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Comparative predatory efficiency of *Acanthaspis pedestris* Stål (Hemiptera: Reduviidae) on two cotton pests

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ABSTRACT: **The comparative predatory efficiency of *Acanthaspis pedestris* Stål a major reduviid predator of many insect pests in South India was assessed on two cotton pests, *Helicoverpa armigera* (Hübner) and *Spodoptera litura* Fabricius. Gradual increase in prey consumption was recorded by the progression of the developmental stages of the predator. The adult female consumed more than the male. The consumption of predators was found to be decreased with the advancement of prey stages. First and second instar *A. pedestris* were limited in their ability to capture large sized prey in both the prey species. Among the two prey species, *S. litura* was the most preferred prey.**

KEY WORDS: *Acanthaspis pedestris*, *Helicoverpa armigera*, nymphal instars, predatory efficiency, *S. litura*

INTRODUCTION

Reduviids (Assassin bugs) have considerable potential to act as biocontrol agents (Ambrose, 2000). The prey insects significantly influence rate of development, survival and reproductive potential of insects, which ultimately determine the rate of population buildup. *Acanthaspis pedestris* Stål is an important reduviid predator used in biological control of various insect pests (Ambrose, 2003). Of the insect pests, *Helicoverpa armigera* (Hübner) and *Spodoptera litura* Fabricius are difficult pests to control in many agricultural crops. Although *A. pedestris* has been observed preying on both these pests, its ability to capture and consume them, preferred developmental stages, and the preferred insect among the two are largely unknown. Before utilizing a natural enemy for biological control, it is important to assess its ability to capture and consume relevant stages of the targeted insect pests (Schaefer, 1988). Such assessment can identify the limitations of the predator and its potential impact. Hence the present study aims at generating information on the comparative predatory efficiency of *A. pedestris* on the two key pests *H. armigera* and *S. litura* in the laboratory.

MATERIALS AND METHODS

The adults and nymphs of *A. pedestris* were collected from the foothills of Kodaikanal (10.0° N, 78.0° E), Madurai district, Tamil Nadu, and reared in the laboratory on the larvae of *S. litura* and *H. armigera* and the adults were allowed to mate. The eggs were collected and allowed to hatch and the nymphs were reared up to adults. The adults and nymphs were separated into two groups, each group reared with *S. litura* and *H. armigera*, separately.

Comparative predatory efficiency of each nymphal instar of *A. pedestris* towards the different size group of prey *S. litura* and *H. armigera* was evaluated by no choice test. Life stages of the reduviid *A. pedestris* (newly emerged I, II, III, IV and V nymphal instars and adult male and female) were tested against three different size groups of prey (0.1-1.0, 1.1–2.0, 2.1–3.0cm long). One reduviid predator and 20 larvae of any one stage were introduced into a mesh cage covering a cotton plant. Larvae were placed on the leaves of cotton plant. Predatory efficiency was assessed in terms of number of prey consumed/ killed by the predator in 24 hours. This was carried out separately for all the size groups of *S. litura* and *H. armigera*. Six replicates were maintained for each life stages of the predator and for each prey groups. The variation in the predation between the two prey species was subjected to students 't' test.

RESULTS AND DISCUSSION

The results indicate that all the nymphal instars of *A. pedestris* preferred *S. litura* than *H. armigera* in all the size groups. When smaller prey was provided (0.1–1.0cm long), the first instar of *A. pedestris* consumed 3.3 ± 0.52 and 2.7 ± 0.52 larvae in *S. litura* and *H. armigera*, respectively. The consumption was increased by the progression of nymphal instars and maximum consumption was observed in the adults. The adult female consumed 7.5 ± 0.55 and 6.5 ± 0.55 larvae of *S. litura* and *H. armigera*, respectively. The preys killed by all the nymphal instars of the predator are more than the prey consumed. The variation in the consumption of different prey species by the different nymphal instars of predator is significant only in the adult male and female (Table 1).

