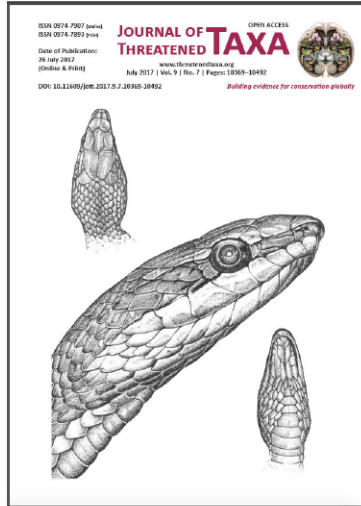


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## Journal of Threatened Taxa

Building evidence for conservation globally

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

### SHORT COMMUNICATION

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26 July 2017 | Vol. 9 | No. 7 | Pp. 10445–10452  
10.11609/jott.3689.9.7.10445–10452



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

## DRAGONFLIES AND DAMSELFLIES (ODONATA: INSECTA) OF KEOLADEO NATIONAL PARK, RAJASTHAN, INDIA

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**Abstract:** The present study was undertaken to examine the diversity, occurrence and distribution pattern of damselflies and dragonflies (Odonata) in Keoladeo National Park from 2010–2015. A combination of direct search, observation and opportunistic sighting methods were used to record 37 different species of Odonata (9 damselflies and 28 dragonflies). Among the Odonata recorded, the most diverse families are Libellulidae presented by 22 species and Coenagrionidae was present with eight species. According to the list presented by Palot & Soniya (2000) 21 species could be added; of the species presented here five are recorded for the first time from Rajasthan.

**Keywords:** Abundance, Bharatpur, diversity, habitat types, odonates, protected area.

Dragonflies and Damselflies (Insecta: Odonata) are among the most fascinating insects of the aquatic habitats. The most recent checklist of Indian Odonata counts 474 species (Subramanian 2014). Sharma (2014, 2015) published a list of 47 species for Rajasthan including species mentioned by previous authors like Agrawal (1957), Bose & Mitra (1975), Kulshrestha & Kulshrestha (1990), Prasad & Thakur (1981), and Thakur (1985); however, Sharma (2015) did not mention *Ischnura elegans* and *Pseudagrion malabaricum*. This article presents a recent overview of the odonate fauna of Keoladeo National Park, Bharatpur based upon observations made between 2010 and 2015 by the

authors. The list presented here gives an extension to the former list by Palot & Soniya (2000).

### STUDY AREA

Keoladeo National Park is part of the Indo-Gangetic flood plains situated between 77.48583333 E & 27.11833333–27.20055556 N in Bharatpur District of Rajasthan (Fig. 1). The Park is a man-made that covers 29km<sup>2</sup> out of which 12km<sup>2</sup> is a wetland zone. The area receives water from River Chambal, a tributary of river Yamuna and water level varies from 0–2 m. Temperature ranges from 2°C in winter (November–February) to 49°C in summer (March–June). The average rainfall is 662mm, mostly from the southwest monsoon during July to September. The vegetation of the Park around the wetland area is a mixture of xerophytic and semi-xerophytic species consisting predominantly of *Acacia nilotica*, *Prosopis cineraria*, *Salvadora oleoides*, *Capparis decidua* and *Capparis sepiaria*. Because of the varying eco-climatic conditions the Park comprises 379 species of plants (Meena & Sharma 1996).

The wetlands of Keoladeo National Park have 96 species of flowering plants, of which *Paspalum distichum*, a perennial grass, is the most dominant species (Meena & Sharma 1996; Prasad 1988). Free

**DOI:** <http://doi.org/10.11609/jott.3689.9.7.10445-10452> | **ZooBank:** urn:lsid:zoobank.org:pub:80E72EAE-71E0-4D26-9BBE-FCD9F8957D2D

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

**Date of publication:** 26 July 2017 (online & print)

**Manuscript details:** Ms # 3689 | Received 13 December 2016 | Final received 04 July 2017 | Finally accepted 08 July 2017

**Citation:** Singh, D., B. Singh & J.T. Hermans (2017). Dragonflies and Damselflies (Odonata: Insecta) of Keoladeo National Park, Rajasthan, India. *Journal of Threatened Taxa* 9(7): 10445–10452; <http://doi.org/10.11609/jott.3689.9.7.10445-10452>

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**Funding:** None.

**Competing interests:** The authors declare no competing interests.

**Acknowledgements:** The authors would like to thank Prof. Dr. B. Kiauta (The Netherlands) for his support in providing us with some missing literature.

