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Odonata larvae of Keibul Lamjao National Park, Manipur, northeastern India

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Abstract: Odonata larvae were collected from Keibul Lamjao National Park, Manipur, northeastern India during 2009–2011. The study recorded 15 species of Odonata larvae belonging to the anisopteran families Aeshnidae, Libellulidae and zygopteran families Calopterigidae, Lestidae and Coenagrionidae. The study revealed that there is a need for a detailed study of Odonata fauna of the national park as thorough knowledge of the important species of a conservation area is very essential for proper management.

Keywords: Anisoptera, national park, Odonata, Zygoptera.

The Keibul Lamjao National Park (KLNP) situated in the state of Manipur, northeastern India, is the only floating park in the world and noted as the last refuge of the Sangai *Rucervus eldii eldii*. It is an integral part of Loktak Lake formed by phumdis with an area of 40km^2. Phumdis, are a heterogeneous mass of soil, vegetation and organic matter at various stages of decomposition floating on lake water.

Odonata larvae have exploited a wide range of permanent and temporary aquatic habitats including brackish pools and estuarine habitats. In recent years all known Odonata species from the Japanese Archipelago were published by Okudaira et al. (2005). In Malaysia, Indonesia, Singapore and Brunei ca. 700 species occur in the region of which ca. 500 are endemic (Orr 2004). Fraser (1933–1936) published three volumes on Odonata in the 'Fauna of British India' including 536 species and subspecies of Odonata from India with many species from Bangladesh, Bhutan, Myanmar, Nepal, Pakistan and Sri Lanka. According to Subramanian (2009), in India there are 463 species/subspecies belonging to 140 genera. Some taxonomic studies on larvae have been done in India, such as Needhams (1911). Prasad & Varshney (1995) published a checklist of the Indian odonates, including updated data on larval studies of all known species. This paper presents a list of different species of Odonata larvae collected from Keibul Lamjao National Park.

MATERIALS AND METHODS

The Odonata larvae were collected from water with a dip net (mesh size - 60µm) from various places of Keibul Lamjao National Park using the 'kick sampling' method and by dragging the net around the vegetation for three minutes (Macan & Maudsley 1968; Brittain 1974; Subramanian & Sivaramakrishnan 2007).

To ensure a representative sample of the odonate fauna, a monthly collection was undertaken from 2009 until 2011. Collected Odonata larvae were immediately sorted and preserved in 70% ethyl alcohol. They were later identified using a Dewinter advance stereozoom microscope with the help of standard keys (Kumar 1973a, b; Westfall & Tennessen 1996; Srivastava & Sinha

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2004).

RESULTS AND DISCUSSION

A total of 15 species of Odonata larvae belonging to 15 genera, five families and two suborders were recorded (Table 1). The Odonata larvae recorded from the park are shown with their systematic position in the Table 1 and Image 1.

1) *Crocothemis servilia servilia* (Drury): Absence of mid dorsal abdominal spines. Premental setae 14+14. Palpal setae 10 &10

2) *Sympetrum* sp.: Presence of mid- dorsal abdominal spines. Superior abdominal appendage much shorter than inferiors. Lateral spines of abdomen short, not reaching tips of anal appendages.

3) *Rhodothemis* sp.: Mid-dorsal abdominal spines are absent. Lateral spine on abdominal segment 9 only. Lateral spine short, length less than half the mid-dorsal length of segment 9. Premental setae 12+12; palpal setae 8+8.

4) *Zyxomma petiolatum* (Ramb): With well developed mid-dorsal abdominal spines. Premental setae 13+13. Palpal setae 8+8.

5) *Tramea* sp.: Without mid dorsal abdominal spines. Superior abdominal appendage slightly shorter than inferiors. Lateral spine of abdominal segment 8 slightly shorter than those of segment 9. Lateral spine of segment 9 reaching tips of anal appendages.

6) *Potomarcha* sp.: Not much hair, without mid-

Table 1. Odonata larvae collected from KLNP, Manipur, northeastern India

Sub-order: Family/Sub-family	Species
Anisoptera	
Libellulidae: Sympetrinae	*Crocothemis servilia servilia* (Drury)
Libellulidae: Sympetrinae	*Sympetrum* sp.
Libellulidae: Sympetrinae	*Rhodothemis* sp.
Libellulidae: Zyxommatinae	*Zyxomma petiolatum* (Ramb)
Libellulidae: Trameinae	*Tramea* sp.
Libellulidae: Libellulinae	*Potomarcha* sp.
Libellulidae: Libellulinae	*Urothemis* sp.
Libellulidae: Leucorrhininae	*Leucorrhinia* sp.
Aeshnidae: Anactinae	*Anax* sp.
Aeshnidae: Anactinae	*Aeshna Juncea* (Mongolica)
Zygoptera	
Calopterygidae: Calopteryginae	*Neurobasis chinensis chinensis* (Linnaeus)
Coenagrionidae: Pseudagriinae	*Ceragrion* sp.(Selys)
Coenagrionidae: Pseudagriinae	*Pseudagrion rubriceps* (Selys)
Lestidae: Ischnurinae	*Ischnura senegalensis* (Charpentier)
Lestidae: Lestinae	*Lestes* sp. (Leach)

