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Evaluation of Anthocorid Predators against Storage Pests of Rice in Assam Situation

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A B S T R A C T

Laboratory experiment was conducted to evaluate the efficacy of two important anthocorid predators, *Blaptostethus pallescens* Poppius and *Xylocoris flavipes* (Reuter) for the suppression of stored grain pest of rice, *Corcyra cephalonica* Stainton. Performance of both the anthocorid bug is significant against the infestation of *C. cephalonica* in storage. However, due to smaller size of *X. flavipes,* it was better than *B. pallescens* to enabling them to fit in storage condition. The higher doses of *X. flavipes* @ 30 nymphs/100 eggs/ jar (12.75-18.00 moths/jar) and 20 nymphs/ 100 eggs/ jar (26.50- 26.75 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 (4.50-14.25 nymphs/ jar) was recovered as compared to *B. pallescens,* where, negligible number of living nymphs (0-7.70 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 storage of rice grain.

Introduction

Rice moth, *Corcyra cephalonica* Stainton (Pyralidae: lepidoptera) is one of the most extensive feeders among the storage pests which feed on a wide variety of cereals, dried vegetable materials, dried fruits like almonds, date palm, nuts, chocolates, biscuits, oilcakes etc in India as well as in other tropical and su btropical regions of the world causing severe economic losses (Adeyemi, 1968; Hodges, 1979). In India, there are about 500 species of insects associated with stored grain products. Among these, nearly 100 species of insect-pests of stored product cause economic losses (Kumar, 2015). Shukla and Toke, 2013 reported that more than 20,000 species of field and storage pests causes post-harvest loss of approximately one-third of global food production, valued economically above $100 billion per annum. The quantitative and qualitative damage by storage insect pests may vary from 20-30% in the tropical zone and 5-10% in the temperate zone (Yankanchi *et al.*, 2014). Anthocorid bugs are important predators amongst different bicontrol agents of C. *cephalonica.* These, predatory anthocorids are equally effective to control different insect pests including thrips, aphids and mealy bugs in various cropping systems in the Mediterranean Basin and sub-Saharan Africa (Hernandez and Stonedahl, 1999; Sengonca *et al.*, 2008; Zhang *et al.*, 2012; Efe and Cakmak, 2013; Wang *et al.*, 2014). Some indigenous anthocorids identified such as *B. kumbi* Rajasekhara, *B. pallescens* and *Blaptostethus pluto* (Distant) are promising biocontrol agents (Rajasekhara 1973; Muraleedharan, 1977; Jalali and Singh, 2002). A considerable amount of information has been generated at the National Bureau of Agricultural Insect Resources (ICAR - NBAIR), Bangalore, on the diversity of indigenous anthocorid predators; protocols for mass rearing them have been devised and some potential ones have been successfully evaluated in the field (Ballal *et al*., 2012). Insect pest management through injudicious application of synthetic chemical pesticides in agriculture is facing several obstacles including, development of pesticide resistance as well as environmental pollution besides human health hazards. Therefore, biological control of crop pests may be an important alternate option for pest management in different crop ecosystems. Several anthocorids species were reported to provide control several pests (Ballal and Yamada, 2016). The predatory bug, *X. flavipes* 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). Similarly, *B. pallescens*, a general predator with wide host range has also been reported on maize, rose, castor, grapes, bamboo (Jalali and Singh, 2002; Ballal *et al.*, 2003; 2009; Gupta, 2009; Sobhy and Abdul-Hamid, 2014) in India. *Blaptostethus pallescens* has been identified as a potential bio-control agent for the management of eggs and larvae of lepidopteran pest, sucking pests like mites, thrips, mealybugs, aphids and stored insect pests (Ballal*et al*., 2009; 2012; Gupta and Ballal, 2011; Lessando *et al*., 2015; Kaur *et al*., 2019). From another experiment conducted by Borkakati *et al.*, (2018), found that the highest numbers of predator was proportional to highest yield of crop.

The present study was executed to evaluate the efficacy of anthocorid predators, *B. pallescens*and *X. flavipes* against the stored rice grain moth, *C. cephalonica.*

