastern Ghats Highlands, Lower Gangetic Plain and the Eastern Coastal Plain's biogeographic provinces (Ray 2005), represents a mixture of both Indo-Malayan and Afro-Mediterranean biodiversity elements (Das et al. 2015). Odonata research in Odisha dates back to the early 1900s when Laidlaw (1915) and Fraser & Dover (1922) studied the faunal diversity of Chilika Lake. Afterwards, as part of faunal expeditions, several collections were made from different parts of Odisha and the results of 58 species were documented in the state fauna series (Srivastava & Das 1987). Some of the recent published works from Odisha include: Mitra (2000) who reported 69 species of odonates throughout Odisha; Sethy & Siddiqi (2007) reported 16 species from Simlipal Biosphere Reserve; Das et al. (2010, 2011) reported 31 species from Baripada Forest Division, 26 species from Nandankanan Zoological

Park and 58 species within the buffer area of Simlipal Tiger Reserve, respectively; Nair (2011) reported 110 species throughout Odisha and eastern India and 92 species from Simlipal Biosphere Reserve; Debata et al. (2013) reported 55 species from Hadgarh Wildlife Sanctuary; Payra et al. (2014) reported 56 species from Athagarh Forest Division; Sajan & Mohapatra (2014) reported the occurrence of Lesser Blue Wing (*Rhyothemis triangularis* Kirby, 1889) in Odisha from Kotgarh Wildlife Sanctuary and recently Pandey & Mohapatra (2017) reported 24 species from the Regional Institute of Education campus, Bhubaneswar. The vital information on diversity and distribution of odonates, however, is still missing from different parts of Odisha. Moreover, the increasing biotic pressure, deforestation and disappearance of wetlands are becoming major threats to odonates today. Therefore, documentation of Odonata from different geographic regions and habitats of Odisha is crucial for establishing baseline data for future comparison (Nair 2011). In this study, we summarize our findings of odonate fauna of Kuldiha Wildlife Sanctuary (KWS) in Odisha.

MATERIALS AND METHODS

Study Area

The KWS (Fig. 1) is situated along the tropic zone between 21.333–21.500°N and 86.500–86.750°E covering an area of 272.75km² in northern Odisha region. The landscape is characterized by undulating terrain and altitude ranges between 169–682 m. The climate is seasonal, with summer season between March to

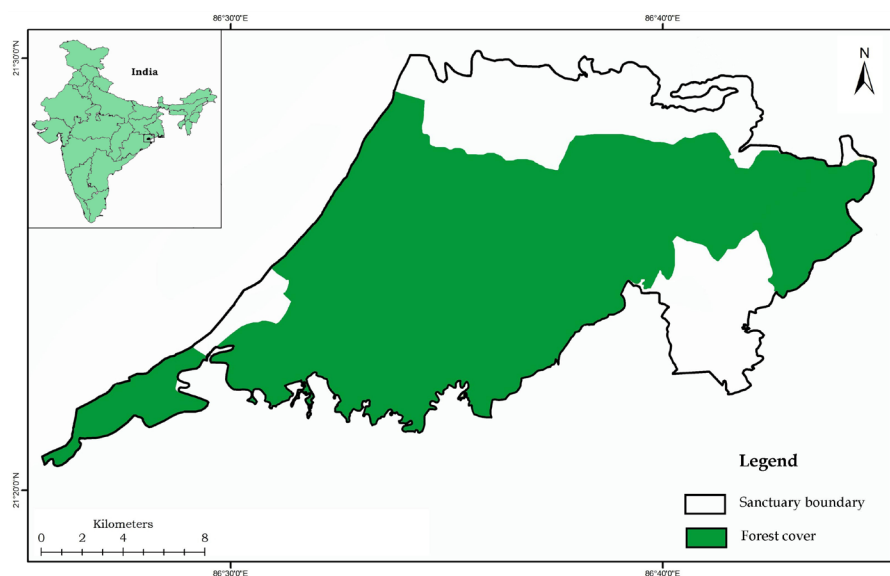


Figure 1. Map showing location of Kuldiha Wildlife Sanctuary, Odisha, eastern India

June, monsoon (July–October) and winter (November–February). The area receives an annual average rainfall of 1,460mm from the south-west monsoon and the temperatures range from 8°C in December to 42°C in June. Vegetation is mostly mixed deciduous type (Champion & Seth 1968). There are numerous perennial and seasonal hill streams and water bodies in and around KWS, which are habitats preferred by odonates.

