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Research Note

Role of *Blaptostethus pallescens* Poppius and *Xylocoris flavipes* (Reuter) in the suppression of *Corcyra cephalonica* Stainton in stored rice grain

RABINDER KAUR* and JASPAL SINGH VIRK
Department of Entomology, Punjab Agricultural University, Ludhiana 141 004, Punjab
**Corresponding author E-mail:* rebakaur@yahoo.com

ABSTRACT: The predatory performance of anthocorid bugs, *Blaptostethus pallescens* Poppius and *Xylocoris flavipes* (Reuter) was evaluated against stored rice grain moth, *Corcyra cephalonica* Stainton. Both the predators significantly suppressed the infestation of *C. cephalonica* in stored rice grain. However, *X. flavipes* performed better than *B. pallescens* which was attributed to their small size enabling them to adapt to store rice grain. The higher doses of *X. flavipes* @ 30 nymphs/100 eggs/ jar (11.9 moths/jar) and 20 nymphs/ 100 eggs/ jar (15.5 moths/ jar) were found to be most effective in suppressing the population build-up of *C. cephalonica* in stored rice grain. *X. flavipes* with respect to nymphal survival was found to be most suitable as higher number of their living nymphs (13.4 to 24.4 nymphs/ jar) was recovered as compared to *B. pallescens,* where, negligible number of living nymphs (0-0.2 nymphs/ jar) was recovered. It was concluded that *X. flavipes* @ 30 nymphs/ jar, followed by *X. flavipes* @ 20 nymphs/ jar was most effective in controlling *C. cephalonica* in stored rice grain.

KEY WORDS: *Blaptostethus pallescens*, *Xylocoris flavipes*, predatory performance, rice grain moth, *Corcyra cephalonica*

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Protecting stored food grains has assumed greater importance as post-harvest grain loss has reached greater heights. Insects play a significant role in deterioration of food grains, causing both qualitative and quantitative losses. In tropical countries, insects cause more than 20 per cent post harvest losses, due to highly favorable the storage conditions for insect growth and development (Mondal and Port, 1995). In India, the post harvest losses of grains are estimated to be around 10 per cent; out of this, losses incurred during storage are estimated to be 6.6 per cent. The control measures adopted at farm, market and public sector storage include the use of plant materials/ botanicals, and/ or contact insecticides and fumigants (Shakil *et al.*, 2009; Tripathi *et al.*, 2009). These measures are not very effective and may pose problems like insecticide resistance, residue, health hazards and environmental pollution. Therefore, there is a strong need to evaluate other non-chemical and eco-friendly methods of pest control. Biological control may provide an affordable and sustainable option for controlling stored grain pests. The predatory bug, *Xylocoris flavipes* (Reuter) (Hemiptera: Anthocoridae) has been exploited as biological control agents against stored-product pests such as bruchids, moths and mites (Murata *et al.*, 2007; Sing and Arbogast, 2008; Rahman *et al.*, 2009). Another predatory bug, *Blaptostethus pallescens* Poppius (Hemiptera: Anthocoridae) has been found to be potential predator of pests of maize and mites of grain warehouses in Egypt (Tawfik *et al.,* 1974; Tawfik and El-Husseini, 1971). In India, it has been recorded from Tamil Nadu and Bombay (Muraleedharan, 1977) and Bangalore on fodder maize (Jalali and Singh, 2002). The rearing of *B. pallescens* has been standardized on alternate laboratory host eggs (Ballal *et al.,* 2003). The present study was planned to evaluate the predatory abilities of these bugs against the stored rice grain moth, *Corcyra cephalonica* Stainton.