Materials and Methods

The experiment was carried out at Biological Control Laboratory, Department of Entomology, Assam agricultural University, Jorhat during 2015-16 and 2016-17 session. The nucleus cultures of *B. pallescens* and *X. flavipes* along with their rearing protocol were supplied by NBAIR, Bengaluru. Mass rearing of both the anthocorids was undertaken in the biocontrol laboratory. The experiment was executed with seven treatments as well as four replications of each treatment under completely randomized block design. One kilogram of untreated rice was taken in plastic jars of two –kilogram capacity for each treatment and each container was infested with 100 numbers eggs of *C. cephalonica*. Seven day old nymphs of the anthocorids @10,20 and 30 nymphs per container were released. The treatments were,- T1: Release of 10 *B.pallescens* nymphs; T2: Release of 20 *B.pallescens* nymphs; T3: Release of 30 *B. pallescens* nymphs; T4: Release of 10 *X. flavipes* nymphs; T5: Release of 20 *X.flavipes* nymphs; T6: Release of 30 *X.flavipes* nymphs and T7: Infested grain with no anthocorid predator. The jars were closed along with some pin hole for ventilation and kept at 26±1^{0}C, 80±2% RH and L14: D10 photoperiod inside the laboratory. Observations recorded on the number of *C. cephalonica* moths (F_1) and the number of live anthocorid nymphs or adults emerging after a month from each treatment, respectively.

Result and Discussion

The experiment conducted during 2015-16 indicated that (Table 1) the inoculated release of *X.flavipes* @ 30 nymphs per kg of stored rice (12.75 moths/ container) was significantly superior to all other treatments in reducing the emergence of *C. cephalonica* moths. In untreated control mean number of emergence of *C. cephalonica* was 70.25.However, all the treatments showed comparatively better results in reducing the emergence of *C. cephalonica* moths while compared to untreated control. Maximum number of living nymphs was recorded from the treatment of *X. flavipes* @ 30 nymphs/ container (14.25) followed by *X. flavipes* @ 20 nymphs/ container (9.50), whereas comparatively less number of living nymphs was observed in different treatments of *B. pallescens*, the maximum average emergence of living nymphs (7.70) was found in the treatment with 30 nymphs of *B. pallescens*.

The same experiment was also conducted again during 2016-17 for confirmatory trial revealed that (Table 1) the inoculative release of *X.flavipes* @ 30 nymphs per kg of stored rice (18.00 moths/ container) was significantly superior to all other treatments in reducing the emergence of *C. cephalonica* moths. However, *B pallescens* @ 30 nymphs/container and *X. flavipes* @ 10 nymphs / container were on par with each other (32.5 and 36.0 moth emerged respectively) in infested stored rice. On an average, the moth emergence in untreated control was 59.25. Maximum number of living nymphs was recorded from the treatment of *X.flavipes* @ 30 nymphs/ container (12.50) followed by *X. flavipes* @ 20 nymphs/ container (7.75), whereas negligible number of living nymphs was observed in different treatments of *B. pallescens*, the maximum average emergence of living nymphs (1.25) was found in the treatment with 30 nymphs of *B. pallescens*.

From the investigation carried out by Brower and Mullen (1990) and Brower and Press (1992) also revealed that the usefulness of *X. flavipes* as a component in integrated pest management programme of moths in peanut storage and empty corn bins. 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). LeCato and Davis (1973) reported that small size of *X. flavipes* enables them to move freely in stored grain. Further, unavailability of surviving and preferred stages of *C. cephalonica* eggs may lead to cannibalism amongst *X. flavipes* and results minuscule recovery of bioagent **(**Kaur and Virk, 2011). However, natural population of this predator is insufficient to maintain the target pest population below economic injury levels on several crops. Therefore, mass production and augmentative releases of natural enemies may help to maintain some of the target pests below economic injury levels (Gupta et al., 2018). It was, therefore, concluded from the experiment that *X. flavipes* was better than *B. pallescens* in controlling *C. cephalonica* moth infestation in stored rice in the laboratory condition.

Table.1 Effect of anthocorid predators against storage pests of rice (2015-16 and 2016-17)

Treatments	Mean no. of *C. cephalonica* moth emergence*		Mean no. of living anthocorids (nymphs)*	
	2015-16	2016-17	2015-16	2016-17
***Blaptostethus pallescens* @ 10 nymphs**	61.75[b]	55.75[a]	0	**0**
***Blaptostethus pallescens* @ 20 nymphs**	53.25[c]	41.25[b]	5.50[d]	**0.75[d]**
***Blaptostethus pallescens* @ 30 nymphs**	46.75[d]	32.5[c]	7.70[c]	**1.25[d]**
***Xylocoris flavipes* @ 10 nymphs**	38.50[e]	36.0[c]	6.75[cd]	**4.50[c]**
***Xylocoris flavipes* @ 20 nymphs**	26.50[f]	26.75[d]	9.50[b]	**7.75[b]**
***Xylocoris flavipes* @ 30 nymphs**	12.75[g]	18.00[e]	14.25[a]	**12.50[a]**
Untreated	70.25[a]	59.25[a]	0	**0**
S. Ed±	9.30	2.34	24.40	**0.58**
CV	4.32	4.91	1.52	**1.22**
CD at 5%		**8.75**		**21.55**

*Mean of 4 replication)

**Means followed by the same letter in a column are not significantly different

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