J. Biol. Control, 15 (1): 15-20, 2001

Evaluation of *Rhynocoris kumarii* Ambrose & Livingstone (Hemiptera: Reduviidae) as a potential predator of some lepidopteran pests of cotton

M. A. CLAVER and D. P. AMBROSE
Entomology Research Unit, St. Xavier's College
Palayankottai 627 002, Tamil Nadu, India
Email. sxcent@md4.vsnl.net.in

ABSTRACT: Biocontrol potential of *Rhynocoris kumarii* Ambrose & Livingstone against *Helicoverpa armigera* (Hübner), *Spodoptera litura* (Fabricius) and *Euproctis mollifera* Thunberg was evaluated in cotton field cages at Entomology Research Unit Experimental Station. The adult *R. kumarii* significantly suppressed the population of *H. armigera* larvae during the initial infestation, but the subsequent suppression of *H. armigera* larvae was not significant. Though the adult and 5[th] instars of *R. kumarii* minimised the damage in *S. litura* and *E. mollifera* infested cages the suppression was not significant and their release did not significantly increase the yield in these cages. Yield significantly increased in predator released *H. armigera* infested cages than in the control cages. However, *R. kumarii* significantly reduced the plant damage in *H. armigera* infested cages.

KEY WORDS: Biocontrol, cotton, field cages, *Rhynocoris kumarii*, reduviid predator

The aspect of release methodology that most commonly requires some decision is whether to place agents initially into field cages (or sleeve cages) stocked with hosts or not. Field cage studies make prediction of the population of pests and their natural enemies easier and are more reliable than in the field situation (van Lenteren and Woets 1988; Simmons and Minkenberg, 1994). Field studies to evaluate the benefits of augmentative release of reduviid predators of cotton pests in India is very meager except those of Sahayaraj and Ambrose (1997). Hence an attempt was made to evaluate the biocontrol potential of *Rhynocoris kumarii* Ambrose & Livingstone against cotton bollworm *Helicoverpa armigera* (Hübner), leaf worm *Spodoptera litura* (Fabricius) and hairy caterpiller *Euproctis mollifera* Thunberg in field cages. Our research made baseline measurements of the potential of augmentative release of *R. kumarii* to *H. armigera, S. litura* and *E. mollifera.* Such studies help in evaluating the effectiveness of a predator under natural condition.

MATERIALS AND METHODS

The predator *R. kumarii* was collected from Marunthvazhmalai scrub jungle bordering agro-ecosystem (77.55°E and 8.1°N) near Cape Comorin. They were mass-reared in the laboratory (30±3°C temperature; 12±1h photoperiod; 75±5 % relative humidity) in plastic troughs (10L) on larvae of rice moth *Corcyra cephalonica* Stainton as reported by Claver (1998). Laboratory mass-reared 3-10 day old adult or 5[th] instar reduviids were used for assessing their biocontrol potential in field cages.

The pests *S. litura* and *E. mollifera* were collected from the cotton agro-ecosystem at Arokianathapuram (72.21°E and 8.31°N) 5km southwest of Palayankottai. *H. armigera* were collected from Agricultural College & Research Institute Campus, Killikulam, Vallanad (11km southwest of Palayankottai). Experiments were carried out in field cages made up of iron frame (2 x 1.25 x 2.5m) covered with galvanized iron screen (18 x 4 mesh) at Entomology Research Unit Experimental Station, St. Xavier's College Campus. Cotton plants (MCU5) were raised inside the cages in 3 rows with 10 plants per row. Thus, each cage contained thirty plants. Insecticides were not used during the growing season. Cotton plants in the cages were squaring when the test was started. Though the cages served to prevent infestation of other insects, other population of insect pests, predators, parasitoids and spiders were hand picked and removed form the cages. Then *H. armigera, S. litura* and *E. mollifera* were released, two each, per plant in separate cages. Thus, on the 90th day there were sixty *H. armigera, S. litura* and *E. mollifera* infested, each per cage.

Infestations were made at various intervals by placing *H. armigera, S. litura* and *E. mollifera* larvae on the plant terminals with small brushes to glue them to the leaves and bolls and by releasing on the bolls. The adults and nymphs of *R. kumarii* were released at the rate of one per plant manually by walking between the rows of the cotton and shaking them from the rearing containers. The following treatments were made: 1. infestation with *H. armigera,* 2. infestation with *S. litura,* 3. infestation with *E. mollifera,* 4. infestation with *H. armigera* + 30 adult *R. kumarii* released (rate of 2 prey/predator), 5. infestation with *S. litura* + 30 adult *R. kumarii* released, and 6. infestation with *E. mollifera* + 30 5th nymphal instar *R. kumarii* released.

After the release, the cages were checked and the counts of live *H. armigera, S. litura* and *E. mollifera* larvae and predators were made every 2nd or 3rd day by whole plant search and observance. Cannibalised and dead predators found during counting were replaced. Cotton bolls, harvested and damaged and healthy bolls were counted. The seed-cotton yield was weighed separately, at each interval till the final picking and percentage damage was computed in each cage.