Methods

While carrying out a biodiversity survey in KWS from November 2012 to October 2013, odonates were observed along hill streams, water bodies and temporary water logged areas. Whenever a species was encountered, its close up photographs were taken and later identified following the keys provided by Subramanian (2009) and Nair (2011); however, the species with confirmed identification were only taken under consideration for the checklist. The taxonomy and nomenclature of all the identified species followed Subramanian (2014). Based on the encounter rate of different species, we categorized them into five different groups such as very common (species encountered during 81–100 % of the survey days), common (61–80 %), occasional (41–60 %), rare (20–41 %) and very rare (less than 20%). To understand the significant difference in species richness between different months and seasons, a Chi-square test (χ^2) was performed.

RESULTS AND DISCUSSION

During the survey, 54 species of odonates (Images 1–53) including 37 species of Anisoptera (dragonflies) and 17 species of Zygoptera (damselflies) were recorded from KWS (Table 1). In Anisoptera, the family Libellulidae was well represented by 31 species followed by Aeshnidae and Gomphidae (3 species each). Likewise, in Zygoptera Coenagrionidae was dominated by seven species followed by Calopterygidae and Protoneuridae (3 species each), Chlorocyphidae (2 species), and Platynemididae and Lestidae with a single species each (Fig. 2). Our observations on family wise species richness are more or less similar with the earlier studies from different protected areas of Odisha (Sethy & Siddiqi 2007; Das et al. 2011; Nair 2011; Debata et al. 2013) and elsewhere in India (Varghese et al. 2014; Adarsh et al. 2015).

During the study period, a maximum of 51 species were encountered during the months of April and a minimum of 12 species during the month of January

(Fig. 3) and the observed species richness varied significantly between the months ($\chi^2 = 80.49$, $df = 11$, $p < 0.05$). Similarly during seasonal analysis, a maximum of 51 species were recorded during summer and a minimum of 16 during monsoon (Fig. 3) and it also varied significantly between the seasons ($\chi^2 = 18.76$, $df = 2$, $p < 0.05$). In terms of species encounter rate, a majority of 16 species were found to be occasional followed by 15 species as very common, 13 species as common, nine species as rare and one species as very rare (Table 1; Fig. 4). Species like *Ictinogomphus rapex* and *Paragomphus lineatus* were more commonly sighted inside the sanctuary indicating unpolluted water sources and good habitat quality where as *Brachythemis contaminata* was frequently sighted at the peripheral zones indicating presence of polluted water within anthropogenic habitats (Nair 2011). Referring to IUCN Red List classification, 45 species from our study area are classified under Least Concern and one species under Data Deficient categories (Table 1). The rest of the species have not yet been assessed.

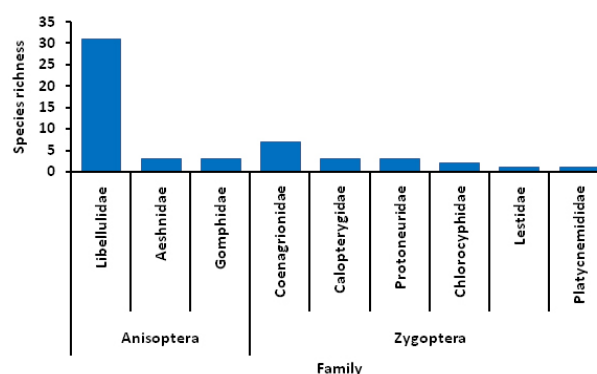


Figure 2. Family-wise species richness of odonates in Kuldiha Wildlife Sanctuary, Odisha from November 2012 to October 2013

