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An annotated checklist of Odonata (Insecta) of Kanha Tiger Reserve and adjoining areas, central India

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The study was carried out at the Kanha Tiger Reserve (KTR) India, which is a major conservation area. It is an internationally renowned protected area in India and located in the Maikal ranges at the eastern base of the triangular Satpura range in the central Indian highlands of Madhya Pradesh. Kanha is known for its exceptional natural beauty and its unique and diverse flora and fauna. The immense natural beauty of Kanha even inspired the famous author Rudyard Kipling to write his all time classic 'Jungle Book'. The area is well known for big-cats and harbors an average population of 60 (45–75) Bengal Tigers *Panthera tigris* (Jhala et al. 2011) with their prey base and also supports more than 200 species of birds (Newton et al. 1986). But very little information on invertebrates like odonates is available. They are one of the least studied groups of insects though they are known as bio-indicators in the natural ecosystem (Watson et al. 1982). Joshi et al. 2004, studied the insect fauna of Kanha, but Odonata (Insecta) fauna of the reserve was primarily revealed in scientific literature such as Fraser (1933, 1934, 1936) and Tiple et al. (2010). The present study aimed at collecting baseline information on this magnificent group of insects and covered the Kanha Tiger Reserve including the core and buffer areas.

Study area

The study area included the Supkhar range of the Kanha National Park which is 35km from Mukki gate of Mukki range of the Kanha National Park. It is in the Balaghat District of Madhya Pradesh. It lies between 22°20'N & 80°38'E and the reserve occupies an area of 940km². The Kanha Tiger Reserve includes the area of two sanctuaries namely Hallon and Banjar, of 250 and 300 km² respectively, together with a surrounding buffer zone of 1,009km² and the neighboring 110km² Phen Sanctuary (Image 1).

Vegetation: The broad vegetation of Kanha Tiger Reserve is dry deciduous forest. The terrain is undulating. Champion & Seth (1968) have identified the following forest types in Kanha: (i) moist peninsular sal forest (a - high level sal, b - low level sal, c - valley sal); (ii) southern tropical moist deciduous forest; (iii) southern tropical dry mixed deciduous forest. The floral diversity comprises 609 species and 10 varieties of angiosperms belonging to 386 genera and 104 families and 17 species of pteridophytes belonging to 11 genera and nine families (Dash 2010). The major tree species are Sal *Shorea robusta,* Saja *Terminalia alata*, Lendia *Lagerstroemia parviflora*, Dhawa *Anogeissus latifolia,* Tendu *Diospyros melanoxylon*, Palash *Butea monosperma*, Bija *Pterocarpus marsupium*, Mahua *Madhuca indica*, Aonla *Emblica officianalis*, Achar *Buchanania lanzan*. The

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major grass species include *Eragostis* sp., *Andropogon* sp., *Cynodon* sp., and *Bambusa* sp.

Methods

The study was carried out from January 2010 to December 2010. Odonates are most active during midday, (Subramanian 2005) therefore, direct search technique (Sutherland 1996) was used during this period (1000–1400 hr). Opportunistic sightings were also recorded. The identification of dragonflies and damselflies is based on Subramanian (2009). Photographs were taken with a Nikon P90 digital camera with double close up mode. Odonates are categorized into three groups based on the observations during the period of study. Accordingly, those species observed on 75–100 % of the survey days were categorized as very common (A), 50–75 % as common (C), 25–50 % as occasional (OC) and below 25% as rare (R). We surveyed mainly the banks of major rivers such as Banjar and Hallon with surveys of perennial and seasonal streambeds of all types of forest habitats of the reserve. We also surveyed the major tals (lakes) such as Sharvan Tal, Phuta Tal, Sunder Tal which serve as prime habitats for odonates in and around the reserve (Image 1).