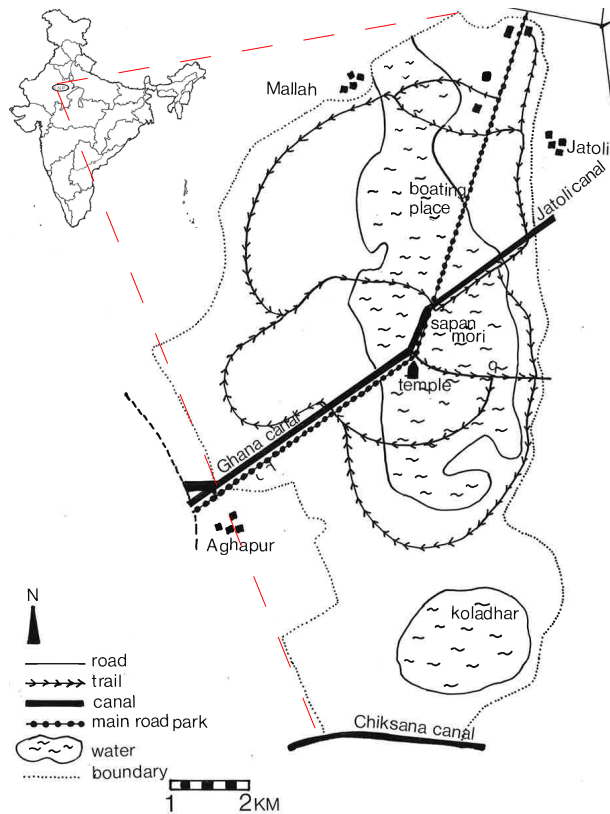


Figure 1. Keoladeo National Park - study area



Image 1. Free floating plant communities of Lemna, Spirodela and Wolffia.



Image 2. Rooted plant communities with floating leaves or branches like Nymphaoides and Neptunia.

floating plant communities are represented by species like *Spirodela polyrhiza*, *Lemna perpusilla*, *Azolla pinnata* and *Eichhornia crassipes* (Images 1 & 2). The invasive *E. crassipes* is removed from time to time; it often forms large dominating patches, which displaces the native aquatic vegetation. These free-floating plant species usually occur in open water areas and keep drifting along with the wind. Confined to the deepest areas with open water and a loose muddy bottom is the *Hydrilla-Najas* vegetation. The main species forming this association are *Hydrilla verticillata*, *Najas minor*, *Potamogeton nodosus*, *Nymphaoides indicum*, *N. cristatum* and *Nymphaea pubescens*. This type of vegetation is very important for several odonates, because this variety of submerged plants gives excellent breeding habitat for odonates, which lay their eggs into the plant tissue (endophytic oviposition).

Another important type of vegetation for dragonflies and damselflies is the *Paspalum-Ipomoea* association with species like *Paspalum distichum*, *Ipomoea aquatica*, *Scirpus littoralis*, *Scirpus tuberosus* and *Utricularia* species. This vegetation is mostly present in shallow water areas or along the wetland shores. The extensive patches of *Paspalum distichum* are characteristic, which

form a perfect hiding and roosting habitat for smaller damselflies like *Agriocnemis pygmaea*, *Ceriatrigon coromandelianum*, *Ischnura aurora* and *Ischnura senegalensis*.

#### MATERIALS AND METHODS

The observed odonates were all documented with photos and identified with the help of Identification keys provided by Fraser (1933, 1934, 1936), Mitra (2006) and Subramanian (2005). Use of a binocular during the field trips was very helpful. The fieldwork was mainly conducted from March to December from 2010–2015. The study sites include: the boating place area with Sapan Mori, the region around the Keoladeo Temple (called Chakwa Chakwi and Mansarovar) and along Ghana and Jatoli Canal. At every site an estimation of numbers, additional information about observed reproductive behaviour (egg-laying, exuviae, teneral) and habitat (water level, vegetation) of all recorded species were collected. The odonates were categorized on the basis

of their abundance: 1 - very common (>100 sightings), 2 - common (50–100 sightings), 3 - rare (1–10 sightings). The abundance is combined with the reproduction status according to our summarized observations of the past five years.