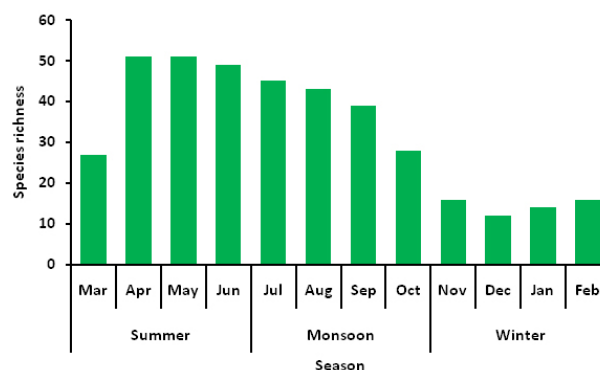


Figure 3. Observed species richness of odonates between different months and seasons in Kuldiha Wildlife Sanctuary, Odisha from November 2012 to October 2013

Table 1. Checklist of odonates recorded in Kuldiha Wildlife Sanctuary, Odisha during November 2012 to October 2013

Sub Order / Family / Scientific name	Common name	Image number	Season	Abundance	IUCN status
Sub Order: Anisoptera (Dragonflies)					
Family: Aeshnidae (Darners)					
1. <i>Anax guttatus</i> (Burmeister, 1839)	Blue-tailed Green Darner	1	S, M	O	LC
2. <i>Gynacantha bayadera</i> Selys, 1891	Parakeet Darner	2	S, M	R	LC
3. <i>Gynacantha dravida</i> Lieftinck, 1960	Brown Darner	3	M	C	DD
Family: Gomphidae (Clubtails)					
4. <i>Ictinogomphus rapex</i> (Rambur, 1842)	Common Club Tail	4	S, M, W	C	NA
5. <i>Macrogomphus annulatus</i> (Selys, 1854)	Deccan Bow Tail	5	S, M	R	NA
6. <i>Paragomphus lineatus</i> (Selys, 1850)	Common hook Tail	6	S, M	O	LC
Family: Libellulidae (Skimmers)					
7. <i>Acisoma panorpoides</i> Rambur, 1842	Trumpet Tail	7	S, M	C	LC
8. <i>Brachydiplax sobrina</i> (Rambur, 1842)	Little Blue Marsh Hawk	8	S, M	VC	LC
9. <i>Brachythemis contaminata</i> (Fabricius, 1793)	Ditch Jewel	9	S, M, W	VC	LC
10. <i>Bradynopyga geminate</i> (Rambur, 1842)	Granite Ghost	10	S, M, W	C	NA
11. <i>Crocothemis servilia</i> (Drury, 1770)	Ruddy Marsh Skimmer	11	S, M, W	O	LC
12. <i>Diplacodes nebulosa</i> (Fabricius, 1793)	Black-tipped ground Skimmer	12	S, M	O	LC
13. <i>Diplocodes trivialis</i> (Rambur, 1842)	Ground Skimmer	13	S, M, W	VC	NA
14. <i>Lathrecista asiatica</i> (Fabricius, 1798)	Asiatic Bloodtail	14	S	R	LC
15. <i>Neurothemis fulvia</i> (Drury, 1773)	Fulvus Forest Skimmer	15	S, M	VC	LC
16. <i>Neurothemis intermedia</i> (Rambur, 1842)	Ruddy Meadow Skimmer	16	S, M, W	O	LC
17. <i>Neurothemis tullia</i> (Drury, 1773)	Pied Paddy Skimmer	17	S, M, W	R	LC
18. <i>Orthetrum glaucum</i> (Brauer, 1865)	Blue Marsh Hawk	18	S	R	NA
19. <i>Orthetrum luzonicum</i> (Brauer, 1868)	Tricoloured Marsh Hawk	19	S	R	LC
20. <i>Orthetrum prunosum</i> (Burmeister, 1839)	Crimson Tailed Marsh Hawk	20	S, M, W	VC	LC
21. <i>Orthetrum sabina</i> (Drury, 1770)	Green Marsh Hawk	21	S, M, W	VC	LC
22. <i>Orthetrum taeniolatum</i> (Schneider, 1845)	Taeniolata Marsh Hawk	22	S	VC	LC
23. <i>Orthetrum triangulare</i> (Selys, 1878)	Blue tailed forest Hawk	23	S, M	O	LC
24. <i>Palpopleura sexmaculata</i> (Fabricius, 1787)	Blue Tailed Yellow Skimmer	24	S	O	LC
25. <i>Pantala flavescens</i> (Fabricius, 1798)	Wandering Glider	25	S, M, W	VC	LC
26. <i>Potamarcha congener</i> (Rambur, 1842)	Yellow-tailed Ashy Skimmer	26	S, M	C	LC
27. <i>Rhodothemis rufa</i> (Rambur, 1842)	Rufous Marsh Glider	27	S, M, W	O	LC
28. <i>Rhyothemis variegata</i> (Linnaeus, 1763)	Common Picture Wing	28	S, M, W	VC	LC
29. <i>Tetrathemis platyptera</i> Selys, 1878	Pygmy Skimmer	29	S, M	R	LC
30. <i>Tholymis tillarga</i> (Fabricius, 1798)	Coral-tailed Cloud Wing	30	S, M	VR	LC
31. <i>Tremea basilaris</i> (Palisot de Beauvois, 1805)	Red Marsh Trotter	31	M	O	LC
32. <i>Tremea limbata</i> (Desjardins, 1832)	Black Marsh Trotter	32	S, M	C	LC
33. <i>Trithemis aurora</i> (Burmeister, 1839)	Crimson Marsh Glider	33	S, M, W	C	LC
34. <i>Trithemis festiva</i> (Rambur, 1842)	Black Stream Glider	34	S, M	VC	LC
35. <i>Trithemis pallidinervis</i> (Kirby, 1889)	Long-legged Marsh Glider	35	S, M	C	LC
36. <i>Urothemis signata</i> (Rambur, 1842)	Greater Crimson Glider	36	S, M	O	LC
37. <i>Zyxomma petiolatum</i> Rambur, 1842	Brown Dusk Hawk		S, M	VC	LC
Sub Order: Zygoptera (Damselflies)					
Family: Calopterygidae (Glories)					
38. <i>Neurobasis chinensis</i> (Linnaeus, 1758)	Stream Glory	37	S, M	O	LC
39. <i>Vestalis apicalis</i> Selys, 1873	Black-tipped Forest Glory	38	S, M	O	NA
40. <i>Vestalis gracilis</i> (Rambur, 1842)	Clear-winged Forest Glory	39	S	C	LC
Family: Chlorocyphidae (Stream Jewels)					
41. <i>Libellago lineata</i> (Burmeister, 1839)	River Helioder	40	S	R	LC
42. <i>Rhinocypha bisignata</i> Hagen in Selys, 1853	Stream Ruby	41	S, M	C	LC