RESULTS AND DISCUSSION

The adult reduviid, *R. kumarii* significantly (49%) suppressed the population of *H . armigera* larva during the initial infestation. The prior suppression of *H. armigera* (39, 21,30 and 34% at 97, 100, 103 and 108 days of observation, respectively) was not significant (31, 21, 26, 33 and 42% at 94, 97, 100, 103, and 106 days of observation, respectively) (Fig. 1). The adult and 5th instar *R. kumarii* could not cause similar suppression of *S. litura,* and *E. mollifera* (37, 39, of 07, 17 and 29% at 94, 97, 100, 103 and 106 days of observation, respectively). Similar reduction of artificial infestation of lepidopteran larvae by reduviids, *Zelus rendardii* Kolenati, *Zelus exsanguis* (Stål) and *Arilus cristatus* (Linn.) in cotton and soybean field cage plots was observed in USA by Lingren *et al.* (1968), van den Bosch *et al.* (1969), Leigh and Gonzalez (1976), Ables (1978) and Richman *et al.* (1980). In India, Sahayaraj and Ambrose (1997) also reported similar suppression by a peiratine reduviid, *Ectomocoris tibialis* (Distant) against red cotton bug *Dysdercus cingulatus* (Fabricius) in cotton field cages.

Rhynocoris kumarii significantly reduced the cotton leaf and boll damage in *H. armigera* infested cages and minimized the damage in *S. litura,* and *E. mollifera* infested cages (Table 1). Similarly, *Rhynocoris marginatus* (Fabricius) reduced the plant damage by *S. litura, D. cingulatus,* and *Mylabris pustulata* Thunberg in cotton (Ambrose and Claver, 1999). van den Berg and Cock (1993) also stated that predator exclusion cages had more damaged fruiting cotton plant parts (squares, flowers and bolls) than predator inclusion cages. However, Barry *et al.* (1974) stated that *Chrysoperla carnea* (Stephens) release in field cages did not reduce defoliation damage caused by bollworm *Helicoverpa zea* (Boddie), and cabbage looper, *Trichoplusia ni* (Hübner) as

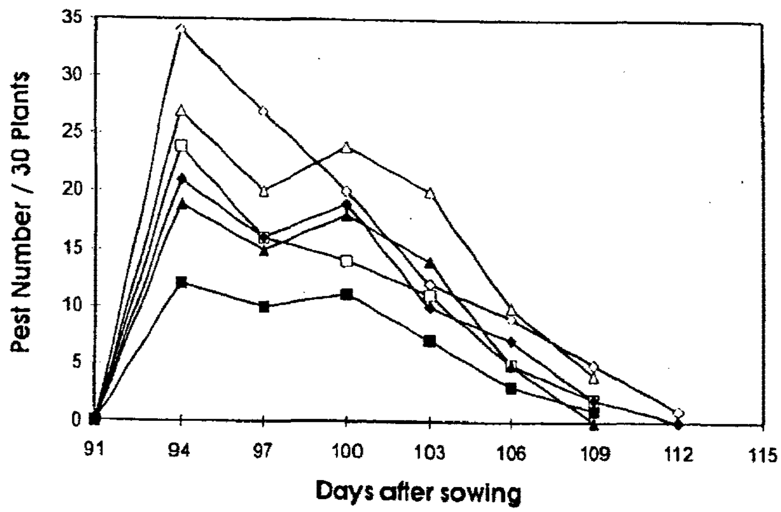

Fig. 1. Effect of *Rhynocoris kumarii* release on the density of pests in cotton field cages. [*H. armigera* infested cages with (■) and without *R. kumarii* (□); *S. litura* infested cages with (▲) and without *R. kumarii* (Δ); *E. mollifera* infested cages with (✦) and without *R. kumarii* (*)]

compared with control. Seed-cotton yield loss was reduced to 1.52, 1.18 and 1.37 times in *H. armigera, S. litura,* and *E. mollifera* infested cages, respectively (where *R. kumarii* was released) than in such field without *R. kumarii.* However, the predator release increased the yield significantly

Table 1. Effect of *R . kumarii* release on percentage of leaves / bolls damage in the pests infested cotton cage plots

Pest		No. of leaves / bolls damaged (days after sowing) per plant							
		94	97	100	103	106	109	112	115
S. litura	^	1.85a	2.57a	3.72a	4.45a	5.32a	6.31a	5.47a	4.35a
	*	1.07b	1.34b	2.51a	3.14a	3.11a	3.18b	3.02a	2.59b
E. mollifera	^	1.17a	2.25a	3.52a	4.34a	5.52a	6.24a	5.72a	3.96a
	*	1.21a	1.64a	2.34a	3.41a	3.44a	3.34a	3.11b	2.23a
H. armigera	^	1.67a	2.54a	2.63a	3.12a	3.41a	3.52a	3.24a	2.97a
	*	1.12a	1.43b	1.51b	2.58a	3.12a	3.10a	2.57a	2.44a

* *R. kumarii* released, ^*R. kumarii* not released

Values followed by different letters within a column are statistically significant.

in *H. armigera* infested cages (P<0.01), but such an impact was not obtained in the *S. litura*, and *E. mollifera* infested cages by predator release (Table 2). Increased seed-cotton yield due to the presence of predators and parasitoids was also observed by King *et al.* (1989) and Simmons and Minkenberg (1994). The results clearly indicate the potential of using *R. kumarii* for the control of *H.armigera*, *S.litura* and *E. mollifera* in cotton agroecosystems.

