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Biology and Predatory Potential of Rhynocoris fuscipes (Fabricius) (Hemiptera: Reduviidae) on the Rice Leaffolder Cnaphalocrocis medinalis (Guenee)

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Abstract

Biology and feeding potential of the reduviid predator, *Rhynocoris fuscipes* (Fabricius) studied on the leaffolder *Cnaphalocrocis medinalis* Guenee. Approximately 117.7±18.16 *C. medinalis* larvae were required for development of one nymph throughout its developmental period of about 72.37±6.78 days (1.01 to 2.06 larvae per day). The mean nymphal survival was 74.77 to 94.45 % from I to V instar with a total survival rate of 86.21%. The per day predation rate of I, II, III, IV and V instar nymphs were 1.24±0.36, 1.01±0.30, 2.06±0.38, 1.66±0.61, and 1.25±0.38 larvae respectively. Adult females had a greater feeding potential and higher longevity (70.30±19.06 days) in comparison to males (57.20±16.16days). The results indicated that *R. fuscipes* had great biocontrol potential for leaffolder management in rice.

Keywords: Reduviid, harpactorine, biocontrol, prey

Introduction

The Reduviidae is the largest family of predaceous land Heteroptera and many of its members are potential predators of a number of insect pests. *Rhynocoris fuscipes* (Fab.) (Reduviidae: Heteroptera) is common generalist predator in rice fields. *R. fuscipes* was reported to predate upon more than 42 insect pests (Sahayaraj and Selvaraj, 2003) and is a potential biocontrol agent for pests of pigeonpea, cotton, groundnut and other crops. It has also been observed predating on many insect pests in the rice ecosystem. The rice leaffolder, *Cnaphalocrocis medinalis* Guenée (Lepidoptera: Pyralidae), is the most widely distributed foliage feeder in all the rice growing tracts of Southeast Asia. The large scale cultivation of high yielding varieties, application of fertilizers, and continuous use of insecticides have caused an increase in leaffolder population in several countries, including India. (Gurr *et al*., 2012). *C. medinalis* damages the rice plant through-out the crop growth period resulting in increased insecticide use. At flowering stage, damage of above 25 per cent of the flag leaf area could cause 50 per cent unfilled grains (Padmavathi *et al*., 2013). The knowledge on biology and pest suppression efficacy is a prerequisite for its utilization as a biological control agent. Though biological control potential of *R. fuscipes* has been studied on many agricultural pests, less information is available on rice pests. In order to reduce use of insecticides against this pest and to assess an indigenous predator for its potential to control it, an attempt was made to assess the predatory potential and developmental biology of the reduviid *R. fuscipes* on rice leaffolder in the laboratory.

Materials and Methods

The adult males and females of the reduviid, *R. fuscipes* were collected from rice fields and maintained in plastic containers (4 cm diameter) on the larvae of *Corcyra cephalonica* (Stainton) under laboratory conditions (28±2^{0}C and ambient RH). The eggs laid in the laboratory were allowed to hatch in petri dishes (9.2 x 2.0 cm) with wet cotton swabs for maintaining optimum humidity. The cotton swabs were changed periodically in order to prevent fungal attack. Freshly hatched first instar nymphs of the predator were introduced into individual plastic containers and offered leaffolder larvae. Observations on the biological parameters such as number of eggs laid/ female, developmental period, prey consumed by predator, nymphal mortality, adult emergence, sex ratio, longevity of adults that emerged in the laboratory was recorded daily. From the quantity of prey consumed per predator and stadial period data, quantity of prey consumed per predator per stadium was calculated.

Results and Discussion

Biology

The adult laid deep brown coloured eggs in small clusters of 6 to 12. Observations on continuous rearing of *R. fuscipes* on leaffolder larvae for three generations revealed that there were no significant differences in the nymphal duration and total development period (Table 1) except in the second and fifth instar stages. All stages fed well on *C. medinalis* larvae and completed their life cycle. *R. fuscipes* female laid a mean of 60.4±20.23 eggs during its