When medium sized prey was given (1.1–2.0 cm long) the first instar did not consume the prey and the consumption by the II instar predator was reduced to 2.5 ± 0.55 and 1.3 ± 0.52 larvae in *S. litura* and *H. armigera*, respectively by the II

Table 1. Comparative predatory efficiency of different stages of *A. pedestris* when fed on the small sized larvae of *S. litura* and *H. armigera*

Predatory stage	Prey consumed ($\bar{X}$±SD)		't' value	Prey killed ($\bar{X}$±SD)		't' value
	S. litura	*H. armigera*		*S. litura*	*H. armigera*	
I	3.3±0.52	2.7±0.52	2.188	5.0±0.89	3.5±0.55	3.488**
II	4.3±0.75	3.3±0.52	2.224	5.7±0.82	4.5±0.55	2.895*
III	4.7±0.52	4.5±0.55	0.548	6.5±0.55	6.5±0.55	0.000
IV	4.8±0.41	4.5±0.55	1.173	7.0±0.89	6.7±0.52	0.803
V	5.8±0.75	5.3±0.52	1.336	9.5±0.55	8.8±0.41	2.391*
Adult male	6.8±0.75	5.8±0.41	2.853*	12.3±0.82	9.3±0.52	7.577***
Adult female	7.5±0.55	6.5±0.55	3.135*	13.3±0.82	12.5±0.84	1.731

Significant at (P=0.05) *, (P=0.1)** and (P=0.01)*** instar. The consumption increased with the progression of nymphal instars. The prey consumption by the adult female was 5.7±0.82 and 4.5±0.55 on *S. litura* and *H. armigera*, respectively. Significant variation in consumption between the two different prey species was noticed in all the stages of the predator (Table 2).

When large sized prey was given (2.1–3.0 cm long), two nymphal instars of *A. pedestris* did not consume or kill both the prey species. The III nymphal instars consume 1.5 ± 0.55 and 1.2 ± 0.40 prey in *S. litura* and *H. armigera*, respectively. The consumption was increased by the progression of nymphal instars and adults consumed more. Among the adults the female predators consumed more than the male (3.3±0.52 and 2.7±0.82 larvae in *S. litura* and *H. armigera*, respectively). The preys killed by the various nymphal instars of *A. pedestris* are more than the prey consumed. The variation in the consumption between the two prey species was statistically significant only in the adult male (Table 3).

The results clearly showed that the earlier nymphal instars of *A. pedestris* (I and II instar) preferred small sized prey followed by medium sized prey. The size of the *A. pedestris* in relation to that of its prey appeared to be the major factor determining success in capturing and consuming prey. First and second instar nymphs of *A. pedestris* were unable to prey successfully on large sized *S. litura* and *H. armigera*. The high predation rates on the early instars of the two prey species is of particular interest, as these represent the life stages of the pests most frequently targeted in the field for insecticidal control (Grundy and Maelzer, 2000). Hence in cotton crops where *H. armigera* and *S. litura* may be present, *A. pedestris* has the potential to consume or kill large numbers of these pests. The present observations were in line with the earlier observations of Wilson (1976), Weseloh (1988), and George and Seenivasagan (1998).

The preference for *S. litura* was significantly higher for *A. pedestris* than *H. armigera*. This may be due to the fact that when the predator captured *H. armigera*, it emitted a viscous defensive fluid, which compelled the predator invariably to leave the prey, and only after some time the predator could again hold the same prey and suck the body fluid.

Table 2. Comparative predatory efficiency of different stages of *A. pedestris* when fed on the medium sized larvae of *S. litura* and *H. armigera*

Predatory stage	Prey consumed ($\bar{X}$±SD)		't' value	Prey killed ($\bar{X}$±SD)		't' value
	S. litura	*H. armigera*		*S. litura*	*H. armigera*	
I	-	-	-	-	-	-
II	2.5±0.55	1.3±0.52	3.866**	4.0±0.89	3.0±0.89	1.928
III	3.2±0.41	2.3±0.52	3.093*	5.2±0.41	3.7±0.52	5.582***
IV	4.3±0.52	3.0±0.63	3.970**	5.0±0.63	4.5±0.55	1.457
V	4.7±0.52	3.7±0.52	3.316**	7.7±0.52	5.7±0.82	5.051***
Adult male	5.5±0.55	4.2±0.75	3.487***	7.7±0.52	6.7±0.82	2.526*
Adult female	5.7±0.82	4.5±0.55	2.889*	8.5±0.55	8.0±0.63	1.457

Significant at (P=0.5)*, (P=0.1)** and (P= 0.01)***.

