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Research Article

Feeding potential of adult dragonflies, *Pantala flavescens* (Fabricius), *Brachythemis contaminata* Fabricius and *Bradinopyga geminata* Rambur (Anisoptera: Libellulidae) on insect pests under laboratory condition

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ABSTRACT: Feeding potential of three dragonfly species was worked out on the basis of numerical value and fresh prey weight under laboratory condition at Anand (Gujarat) during 2013. Adult dragonflies, *viz.*, *Pantala flavescens*, *Brachythemis contaminata* and *Bradinopyga geminata* were used as predator and *Nilaparvata lugens*, *Aphis craccivora* and *Aedes* sp. were used as prey. Daily biomass consumption of *P. flavescens*, *B. contaminata* and *B. geminata* were 224.51 mg, 149.35 mg and 169.34 mg respectively. The prey numbers consumed by each dragonfly species were significantly different. However, irrespective of prey species biomass consumption was the same. Feeding potential of the dragonflies was positively correlated with their body weight. Feeding potential of females of *P. flavescens* and *B. contaminata* was slightly higher than their respective males.

KEY WORDS: Feeding potential, *Pantala flavescens*, *Brachythemis contaminata*, *Bradinopyga geminata*, *Nilaparvata lugens*, *Aedes* sp., *Aphis craccivora*, biomass consumption

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INTRODUCTION

Adult odonates feed on mosquitoes, blackflies and other blood-sucking flies and act as an important biocontrol agent. In the urban areas of Thailand, larvae of the container breeding dragonfly, Granite Ghost (*Bradinopyga geminata* Rambur) was successfully used to control *Aedes* mosquito, an important vector of the dengue fever (Andrew *et al.,* 2008).

Adult free flying dragonflies are generalist predators, largely capturing prey on wing (Olberg *et al*., 2000), difficult to rear under controlled condition and hence, they are not being used as a tool under biological control programmes (Sathe, 2013).

Information on prey of adult dragonflies is scanty and often remains restricted to the reporting of a single incidence of predation on particular prey species. Hence, reports regarding adult odonates as predator are restricted to qualitative aspects of odonata species seen in the crop or incidences of insect pests observed being consumed (Anon, 1986; Harit and Dhavan, 2009; Basappa, 2011). However, quantitative data on the feeding potential of dragonflies are scanty and it is very difficult to obtain so.

Normally, feeding potential of adult odonates is worked out in the laboratory experiments by force feeding (Yousuf and Ali, 1986; Yousuf *et al*., 1998; Ali, 1983; Khaliq, 2002). Often, impressive data on the number of prey items consumed by the predator in a day (Khaliq, 2002) is reported. Looking to the numerical value of various prey species consumed, often a significant difference is observed. To explain such differences and to determiner exact predatory potential of odonate species, we evaluated feeding potential of three dragonfly species using three prey species in the laboratory.

MATERIALS AND METHODS

Three adult dragonflies namely, Wandering Glider (*Pantala flavescens* (Fabricius)), Ditch Jewel (*Brachythemis contaminata* Fabricius) and Granite Ghost (*B. geminata*) were used in feeding potential experiment. Adult dragonflies were collected from the rice fields of university campus within 30 minutes after sunrise. Five male and five female of *P. flavescens* and *B. contaminata* and ten unsexed *B. geminata* were tested for 10 days. Every day, new individuals were brought for the experiment. Experimental prey, *viz*., brown plant hoppers (*Nilaparvata lugens*) collected from the rice fields, aphids (*Aphis craccivora*) from cowpea and

groundnut crops and *Aedes* mosquitoes reared in the laboratory from the larvae collected from water tanks. Weight of 10 prey items of each species was measured on electric balance and weight of a single adult of each species was extrapolated.

Thirty adults of one species were used as predator for ten days. At the end of the day, predators were released back to the environment. Next day morning a fresh batch of predators was brought to the laboratory. Three prey items were tested for 10 consecutive days against one predatory species. Three dragonfly species were tested one after the other. Prey items of each species were offered to the dragonfly at one hour interval. Three individuals were involved in conducting feeding experiment, one taking care of ten predators. The live prey was held with forcep near the mouth of dragonfly for 15 seconds. Offering of next prey was withdrawn, if not consumed within 15 seconds. After one hour again the prey items were offered. Experiment was performed at Anand during August to October 2013. This feeding procedure was repeated from 9.00 to 18.00 hours.

Number of prey consumed by each predator during a day was counted (numerical value) and its equivalent biomass was extrapolated.

Statistical analysis of data was carried out as per Factorial CRD following appropriate transformation (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Fresh weight of adult dragonfly and insect prey used

Amongst three species of dragonflies used in the experiment, weight of *P. flavescens* was the highest (312.00 mg) followed by *B. geminata* (263.8 mg) and *B. contaminata* (168.5 mg). Amongst three species of prey used in the experiment, weight of *Aedes* spp. was the highest (1.64 mg) followed by *N. lugens* (0.83 mg) and *A. craccivora* (0.63 mg).

Feeding potential of dragonflies

All three predators consumed highest number of *A. craccivora* followed by *N. lugens* and *Aedes* spp. The difference in the mean number of three insect prey consumed was significantly different from each other (Table 1, Fig. 1).

