
SEASONAL VARIATION AND MITE INFESTATION IN THE ANISOPTERAN DRAGONFLIES OF GOREWADA LAKE OF NAGPUR CITY, INDIA

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ABSTRACT

Dragonflies are amphibiotic insects since the females lay eggs in water; the larvae are aquatic while the adults aerial in habitat. There is a great variation in the oviposition behavior and larval microhabitat of these insects. A field study throughout the year was undertaken at Gorewada lake of Nagpur city (which supplies water to the city) to study the seasonal activity pattern of anisopteran dragonflies. Although a total of 33 anisopterans were detected, we could study the following three parameters- flight period, reproductive behavior, breeding habitats and mite parasitism of twenty species. The result indicates a distinct variation in the breeding site and flight period of the species observed. Such variation in the choice of breeding habitat allows the species to avoid competitive pressure for breeding and larval microhabitats. Only six species (*Acisoma panorpoides*, *Brachythemis contaminata*, *Crocothemis servilia*, *Diplacodes trivialis*, *Neurothemis t. tullia* and *Trithemis pallidinervis*) were found to be parasitized with mite *Arrenurus* spp. mostly on the ventral region of the thorax and abdomen.

Key Words : Gorewada lake, Dragonfly, Nagpur, breeding habitat, Anisoptera, *Arrenurus* spp.

Introduction

Man- made lakes are becoming important in many parts of the world, primarily intended as source of either public water supply or hydro electric power. They also provide new opportunities for irrigation farming, fisheries development, transport and recreation. Many lakes and reservoir have been impounded in India to provide a continuous water supply and provide an opportunity to investigate the seasonal variation in physiochemical and biological factors. A perusal of literature indicates that no substantial work has been undertaken to study the seasonal variations in the activities of dragonflies from central India (ANDREW, 1982, 95; ANDREW & TEMBHARE, 1997).

Larvae of *Arrenurus* spp are common and widespread ectoparasite of dragonflies and damselflies (SMITH, 1988). More than 55 species of the mite *Arrenurus* have been described as ectoparasites of Odonata (CORBET, 1999). Arrenurid larvae are true parasites and exploit their odonate hosts for both food and dispersal. Further, they also

form a phoretic association with the last instar larvae of the host. As the host emerges out of water during the final metamorphosis, the mite larvae crawl from the exuvia to the newly emerged adult and become parasitic (ZAWAL, 2006). They start penetrating the host cuticle and full engorgement of the mite larvae can be detected 48 hours later (ABRO, 1982). Mites remain attached to the host throughout the pre-reproductive period of the host and progressively change color almost in unison. They drop off in water when the odonate comes to copulate and oviposit in a water body. There is no report on the frequency, species selection and site specificity of water mite's ectoparasitism within and among dragonfly species of India.

The present paper incorporates the results of an investigation carried out in Gorewada Lake in the year 2010-2011 to study the seasonal activity of anisopteran dragonflies breeding in this waterbody. We also surveyed species selection and site specificity of ectoparasite larval arrenurid mites on the

anisopteran dragonflies during the present study.

Material and Methods

Nagpur city lies at the southern fringe of Satpuda mountain range (21° 10' N 79° 12' E) and is an undulating plateau with altitude ranging between 274 to 305 m above mean sea level. The diurnal temperature varies from 10°C in Dec-Jan (winter) to a maximum of 46°C in May June (summer). The normal rainfall varies from 100-200 cm which precipitates mostly during monsoon from June to September. Gorewada Lake is one of the major source of potable water supply to the Nagpur city. It is located about 4 km north west of Nagpur at 21.09°N and 70.07°E at an elevation of about 300 meters above mean sea level. It has a catchment area of 2800 hr and water spread of 259hr. The shore is irregular and the littoral vegetation is composed of *Vallisneria* sp., *Chara* sp., *Potamogeton alpinus* and *P. falciformis*. The catchment area is well protected and there is no major source of pollution of the lake.

The anisopteran dragonflies where observed from January to December in the year 2010-11 at and around the Gorewada lake of Nagpur city. Most of the specimens were photographed and some specimens were also fixed in 70% alcohol and confirmation. Parasitized individuals were fixed in Bouins fluid for further studies.

Observation

The seasonal variation and mite infestation in the anisopteran dragonflies of Gorewada lake of Nagpur city is given in Table 1.

The anisopteran dragonflies observed during the present study are –

Anax guttatus (Burmeister)

[Family- Ashenidae]

This is one of the largest dragonfly of Central India and is found patrolling along the margins of large water bodies. It has a greenish-yellow head and thorax with transparent wings, but the hind wings contains a large brownish yellow patch. The abdomen is mostly black with large triangular yellow spot, but the first two segments of the abdomen are bright turquoise blue. It breeds in small and large deep water bodies. It exhibit endophytic oviposition with or without male guarding in tandem.