## RESULTS AND DISCUSSION

A total of 37 species of odonates belonging to 25 genera belonging to four families, viz., Lestidae, Coenagrionidae, Aeshnidae and Libellulidae were recorded. The five species recorded for the first time from Rajasthan are: *Lestes umbrinus*, *Pseudagrion spencei*, *Anax imperator*, *Anaciaeschna jaspidea* and *Rhodothermis rufa*. Comparing to the list of Palot & Soniya (2000) we could add 21 species not mentioned before. *Agriocnemis pygmaea*, *Ceriagrion coromandelianum*, *Brachythemis contaminata*, *Crocothemis servilia* and *Orthetrum sabina* are the most abundant species in the Park, followed by *Ischnura senegalensis*, *Ischnura nursei* and *Tramea basilaris burmeisteri*. It is remarkable that in the list by Palot & Soniya (2000) common species like *Ischnura nursei* or *Potamarcha congener* are lacking. The family Aeshnidae is also not presented in their list and probably the species could not be observed because their odonate survey covered only a short period (one year) in the months April and December. This proves that a more extensive survey (including the different flight periods of species) is necessary to give a comprehensive overview of odonate species in a given area.

The list presented here shows that the most dominant family in Keoladeo National Park is Libellulidae with 22 species. The suborder Zygoptera is dominated by the family Coenagrionidae. The species from both families are characteristically found in stagnant, mesotrophic waters with well-developed aquatic vegetation with a mixture of submerged and emerged plant species. The detailed systematic list with their locations, abundance and status is given in Table 1. The classification and nomenclature is adapted after Subramanian (2014).

**Order: Odonata**

**Suborder: Zygoptera**

**Superfamily: Lestoidea**

**Family: Lestidae**

### 1. *Lestes umbrinus* Selys

Observed individuals: Only one male and female were observed on 18.x.2010 in dry shrubs near the boating place. After that year we never saw any individual of this species.

Remarks: We regard this spread wing as a guest.

## Superfamily: Coenagrionidea

### Family: Coenagrionidae

#### 2. *Agriocnemis pygmaea* (Rambur) (Image 3)

Observed individuals: Very common at all water bodies in the Park, especially in places with a vegetation of *Paspalum* grass. These tiny damselflies are easily overlooked when they fly over the grass. Near Mansarovar we found more than 50% females in the red form. Many freshly emerged individuals were eaten by *Ceriagrion coromandelianum*. We observed one individual eating an ant.

Remarks: Very common, mostly in good numbers varying from 10–50, in optimal habitats more than 100.

#### 3. *Ceriagrion coromandelianum* (Fabricius)

Observed individuals: Found in the same grassy habitats as *Agriocnemis pygmaea*, but sometimes far away from the water and to be found along the main road in dry shrubs.

Remarks: This species prefers submerged vegetation in open water areas; in 2015 we observed more than 100 tandems laying eggs in *Hydrilla verticillata* at the boating place together with *Pseudagrion decorum*.

#### 4. *Enallagma parvum* Selys

Observed individuals: Only one record of two males on 25.iv.2015 on *Hydrilla verticillata* at the boating place.

Remarks: It must be regarded as a very rare species in the Park, because it has never been recorded before.

#### 5. *Ischnura aurora* (Brauer)

Observed individuals: This species always occurs in small numbers from 1–10 individuals. Females are easily overlooked; like *Agriocnemis pygmaea* it likes hiding in grassy habitats along the wetland shores. It seems to prefer the more open temporary pools with scattered patches of grasses.

Remarks: It is a common species in the Park, although it is not easily found because of low numbers.

#### 6. *Ischnura nursei* (Morton) (Image 4)

Observed individuals: As it is with other small damselflies, this species prefers shallow waters with well-developed grass vegetation.

Remarks: Despite the beautiful colours it disappears quickly between the grasses. Common at many water bodies in the park with a few individuals; sometimes more than 10. We also found androchrome females near the boating place and Sapan Mori. This species often occurs together with *Ischnura aurora*, *Agriocnemis pygmaea* and *Ischnura senegalensis*.



Image 3. *Agriocnemis pygmaea*, male



Image 4. *Ischnura nursei*, male

### 7. *Ischnura senegalensis* (Rambur)

Observed individuals: Common at all visited places in the Park, mostly varying from 2–50.

Remarks: Heterochrome females dominate; we found the orange form of the female near the Keoladeo Temple and one androchrome female at the boating place on 26.iv.2014.

### 8. *Pseudagrion decorum* (Rambur) (Image 5)

Observed individuals: Common but more restricted to places with well-developed submerged vegetation such as *Hydrilla verticillata* at the boating place or Chakwa Chakwi.

