

Territory Behavior, Copulation and Oviposition in *brachythemis contaminate odonata*: Libellulidae

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Abstract

The present investigation explains the reproductive behavior i.e. territory, copulation and oviposition for *Brachythemis contaminata* which was carried out for a year between June 2013 to April 2014. The male plays significant role in mating as competing for fertilization by attracting females, but in odonates female also actively involving as taking mating decision, male selection and activities during tandem formation. Territory of mating male is well marked of about 2 to 3 meter in diameter and is at the same place of oviposition. Male prefer territory attachment as strategies of mutual avoidance which reduces energy spent in inter-male fight. Male-females are generally in group with high male ratio till evening and male become more careful and aggressive in evening for his territory. When receptive female visits to mate in male's territory she chooses the fittest male for mating. Male shows aggressiveness, wing vibration, abdominal display, chasing to competitor are the main events use for mating strategies. Copulation takes place in air for only few seconds and mating success for territorial male is high.

Keywords: Territory, mating strategies, copulation, *brachythemis contaminata*.

1. Introduction

Odonata have long been studied as an insect order that plays an important role in the balance of aquatic invertebrate communities, and their general visibility, diversity and abundance around lentic waters makes them an ideal candidate for development as a group of ecological indicators. To reproduce all sexually mature dragonflies need to encounter, recognize and copulate with a co-specific opposite sex and the female with or without the males help needs to oviposit in a place which is optimum for egg hatching and larval survival (Corbet 1999) [3]. The reproductive behavior of dragonflies can be divided in to two broad categories, in the first males defend territories usually containing oviposition site so that they can capture the females as these approaches the water bodies. Males therefore compete strongly with each other to acquire retain territories. If a male cannot obtain a territory it may still be able to capture a female as a satellite or sneaker. For winning the territories the males often involve in fights and the dominant male wins. The aggression behavior differs from species to species and the strategies applied to win the territories also vary. When there is territoriality females must rely on clues that indicate male quality, such as territory characteristics, secondary sexual features or courtship behavior, all of which will influence the mate selection strategies adopted (Gontard-Danek and Möller 1999; Luttbeg 2004) [4]. There are some Dragonflies species which are non-territorial but successful in getting the females through their alert and quick responses, as characteristic

movements of their wings, abdomen and legs as in calopterygines (Buchholtz, 1951) [2]. The flight of these defending males was more directed and intense than that seen in male-male interactions. Such behavior can be regarded as truly territorial in the same sense as this term has been used to describe certain kinds of intra specific fighting in birds and other animals (Moore 1957; Kormondy, 1961) [6].

Miller (1984) [8] found sperms in the secondary male genitalia of some males of libellulid dragonflies and supposed that they could control the amount of sperm release. Despite increasing documentation that females of many species exercise considerable control over reproductive decisions (reviewed by Andersson, 1994), In some Anisoptera, females are more likely to remate when male density is high (Wolf et al., 1989; Koenig, 1991; Rehfeldt, 1991) [12, 5, 10], suggesting that males coerce matings. However, without knowing the sperm loads of the remating females, this trend is equally consistent with the hypothesis that at high male density, females are more at risk of receiving insufficient sperm because copulation duration is also shorter. If the operational sex ratio is male biased, female choice would minimize the first of these costs by having a large number of males available. This would reduce mate selection waiting time, but the risk of injury could rise as a result of the increased pressure of males attempting to mate, which could cause females to relax their selection criteria, culminating in convenience polyandry (Rowe 1992) [11].

As with many insects, male dragonflies make the first move to initiate sex. When a male spots a female of his own species, he must first subdue her. He'll approach her from behind, usually while they are both in flight, and hold onto her thorax with his legs. If he's feeling feisty, he might bite her, too. If he hopes to mate successfully, he must get a firmer grip on her quickly. The male dragonfly will pull his abdomen forward and use his anal appendages, a pair of cerci, to clasp her by the neck (her prothorax). Once he has her tightly by the neck, he can extend his body and continue to fly with her, in tandem. This position is known as tandem linkage. Female dragonflies operate by the "last in, first out" rule of fertilization. If given the opportunity, she might mate with multiple partners, but the sperm from her final sexual partner will fertilize her eggs, in most cases. Male dragonflies, therefore, have an incentive to make sure their sperm is the last to be deposited in her.

Oviposition in Odonates was observed by Needham and Westfall (1955) [9] and they found that the male defended the female from interference by other males only as long as she remained within his territory. Oviposition varies according to species and/or circumstance. Sometimes the male will guard the female to ensure the eggs he fertilized are deposited. Some species utilize quite specific plants or parts of plants (Martens 1993) [7].

2. Material Methods

The present study was carried out at drainage of village kathora bk. near Amravati city of Maharashtra state (India) during June 2013 to April 2014 .The present nala was purposely selected as it carries the domestic waste water of city and the target species is mostly habitual for contaminated water. The study area will be frequently visited in all seasons between 12 pm to 7 pm. Reproductive behavior is carefully observed and some events are recorded in camera coolpix L-820 for further detail studies. At the field the reproductive behavior in detail as territorial behavior, copulation behavior and oviposition behavior of this species is documented.



