Study of Impact of Different Treatments on per cent Reduction in Infestation of Stem borer *s. incertulas* over control

Chavan D. M., V. S. Desai and D. U. Lad

Abstract: *The data on impact of different treatments on stem borer infestation revealed that the per cent reduction was in the range of 42.53 to 94.20. The maximum (94.20%) reduction was observed in treatment Cosmos followed by Gomphrina (93.30%), Marigold (86.08%), Sesamum (82.79%) and Niger (82.28%) as nectar rich plants on bunds.*

Key word: *stem borer, rice, natural enemy, nectar rich border plants*

INTRODUCTION

In Maharashtra state, rice is cultivated on 15.13 lakh hectares area in almost all four regions *viz.*, Vidharbha (7.95 lakh ha.), Konkan (3.83 lakh ha.), Western Maharashtra (3.23 lakh ha.) and Marathwada (0.12 lakh ha.) with annual production of 41.71 lakh tons unmilled (brown rice) and 28.78 lakh tons milled rice. The area and production of rice crop is more in Vidharbha region while highest productivity of 2.75 tons hectar[-1] milled rice and 3.83 tons hectar[-1] unmilled rice (brown rice) was observed in Konkan region. The production of Konkan region is 15.26 lakh tons unmilled (brown rice) and 10.53 lakh tons milled rice from 3.83 lakh hectares area (Anonymous, 2014).

The warm and humid climatic condition being conducive for many pests, form a major constraint for increasing rice production in this ecosystem. Only 18-20 species out of nearly 800 insect pest species recorded on rice are major pests in tropical Asia. Few pests like gall midge, stem borer, leaf folder and brown plant hopper are of major significance limiting rice production. The average yield losses in rice have been estimated to vary between 21-51 per cent (Krishnaiah and Verma, 2012).

Conservation of the natural enemy fauna *in situ* for suppressing the pest population seems to be a very good alternative. Farmers continue to resort on insecticidal use for checking pest incidence in their fields without being aware of either the natural biological suppression taking place or impact of the insecticides on the natural bio agents. It is therefore essential to convince the farmers of its importance.

Odum (1962) was among the first who used the term 'Ecological engineering' which was reviewed as 'environmental manipulation by man using small amounts of supplementary energy to control systems in which the main energy drives are still coming from natural sources.

MATERIAL AND METHODS

The present investigation entitled "Study of impact of different treatments on per cent reduction in infestation of stem borer *s. incertulas* over control." was undertaken at Agronomy Farm, College of Agriculture, Dapoli during *Kharif* 2014. The details of the material used and methodology adopted during the course of investigation are given in this chapter.

* Department of Agricultural Entomology, College of Agriculture Dapoli, Tal- Dapoli, Dist- Ratnagiri, (MS) India.

** Department of Agricultural Entomology, LMK College of Agriculture Hingangaon, Tal- Kadegaon Dist- Sangli, (MS) India, *E-mail: dhananjaychavan8989@gmail.com; vvpp_s@yahoo.co.in*

Experimental site

The research work comprising field experiment of nectar rich plants on bunds of rice crop for habitat manipulation for biological control of rice pests was conducted at Agronomy farm of College of Agriculture, Dapoli.

Details of the material used

Seed

The healthy seeds of 'Local varieties of Sunflower, Mustard was obtained from the Krishi Sawardhan Kendra, Dapoli, and seeds of Sesamum and Niger was obtained from Department of Agronomy, College of Agriculture, Dapoli. Healthy seeds of Gomphrina, Calendula, Cosmos and Marigold were obtained from Department of Horticulture, College of Agriculture, Dapoli. The seeds of *Ekdandi* and *Cock's comb* were collected from field and 200 seeds of each were used for raising 200 seedlings.

Seedlings

The healthy 200 potted plants of all the treatments were raised in the Nursery, College of Horticulture, Dapoli.

Manures

Farm Yard Manure as organic manure was used to mix with soil for filling of polythene bag at the rate of 250-500 g per bag.

Fertilizers

Nitrogen and Phosphorus were applied in the form of straight fertilizers through Urea (46% N) and Single Super Phosphate (16% P_2O_5) to Sunflower, Mustard, Sesamum and Marigold seedlings according to requirements.

Rows of nectar rich plants on bunds

The potted plants of Mustard, Sesamum, Cosmos, Marigold, Niger, Sunflower, Gomphrina, *Ekdandi*, Cock's comb, Calendula were transferred and planted in three rows on bunds of the rice plots before flowering of rice crop to synchronize the flowering of nectar rich plants as well as rice.

METHODOLOGY

Habitat manipulation for biological control of rice pests.

Details of the experiment

A statistically designed field experiment using three replications, eleven treatments (ten with nectar rich flowering plants on bunds and without nectar rich plants as control) was conducted during *kharif* season of 2014 at Agronomy Farm, College of Agriculture, Dapoli to evaluate the effect of nectar rich flowering plants for conserving the natural enemies in rice ecosystem and their impact on rice pests.