Image 1. Odonata larvae of KLNP, Manipur, northeastern India. © Kiranbala Takhelmayum
a - *Crocothemis servilia servilia*(Drury); b - *Sympetrum* sp.; c - *Rhodothemis* sp.; d - *Zyxomma petiolatum* (Ramb), e - *Tramea* sp.; f - *Potomarcha* sp.; g - *Urothemis* sp.; h - *Leucorrhinia* sp.; i - *Anax* sp.; j - *Aeshna juncea* (Mongolica); k - *Neurobasis chinensis chinensis* (Linnaeus); l - *Ceragrion* sp.; m - *Pseudagrion rubriceps* (Selys); n - *Ischnura senegalensis* (Charpentier); o - *Lestes* sp.

dorsal abdominal spines. Eyes tend to point upwards; eye tending to round. Lateral spines on abdominal segments 8–9, spines on segment 9 small, not longer than middorsal length, spines on segment 8 small, at least shorter than middorsal length.

7) *Urothemis* sp.: Eyes extended to posterior corners of head, pointed. Lateral spines on abdominal segments 8-9, spines on segment 9 substantial as long as the middorsal length, spines on segment 8 at least shorter than middorsal length.

8) *Leucorrhinia* sp.: The eyes generally make up about half the length of the head. Superior abdominal appendage about as long as the inferiors. Length of the lateral spine of segment 9 less than the mid-dorsal length of segment 9.

9) *Anax* sp.: Abdomen with lateral spines on segments 7 to 9. Superior anal appendage but slightly shorter than inferiors. Inferiors about one and one-half times as long as mid-dorsal length of segments 9 and 10.

10) *Aeshna juncea* (Mongolica): Abdomen with lateral spines on segments 6 to 9. Lateral anal appendages greater than one-half the length of the inferiors. Palpal lobes >1.50x as wide as the movable hook at its basal articulation, the distal margin squarely truncate and the outer distal angle a little rounded.

11) *Neurobasis chinensis chinensis* (Linnaeus): Large caudal lamellae, epiproct and paraproct in the form of large, elongated lamellae. Major premental and palpal setae absent. Prementum widely bifurcated in the middle. Laterally the distal ends project into long thin processes. One small spiniform setae present at about the middle of each of these processes.

12) *Ceriagrion* sp.: Caudal lamellae rounded, short, marked with blotches along the periphery. Posterior corners of head rounded or slightly angular; caudal gills denudate. Premental setae 1+1, palpal setae 6&6.

13) *Pseudagrion rubriceps* (Selys): Caudal lamella long, typically laminar type, rounded at the apices and divided distinctly into ante-nodal and post-nodal areas. Premental setae 1+1, palpal setae 4&4.

14) *Ischnura senegalensis* (Charpentier): Premental setae 4+4, palpal setae 5&5, a few spiniform setae present on the sides of prementum. Movable hook medium sized. Caudal lamellae duplex lamellae, tapering at both ends, light brown with darker tracheae.