Remarks: Eggs are laid on *Hydrilla verticillata*. We never observed more than 10 individuals at the same place.

### 9. *Pseudagrion spencei* Fraser

Observed individuals: Seen only once along the Jatoli Canal on 14.x.2013, two tandems laying eggs in *Hydrilla verticillata* and *Ceratophyllum demersum*.

Remarks: Very rare.

#### Suborder: Anisoptera

#### Superfamily: Aeshnoidea

#### Family: Aeshnidae

### 10. *Anaciaeschna jaspidea* (Burmeister) (Image 6)

Observed individuals: Only one freshly emerged male was observed in *Capparis sepiaria* bush near Mansarovar on 9.xi.2010.

Remarks: This seems to be a very rare dragonfly, very difficult to spot. Never observed flying around like other aeshnids.

### 11. *Anax guttatus* (Burmeister)

Observed individuals: Only two observations: one female near the boating place laying eggs on 13.x.2012 and one male fresh emerged on 7.vi.2015 in the bushes

also near the boating place.

Remarks: Because of the very few sightings we regard it as a rare species in the Park, which does not breed here every year.

### 12. *Anax immaculifrons* Rambur

Observed individuals: Only observations of two flying females, one above the Ghana Canal on 25.iv.2011 and one on 25.iv.2015 near the Keoladeo Temple.

Remarks: This species must be regarded as a guest in Keoladeo National Park, because of the very few observations and the absence of an optimal breeding habitat.

### 13. *Anax imperator* Leach

Observed individuals: On 9.ii.2010 one male was observed patrolling around above Sapan Mori.

Remarks: Very rare, a guest.

### 14. *Anax parthenope* (Selys)

Observed individuals: Two territorial males were seen above the Ghana Canal on 25.iv.2015.

Remarks: Very rare, probably guest, but suitable reproduction habitats are available at several places.

### 15. *Hemianax ephippiger* (Burmeister)

Observed individuals: Every year some individuals could be seen near the boating place, Sapan Mori and Mansarovar. On 17.x.2014 we observed a tandem laying eggs at Mansarovar.

Remarks: A species that is rather common and probably reproduces in the Park annually. On 9.xi.2010 we found three freshly emerged males hanging on *Capparis sepiaria* bushes.

#### Superfamily: Libelluloidea

#### Family: Libellulidae

### 16. *Acisoma panorpoides* Rambur



Image 5. *Pseudagrion decorum*, tandem



Image 6. *Anaciaeschna jaspidea*, fresh emerged male

Observed individuals: A common Libellulid, mostly observed near the boating place and Mansarovar. This dragonfly with its peculiar abdomen prefers (like many damselflies) the grassy habitats, where they hide and sit. Therefore, it is sometimes difficult to find.

Remarks: Common at the preferred habitats.

#### 17. *Brachydiplax sobrina* (Rambur)

Observed individuals: Prefers shaded places with grass in the neighbourhood of trees or shrubs near the waterside: seen at the boating place and many times near the pumping place at Sapan Mori. Females lay eggs in small open places between the grasses, often in the shade.

Remarks: Contrary to Palot & Soniya (2000) we think that *Brachydiplax sobrina* is not common and only occasionally present. Males are often seen perching on their favourite twig in open sunny areas.

#### 18. *Brachthemis contaminata* (Rambur)

Observed individuals: Very common throughout the wetlands in the park, often in very high numbers of more than 50–100 individuals. One of the most common species.

Remarks: Shows no special preference for a habitat or type of vegetation.

#### 19. *Bradinopyga geminata* (Rambur)

Observed individuals: Very rare dragonfly in the Park. Only one observation of a male sitting at a cemented tank near Sita Ram Bani.

Remarks: A species that breeds in tanks or small water bodies. Probably only a guest; breeds outside the Park in several man-made water tanks.

#### 20. *Crocothemis servilia* (Drury) (Image 7)

Observed individuals: Together with *Brachthemis contaminata* the most common and abundant dragonfly



Image 7. *Crocothemis servilia*, male

at every place in the Park. Individuals can be observed almost throughout the year, often in big numbers of more than 50 individuals.

Remarks: Very numerous and dominant at open, shallow water with grasses or sedges, often in combination with floating algae patches. Here the females prefer to lay eggs.

#### 21. *Diplacodes lefebvrrii* (Rambur)

Observed individuals: Rather common at several places in the Park namely: near the boating place, Sapan Mori, Mansarovar. Always in limited numbers (1–5) often scattered individuals.