Result and Discussion

Madhya Pradesh provides a suitable habitat to 72 species of odonates. Mishra (2000) and Andrew et al. (2008) listed common 45 species of odonata from central India. Six species of odonates were previously recorded from Panchmarhi Biosphere Reserve, Madhya Pradesh (ZSI 2009). Chandra (2009) reported the distribution of eight species of odonates from Bandhavgarh Tiger Reserve. From Kanha 36 species of odonates were previously recorded (Tiple et al. 2010), with 34 genera. The present study records the distribution of 38 species of odonates in Kanha Tiger Reserve including seven families and 26 genera, where 12 species distribution are recorded for the first time. The family Libellulidae (21) is well represented in the present study followed by Coenagrionidae (8), Calopterygidae (2), Gomphidae (2), Lestidae (2) and Aeshnidae (3). In the case of zygopterans, *Ischnura aurora* (Brauer) was more abundant than the others. Among the collected libelluids, *Orthretum sabina sabina* (Drury) was the most abundant species. The family and species level classification follows Subramanian (2009). With the addition of these 12 newly recorded species, the existing checklist of Kanha is updated (Tiple et al. 2010) and the species richness

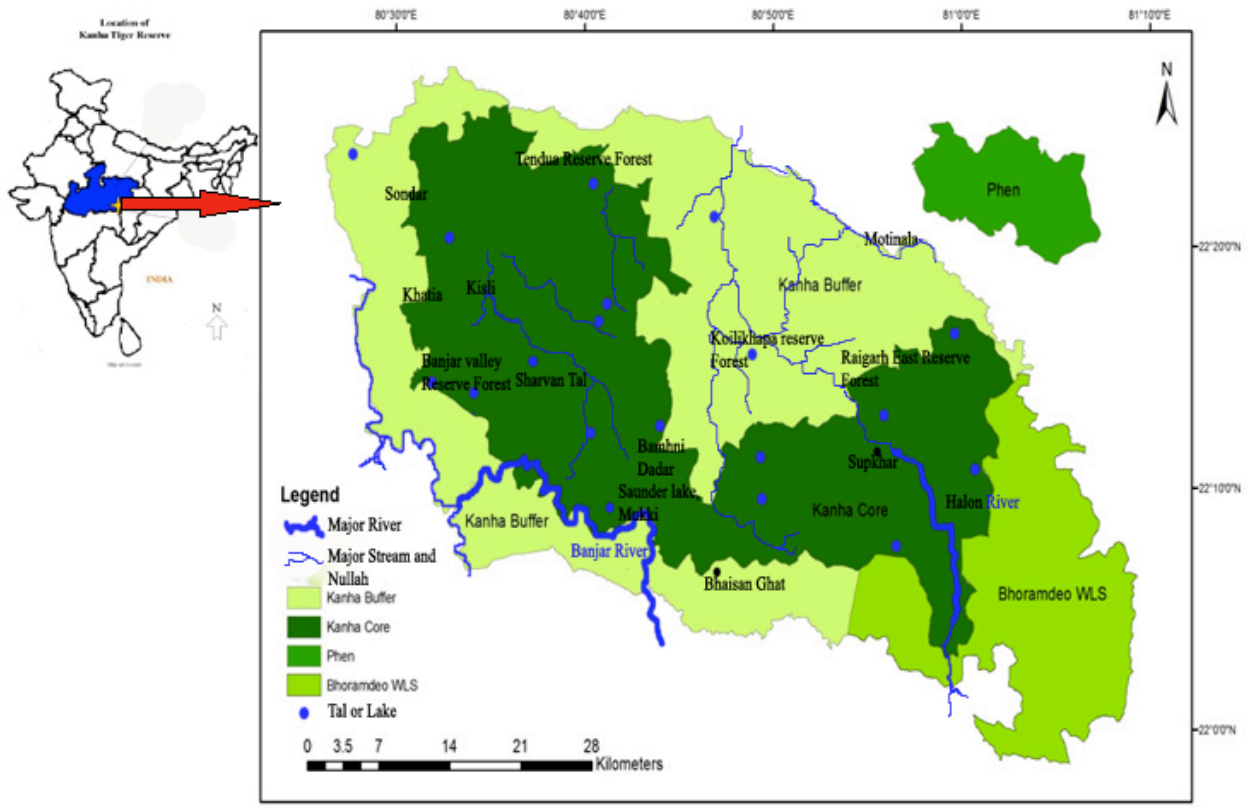

Image 1. Kanha Tiger Reserve with the water bodies surveyed for odonates

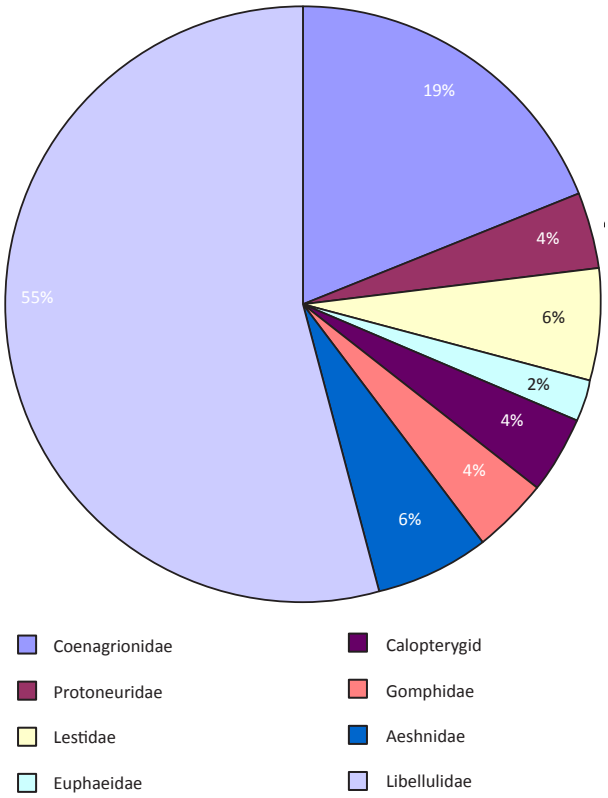

Figure 1. Percentage of species from each family

in the reserve has increased to 48 species, belonging to eight families (Table 1; Fig. 1). The checklist provides the status for only 38 species as 10 species reported in earlier studies were not recorded during the present study (Table 1). On the basis of direct sightings we found that of 38 species, seven are abundant, 25 common, five occasional and one rare as it was sighted only once during the field study.