Flight period: It is abundantly found in the months of August – April except in the months of May, June and July.

Reproductive Behavior: Found copulating during September – October, June- July.

Breeding Habitat: Large and small deep pool.

Acisoma panorpoides Rambur

[Family- Libellulidae]

A small pale blue/ yellow dragonfly with marbled black and white pattern in thorax and abdomen.

Flight period- August- March

Reproductive behavior: aquatic oviposition.

Breeding habitat: Ponds and lakes

Brachythemis contaminata (Fabricius)

[Family- Libellulidae]

It exhibits major sexual dimorphism. The males have a deep conspicuous reddish brown abdomen. The wings exhibit a large bright orange patch while the pterostigma is rust red. The females have a yellow head with a plane greenish yellow/ brown thorax carrying a pair of transparent wings with a light brownish patch in the posterior pair. The abdomen is brownish black. It is found in stagnant, slow flowing ditches, nallas and in shallow canals, lakes etc.

Flight period: It is found throughout the year except.

Reproductive Behavior: Copulation takes place in late evenings. The males guard the ovipositing site during the day time and female comes only during evening to copulate and lay eggs. It exhibit epiphytic, non-contact guarding oviposition.

Breeding Habitat: Shallow slow flowing, stagnant water bodies, weedy ditches, pools etc.

Brachydiplax sobrina (Rambur)

[Family- Libellulidae]

Average size, the mature males are metallic blue while the teneral male and female have yellow body with metallic black stripes.

Flight period: March –September

Reproductive Behavior- Aquatic, non guarding oviposition

Breeding habitat: Weedy small and large lakes

Bradinopyga geminata (Rambur)

[Family- Libellulidae]

It is one of the most common household dragonflies in India. It is gray with black and white markings and transparent wings. It is found clinging to compound cement walls, stones, near small, shallow water bodies, garden, ornamental lake etc.

Flight period: Throughout the year.

Reproductive behavior: Sexually active in late morning and afternoon. It exhibits non contact guarding, aquatic oviposition.

Breeding habitat: Shallow small cement lakes and water holes.

Crocothemis servilia (Drury)

[Family- Libellulidae]

It is a medium size exhibiting major sexual dimorphism in body colour. The male is a blood red coloured dragonfly with red face, head, thorax and abdomen while the female is yellowish brown with a conspicuous dorsal black strip on the abdomen. It is mostly found perched on the tip of dried twigs, it is found mostly

in pairs near shallow slow flowing waterbodies or shallow spread water puddle.

Flight period: January- February and July to December.

Reproductive behavior: late morning and late afternoon, oviposition is of non contact guarding type.

Breeding habitat: Large and small shallow water bodies, slow flowing streams and rain water puddle.

Diplacodes trivialis (Rambur)

[Family- Libellulidae]

It is one of the smallest anisopteran dragonflies of central India measuring about 26-28 mm in length. It is found on grassy ground exhibiting short flight when disturbed. It is typically seen perching on ground or low on vegetation or flying very low along the ground. The newly molted adult is yellowish which turns to green during maturity and latter a blue pruinescence develops all over the body.

Flight period: October – December and January - April.

Reproductive behavior: Exhibit aquatic, non contact guarding oviposition.

Breeding habitat: Very shallow road side ditches and water puddles.

Diplacodes nebulosa (Fabricius)

[Family- Libellulidae]

It is a small dragonfly. The male is blue with dark patches on the wing tips. The female is pale yellow with a broad dark line along the dorsum of abdomen. The wings of the female are clear.

Flight period: July- August

Reproductive behavior- not observed

Breeding Behavior- shallow ponds and marshes.

Epophthalmia vittata Burmeister

[Family- Corduliidae]

Robust dragonfly with dark brown to dark ochreous stripes at the base of the wings.

Flight period-July-December

Reproductive behavior: not observed
Breeding habitat: Large, deep water bodies

Ictinogomphus rapax (Rambur)
[Family- Gomphidae]

This is a large dragonfly with black and yellow strips, transparent wings and bluish gray eyes.

Flight period: They are mostly found perched in obelisk posture on high tips of dried shrubs and trees. They are found in substantial numbers during the month of July – October but are also observed in the months from January to April.

Reproductive Behavior: Tandem pairs are observed in the morning hours.

Breeding Habitat: It breeds in large, deep water bodies.

Neurothemis tullia tullia (Drury)
[Family- Libellulidae]

A small and delicate dragonfly. It exhibits striking sexual dimorphism in its colour and wing spot patterns. The male is dark and the basal half of the wing is blue/brown black, bordered by a milky white patch while the wing tip is transparent. The female are dull olivaceous and the wing base is amber yellow and the front edge is blackish brown which forms a very large brown black spot.