Remarks: We mainly observed males; females hide often in the shade of trees like the females of *Brachydiplax sobrina*.

#### 22. *Diplacodes trivialis* (Rambur)

Observed individuals: Rather common in the Park. In the past five years mostly seen at the boating place and along the road near Sapan Mori; never seen in big numbers (1–5 individuals).

Remarks: Old males are often completely blue pruinosed.

Table 1. Species list Keoladeo National Park, Bharatpur 2010-2015.

Details	2010			2011			2012			2013			2014			2015			Status
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
Suborder: Zygoptera																			
Family: Lestidae																			
1* <b>Lestes umbrinus</b>	•																		3
Family Coenagrionidae																			
2 <b>Agriocnemis pygmaea</b>	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	1
3 <b>Ceriagrion coromandelianum</b>	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	1
4 <b>Enallagma parvum</b>																		•	3
5 <b>Ischnura aurora</b>			#	#	#		#	#		#			#				#		2
6 <b>Ischnura nursei</b>	#	#	#		#			#		#				#			#		2
7 <b>Ischnura senegalensis</b>	#	#	#	#	#		#	#		#	#		#	#		#			2
8 <b>Pseudagrion decorum</b>	#	#			#			#		#			#	#		#			2
9* <b>Pseudagrion spencei</b>												#							3
Suborder: Anisoptera																			
Family: Aeshnidae																			
10* <b>Anaciaeschna jaspidea</b>		•																	3
11 <b>Anax guttatus</b>								•									•		3
12 <b>Anax immaculifrons</b>								•									•		3
13* <b>Anax imperator</b>	•																		3
14 <b>Anax parthenope</b>																		•	3
15 <b>Hemianax ephippiger</b>		#			•		•	#		•			•	#					2
Family: Libellulidae																			
16 <b>Acisoma panorpoides</b>	•			•			•			#			#	#		#			2
17 <b>Brachydiplax sobrina</b>										#			•	#		•	•		2
18 <b>Brachythemis contaminata</b>	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	1
19 <b>Bradinopyga geminata</b>							•												3
20 <b>Crocothemis servilia</b>	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	1
21 <b>Diplacodes lefebvrii</b>			•							•			#	#		#	#		2
22 <b>Diplacodes trivialis</b>	•	•			#		•												2
23 <b>Neurothemis tullia</b>														•					3
24 <b>Orthetrum pruinosum</b>										•									3
25 <b>Orthetrum sabina</b>	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	1
26 <b>Orthetrum taeniolatum</b>														•					3
27 <b>Palpopleura sexmaculata</b>			•																3
28 <b>Pantala flavescens</b>	•			#	#		\$	\$		#			#			#			2
29 <b>Potamarcha congener</b>	•	•	#	•			#	•		#	•		•			•			1
30* <b>Rhodothemis rufa</b>								•			#			#			•		3
31 <b>Rhyothemis variegata</b>	#			#			#			#	\$		\$	•		#			1
32 <b>Tholymis tillarga</b>	#	#		#			#			#			#			#			2
33 <b>Tamea basilaris</b>	#	#	#	#	#		#	#		#	#		#	#		#			1
34 <b>Tamea limbata</b>								•											3
35 <b>Trithemis aurora</b>								•											3
36 <b>Trithemis festiva</b>														#					3
37 <b>Trithemis pallidinervis</b>			#											#					3

Species in bold: additions to the published list of Palot and Soniya (2000); Species with asterisk: addition and new to the list of Odonata of Rajasthan (Sharma, 2015)  
Locations in Keoladeo: 1 - boating place and Sapan Mori; 2 - area around the temple; 3 - canal areas

Abundance, symbols: • = one single specimen; # = 2–50; \$ = >50–100

Status: 1 - very common and with good populations in the park; 2 - common, almost yearly with populations; 3 - very rare or vagrant species; no population in the park.





Image 8. *Potamarcha congener*, male



Image 9. *Tholymis tillarga*, female

### 23. *Neurothemis tullia* (Drury)

Observed individuals: Only one observation of a male on 17.x.2014 near Mansarovar.

Remarks: Only a vagrant drifter.

### 24. *Orthetrum pruinosum interjectum* (Burmeister)

Observed individuals: Only one observation of a male at the boating place on 27.iv.2013.

Remarks: A vagrant drifter like *Neurothemis tullia*. Suitable reproduction habitats (small stony and muddy streams) are not available in the Park.