Table 2. Effect of *R. kumarii* release on seed cotton yield in pest infested cotton cage plots

Pest		Seed Cotton yield (gm)
H. armigera	^	321a
	*	647b
S. litura		217a
	*	384a
E. mollifera		274a
	*	361a

* *R. kumarii* released, ^*R. kumarii* not released. Values followed by different letters within a column are statistically significant.

Although the results clearly establish the biocontrol potential of *R. kumarii* in field cage release programme; augmentative release and subsequent monitoring on their synchronization are required. Efforts should be made to enhance the efficiency of mass production and to make it economical, besides developing the infrastructure that can ensure timely and adequate supplies of the natural enemies.

ACKNOWLEDGEMENTS

We are thankful to Rev. Dr. A. Lourdusamy, S. J., Principal, St. Xavier's College, Palayankottai for facilities and encouragement. Thanks are extended to Dr. David G. Riley, Coastal Plain Experimental Station, University of Georgia, USA for his comments on the first draft of the manuscript. Department of Environment and Forest (Govt. of India) research Scheme No 30/14-96-RE given to DPA is gratefully acknowled ged.

REFERENCES

Ables, J. R. 1978. Feeding behavior of an assassin bug, *Zelus renardii*. *Annals of the Entomological Society of America*, **71**: 476-478.

Ambrose, D. P. and Claver, M. A. 1999. Suppression of cotton leafworm *Spodoptera litura*, flower beetle *Mylabris pustulata* and red cotton bug *Dysdercus cingulatus* by *Rhynocoris marginatus* (Heteroptera: Reduviidae) in cotton field cages. *Journal of Applied Entomology*, **123**: 225-229.

Barry, R. M., Hatchett, J. H. and Jackson, R. D. 1974. Cage studies with predators of the cabbagelooper, *Trichoplusa ni*, and corn earworm, *Heliothis zea*, in soybeans. *Journal of Georgia Entomological Society*, **9**: 71-78.

Claver, M. A. 1998. Biological control potential evaluation of the predator, *Rhynocoris kumarii* Ambrose and Livingstone (Heteroptera: Reduviidae) against three selected cotton insect pests. *Ph.D. Thesis*. M. S. University, Tirunelveli, T. N., India.

King, E. G., Powell, J. E. and Steiner, W. M. M. 1989. Control of *Heliothis* spp. (Lepidoptera: Noctuidae) in the western Hemisphere by propagation and release of predators and parasites, strains, pp.425-425. In: E.G. King and R.D. Jackson (Eds). *Biological control of Heliothis: Increasing the effectiveness natural enemies*. Amerind Pubishers, New Delhi, India.

Leigh, T. F. and Gonzalez, D. 1976. Field cage evaluation of predators for control of *Lygus hesperus* Knight on cotton. *Environmental Entomology*, **5**: 948-952.

Lingren, P. D., Ridgway, R. L. and Jones, S. L. 1968. Consumption by several common arthropod predators of eggs and larvae of two *Heliothis* species that attack cotton. *Annals of the Entomological Society of America*, **61**: 613-618.

Richman, D. B., Hememway, R. C. Jr. and Whitcomb, W. H. 1980. Field cage evaluation of predators of the soybean looper, *Pseudoplusia includens* (Lepidoptera: Noctuidae). *Environmental Entomology*, **9**: 315-317.

Sahayaraj, K. and Ambrose, D.P. 1997. Field cage evaluation of predator *Ectomocoris tibialis* Distant (Heteroptera: Reduviidae) to control *Dysdercus cingulatus* (Fab.). *Journal of Insect Sciences*, **10**(1): 65-66.

.Simmons, G. S. and Minkenberg, O. P. J. M. 1994. Field cage evaluation of augmentative biological control of *Bemisia argentifolii* (Homoptera: Aleyrodidae) in southern California cotton with the parasitoid *Eretmocerus* nr. *californicus* (Hymenoptera: Aphelinidae). *Environmental Entomology*, **23**: 1552-1557.

van den Berg, H. and Cock, M. J. W. 1993. Exclusion cage studies on the impact of predation on *Helicoverpa armigera* in cotton. *Biocontrol Science and Technology*, **3**: 491-497.

van den Bosch, R., Leigh, T. F., Gonzalez, D. and Stinner, R. E. 1969. Cage studies on predators of the bollworm in cotton. *Journal of Economic Entomology*, **62**: 1486-1489.

van Lenteren, J. C. and Woets, J. 1988. Biological and integrated pest control in greenhouses. *Annual Review of Entomology*, **33**: 239-269.