The experiment to evaluate anthocorids, *B. pallescens* and *X. flavipes* against stored rice grain moth, *C. cephalonica* was conducted in the Biological Control Laboratory, Department of Entomology, Punjab Agricultural University, Ludhiana for two years (2009 and 2010). The nucleus cultures of both anthocorids and their product protocols were supplied by National Bureau of Agriculturally Important Insects (NBAII), Bangalore. The cultures of both the anthocorid predators were maintained in the laboratory at 26 ± 1°C, 75 ± 5% RH and a L14:D10 photoperiod. There were seven treatments *viz*., T_1- T_3: *B. pallescens* @ 10, 20 and 30 nymphs/ 100 eggs/ jar respectively; T_4- T_6: *X. flavipes* @ 10, 20 and 30 nymphs/ 100 eggs/ jar respectively and T_7: Control (untreated). There were four replications and the experiment was conducted under complete randomized block design. One kilogram of rice grain was taken in the plastic jars of two-kilogram capacity for each treatment/ replication and they were infested with 100 eggs of *C. cephalonica*. The seven day-old nymphs of each anthocorid as per the doses given above were released in these jars. The jars were sealed with plastic lids (with pinholes) and maintained in the laboratory at 26 ± 1°C, 75 ± 5% RH and a L14:D10 photoperiod. These jars were checked on every alternate day for any microbial infection and after one month, the data was recorded on number of *Corcyra* moths emerged and number of live nymphs of anthocorids recovered. Since, life cycle of bugs is completed in 25-30 days, the surviving nymphs after one month were considered as nymphs of F_1 generation. The data were statistically analyzed through ANOVA by applying square root transformations.

Data of year 2009 mentioned in the Table 1 revealed that the lowest number of *C. cephalonica* moths emerged in *B. pallescens* @ 30 nymphs/ jar (12.3 moths / jar) and it was on par with *B. pallescens* @ 20 nymphs/ jar (15.3 moths / jar) and all the three treatments of *X. flavipes* nymphs (15-24.8 moths/ jar) (Table 1). The maximum number of moths emerged in lower dose (@10 nymphs/ jar) of *B. pallescens* (26.5 moths/ jar) and it was on par with control (65.3 moths/ jar) and significantly inferior to other treatments. All three *X. flavipes* nymph treatments were significantly on par with each another with respect to nymphal survival (16.5- 26.3 nymphs/ jar) and nymphal survival in these treatments of *X. flavipes* was significantly higher than all the treatments of *B. pallescens* (Table 2). Though, *B. pallescens* was effective in controlling *C. cephalonica*, negligible number of living nymphs of F_1 generation (1-1.2 nymphs/ jar) was recovered from the stored rice grain.

When the experiment was repeated for second time in the year 2010, it was found that the treatments with *X. flavipes* @ 30 nymphs/ jar, followed by 20 nymphs/ jar were superior than remaining treatments in suppressing the population of *C. cephalonica* in stored rice grain (Table 1). The lowest *Corcyra* moths emergence (8.8 moths/ jar) was observed in *X. flavipes* @ 30 nymphs/ jar and it was on par with *X. flavipes* @ 20 nymphs/ jar (13.8 moths emerged/ jar), but significantly better than all other treatments. The treatments of *X. flavipes* @ 10 nymphs/ jar and *B. pallescens* @ 30 nymphs/ jar were on par with one another (21.3 and 33.8 moths/ jar, respectively) and better than other two treatments of *B. pallescens* i.e. 10 and 20 nymphs/ jar (46.5 and 41.0 moths/ jar, respectively). The latter two were also on par with untreated control (56.3 moths emerged/ jar). With respect to anthocorid nymphal survival, all the three treatments receiving *X. flavipes* were on par with one another (10.4 – 22.5 nymphs/ jar), but, statistically superior to all treatments of *B. pallescens,* where no living nymphs were recovered (Table 2).

Table 1. Emergence of *Corcyra cephalonica* in the jars of rice grains treated with anthocorid predators under storage condition

Treatments	Mean number of *Corcyra* emerged/ jar		
	2009	2010	Mean
B. pallescens @ 10 nymphs/ 100eggs	26.5 (5.9[ab])	46.5 (6. 9 [de])	36.5 (6.4[bc])
B. pallescens @ 20 nymphs/ 100eggs	15.3 (3.8 [a])	41.0 (6.5 [de])	28.1 (5.1[ab])
B. pallescens @ 30 nymphs/ 100eggs	12.3 (3.4 [a])	33.8 (5.8 [cd])	23.0 (4.6[ab])
X.flavipes @ 10 nymphs/ 100eggs	24.8 (4.4 [a])	21.3 (4.7[bc])	23.0 (4.5[ab])
X. flavipes @ 20 nymphs/ 100eggs	17.3 (3.9 [a])	13.8 (3.7[ab])	15.5 (3.8 [a])
X. flavipes @ 30 nymphs/ 100eggs	15.0 (3.4 [a])	8.8 (3.0 [a])	11.9 (3.2 [a])
Control (untreated)	65.3 (8.1 [b])	56.3 (7.6 [e])	60.8 (7.8 [c])
CD $P \leq 0.05$	2.8	1.1	1.9

Figures in brackets are the values of square root transformation.

