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Predatory Potential of *Canthecona furcellata* (Pentatomidae: Hemiptera) Against Key Defoliator Pests of Teak in Nursery and Chik Pea under Field Conditions

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ABSTRACT

Canthecona furcellata (Wolff.) (Hemiptera: Pentatomidae) is important biological control agents of many Lepidopteron, Coleopteran and Heteropteran insects. This predatory behavior of the species, this is a promising biological control agent for insect pests of agriculture and forest ecosystem. The nursery and field experiments were conducted to find out the predation potential of *E. furcellata*. The results revealed that maximum 93.66% predation was recorded on larvae of *E. macheralis* followed by 89.0 and 84.39% on larvae of *H. puera* and *H. armigera* respectively. Therefore, *E. furcellata* could be utilised effectively against *E. machaeralis* under field conditions, moreover, *H. puera* and *H. armigera* could be employed as laboratory hosts for mass rearing of *E. furcellata*.

Key words: *Canthecona furcellata*, *Hyblaea puera*, *Eutectona macheralis* and *Helicoverpa armigera*.

Introduction

The qualitative and quantitative decline in forest resources and their productivity due to insect pests has been a major concern since long (Browne, 1968; Thakur, 2000). Indiscriminate use of chemical insecticides in agro-and forest ecosystems in the past, have brought in environmental problems, such as groundwater contamination, loss of non-target species, reduction of beneficial species, insect pest resistance to insecticides, pest rebound, secondary pest outbreaks and residues in food (Stark *et al.*, 2007). In order to protect the environment and to ensure food safety with increased productivity, researchers constantly explore various biorational and eco-friendly alternatives, each either as an individual component of the species and locality specific Integrated Pest

Management Programme (Pathak *et al.*, 1995; Shukla and Joshi, 2012; Singh, 2003; Kulkarni *et al.*, 2004; Kulkarni, 2014, Sambaraju *et al.*, 2016).

Canthecona furcella tawolff. (Syn. *Eucanthecona furcellata*) (Hemiptera: pentatomidae), is a polyphagous predatory stink bug, was first described by Distant (1904). Beeson (1968) studied the life cycle starts with laying eggs, five instar nymphal periods of nearly 13-21 days. He is also estimated that nearly 170 eggs are laid by an individual during its life cycle, which has the potential to kill 1600 caterpillars in nymphal stage and 5000 caterpillars in adult stage as bug. Fletcher (1914) reported the bug feeding on larvae of *Athalia proxima* found on entire plain areas of South India. Beeson (1968) had reported this insect as a polyphagous predatory stink bug, feeding on large number of caterpillars and pupae of

Lepidopteran insects such as *Hyblaepuera* (Hyblaiedae), *Eutectona machaeralis*, *Nephoteryxrhobasalis* (Pyralidae), *Plecopterareflexa* and *Spodopteralitura* (Noctuidae), larvae of *Calopeplaleayana* (Chrysomelidae) of agriculture, horticulture and forestry. Ahmad *et al.* (1996) reported the *C. furcellata* (*E. furcellata*) as an important predator of several important forest insect pests in India, including *E. machaeralis*, *H. puera*, *P. reflexa*, *S. litura*, *C. leayana*, *C. cupreata*, the primary defoliator of poplar (*Populus deltooides*), has been found as a preferred prey. It has also been reported to predate on larvae of coleopteran and heteropteran insects. It is ubiquitous in forests, but its abundance is more in slightly moist forest and is most frequently observed to feed on the larvae of lepidopteran insect pests.

The aim of present study is to test the predatory potential of *C. furcellata* against teak defoliator *H. puera*, teak skeletonizer *E. machaeralis* in nursery and *H. armigera* in chick pea under field conditions.

Materials and Methods

Rearing and culture of *C. furcellata*

Rearing of Predator was carried out on *C. cephalonica*, *E. machaeralis*, *H. puera*, *H. armigera* and *G. melonella* for test the predator potential of *C. furcellata* in teak nursery and chick pea under field conditions.

Regular culture of *C. furcellata* was maintained in the laboratory in 1-2 liter glass jars with fresh leaves of teak. The bugs were reared in glass jars (1-2 liter capacity), lined with blotting paper and provided with sufficient disease-free larvae of *C. cephalonica* (stainton) as regular food along with teak leaves. Jars were covered with muslin cloth tied with rubber bands for aeration. The female bugs laid eggs on the leaves and blotting paper. Eggs laid were collected and transferred to another glass beaker. The young nymphs (1st instar) hatched were provided with wet cotton, as they do not feed. Larvae of *C. cephalonica* were provided 2nd instar onwards. Beakers were changed daily for hygiene purpose; nymphs were transferred to another beaker. Observations on molting were recorded daily to observe the duration of different nymphal instars. The moulting of nymphal instars was clearly observed with moulted nymphal body or exuviae were seen through naked eyes. Adults, male and female were allowed to mate in a glass beaker. Female laid eggs on teak leaf and blotting paper. Just moulted nymphs and adults were

used for studying for total feeding and per day consumption by nymph and adult, total feeding during total life cycle, fecundity and adult longevity.

Rearing of test insects

Leaf skeletonizer, *E. machaeralis* and teak defoliator, *H. puera* larvae were collected from teak nurseries and plantation areas in and around the institute campus, reared on fresh teak leaves in plastic containers. Mature larvae, separated daily from the main culture, were used for experiments.

Helicoverpa paarmigera is a leaf defoliator and pod borer of chick pea. Collections were made from chick pea and red gram, this defoliator larva, brought to the laboratory and reared on leaves and young pods of chick pea. Desired stage, most preferably, last stage larvae were used for experiments.