Sub Order / Family / Scientific name	Common name	Image number	Season	Abundance	IUCN status
Family: Coenagrionidae (Marsh Darts)					
43. <i>Agriocnemis lecteola</i> Selys, 1877	Milky Dartlet	42	S, M	VC	NA
44. <i>Agriocnemis pygmaea</i> (Rambur, 1842)	Pygmy Dartlet	43	S, M, W	VC	LC
45. <i>Amphiallagma parvum</i> (Selys, 1876)	Azure Dartlet	44	S, M	O	LC
46. <i>Ceriatagris coromandelium</i> (Fabricius, 1798)	Coromandel Marshdart	45	S, M, W	VC	NA
47. <i>Ischnura aurora</i> (Brauer, 1865)	Golden Dartlet	46	S, M, W	C	LC
48. <i>Pseudagrion decorum</i> (Rambur, 1842)	Three lined Dart	47	S	R	LC
49. <i>Pseudagrion rubriceps</i> Selys, 1876	Saffron Faced Blue Dart	48	S	C	LC
Family: Lestidae (Spread Wings)					
50. <i>Lestes viridulus</i> Rambur, 1842	Emerald Striped Spreadwing	49	M	O	LC
Family: Platycnemididae (Bush Darts)					
51. <i>Copera vittata</i> Selys, 1863	Blue Bush Dart	50	S, M	O	LC
Family: Protoneuridae (Bamboo Tails)					
52. <i>Caconeura ramburi</i> (Fraser, 1922)	Coorg Bambootail	51	S, M	VC	DD
53. <i>Disparoneura quadrimaculata</i> (Rambur, 1842)	Black-winged Bambootail	52	S, M	O	LC
54. <i>Prodasineura verticalis</i> (Selys, 1860)	Black Bambootail	53	S, M	C	LC