15) *Lestes* sp.: Caudal lamellae simplex, lamellate

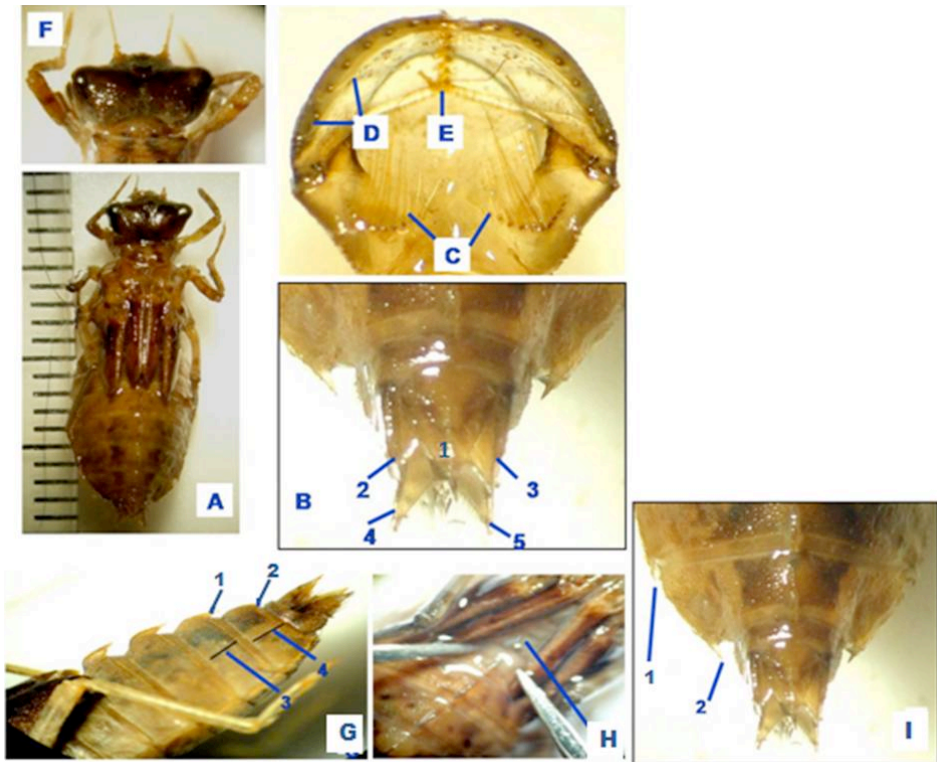

Image 2. Different characters of *Leucorrhinia* sp. larva of KLNP, Manipur, northeastern India. © Kiranbala Takhelmayum
A - *Leucorrhinia* sp.; B - (1) Epiproct, (2-3) Cerci, (4-5) Paraproct; C - Premental Setae; D - Palpal setae; E - Ligula; F - Head; G - (1-8th) mid dorsal spine, (2-9th) mid-dorsal spine, (3-8th) mid-dorsal segment, (4-9th) mid-dorsal segment; H - 3rd mid-dorsal spine; I - (1-8th) lateral spine, (2-9th) lateral spine

type. Inner portion of labial palps with apex long, thin, claw-shaped. Premental setae 6+6, palpal setae 3&3.

Of the numerous candidates of species that serve as wetland indicators, odonates (Odonata: dragonflies, damselflies) have been deemed a 'flagship' group of indicators (Oertli et al. 2002) because of their amphibious life history, relatively short generation time, high trophic position, and diversity (Corbet 1993; Clark & Samways 1996). Odonata species diversity are generally affected by contamination of water bodies (Watson et al. 1982) and the presence of predators (Williams 1987). There are many wetland complexes throughout the world where the Odonata fauna is under sampled and incompletely understood (Kalkman et al. 2008). There are several studies on Odonata of Manipur (Lahiri 1977, 1979; Mitra 1975, 1996; Asahina 1967; Srivastava & Sinha 2004). According to Srivastava & Sinha (2004) the total number of Odonata species recorded from Manipur were 68 species, 41 genera and eight families. In the above mentioned studies adult Odonata were collected from Keibul Lamjao National Park, Manipur Reserve Forest, Kharsom, Manipur Longienmandeei, Churachandpur, Kangpokpi, Loktak Lake, Ranginmanlli, Siendra Hill, Moirang, Annangtang Ukhrul and other places (Srivastava & Sinha 2004). A study on the Takmu area of Loktak Lake, Manipur revealed the presence of larvae of *Tramea* sp., *Sympetrum* sp. etc. belonging to the family Libellulidae (Takhelmayum & Gupta 2011).

In the present study, Anisoptera larvae were abundant in all the study sites. This could be attributed to their high dispersal ability and adaptability to a wide range of habitats (Batzer & Wissinger 1996; Lawler 2001; Kadoya et al. 2004; Suhling et al. 2004, 2005). The abundance of Libellulidae larvae (Anisoptera) might be due to their shorter life cycle and widespread distribution (Norma-Rashid et al. 2001). Further they are tolerant to a wide range of habitats (Gentry et al. 1975; Samways 1989). Among the 10 genera of the family Libellulidae recorded in the present study, the genus *Leucorrhinia* is a new record from India (Image 2).

The survey of Odonata larvae during 2009–2010 and 2010–2011 in the national park revealed that the number of species was higher in the first year than