Odonates are one of most significant groups of insects with their impact on the ecosystem as bio-indicators, predators and as prey for many living organisms from birds to other arthropods like spiders. The prey of the adults consists mostly of insects harmful to crops, orchards and forests, thus they have a regulatory impact on agro-forestry. Public attentiveness is requisite to conserve these odonates and their habitats. The study reflects the baseline information on these beautiful groups of insects, but is limited in explanation of their use of different habitat types in the central Indian landscape. Therefore, an extensive odonatological survey needs to be carried out to explore the rich diversity of these elegant insects with their richness in different forest vegetation.

Table 1. Annotated checklist of odonates of Kanha Tiger Reserve, central India

	Family and species *	Tiple et al. 2010	Present Study	Status
	Coenagrionidae			
1	*Agriocnemis pygmea* (Rambur, 1842)	r	r	A
2	*Ceriagrion coromandelianum* (Fabricius, 1798)	r	r	A
3	*Ceriagrion olivaceum* Laidlaw, 1914	nr	r	C
4	*Ischnura aurora* (Brauer, 1865) (Image 2)	r	r	A
5	*Ischnura senegalensis* (Rambur, 1842) (Image 3)	r	r	C
6	*Pseudagrion microcephalum* (Rambur, 1842) (Image 4)	r	r	C
7	*Pseudagrion rubriceps* Selys, 1876	r	r	C
8	*Pseudagrion decorum* Rambur, 1842	r	r	C
9	*Rhodischnura nursei* Morton, 1907	r	r	A
	Protoneuridae			
10	*Disparoneura quadrimaculata* (Rambur, 1842)	r	r	R
11	*Prodasineura verticalis (*Selys, 1860)	r	r	A
	Lestidae			
12	*Lestes viridulus* Rambur, 1842	nr	r	C
13	*Lestes elatus* Hagen in Selys, 1862	nr	r	C
14	*Lestes umbrinus* Selys, 1891	r	r	R
	Euphaeidae			
15	*Dysphaea ethela* Fraser, 1924	r	r	R
	Calopterygidae			
16	*Neurobasis chinensis* (Linnaeus, 1758)	nr	r	C
17	*Vestalis apicalis* Selys, 1873	nr	r	C
	Gomphidae			
18	*Ictinogomphus rapax* Rambur, 1842 (Image 5)	r	r	C
19	*Paragomphus lineatus* (Selys, 1850)	r	r	C
	Aeshnidae			
20	*Anaciaeschna jaspidea* (Burmeister, 1839*)*	nr	r	OC
21	*Anax guttatus* (Burmeister, 1839)	r	r	OC
22	*Anax immaculifrons* Rambur, 1842	r	r	OC
	Libellulidae			
23	*Acisoma panorpoides* Rambur, 1842	nr	r	C
24	*Aethriamanta brevipennis* (Rambur, 1842)	nr	r	C

