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Suppression of Dead-Heart and Folded Leaf Symptoms in Paddy by *Trichogramma japonicum* Ashmead in Seppa Area of Arunachal Pradesh, India

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Abstract An experiment was conducted at three different location to evaluate the field efficacy of egg parasitoid, *Trichogramma japonicum* Ashmead in suppressing dead-geart and folded leaf symptoms caused by stem-borer, *Scirpophaga incertulus* Walker and leaf-folder, *Cnaphalocrocis medinalis* (Guinee) respectively, in paddy. It was observed that dead-hearts were significantly suppressed at 20 and 35 DAT in treated plots of all the three locations whereas significant control in case of folded leaves were achieved at 60 DAT. The dead-heart symptoms were significantly suppressed from 26.07 to 18.21% at 20 DAT and from 17.95 to 12.24% at 35 DAT. The folded leaves symptoms reduced from 21.08 to 18.73% at 35 DAT and significantly reduced from 36.71 to 23.45% at 60 DAT.

Keywords Paddy, Dead-heart, Folded leaf, *Trichogramma japonicum*, Field efficacy.

Introduction

Rice is the staple food and most important agricultural crop of all the crops grown in Arunachal Prasdesh. Paddy stem-borer, *Scirpophaga incertulus* Walker and leaf-folder, *Cnaphalocrocis medinalis* (Guenee) are serious pests of rice causing significant yiled losses [1, 2]. Use of synthetic insecticides are discouraged for a number of reasons including pro-organic orientation of the state in recent years. *Trichogramma japonicum* Ashmead is a hymenopteran egg parasitoid which suppresses the pest population, particularly paddy stem-borer and leaf-folder in rice, by infecting and killing their eggs. Large scale utilization of natural enemies for pest management in farmers fields is still at its infancy stage. The parasitoid is under utilized because of its non-availability and difficult reach to the farmers. There is need for its popularization and awareness among the farmers of the region. In this view, the experiment was

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Table 1. Mean dead-heart and folded leaf percent in untreated and treated plots of three locations. Total no of observations=100, t–Table (0.05)=1.96, t–Table (0.01)=2.576, **Samples are significantly different at both 5% and 1% level of significance, *Samples are significantly different at 5% level of significance, Samples are not significantly different.

Villages	Time of observation	Mean bead-heart (%)			Mean folded leaf (%)		
		Untreated	Treated	't' stat	Untreated	Treated	't stat
Mebua	20 DAT	21.32	15.08	4.59**	–	–	–
	35 DAT	13.32	9.88	3.20**	15.96	13.40	1.99*
	60 DAT	–	–	–	33.68	17.4	8.41**
Sangrikwa	20 DAT	33.16	27.12	2.59**	–	–	–
	35 DAT	22.32	14.40	4.69**	19.88	18.12	1.07´
	60 DAT	–	–	–	35.24	23.16	5.23**
Jayanti	20 DAT	23.72	12.44	6.95**	–	–	–
	35 DAT	18.20	12.44	3.36**	27.40	24.67	1.24´
	60 DAT	–	–	–	41.20	29.80	4.37**

undertaken in farmers fields itself to evaluate the field efficacy of the parasitoid in suppressing the symptoms caused by the above said insect-pests.

Materials and Methods

The experiment was conducted to evaluate the efficacy of the egg parasitoid, *T. japonicum* in suppressing the level of infestation by two major insect-pests of rice, stem-borer and leaf folder in Seppa area of Arunachal Pradesh. The study area is located in eastern Himalayan zone between 92°36´ and 93°24´ East longitude and 26°56´ and 27°57´ North latitude at 356 meter above MSL. Rice variety Aadi/Naga was grown in WRC system of cultivation in *kharif* season of 2014 and 2015 in two plots of 30 m × 20 m size in each of three different locations (villages) (viz. Mebua, Sangrikwa and Jayanti) in Seppa area of East Kameng district of Arunachal Pradesh, India, where one plot was treated with releases of the egg parasitoid and other was left untreated. Total six releases of the parasitoid were made at 7 days interval starting from 7 DAT (days after transplanting). The dose of 1,00,000 adults per ha was followed in one release. The *Tricho* cards were stapled on the lower side of the leaf surface. The *Tricho* cards were procured from State Biocontrol Laboratory, Department of Agriculture, Naharlagun 791 110, Arunachal Pradesh. Each *Tricho*-card was containing approximately 40,000 eggs of the parasitoid, *T. Japonicum* with approximately 80% hatching efficiency. The observations were made on the infestation level of stem-borer by counting the number of dead-hearts and number of folded leaves were counted to observe the infestation level of leaf folder in each treated and untreated plot separately in three locations. Counting was made in 1 × 1 meter area containing 25 plants, hereby referred as sub-plots. The overall observation was based on randomly selected 100 numbers of such sub-plots in each of the treated and untreated plots. Percent dead-heart and percent folded leaves were calculated out of 25 plants of each sub-plots. The mean percent of dead-hearts and folded leaves from untreated and treated plots were compared subjecting it to the 't' test of significance. Data analysis were done using WASP 2.0 software developed by ICAR Research Complex for Goa.