Investigation on predation efficiency of the predatory bug, *C. furcellata* on different hosts under nursery and field condition

A field experiment was conducted to evaluate the predatory potential of *C. furcellata* against *H. puera*, *E. machaeralis* in Teak nursery at Kanchangaon range and *H. armigera* in Chick pea crop at Para village (Bargi), Jabalpur. M.P. Experiments were laid out in randomized block design with six treatments of three replications. Five plants were randomly selected from each plot and tagged for recording the observations. The numbers of major larval defoliator pests per three leaves per five plants and larval consumption by predatory bug were recorded at 24 hrs after release.

Statistical analyses

Data obtained in numbers were transformed suitably into square root values and that in proportions into Arc Sin (Angular) transformation, before subjecting them to ANOVA and comparison of means.

Results and Discussion

Result in Table 1 indicated that the first instar larvae were not feeding on all the three hosts due to their zoophytophagous nature. Second instar onward the per cent predation showing slight increasing trend upto fifth instar for all the hosts. Maximum per cent predation by third, fourth and fifth nymphal instar of *E. furcellata* was observed in case of *E. machaeralis* 89.17%, 94.58 % and 92.39 %, respectively. Maximum per cent predation of 84.93 per cent was ob-

Table 1. Study on the predatory efficiency of predatory bug *C. furcellata* on different hosts under nursery and field condition.

Predatory stages	Percent prey consumption		
	<i>H. puera</i>	<i>E. macheralis</i>	<i>H. armigera</i>
Nymphal instar I	No feeding	No feeding	No feeding
Nymphal instar II	71.18 (57.53)*	83.28 (65.86)	69.32 (56.37)
Nymphal instar III	81.42 (64.47)	89.17 (70.79)	79.77 (63.27)
Nymphal instar IV	84.65 (66.93)	94.58 (76.54)	81.33 (64.41)
Nymphal instar V	88.25 (69.95)	92.39 (73.99)	78.14 (62.13)
Adult	73.37 (58.93)	84.93 (67.16)	82.12 (64.99)
SEm±	-1.95	-1.85	-1.2
CD (0.05)	-5.28	-6.43	-4.22

*Figures mentioned in the parenthesis are angular transformed values.

served in adults on *E. macheralis* larvae followed by on larvae of *H. armigera* with 82.12 per cent predation and 73.37 per cent predation on *H. puera* larvae. The present study is in conformity with the work done earlier by Ahmad *et al.* (1996), however, consumed as many as 115.75, 89.68, 86.53 and 159.98 *C. fulgurita* larvae, respectively. Thus, the present result clearly reflects that *C. furcellata* could safely be considered as potential bio-control agent in pest management programme of major larval defoliator in teak and Chick pea. *E. macheralis*, *H. puera* and *H. armigera* found to be suitable prey with successful life cycle under field conditions as well as per cent prey consumption was also observed at each nymphal instar.

Conclusion

It was concluded from the result that *E. macheralis*, *H. puera* and *H. armigera* are the preferred and suitable hosts of *C. furcellata*. Hence, this predator could be utilized as effective biocontrol agent against *E. macheralis*, *H. puera* and *H. armigera* under teak and Chick pea ecosystems, whereas, larvae of *H. armigera* and *C. cephalonica* could be utilized as laboratory host for *C. furcellata* for mass culture.

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References

Ahmad, M., Pratap Singh, A., Sharma, S., Mishra, R.K. and Ahmad, Md. Jamal, 1996. Potential estimation of

predatory bug, *Canthecona furcellata* Wolff (Hemiptera: Pentatomidae) against poplar defoliator, *Closteracupreata* (Lepidoptera: Notodontidae). *Annals of Forestry*. 4(2) : 133-138.

- Browne, F.G. 1968. *Pests and Diseases of Forest Plantation Trees*. Clarendon Press, Oxford
- Distant, W.L. 1904. The Fauna of British India, Including Ceylon and Burma. Rhynchota – Vol. I (Heteroptera). 1977 reprint edition. Today and Tomorrow's Printers & Publishers, New Delhi.
- Kulkarni, N., Kushwaha, D.K., Mishra, V.K. and Paunikar, S. 2012. Effect of economical modification in artificial diet of Greater Waxmoth, *Galleria mellonella* (Lepidoptera: Pyralidae). *Indian Journal of Entomology*. 74(4) : 133-138.
- Pathak, S.C., Kulkarni, N. and Meshram, P.B. 1995. Forest insect control. *Encyclopaedia of Environmental Biology*. 3: 119-130. Academic Press, San Diego
- Sambaraju, K., Des Rochers, P., Rioux, D., Boulanger, Y., Kulkarni, N., Verma, R.K., Pautasso, M., Pureswaran, D., Martel, V., Hebert, C., Cusson, M. and Delisle, J. 2016. Forest ecosystem health and biotic disturbances: perspectives on indicators and management approaches. Pp.459-502. In: *Ecological Forest Management Handbook* (Ed. Larocque, G.R.), CRC Press, Boca Raton, 589p.
- Shukla, P.K. and Joshi, K.C. 2001. *Recent Trends in Insect Pest Control to Enhance Forest Productivity*. Tropical Forest Research Institute, Jabalpur (M.P.) India, 235pp.
- Singh, S.P. 2003. Role of predators and parasitoids in biological control of crop pest. In: O.Koul, G.S. Dhaliwal, S.S. Marwaha and J.K. Arora (eds.), *Biopesticides and Pest Management*, Vol.1, Campus Books International, New Delhi, pp. 196-221.
- Stark, J.D, Vargas, R.I. and Banks, J.E. 2007. Incorporating ecologically relevant measures of pesticide effect for estimating the compatibility of pesticides and biocontrol agents. *J. Econ. Entomol.* 100 : 1027-1032.
- Thakur, M.L. 2000. *Forest Entomology*. Sai Publishers, Dehradun.