	Family and species *	Tiple et al. 2010	Present Study	Status
25	*Brachydiplax farinosa* Krüger, 1902	r	r	R
26	*Brachythemis contaminata* (Fabricius, 1793)	r	r	C
27	*Bradinopyga geminata* (Rambur, 1842)	r	r	C
28	*Crocothemis servilia* (Drury, 1770)	r	r	C
29	*Diplacodes trivialis* (Rambur, 1842)	r	r	A
30	*Diplacodes nebulosa* (Frbricius, 1793)	r	r	A
31	*Lathrecista asiatica* (Fabricius, 1798)	r	r	A
32	*Neurothemis fulvia* (Drury, 1773)	r	r	A
33	*Neurothemis tullia* (Drury, 1773)	nr	r	C
34	*Neurothemis intermedia* (Rambur, 1842)	r	r	A
35	*Orthetrum pruinosum* (Rambur, 1842) (Image 6)	r	r	C
36	*Orthetrum sabina* (Drury, 1770)	r	r	A
37	*Orthetrum triangulare* (Selys, 1878)	nr	r	OC
38	*Pantala flavescens* (Fabricius, 1798)	r	r	A
39	*Potamarcha congener* (Rambur, 1842) (Image 7)	r	r	C
40	*Rhodothemis rufa* (Rambur, 1842)	nr	r	C
41	*Rhyothemis variegate* Linnaeus, 1763	nr	r	C
42	*Tetrathemis platyptera* Selys, 1878	r	r	Lc
43	*Tholymis tillarga* (Fabricius, 1798)	r	r	C
44	*Tramea basilaris* Kirby, 1889	r	r	C
45	*Trithemis aurora* (Burmeister, 1839)	r	r	C
46	*Trithemis festiva* (Rambur, 1842)	r	r	C
47	*Trithemis kirbyi* Selys, 1891	r	r	OC
48	*Trithemis pallidinervis* Selys, 1889	r	r	C

r - recorded; nr - not recorded; A - Abundant, C - Common, dd - data deficit, Lc - Lease concern; OC - Occasional, R - Rare; * - Name as in Subramanian 2009.

Image 2. ***Ischnura aurora***

Image 3. ***Ischnura senegalensis***

Image 4. ***Pseudagrion microcephalum***

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Image 5. *Ictinogomphus rapax*

Image 6. *Orthetrum pruinosum*

Image 7. *Potamarcha congener*

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Appendix 1. Presence or absence of every species in study area. √ - Presence; X - Absence