Table 3. Comparative predatory efficiency of different stages of *A. pedestris* when fed on the large sized larvae of *S. litura* and *H. armigera*

Predatory stage	Prey consumed ($\bar{X}$±SD)		't' value	Prey killed ($\bar{X}$±SD)		't' value
	S. litura	*H. armigera*		*S. litura*	*H. armigera*	
I	-	-	-	-	-	-
II	-	-	-	-	-	-
III	1.5±0.55	1.2±0.40	1.183	3.2±0.41	2.7±0.41	2.126
IV	1.5±0.55	1.3±0.52	0.548	3.2±0.75	2.8±0.52	0.889
V	2.3±0.52	2.2±0.75	0.454	4.5±0.55	3.7±0.41	2.987*
Adult male	3.2±0.41	2.5±0.55	2.381*	5.3±0.52	4.2±0.41	4.326**
Adult female	3.3±0.52	2.7±0.82	1.657	5.7±0.82	4.3±0.82	2.817*

Significant at (P=0.5)*, (P=0.1)** and (P= 0.01)***.

Strong (1967) observed that the prey species produced defensive secretion from the cornicle at the time of predatory activity. Similar reports were also made by Ambrose (2003) in the reduviids namely, *Ectomocoris tibialis* Distant and *Catamiarus brevipennis* Serville in *H. Armigera* and George and Seenivasagan (1998) in *Rhynocoris marginatus* Fabricius. Even though *H. armigera* produced defensive secretion, *A. pedestris* preferred it after *S. litura* suggesting the predators' efficiency.

The female predator consumed/killed more prey than the male predator. The present results are in line with the observation of Prabakar (1994) and Sahayaraj (1994). This is obviously due to the higher nutritional requirement of the females for reproduction. Moreover, the prey killed by *A. pedestris* was more than it consumed in all the three size groups of the prey *H. armigera* and *S. litura* provide complementary data on the reduviid predator which may prove useful in planning its utilization in classical biological control programmes.

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REFERENCES

Ambrose, D. P. 2000. Assassin bugs (Reduviidae excluding Triatominae). pp. 695 – 712. In: C.W. Schaefer and A. Panizzi (Eds.), *Heteroptera of Economic Importance*. CRC Press, Boca Raton, Florida, USA.

Ambrose, D. P. 2003. Biocontrol potential of assassin bugs (Hemiptera: Reduviidae). *Journal of Experimental Zoology India*, **6**: 1 – 44.

George, P. J. E. and Seenivasagan, 1998. Predatory efficiency of *Rhynocoris marginatus* (Fabricius) (Heteroptera: Reduviidae) on *Helicoverpa armigera*

(Hübner) and *Spodoptera litura* (Fabricius). *Journal of Biological Control*, **12**: 25- 29.

Grundy, P. and Maelzer, D. 2000. Predation by the assassin bug *Pristhesancus plagipennis* (Walker) (Hemiptera: Reduviidae) of *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) and *Nezara viridula* (L.) (Hemiptera: Pentatomidae) in the laboratory. *Australian Journal of Zoology*, **39**: 280 – 282.

Prabakar, V. 1994. Impact of prey deprivation on the predatory behaviour of *Rhynocoris marginatus* (Fabricius) (Insecta: Heteroptera: Reduviidae) on *Helicoverpa armigera* (Hübner). M. Phil. thesis, Manonmaniam Sundaranar University, Tirunelveli, India.

Sahayaraj, K. 1994. Biological potential evaluation of the reduviid predator *Rhynocoris marginatus* (Fabricius) to the serious groundnut pest *Spodoptera litura* (Fabr.) by functional response study. *Fresenius Environmental Bulletin*, **3**: 546 – 550.

Schaefer, C. W. 1988. Reduviidae (Hemiptera: Reduviidae) as agents of biological control. In: K. S. Ananthasubramanian, P. Venkatesan and S. Sivaraman (Eds.). *Bicovas*, **1**: 27 – 33.

Strong, F. E. 1967. Observation on cornicle secretions. *Annals of the Entomological Society of America*, **60**: 668 – 673.

Weseloh, R. M. 1988. Prey preference of *Calosoma sycophanta* L. (Coleoptera: Carabidae) larvae and relationship of prey consumption to predator size. *Canadian Entomology*, **120**: 873 – 888.

Wilson, D. S. 1976. Deducing energy available in environment and application of optimal foregoing theory. *Biotropica*, **8**: 96 – 103.