Table 2. Nymphal survival of anthocorid predators in the jars of rice grains infested with eggs of *Corcyra cephalonica S.* under storage condition

Treatments	Mean number of living anthocorid (nymphs)/ jar		
	2009	2010	Mean
B. pallescens @ 10 nymphs/ 100eggs	0.0 (1.0 b)	0.0 (1. 0 b)	0.0 (1.0 b)
B. pallescens @ 20 nymphs/ 100eggs	0.5 (1.2 b)	0.0 (1.0 b)	0.2 (1.1 b)
B. pallescens @ 30 nymphs/ 100eggs	0.5 (1.2 b)	0.0 (1.0 b)	0.2 (1.1 b)
X.flavipes @ 10 nymphs/ 100eggs	16.5 (3.8 a)	10.4 (3.2a)	13.4 (3.5 a)
X. flavipes @ 20 nymphs/ 100eggs	20.3 (4.2 a)	15.7 (4.0 a)	18.0 (4.1 a)
X. flavipes @ 30 nymphs/ 100eggs	26.3 (4.7 a)	22.5 (4.2 a)	24.4 (4.4 a)
Control (untreated)	0.0 (1.0 b)	0.0 (1.0 b)	0.0 (1.0 b)
CD $P \leq 0.05$	2.3	2.0	2.1

Figures in brackets are the values of square root transformation.

When the data of two years (2009 and 2010) were pooled, it was found that all the treatments of *X. flavipes* and *B. pallescens* except, *B. pallescens* @ 10 nymphs/ jar were superior than control in suppressing the infestation of *C. cephalonica* (Table 1). The lowest number of moths emerged in the jar where *X. flavipes* @ 30 nymphs/ jar were released (11.9 moths/ jar), followed by *X. flavipes* @ 20 nymphs/ jar (15.5 moths/ jar) and these two treatments were superior than other treatments. *X. flavipes* @ 10 nymphs/ jar and *B. pallescens* @ 20 and 30 nymphs/ jar were on par with each another in reducing population of *C. cephalonica*. The highest number of moths emerged (36.5 moths/ jar) in treatment with *B. pallescens* @ 10 nymphs/ jar and it was on par with untreated control (60.8 moths / jar). Earlier, Brower and Mullen (1990) and Brower and Press (1992) also proposed the usefulness of *X. flavipes* as a component in integrated pest management programme of moths in peanut storage and empty corn bins. In the present studies, the emergence of *Corcyra* in *B. pallescens* treatments was higher as compared to *X. flavipes*, indicating the need for higher dose of *B. pallescens* for predation of eggs of *C. cephalonica* to the desired extent in stored rice grain. Mean maximum number of living nymphs were recovered from the treatment receiving *X. flavipes* @ 30 nymphs/ jar (24.4 nymphs/ jar) which was on par with other two treatments of *X. flavipes* i.e. *X. flavipes* @ 20 nymphs/ jar (18.0 nymphs/ jar) and *X. flavipes* @ 10 nymphs/ jar (13.4 nymphs/ jar), but significantly superior than all treatments of *B. pallescens*, where, negligible number (0.0- 0.2 nymphs/ jar) of living nymphs of *B. pallescens* were recovered (Table 2). The negligible number of living *B. pallescens* might be due to the fact that *B. pallescens* can lay eggs only on plant material, while, *X. flavipes* can lay eggs on plain surfaces or on cotton (Ballal *et al.*, 2003). In addition to this, the recovery of live nymphs of *X. flavipes* could be due to predator's natural adaptation to store- grain ecosystem. LeCato and Davis (1975) reported that small size of *X. flavipes* enables them to move freely in stored grain. Further, very low recovery of *X. flavipes* from the jar may be due to the availability of lesser number of surviving and preferred stages of pest, causing cannibalism due to lack of food.

It was concluded that the treatments of *X. flavipes* @ 30 nymphs/ 100 eggs/ jar, followed by *X. flavipes* @ 20 nymphs/ 100 eggs/ jar was most effective in controlling *C. cephalonica* in stored rice.

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