Sno	Family and species	Ranges of Kanha National Park and adjoining areas where study carried out					
		Kanha	Kisli	Mukki	Supkhar	Sarrhi	Bhaisan Ghat
	Coenagrionidae						
1	*Agriocnemis pygmea* (Rambur, 1842)	√	√	√	√	√	√
2	*Ceriagrion coromandelianum* (Fabricius, 1798)	√	√	√	√	√	√
3	*Ceriagrion olivaceum* Laidlaw, 1914	√	√	√	√	√	√
4	*Ischnura aurora* (Brauer, 1865)	√	√	√	√	√	√
5	*Ischnura senegalensis* (Rambur, 1842)	√	√	√	√	√	X
6	*Pseudagrion microcephalum* (Rambur, 1842)	√	√	√	√	√	X
7	*Pseudagrion rubriceps* Selys, 1876	√	√	√	√	√	X
8	*Pseudagrion decorum* Rambur, 1842	√	√	√	√	√	X
9	*Rhodischnura nursei* Morton, 1907	√	X	√	X	X	√
	Protoneuridae						
10	*Disparoneura quadrimaculata* (Rambur, 1842)	√	√	√	√	X	X
11	*Prodasineura verticalis (*Selys, 1860)	√	√	√	√	X	X
	Lestidae						
12	*Lestes viridulus* Rambur, 1842	√	√	√	√	X	X
13	*Lestes elatus* Hagen in Selys, 1862	√	√	√	√	X	X
14	*Lestes umbrinus* Selys, 1891	√	√	√	√	X	X
	Euphaeidae						
15	*Dysphaea ethela* Fraser, 1924	√	√	√	√	X	X
	Calopterygidae						
16	*Neurobasis chinensis* (Linnaeus, 1758)	√	√	√	√	X	X
17	*Vestalis apicalis* Selys, 1873	√	√	√	√	X	X
	Gomphidae						
18	*Ictinogomphus rapax* Rambur, 1842	√	√	√	√	X	X
19	*Paragomphus lineatus* (Selys, 1850)	√	√	√	√	X	X
	Aeshnidae						
20	*Anaciaeschna jaspidea* (Burmeister, 1839*)*	√		√	√	X	X
21	*Anax guttatus* (Burmeister, 1839)	√		√	√	X	X
22	*Anax immaculifrons* Rambur, 1842	√		√	√	X	X
	Libellulidae						
23	*Acisoma panorpoides* Rambur, 1842	√	√	√	√	√	X
24	*Aethriamanta brevipennis* (Rambur, 1842)	√	√	√	√	√	X
25	*Brachydiplax farinosa* Krüger, 1902	X	X	X	√	X	X
26	*Brachythemis contaminata* (Fabricius, 1793)	√	√	√	√	√	√
27	*Bradinopyga geminata* (Rambur, 1842)	√	√	√	√	√	√
28	*Crocothemis servilia* (Drury, 1770)	√	√	√	√	√	√
29	*Diplacodes trivialis* (Rambur, 1842)	√	√	√	√	√	√
30	*Diplacodes nebulosa* (Frbricius, 1793)	√	√	√	√	√	√
31	*Lathrecista asiatica* (Fabricius, 1798)	√	√	√	√	√	√
32	*Neurothemis fulvia* (Drury, 1773)	√	√	√	√	√	√
33	*Neurothemis tullia* (Drury, 1773)	√	√	√	√	√	√
34	*Neurothemis intermedia* (Rambur, 1842)	√	√	√	√	√	√
35	*Orthetrum pruinosum* (Rambur, 1842) (Image 6)	√	√	√	√	√	√
36	*Orthetrum sabina* (Drury, 1770)	√	√	√	√	√	√
37	*Orthetrum triangulare* (Selys, 1878)	√	√	√	√	√	√
38	*Pantala flavescens* (Fabricius, 1798)	√	√	√	√	√	√
39	*Potamarcha congener* (Rambur, 1842) (Image 7)	√	√	√	√	√	√
40	*Rhodothemis rufa* (Rambur, 1842)	√	√	√	√	√	√
41	*Rhyothemis variegate* Linnaeus,1763	√	√	√	√	√	√
42	*Tetrathemis platyptera* Selys, 1878	√	√	√	√	√	√
43	*Tholymis tillarga* (Fabricius,1798)	√	√	√	√	√	√
44	*Tramea basilaris* Kirby, 1889	√	√	√	√	√	√
45	*Trithemis aurora* (Burmeister, 1839)	√	√	√	√	√	√
46	*Trithemis festiva* (Rambur, 1842)	√	√	√	√	√	√
47	*Trithemis kirbyi* Selys, 1891	√	√	√	√	√	√
48	*Trithemis pallidinervis* Selys, 1889	√	√	√	√	X	X