Fig 1: Study place

3. Observations and Results

The observations are carried for reproductive behavior of *Brachythemis contaminata* which were studied and recorded in between 12 pm to 7 pm.

3.1 Territory

Males and females with high male ratio are in group in the noon time, male dose not shows any specific interest about his territory initially but when time spent on, in the evening near about 5pm male become active and forms his territory about 2 to 3 meter in diameter and which is well marked. Male makes his seating sites at 2 to 3 places in his territory, but he mostly prefer to one of them. He is showing “this is my place” attitude and not allows other males of same or different species to enter in his place.



Fig 2: Males in group in afternoon

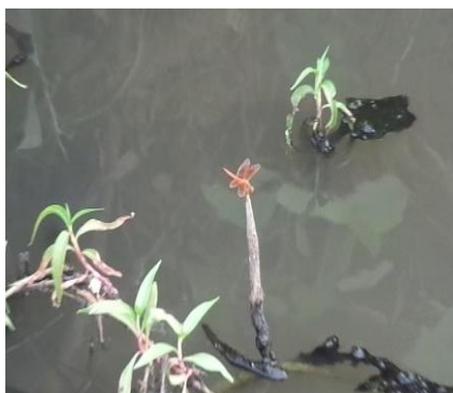


Fig 3: Territorial male in evening

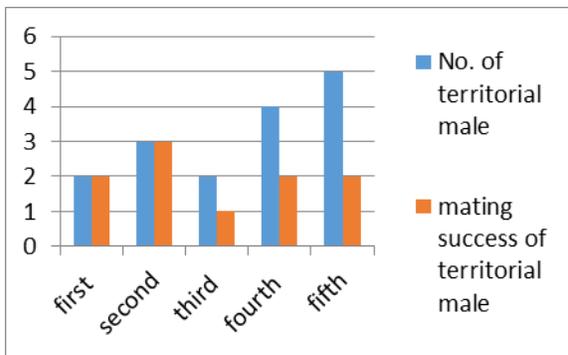
3.2 Mating strategies

Male–male interaction is seen, some non-territorial males are tried to enter in the territory of the territorial male but strongly oppose can be seen here, territorial male opposes by wing vibrating, physically fighting, chasing, abdominal display all these are the part of his mating strategies that secures his territory. Oppose is so strong that male may be injured some time. This type of male-male interaction can be seen for long time about an hour also. After long time waiting by male female suddenly visits to his territory, she is very selective in choosing her desire male. She just visit for few seconds, ran away, again visit, this happens frequently and finally she selects her desire male.

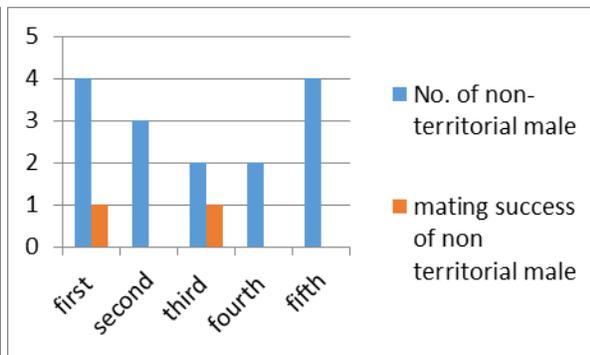


Fig 4 and 5: Aggressive behavior of territorial male.

3.3 Mating success



Graph 1: Mating success of territorial male.



Graph 2: Mating success of non-territorial male.

3.4 Tandem formation

“Tandem” is the term use for interlocking of male and female, this specific for only odonates in the animal world, female interlock her sperm receiving abdominal segments with the secondary sexual organ of male where his sperm is stored. As female selects desire male for her, she enters in his territory

and allow male to for tandem formation. Tandem formation and transfer of sperm is lasts for very small duration all this happens only in 2 to 4 seconds in the air. In my observations single male can be success in forming one after another tandem with more than one female and can guard both the female during oviposition.



Fig 6: Male-female in “tandem” position

3.5 Oviposition

Just after mating female immediately starts egg laying, female lays her eggs within the territory of mating male. Oviposition is exophytic, she lays her eggs on the surface of specific wet object that is immersed or floating in the water, that object may be leaf or bark of a plant. At the single time of oviposition she can lays 60 to 200 batches of eggs. 200 batches of eggs can lays within short time of one and half min. Territory, copulation site and ovipositing site are the same place for *Brachythemis contaminata*.

3.6 Male guarding behavior

At the time of oviposition female became very susceptible, mating male is very careful for her during this event. Male guards her from other males that disturb her. Other males are trying to capture the egg laying female to for tandem with her. If he succeed then he removes the sperms that previously deposited, it indicates sperm competitions here.



Fig 7 and 8: Male guarding behavior

4. Conclusion

From present investigation we conclude that, by studying the reproductive behavior of *Brachythemis contaminata* we understood how the species become successful among all other species in such drastic contaminated water habitats. We also conclude that the strategies applied by males for copulation, short copulation period (tandem) and larger quantities of batches of egg laying (oviposition) by female are the reason for species success.

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6. References

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