Location	:	Agronomy Farm, College of Agriculture, Dapoli.
Variety	:	Karjat-2
Design	:	R.B.D.
Replications	:	Three
Treatments	:	Treatment Plots

Tr. No.	Name of the plant	Botanical name	Family
T1	Marigold	*Tagetes erecta*	Asteraceae
T2	Niger	*Guizotia abyssinica*	Asteraceae
T3	Mustard	*Brassica rapa*	Brassiceae
T4	Sesamum	*Sesamum indicum*	Pedaliaceae
T5	Sunflower	*Helianthus annuus*	Asteraceae
T6	Cosmos	*Cosmos bipinnatus*	Asteraceae
T7	Gomphrina	*Gomphrena globose*	Amaranthaceae
T8	*Ekdandi*	*Tridex procumbens*	Compositae (Asteraceae)
T9	*Cock's comb*	*Celosia argentea*	Amaranthaceae
T10	Calendula	*Calendula arvensis*	Asteraceae
T11	Control	-	-

Bund size for each treatment : 10m length and 0.5m width

Distance between two plots : 2m

Distance between two nectar rich plants : 0.5m

Total experimental area : 1100 m^2

Date of sowing : 09.06.2014

Date of harvesting : 27.10.2014

Potting mixture of polythene bag

Farm Yard Manure as organic manure was used to mix with the soil in 2:1 proportion for filling the polythene bag and bags were filled up to one third height.

Sowing of seeds

The healthy seeds of Mustard, Sesamum, Cosmos, Marigold, Niger, Sunflower, Gomphrina, *Ekdandi*, *Cock's comb* and Calendula were sown in 200 polythene bags each in nursery and watering was done at regular interval.

Raising of seedlings

Thirty to thirty five days old seedlings of all the nectar rich plants were ready to transfer in rice ecosystem.

Planting of border crops on the bunds

The raised nectar rich plants in the polythene bags were planted on the rice bunds at a distance of 0.5 m between plants. Three rows of nectar rich plants were planted by keeping 0.25 m distance between two rows on rice bunds for 10 m length.

METHOD OF RECORDING OBSERVATIONS

Five hills per plot were selected randomly to record the observations on the incidence of rice pests and for recording the natural enemies in rice ecosystem. Same rice hills were used for recording the presence of different natural enemies. Similarly, five nectar rich flowering plants on bunds were randomly selected for recording the natural enemies. The total of eleven treatments having ten nectar rich plants on bunds (mentioned in treatments details) and one control (No nectar rich plants i.e. open bund) were used around the plot size of 5 x 5 m. The experiment was replicated thrice. The nectar rich plants were grown on the bunds at a distance of 0.5 m. between two plants and 0.25 m between two rows.

To record the incidence of rice stem borer

Five hills per plot were selected randomly for recording the observations on the incidence of rice pests. The total number of tillers per hill and number of infested tillers per hill were recorded at weekly interval starting from the incidence of the pest.. The observations were recorded up to harvest. The average pest population per plot in the different treatments was calculated. The per cent infestation of each pest was calculated by using total number of tillers per hill and infested tillers per hill.

$$Per\ cent\ pest\ infestation = \frac{Number\ of\ infested\ tillers}{Total\ number\ of\ tillers} \times 100$$

To record the natural enemies in rice eco system

The same five hills selected for recording rice pest infestation and five randomly selected nectar rich flowering plants on bunds were used for recording the number of natural enemies in different plots having different nectar rich plants on the bunds. Different natural enemies were recorded at weekly interval. The natural enemies were recorded up to the harvest of the crop. The natural enemies were recorded by necked eyes and by collecting with the help of insect collection net. The recorded natural enemies like dragonfly, damselfly, spiders, black ants, syrphid fly, tachinid fly, bombylid fly, and wasp were counted plot wise. The unidentified natural enemies were got identified from the Department of Agril. Entomology, College of Agriculture, Dapoli. Data thus obtained were summed and analyzed.

To study the impact of conserved natural enemies on rice pests

Data on pest incidence recorded in different treatments was used to calculate per cent reduction in infestation of different rice pest over control to find out the impact of conserved natural enemies in rice by using following formula;

$$\% \ reduction\ in\ pest\ infestation = \frac{100}{\%\ per\ infestation\ in\ control} \times \%\ infestation\ in\ treatment - 100$$

STATISTICAL ANALYSIS

Data on per cent infestation of rice pests was converted in arc sine transformation and then analyzed, whereas data on number of natural enemies was summed and the standard deviation was calculated.

RESULTS AND DISCUSSION

Data on per cent reduction in infestation of rice stem borer due to different treatments of nectar rich plants on bunds are presented in Table.