On the basis of fresh weight of the prey, mean biomass consumption of particular predator on *A. craccivora, Aedes* spp. and *N. lugens* was almost similar (Table 1, Fig. 1). Irrespective of prey species, there was no significant difference in daily biomass consumption.

Feeding behavior of different species of dragonfly was observed during the act of feeding. All three preys were almost chewed by the dragonfly. They consumed entire prey body without leaving any part.

The body weight of *P. flavescens* was the highest (312 mg) as compared to *B. geminata* (263.80 mg) and *B. contaminata* (168.50 mg). Therefore the daily biomass consumption of *P. flavescens* was the highest (224.51 mg) followed by *B. geminata* (169.34 mg) and *B. contaminata* (149.35 mg) (Table 2). Obviously, daily food requirement of lighter species was low and heavier species was high.

Sexual differences in feeding potential

Average weight of *P. flavescens* female (320 mg) was higher than its male (304 mg). In *B. contaminata* also, the female (172.5 mg) was heavier than its male (164.5 mg). In both the species, the females were heavier than the males.

In both the species, mean number of each prey consumed by the female was slightly higher than the male. However, there was no significant difference between the sexes in the mean number of each prey species consumed (Table 3).

Daily biomass consumption of both the sexes was almost the same. The female consumed 1 to 4 milligram more biomass than the male. However, the difference was statistically not significant.

Table 1. Feeding capacity of *Pantala flavescens, Brachythemis contaminata* and *Bradinopyga geminata*

Treatments (Prey species)	Prey consumed					
	P. flavescens		*B. contaminata*		*B. geminata*	
	Number	Biomass (mg)	Number	Biomass (mg)	Number	Biomass (mg)
T1- *Aphis craccivora*	359.24	226.32	233.35	147.01	269.71	169.92
T2- *Aedes* spp.	136.61	224.04	091.44	149.96	101.88	167.08
T3- *Nilaparvata lugens*	268.87	223.16	182.05	151.10	206.04	171.01
S. Em.±	001.87	001.97	001.26	001.39	001.48	001.84
C. D. at 5 %	005.19	NS	003.49	NS	004.10	NS
C. V. %	007.35	008.78	007.45	009.31	007.68	010.86

Note: NS-Non significant

Table. 2 A comparison of biomass consumed by dragonfly

Sr. No.	Predator		Prey
	Species	Body Weight (mg)	Biomass consumed (mg)
1	*Pantala flavescens*	312.00	224.51
2	*Brachythemis geminata*	263.80	169.34
3	*Bradinopyga contaminata*	168.50	149.35

Table. 3 Feeding capacity of *Pantala flavescens* and *Bradinopyga contaminata* on the basis of sex

Treatments (Prey species)	Prey consumed							
	P. flavescens				*B. contaminata*			
	Number		Biomass (mg)		Number		Biomass (mg)	
	Sex of predator							
	Female	Male	Female	Male	Female	Male	Female	Male
T1- *A. craccivora*	360.60	357.88	226.01	225.46	234.18	232.52	147.53	146.49
T2- *Aedes* spp.	137.22	136.00	225.04	223.04	93.20	89.68	152.85	147.08
T3- *N. lugens*	270.38	267.16	225.25	221.74	183.88	180.80	152.62	150.06
S. Em.±	001.60		001.66		001.07		001.20	
C. D. at 5 %	NS		NS		NS		NS	
C. V. %	007.67		009.03		007.81		009.90	

Note: NS-Non significant

Feeding potential of three dragonfly species was different in relation to their body size. Feeding potential of lighter (small) species was low whereas feeding potential of heavier (large) species was high. Daily feeding potential of any species, with reference to biomass of prey consumed, remained constant irrespective of prey species consumed. A predator consumed larger number of small (lighter) prey and smaller number of larger (heavier) prey to meet its daily food requirement. That was the reason why there was a significant difference in the number of different prey species consumed.

The dragonflies very actively accepted the prey in the morning but as the time passed in the late evening, they stopped accepting the prey offered. This rejection of the prey might be due to satiation at the day end. The dragonflies being strongly diurnal,stop activity in the evening hours.

The body weight of three species of dragonfly was different. In the present study, biomass consumption of heavier *P. flavescens* (312 mg) was much higher than lighter *B. geminata* (263.8 mg) and *B. contaminata* (168.5 mg).

The study has also shown that daily biomass consumption of a particular species was almost constant throughout the study period. Number of prey items consumed by the dragonfly depended on the weight of the prey item. Hence, all the predators consumed highest number of *A. craccivora* and least number of *Aedes* mosquito. To confirm that total biomass requirement was important and not the number of prey consumed, Granite Ghost (*B. geminata*) was offered adult rice moth *Corcyra cephalonica* Stainton. Five individuals consumed only 16 to 18 moths in a day. Average weight of rice moth was 10.03 mg and hence 16 to 18 moths provided required biomass to the predator *B. geminata.* Yousuf *et al.,* (1998) and Khaliq (2002) conducted study on potential of dragonflies as biocontrol agents of insect pests of rice.

In present study, females of both the species consumed more number of insects as compared to their males. In a similar study, Yousuf *et al*. (1998) and Khaliq (2002) concluded that females of four species consumed higher number of pests as compared to their males.

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