Flight period: August- February

Reproductive behavior- not observed

Breeding Behavior- small lakes, ponds and paddy fields

Orthetrum glaucaum (Brauer)
[Family- Libellulidae]

A medium size dragonfly. The male is dull blue black with reddish brown eyes. The female is yellowish brown with black legs.

Flight period: July- October and January – February.

Reproductive behavior- not observed.

Breeding behavior-

Orthetrum sabina sabina (Drury)
[Family- Libellulidae]

It is a very common, medium sized dragonfly with a yellowish green head and thorax, while the abdomen is striped with black bands, the first three segments of abdomen are distinctly swollen. Wings are transparent and they are found perched at low to medium height on bushes and shrubs.

Flight period: August - December and April - May.

Reproductive behavior: Sexually active throughout the day but mostly during the afternoon. Solitary, aquatic oviposition.

Breeding habitat: Ditches and small, shallow, weedy water bodies

Pantala flavescens (Fabricius)
[Family- Libellulidae]

It is a cosmopolitan robust dragonfly found in thousands over grassland all over the country during the post monsoon season. The males have reddish abdomen while female's abdomen is yellowish brown in colour. The wings are completely transparent but the base of hind wing is slightly tinted.

Flight period: Throughout the year except from December - March.

Reproductive behavior: It shows active reproductive behavior in the morning and exhibits contact, aquatic, ovipositing behavior. It is found ovipositing even in few mm of water collected on tar roads and shallow water of rice field. It never oviposits in deep water.

Breeding habitat: Shallow spread water bodies and very slow flowing open drains.

Rhodothemis rufa (Rambur)
[Family- Libellulidae]

It is a large dragonfly which exhibits a conspicuous sexual dimorphism in its body colour. The male is characterized by the homogenous striking brilliant red body while the female is dull brown with a prominent mid-dorsal light yellow streak running from the top of the head

through the thorax and down to the fifth segment of the abdomen.

Flight period: April - June

Reproductive behavior- not observed

Breeding Behavior- Weedy ponds

Rhyothemis variegata variegata (Linnaeus) [Family- Libellulidae]

It is one of the most spectacular anisopteran dragonflies of India. It is medium sized with large broad wings, spotted with brown and yellow marks. The markings are more prominent in the male than the female. The body is shiny, brownish black. It is found around large water bodies. It is a weak flyer and flutters like a butterfly during flight.

Flight period: September- November.

Reproductive behavior: Not observed.

Breeding habitat: Large, deep ponds.

Paragomphus lineatus Selys

[Family – Gomphidae]

It is a medium size yellow gomphid with black and brown marking and bluish eyes. The last two abdominal segments of male has a oar like expansion.

Flight period: June- Sept

Reproductive behavior- not observed

Breeding Behavior- slow shallow running waters.

Tholymis tillarga (Fabricius)

[Family- Libellulidae]

Medium size, reddish dragonfly with prominent dark and white patches on hind wings. It is crepuscular in nature and is found in large numbers after sunset near the border of large water bodies.

Flight period: September - October.

Reproductive behavior: Intense sexual activity is observed during dusk. It exhibits non contact guarding epiphytic oviposition.

Breeding habitat: Large, weedy water bodies.

Tramea basilaris burmeisteri Kirby [Family- Libellulidae]

A medium size brownish dragonfly with large transparent wings but the hind wing has a conspicuous brown marking with a yellow halo. It is found flying alongwith *Pantala flavescens*.

Flight period: September - November.

Reproductive behavior: Late morning, exhibiting contact aquatic oviposition.

Breeding habitat: Large, deep water bodies.

Tramea limbata (Desjardins)

[Family- Libellulidae]

It is similar to *Tramea basilaris burmeisteri* but darker and has a large black to reddish brown spot on the hind wing. It is found solitary.

Flight period: September- November.

Reproductive behavior: Solitary, aquatic oviposition.

Breeding habitat: Small deep water bodies and large cement lakes.

The following anisopteran were also found in the vicinity of the lake- *Anax immaculifrons*, *Anax parthenope*, *Hemianax ephippiger*, *Acisoma panorpoides*, *Orthetrum chrysis*, *Orthetrum luzonicum*, *Orthetrum pruinosum neglectum*, *Palpopleura sexmaculata*, *Potamarcha congener*, *Trithemis aurora*, *Trithemis festiva*, *Trithemis kirbyi* and *Trithemis pallidinervis*.

Discussion

The dragonfly species observed during the present study indicate that in central India the flight period mostly occurs during the post monsoon season (Table 1) except for *Bradinopyga geminata*, *Brachythemis contaminata*, *Pantala flavescens* and *Orthetrum sabina* which are spring species too.