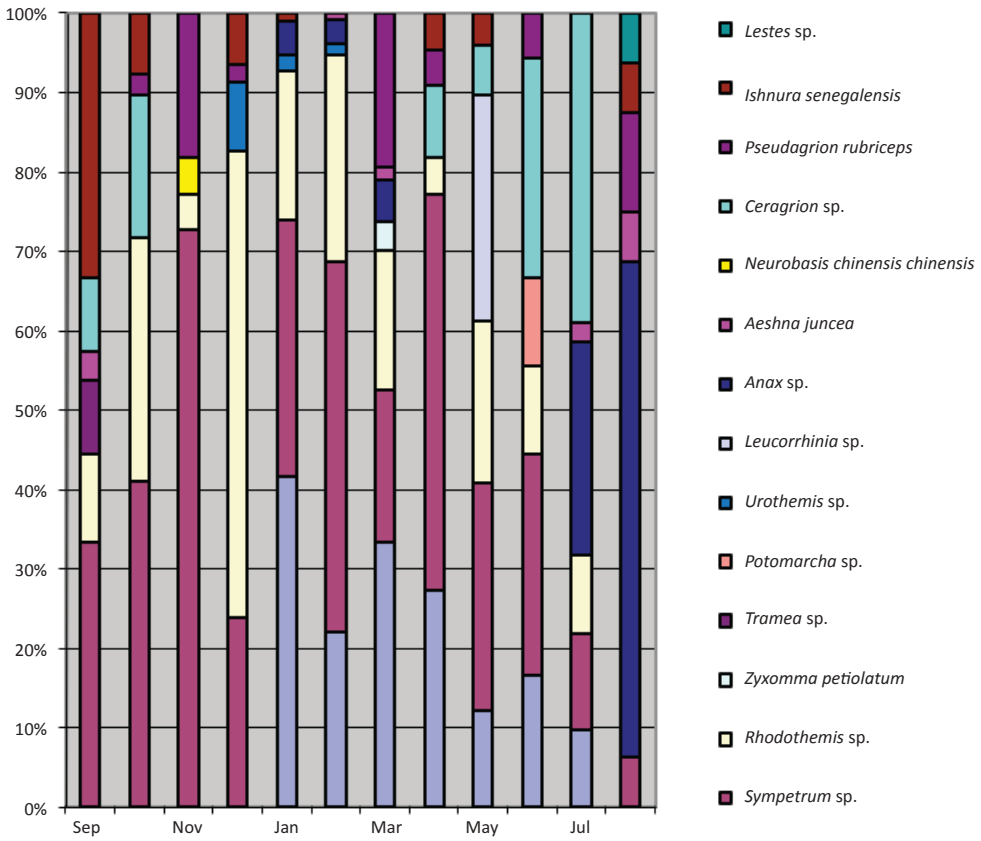

Figure 1. Temporal variation in relative abundance of different Odonata species during 2009–2010 in KLNP, Manipur, northeastern India

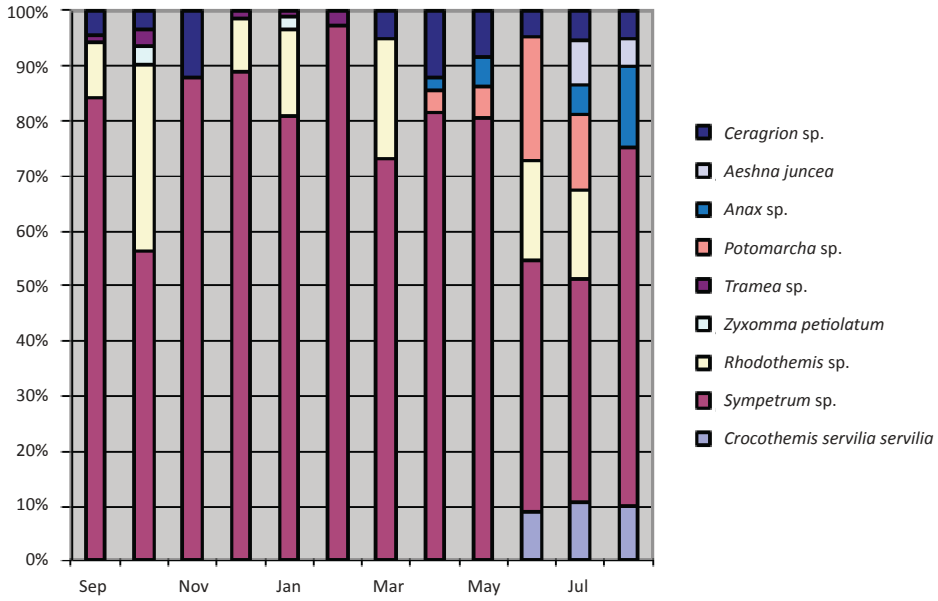

Figure 2. Temporal variation in relative abundance of different Odonata species during 2010–2011 in KLNP, Manipur, northeastern India

in the second year. The highest number of species was recorded in the months of March and June in the first and second years, respectively. *Leucorrhinia* sp. was recorded only in the month of May in the first year (28.6% relative abundance). *Sympetrum* sp. was recorded in all the months in both the years and in the second year in all the months it was found to have the highest relative abundance (Figs. 1 & 2). This study finds that there is a need for a detailed study of Odonata fauna of the national park as thorough knowledge of the important species of a conservation area is very essential for proper management.

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