S - Summer; M - Monsoon; W - Winter; VC - Very Common; C - Common; O - Occasional; R - Rare; VR - Very Rare; LC - Least Concern; DD - Data Deficient; NT - Near Threatened; NA - Not Assessed

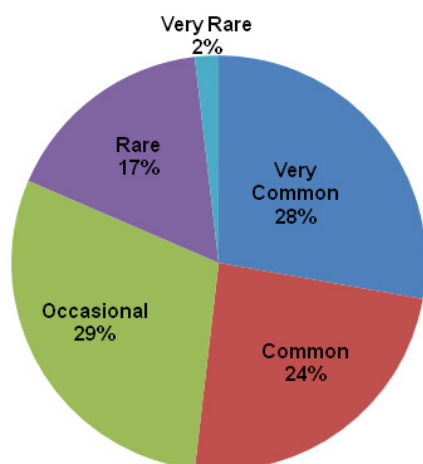


Figure 4. Observed encountered rate of different Odonata species in Kuldiha Wildlife Sanctuary, Odisha from November 2012 to October 2013

Although KWS represents around 0.17 % of the total geographic area and 3.31 % of the total protected areas network of Odisha, it contributes around 49.09 % of the Odonata species richness of the state and 10.73 % of India. Yet, the present study gives a preliminary observation on Odonata fauna of KWS as part of multi taxa inventory. Therefore, more detailed and targeted long term studies on these lesser-known insect fauna will be useful in understanding their status and monitoring the change over time in the study area.

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/JOT.T.03771.6910-9>
- Castella, E. (1987). Larval Odonata distribution as a descriptor of fluvial ecosystems: the Rhone and Ain rivers, France. *Advances in Odonatology* 3: 23–40.
- Champion, H.G. & S.K. Seth (1968). *The Forest Types of India*. Government of India Press, Nasik, India, 404pp.
- Das, P.K., P.P. Mohapatra & A.K. Biswal (2015). *Glimpses of Biodiversity of Odisha*. Odisha Biodiversity Board, Bhubaneswar, Odisha, India, 84pp.
- Das, S.K., H.K. Sahu & S.D. Rout (2010). Odonates of Baripada Division of Simlipal Biosphere Reserve, including North Orissa University Campus, Orissa, India. *Tiger Paper* 37(2): 13–15.
- Das, S.K., B. Baruah, N. Dash, S. Singhnaik & H.K. Sahu (2011). Diversity of Odonates in Nandankanan Zoological Park with range extension notes of White Dartlet (*Agriocnemis pieris*) in Orissa, India. *Tiger Paper* 38(2): 29–32.
- Debata, S., H.K. Sahu, S.D. Rout & R.K. Mishra (2013). An observation on Odonata diversity in Hadgarh Wildlife Sanctuary, Odisha, India. *Tiger Paper* 40(2): 10–13.
- Fraser, F.C. & C. Dover (1922). The fauna of island in Chilika Lake - Dragonflies. *Records of the Indian Museum* 24(3): 303–311.
- Joshi, S., P. Koparde, K.A. Subramanian & P. Roy (eds.) (2017). *Odonata of India*, v. 1.00. Indian Foundation for Butterflies. <http://http://www.indianodonata.org/>. Electronic version accessed 22 April 2017.
- Laidlaw, E.F. (1915). Fauna of the Chilika lake. No.2 Odonata. *Memoirs of Indian Museum* 5: 177–188.
- Mitra, T.R. (2000). A note on an Odonata collection from Orissa, India. *Notul Odonatol* 5: 60–61.
- Nair, M.V. (2011). *Dragonflies & Damselflies of Orissa and Eastern India*. Wildlife Organisation, Forest & Environment Department, Government of Orissa, 252pp.
- Pandey, P. & A.K. Mohapatra (2017). Diversity of two families Libellulidae and Coenagrionidae (Odonata) in Regional Institute of Education Campus, Bhubaneswar, Odisha, India. *Journal of*