### 25. *Orthetrum sabina* (Drury)

Observed individuals: After *Brachythemis contaminata* and *Crocothemis servilia* the most common Libellulid in the Park. From January to December present everywhere throughout the Park without special preference of a special habitat or vegetation.

Remarks: Very aggressive towards other dragonflies. Many times we observed this species predated on *Brachythemis contaminata*.

### 26. *Orthetrum taeniolatum* (Schneider)

Observed individuals: One observation on 17.x.2014 along the road near Keoladeo Temple.

Remarks: Again an example of a vagrant individual, because its preferred habitat is not to be found in the Park.

### 27. *Palpopleura sexmaculata* (Fabricius)

Observed individuals: There exists only one observation of a male at the edge of the Park near Jatoli on 8.xi.2010.

Remarks: Definitely a vagrant individual.

### 28. *Pantala flavescens* (Fabricius)

Observed individuals: Seen every year in variable

numbers, but a common species in the Park. Many individuals (more than 50) were seen in 2011 and 2012 around the boating place, Sapan Mori, Chakwa Chakwa and Mansarovar.

Remarks: On 25.iv.2011 we found three freshly emerged males near the boating place.

### 29. *Potamarcha congener* (Rambur) (Image 8)

Observed individuals: A common species in the Park, mostly seen near the boating place and Sapan Mori, but also at Mansarovar and at a temporary pond near Jatoli.

Remarks: Often roosts in big numbers. On 08.xi.2010 we found a roosting place near the entrance of the Park of around 30 individuals, teneral males and females.

### 30. *Rhodothemis rufa* (Rambur)

Observed individuals: Not regularly seen every year, mostly one or two individuals: one female on 13.x.2012 near Keoladeo Temple; two females along the Jatoli Canal on 14.x.2013; three males near Mansarovar on 17.x.2014 and one male near Keoladeo Temple on 25.iv.2015.

Remarks: Not a common species and does not seem to reproduce.

### 31. *Rhyothemis variegata* (Linnaeus)

Observed individuals: A common species, that can be seen seasonally, often present in high numbers from a few individuals to more than 100, while they hover in groups like butterflies, observed at Sapan Mori several times, near Mansarovar and in less numbers (1–4) near the boating place.

Remarks: Common, especially in April and May.

### 32. *Tholymis tillarga* (Fabricius) (Image 9)

Observed species: During the day seen hanging in the *Capparis sepiparia* or *Salvadora oleoides* bushes;



Image 10. *Tramea basilaris burmeisteri*, female

seen near Keoladeo Temple every year and in the bushes along the main road.

Remarks: Common, but because it is a crepuscular species, very difficult to discover during the day. It becomes just active in the late afternoon.

### 33. *Tramea basilaris burmeisteri* (Palisot de Beauvois) (Image 10)

Observed individuals: A common species to be seen at several sites like the boating place, Sapan Mori, Chakwa Chakwi and Mansarovar, sometimes in high numbers up to 10 individuals.

Remarks: For laying eggs *Tramea basilaris* prefers open water with well-developed submerged vegetation where they lay eggs in tandem linkage.

### 34. *Tramea limbata* (Desjardins)

Observed individuals: Only one observation until now on 08.xi.2010 near the boating place.

Remarks: A very rare species, probably a vagrant individual.

### 35. *Trithemis aurora* (Burmeister)

Observed individuals: One observation of a male at the boating place on 27.iv.2013.

Remarks: Definitely a vagrant male.

### 36. *Trithemis festiva* (Rambur)

Observed individuals: On 17.x.2014 we saw two males near Sapan Mori together with some males of *Brachydiplax sobrina* on grassy vegetation.

Remarks: Vagrant males like *Trithemis aurora*.

### 37. *Trithemis pallidinervis* (Kirby)

Observed individuals: Only observed in 2010 and 2014 near Sapan Mori, the boating place and near the temporary ponds at the edge of the Park near Jatoli.

Remarks: It is a rare species and it is not clear so far if it can reproduce in the Park. We would recommend a more extensive study of some of the larvae and exuviae of the Odonata in the Park in the future. Such a study, in combination with necessary on-going observations of the adults, would provide more clarity about the real reproduction success of many species. Such a survey on larvae and exuviae should be combined with a study of the preferred aquatic vegetation. In this way the results could give more information about the most important parts of the Park to be protected as an important wetland not only for birds, but also for these wonderful insects.

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

July 2017 | Vol. 9 | No. 7 | Pages: 10369–10492

Date of Publication: 26 July 2017 (Online & Print)

DOI: 10.11609/jott.2017.9.7.10369-10492

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