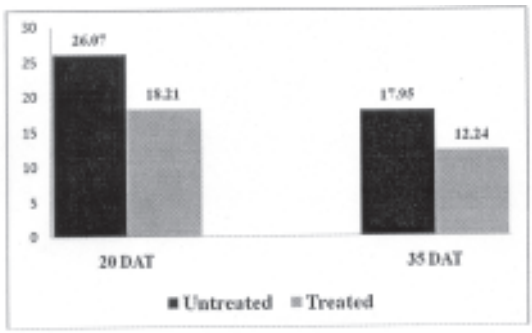

Fig. 1. Overall percent dead-heart in untreated and treated plots (mean of all three locations).

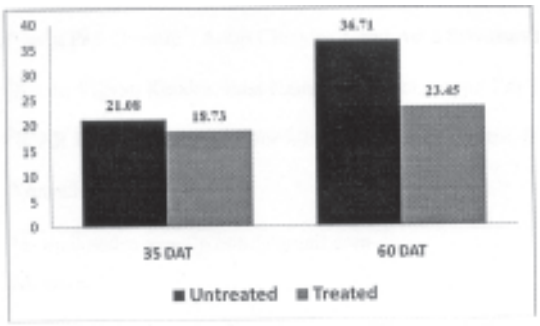

Fig. 2. Overall percent folded leaf in untreated and treated plots (mean of all three locations).

Results and Discussion

Negligible infestation of stem-borer (dead-heart) was found at 60 DAT and that of leaf folder (folded leaves) at 20 DAT. The overall highest mean percent dead-heart was recorded at 20 DAT (26.07%) followed by at 35 DAT (17.95%) whereas the highest mean percent folded leaves were recorded at 60 DAT (36.71%) followed by at 35 DAT (21.08%) in untreated plots. For all locations, the overall mean percent dead-hearts and mean percent folded leaves were observed suppressed in treated plots as compared to untreated plots (Figs 1 and 2). Significant differences between treated and untreated plots were observed both at 20 DAT and 35 DAT in all the three locations with respect to the infestation level of dead-hearts. In Mebua village, the dead-hearts were significantly suppressed from 21.32% to 15.08% at 20 DAT and from 13.32% to 9.88% at 35 DAT (Table 1). In Sangrikwa village, significant suppression in dead-hearts were observed from 33.16% to 27.12% at 20 DAT and from 22.32% to 14.40% at 35 DAT. Similar significant suppression was observed in Jayanti village from 23.72% (20 DAT) and 18.20% (35 DAT) to 12.44%. The difference between untreated and treated plots (from 15.96% to 13.40%) at Mebua village was significant only at 5% level of significance in case of mean percent of folded leaves at 35 DAT but was observed significant (33.68% to 17.4% folded leves) both at 5% and 1% level of significance at 60 DAT. In both Sangrikwa and Jayanti villages, the suppression in mean percent folded leaves was observed significant both at 5% and 1% level of significance at 60 DAT whereas difference of the same was observed non-significant at 35 DAT. In general, the parasitoid was observed more efficient in suppressing the pest at high level of infestation of leaf-folder (high pest density) at 60 DAT as compared to low infestation level of leaf-folder at 35 DAT. Suppression of stem-borer and leaf-folder by *T. japonicum* has been reported where reduction in tiller damage due to stem-borer was observed in the range of 50.1% to 61.3% and folded leaves were suppressed in the range of 63.8% to 75.5% at the dose of 50,000 per ha [3]. Release of *T. japonicum* @ 100000/ha followed by application of azadirachtin 1% against yellow stem borer reduced dead hearts in the range of 12.21 to 91.02% and 27.4 to 58.2% over insecticide application during *kharif* and *rabi* seasons respectively [4].

Conclusion

It may be concluded from the experiment that the egg-parasitoid, *T. japonicum* has the potential for suppressing the serious insect-pests of paddy like stem-borer and leaf-folder and hence the symptoms caused by them. The bio-control agent can efficiently be utilized in minimizing the yield losses in paddy in pro-organic states like Arunachal Pradesh.

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