The data on impact of different treatments on stem borer infestation revealed that in week 1 (4th week of August) the per cent reduction in infestation of stem borer was in the range of -1.35 to 99.96. The treatments Marigold, Cosmos and, Gomphrina were found to be the best treatments in reducing per cent infestation (99.96) of rice stem borer by attracting the natural enemies towards the nectar rich flowering plants. The per cent reduction in the infestation of rice stem borer in the week 2 (1st week of September) was in the range of 3.98 to 99.95. The highest reduction (99.95) in the infestation of rice stem borer was observed in the treatments Marigold, Niger, Cosmos and Gomphrina.

Table
Impact of different treatments on per cent reduction in infestation of rice stem borer over control

Treatments	*Per cent reduction in infestation of stem borer over control*						
	Week 1 Aug. 4th week	*Week 2 Sept.1st week*	*Week 3 Sept.2nd week*	*Week 4 Sept.3rd week*	*Week 5 Sept. 4th week*	*Week 6 Oct.1st week*	*Pooled mean of all 6 weeks*
T1 Marigold	99.96	99.95	99.91	30.61	99.95	8.93	86.08
T2 Niger	71.95	99.95	43.55	99.87	99.95	99.83	82.28
T3 Mustard	69.98	61.42	99.91	99.87	63.60	99.83	76.42
T4 Sesamum	75.28	65.94	99.91	99.87	99.95	99.83	82.79
T5 Sunflower	77.75	70.10	45.42	29.30	68.24	99.83	67.13
T6 Cosmos	99.96	99.95	99.91	43.33	99.95	99.83	94.20
T7 Gomphrina	99.96	99.95	99.91	99.87	35.81	99.83	93.30
T8 *Ekdandi*	-1.35	59.69	99.91	99.87	99.95	99.83	54.72
T9 *Cock's comb*	15.42	3.98	99.91	99.87	99.95	99.83	46.81
T10 Calendula	-1.02	51.88	24.24	99.87	99.95	99.83	42.53
T11 Control	-	-	-	-	-	-	-

The infestation of rice stem borer in week 3 (2nd week of September) was reduced in the range of 24.24 to 99.91 per cent. The highest per cent reduction (99.91) in stem borer infestation was recorded in the treatments Marigold, Mustard, Sesamum, Cosmos, Gomphrina, *Ekdandi* and *Cock's comb*. The per cent reduction in infestation of stem borer in the week 4 (3rd week of September) was in the range of 29.30 to 99.87. The maximum (99.87%) reduction in infestation of stem borer was observed in the treatments Niger, Mustard, Sesamum, Gomprina, *Ekdandi, Cock's comb* and Calendula whereas the treatment Sunflower showed the lowest 29.30 per cent reduction in infestation of stem borer.

In the week 5 (4th week of September) the infestation of stem borer was reduced in the range of 35.81 to 99.95 per cent. The highest (99.95) per cent reduction in the infestation of stem borer was recorded in treatments Marigold, Niger, Sesamum, Cosmos, *Ekdandi, Cock's comb* and Calendula. The per cent reduction in infestation of stem borer in week 6 (1st week of October) was in the range of 8.93 to 99.83. The maximum (99.83%) reduction in infestation of stem borer was observed in the treatments Niger, Mustard, Sesamum, Sunflower, Cosmos, Gomphrina, *Ekdandi, Cock's comb* and Calendula except the treatment Marigold which showed 8.93 per cent reduction.

The pooled mean of per cent reduction of all six weeks was calculated. The per cent reduction was in the range of 42.53 to 94.20. The maximum (94.20%) reduction was observed in treatment Cosmos followed by Gomphrina (93.30%), Marigold

(86.08%), Sesamum (82.79%) and Niger (82.28%) as nectar rich plants on bunds.

The results of the present findings are corroborative with the results of Rani *et al.* (2007). They reported egg parasitoid *Trichogramma* sp., the larval parasitoids *Cardiochiles philippinensis* [*C.philippensis*], *Apanteles* sp., *Goniozus* sp., *Copidosomopsis nacoleiae* and *Trichomma cnaphalocrosis*, the pupal parasitoid *Brachymeria* sp. were prevalent in the rice ecosystem. These different parasitoid helps in control of different lepidopteran rice pests.

From the present study, it was observed that plantation of Cosmos, Gomphrina, Marigold, Sesamum and Niger as nectar rich plants on rice bunds, helps to reduce stem borer infestation respectively, by enhancement of different natural enemies.

Literature Cited

Anonymous, (2014), *Annu Rep. Maharashtra State Rice Workshop*, 2014, p. 12.

Krishnaiah, K. and Verma N. R. G. (2012), Changing insect pest scenario in the rice ecosystem-A national perspective, www.rkmp.co.in

Rani, W. B.; Amutha, R.; Muthulakshmi, S.; Indira, K. and Maheeswari, P. (2007), Diversity of rice leaf folder and their natural enemies. *Res. J. Agril. and Biol. Sci.,* **3** (5) : 394-397.