Image 1. *Anax guttatus* mating



Image 2. *Gynacantha bayadera* Male



Image 3. *Gynacantha dravida* Male



Image 4. *Ictinogomphus rapex* Male



Image 5. *Macrogomphus annulatus* Male



Image 6. *Paragomphus lineatus* Male



Image 7. *Acisoma panorpoides* Male



Image 8. *Brachydiplax sobrina* Female



Image 9. *Brachythemis contaminata* Male



Image 10. *Bradynopyga geminata* Male



Image 11. *Crocothemis servilia* Male



Image 12. *Diplacodes nebulosa* Male

Image 13. *Diplocodes trivialis* FemaleImage 14. *Lathrecista asiatica* FemaleImage 15. *Neurothemis fulvia* MaleImage 16. *Neurothemis intermedia* FemaleImage 17. *Neurothemis tullia* MaleImage 18. *Orthetrum glaucum* MaleImage 19. *Orthetrum luzonicum* MaleImage 20. *Orthetrum prunosum* MatingImage 21. *Orthetrum sabina* MaleImage 22. *Orthetrum taeniolatum* MaleImage 23. *Orthetrum triangulare* MaleImage 24. *Palpopleura sexmaculata* Male

Image 25. *Pantala flavescens* MaleImage 26. *Potamarcha congener* MaleImage 27. *Rhodothemis rufa* MaleImage 28. *Rhyothemis variegata* MaleImage 29. *Tetrathemis platyptera*Image 30. *Tholymis tillarga* MaleImage 31. *Tramea basilaris* MaleImage 32. *Tramea limbata*Image 33. *Trithemis aurora* MaleImage 34. *Trithemis festiva* MaleImage 35. *Trithemis pallidinervis* MaleImage 36. *Urothemis signata* Male



Image 37. *Neurobasis chinensis* Male



Image 38. *Vestalis apicaia* Male



Image 39. *Vestalis gracilis*



Image 40. *Libellago lineata* Male



Image 41. *Rhinocypha bisignata* Male



Image 42. *Agriocnemis lecteola* Male



Image 43. *Agriocnemis pygmaea* Male



Image 44. *Amphiallagma parvum* Male



Image 45. *Ceriagrion coromandelium* Male



Image 46. *Ischnura aurora* Male



Image 47. *Pseudagrion decorum* Male



Image 48. *Pseudagrion rubriceps* Egg laying

Image 49. *Lestes viridulus* MaleImage 50. *Copera vittata* MaleImage 52. *Disparoneura quadrimaculata* MaleImage 53. *Prodasineura verticalis* MaleImage 51. *Caconeura ramburi* Mating

- Threatened Taxa* 9(2): 9851–9857; <https://doi.org/10.11609/jott.2547.9.2.9851-9857>
- Payra, A., S.K. Dash, A.K. Mishra, H.S. Palei, R.K. Mishra & S.D. Rout (2014). A preliminary study on Odonata (Dragonfly and Damselfly) diversity in Athagarh forest division, Odisha, India. *e-planet* 12(2): 43–49.
- Ray, G.C. (2005). *Geography of Orissa*. Kitab Mahal, Cuttack, 308pp.
- Sajan, S.K. & P.P. Mohapatra (2014). New Record of Lesser Blue Wing *Rhyothemis triangularis* Kirby, 1889 (Odonata: Libellulidae) from Odisha, India. *Journal of Bombay Natural History Society* 111(1): 60; <https://doi.org/10.17087/bnhs/2014/v11i1/56544>
- Sethy, P.G.S & S.Z. Siddiqui (2007). Observations on Odonates in Simlipal Biosphere Reserve, Orissa. *Zoos' Print Journal* 22(11): 2893–2894.
- Srivastava, V.K. & S. Das (1987). Insecta: Odonata, pp. 135–159. In: Director (ed.). *Fauna of Orissa. State Fauna Series 1 (Part 1)*. Zoological Survey of India Publication, Calcutta, India.