lifetime. The egg period ranged from 7-12 days and total nymphal developmental period ranged from 67.80±2.04 to 76.80±11.21 days (Table 1). The developmental period varies based on prey. The developmental period of *R. fuscipes* was observed to be 42.5±0.3, 45.6±0.4 and 49.5±0.5 days on *C. cephalonica*, *Dysdercus cingulatus* Fab and *Phenacoccus solenopsis* Tinsley (Majesh, 2015) which was lower than that observed in the present study. On the other hand, some studies have indicated higher duration when reared on hopper pests (Sunil *et al.*, 2013). The growth, development and reproduction of the reduviid predators vary in relation to hosts and rearing environment (Sahayaraj *et al.*, 2004). The developmental rate of individual predator was significantly affected by predator density and prey. Ambrose *et al.* (1990) reported that the total nymphal period of *Rhynocoris marginatus* (Fab.) was higher when it was reared in solitary condition on *Odontotermes obesus* Rambur while it was shorter when it was reared on *Spodoptera litura* (Fab.) in isolation. Rearing in groups on the other hand decreased the total nymphal period (Sahayaraj, 2002). Many reports indicate that lepidopteran larvae increase survival, shorten development in generalist predators but such predators may also feed on inferior prey based abundance and availability (Eubanks and Denno, 2000). Maximum longevity of male and female was 113 and 121 days. Maximum female fecundity was 169 eggs/ female with an average of 60.4±20.23 eggs per female (Table 2). The male-female sex ratio was slightly female biased being 0.83: 1.0. Female biased ratios have been reported in reduviids especially of the genus *Rhynocoris*. However, in some cases it is clearly biased to female with a sex ratio of 1:3 (male to female) observed in *R. fuscipes* when reared on *S. litura* (Ambrose and Claver, 1997). The average nymphal survival ranged from 74.77 to 94.45 % from I to V instar with a total survival rate of 86.21% (Table 3). The adult male longevity was shorter than females. Adult male lived for 57.20±16.16 and female 70.30±19.06 days. Earlier studies confirm that female reduviids usually lived longer than the males (Ambrose *et al.*, 1990). The pre-oviposition period was quite long in *R. fuscipes* in the laboratory (53.20±10.06 days) and was comparable to that observed in a related species *R. marginatus* reared on *C. cephalonica* which ranged from 62.7 ± 15 days to 73.3 ± 1.6 days (Sahayaraj and Sathiamoorthi, 2002). The same study indicated that the pre-oviposition period of *R. marginatus* was found to vary with prey and also with prey rearing media.

Table 1. Nymphal development of *R. fuscipes* on *C. medinalis*

Life stages/ parameter in days	I generation	II generation	III generation	Mean duration	CD
1st instar	15.10±1.55	16.70±1.42	17.90±1›85	15.57 ±1.57	1.72^{NS}
2nd instar	15.20±1.14	14.80±1.32	17.00±1.76	15.70 ±1.60	1.41*
3rd instar	15.60±4.14	14.60±3.53	12.30±1.77	14.40 ±3.43	3.51^{NS}
4th instar	14.70±3.47	13.80±2.66	12.60±0.84	13.70 ±2.50	2.80^{NS}
5th instar	16.20±2.25	12.60±2.84	11.00±0.47	13.27 ±2.10	2.13**
Total developmental period (days)	76.80±11.21	72.50±7.08	67.80±2.04	72.37±6.78	8.34^{NS}

*Significant at 0.05%; ** Significant at 0.01%; NS: Not significant

Table 2. Biological parameters of *R. fuscipes* on *C. medinalis*

Parameter	Mean	Range
Fecundity/female(No.)	60.4±20.23	48-169
Hatchability (%)	94.3	92-100
Per cent Survival	86.21	60-100
Sex ratio (male: female)	0.83:1	
Pre-oviposition period (days)	53.20±10.06	38-74
Male longevity (days)	57.20±16.16	54-113
Female longevity (days)	70.30±19.06	51-121

Table 3. Predatory potential of various stages of R. *fuscipes* on *C. medinalis*

Stadia	No. Observed	% survival	Developmental period (days)	Prey consumed (No.)/ instar	Mean prey (No.)/day
1st instar	45	74.77	13-20	21.72±14.54	1.24±0.36
2nd instar	45	84.85	13-18	16.41±10.15	1.01±0.30
3rd instar	45	94.45	08-21	32.34±26.73	2.06±0.38
4th instar	45	83.64	11-18	26.21±20.73	1.66±0.61
5th instar	45	93.33	09-21	21.03±18.67	1.25±0.38
Mean	45	86.21	54-98*	117.71±18.16*	1.44±0.40

* Total developmental period and Total prey consumed (No.)/instar

Predatory efficiency of *R. fuscipes* on *C. medinalis*

During its nymphal development, *R. fuscipes* predated upon 117.7±18.16 larvae. The predation rate of the five nymphal stages ranged from 16.41±10.15 to 32.34±26.73 with maximum predation being observed in the third instar predator at a mean of 2.06 leaffolder larvae in one day (Table 3). Predatory rate was reported to gradually increase from the first instar to the fourth instar and decreased in fifth instar in *R. fuscipes* (Lakkuundi, 1989). Though reduviids are reported to feed on different species of prey, lepidopteran pests were observed to be the most suitable for its growth (George, 2000). The results signify that *R. fuscipes* being indigenously present in the rice eco-system, is a likely candidate for biocontrol of rice leaffolder. It is also highly amenable for mass rearing on the factitious laboratory host, *C. cephalonica*. Conservation and augmentation of this important predator offers an eco-friendly option for rice pest management.

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