E.vittata



P.lineatus



B. sobrina male



B.sobrina female



N.t.tullia female



N.t.tullia male



R.rufa

Arrenurus mites on



B. contaminata



C.servilia



N. t. tullia



A. panorpoides

Anisopteran dragonflies exhibit contact guarding; non contact guarding and solitary oviposition. Except for *Tramea basilaris burmeisteri*, and *Anax guttatus*, all the remaining ten species are found throughout the year in southern India, but in central India their flight period is mostly limited to the monsoon and post monsoon seasons. This is probably due to geographical and seasonal variation in the central and southern part of India.

The breeding habitats varies from shallow and clean waters, shallow and weedy waters, deep and large water bodies, artificial cement lakes and monsoon water puddles and pools.

The results show that variation in the breeding habitat is of advantage since it avoids competitive pressure for the breeding and growth of the aquatic larvae (FRASER, 1933-36; SUBRAMANIAN, 2005).

The opportunistic dragonfly of central India are *Orthetrum sabina*, *Pantala flavescens*, *Crocothemis servilia*, *Diplacodes trivialis* and *Brachythemis contaminata* which breed in weedy, shallow and temporary small water bodies.

Sr. No.	NAMES	PRESENCE OF <i>Arrenurus</i> spp	FLIGHT PERIOD (2010-11)											
			J	F	M	A	M	J	J	A	S	O	N	D
1.	<i>A. guttatus</i>	-	+	+	+	+	-	-	-	+	+	+	+	+
2.	<i>B. contaminata</i>	Thorax and abdomen	+	+	+	+	+	+	+	+	+	+	+	+
3.	<i>B. geminata</i>	-	+	+	+	+	+	+	+	+	+	+	+	+
4.	<i>D. trivialis</i>	Abdomen	+	+	+	+	-	-	-	-	-	+	+	+
5.	<i>I. rapax</i>	-	+	+	+	+	-	-	+	+	+	+	-	-
6.	<i>O.s. sabina</i>	-	-	-	-	+	+	-	+	+	+	+	+	+
7.	<i>P. flavescens</i>	-	-	-	-	+	+	+	+	+	+	+	+	-
8.	<i>R. v. variegata</i>	Thorax	-	-	-	-	-	-	-	+	+	+	+	-
9.	<i>T. tilarga</i>	-	-	-	-	-	-	-	-	-	+	+	-	-
10.	<i>T. basilaris</i>	-	-	-	-	-	-	-	-	-	+	+	+	-
11.	<i>T. limbata</i>	-	-	-	-	-	-	-	-	-	+	+	+	-
12.	<i>C. servilia</i>	Thorax and abdomen	+	+	-	-	-	-	+	+	+	+	+	+
13.	<i>A. panorpoides</i>	Thorax	+	+	+	-	-	-	-	+	+	+	+	+
14.	<i>E. vittata</i>	-	-	-	-	-	-	-	+	+	+	-	+	+
15.	<i>B. sobrina</i>	-	-	-	+	+	+	+	+	+	+	-	-	-
16.	<i>N.t. tullia</i>	Thorax	+	+	-	-	-	-	-	+	+	+	+	+
17.	<i>O. glaucaum</i>	-	+	+	-	-	-	-	+	+	+	+	-	-
18.	<i>D. nebulosa</i>	-	-	-	-	-	-	+	+	+	-	-	-	-
19.	<i>P. lineatus</i>	-	-	-	-	-	-	+	+	+	+	-	-	-
20.	<i>R. rufa</i>	-	-	-	-	+	+	+	-	-	-	-	-	-

Fig. 1. Table illustrating the yearly flight period of dragonflies and the *Arrenurus* mite infection at Gorewada lake of Nagpur city.

Epiphytic (on floating plant material) mode of oviposition is recorded in *Brachythemis contaminata* and *Tholymis tillarga*, while endophytic (in submerged plant tissue) oviposition is found in *Anax guttatus*. The remaining species are found to exhibit simple, aquatic mode of oviposition.

In the present study on anisopteran dragonflies, *Arrenurus* spp larvae are found attached to the ventral side of the thorax and abdomen of six

species *B. contaminata*, *D. trivialis*, *R. v. variegata*, *C. servilia*, *A. panorpoides* and *N. t. tullia*. In *B. contaminata*, *R. v. variegata*, *C. servilia*, *A. panorpoides* and *N. t. tullia* they are attached only to the segment of the thorax and are mostly arranged in a 'v' or triangular shape. In *B. contaminata*, *C. servilia* mites are found all over the ventral abdominal region where as in *D. trivialis*, water mites are almost exclusively attached to the abdomen.

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