- Subramanian, K.A. (2005). *Dragonflies and Damselflies of Peninsular India- A Field Guide*. 1st Edition. Project Lifescape Series. Indian Academy of Science, Bangalore, 118pp.
- Subramanian, K.A. (2009). *India- A Lifescape, Dragonflies of India - A Field Guide*. Vigyan Prasar, India Offset Press, New Delhi, 180pp.
- Subramanian, K.A. (2014). *A Checklist of Odonata of India*. Zoological Survey of India, Kolkata, 31pp.
- Varghese, A.P., P.R. Nikesh & J. Mathew (2014). Odonata (Insecta) diversity of Salim Ali Bird Sanctuary and its adjacent areas in Thattakkad, Kerala, India. *Journal of Threatened Taxa* 6(6): 5887–5893; <https://doi.org/10.11609/JoTT.o3395.5887-93>
- Watson, J.A.L., A.H. Arthington & D.L. Conrick (1982). Effect of sewage effluent on dragonflies (Odonata) of Bulimba Creek, Brisbane. *Australian Journal of Marine and Freshwater Research* 33: 517–528; <https://doi.org/10.1071/MF9820517>





OPEN ACCESS



The Journal of Threatened Taxa is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use of articles in any medium, reproduction, and distribution by providing adequate credit to the authors and the source of publication.

ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

December 2018 | Vol. 10 | No. 15 | Pages: 12907–13046

Date of Publication: 26 December 2018 (Online & Print)

DOI: 10.11609/jott.2018.10.15.12907-13046

www.threatenedtaxa.org

Articles

Dietary preference and feeding patterns of the urban Rhesus Macaque *Macaca mulatta* (Mammalia: Primates: Cercopithecidae) in Asola-Bhatti Wildlife Sanctuary in India

-- Ishita Ganguly & Netrapal Singh Chauhan, Pp. 12907–12915

Postembryonic development of the Tri-spine Horseshoe Crab *Tachypleus tridentatus* (Merostomata: Xiphosura) in a nursery habitat in the Philippines

-- Dorkas Kaiser & Sabine Schoppe, Pp. 12916–12932

Communications

Copulatory behavior of the Jaguar *Panthera onca* (Mammalia: Carnivora: Felidae)

-- Pedro Nacib Jorge-Neto, Cristiane Schilbach Pizzutto, Gediendson Ribeiro de Araujo, Thyara de Deco-Souza, Leanes Cruz da Silva, Jorge Aparecido Salomão Jr. & Hernan Baldassare, Pp. 12933–12939

Amphibians of the Dibang River Basin, Arunachal Pradesh: an annotated checklist with distribution records

-- Jayanta K. Roy, Ramie H. Begum & M. Firoz Ahmed, Pp. 12940–12952

Taxonomic studies on the gaudy grasshoppers (Orthoptera: Pyrgomorphoidea: Pyrgomorphidae) from the northeastern states of India

-- M. Imran Khan, M. Kamil Usmani, Shahnila Usmani & Hira Naz, Pp. 12953–12968

Odonata (Insecta) diversity of Kuldiha Wildlife Sanctuary and its adjoining areas, Odisha, eastern India

-- Subrat Debata & Kedar Kumar Swain, Pp. 12969–12978

Short Communications

On the diversity of the vertebrate fauna (excluding fishes) of Panchet Hill (Garh Panchkot), Purulia, West Bengal, India

-- Sanjib Chattopadhyay, Somenath Dey & Utpal Singha Roy, 12979–12985

First record of the rare Furry Lobster *Palinurellus wieneckii* (De Man, 1881) (Decapoda: Palinuridae) from the Arabian Sea

-- K.K. Idreesbabu, C.P. Rajool Shanis & S. Sureshkumar, Pp. 12986–12989

Description of life stages of dung beetle *Scaptodera rhammistus* (Fabricius, 1775) (Coleoptera: Scarabaeidae: Scarabaeinae) with notes on nesting and biology

-- Suvarna S. Khadakar, Ashish D. Tiple & Arun M. Khurad, Pp. 12990–12994

An updated list of Odonata of southwestern Bangladesh

-- M. Sajjad Hossain Tuhin & M. Kawsar Khan, Pp. 12995–13001

On the reproductive biology of *Salacia fruticosa* Wall. ex M.A. Lawson

-- an endemic medicinal plant of the Western Ghats, India

-- K. Subin, P.A. Jose & T.V. Sarath, Pp. 13002–13005

Partners



Member



Publisher & Host

