International Journal of Entomology Research
ISSN: 2455-4758; Impact Factor: RJIF 5.24
Received: 07-11-2018; Accepted: 09-12-2018
www.entomologyjournals.com
Volume 4; Issue 1; January 2019; Page No. 22-25

Bio-efficacy of essential oils and chemical insecticides against rice yellow stem borer *Scirpophaga incertulas* (Walk.) under field condition

Ganeshwari[1], Sonali Deole[2], Sada Kumar[3], Nistha Tiwari[4]
[1, 2, 4] Department of Entomology, College of Agriculture, IGKV Raipur, Chhattisgarh, India
[3] Department of Agricultural Meteorology, College of Agriculture, IGKV Raipur, Chhattisgarh, India

Abstract
The investigation entitled "Bio-efficacy of essential oils and chemical insecticides against rice yellow stem borer under field conditions" was carried out at Research cum Instructional Farm of IGKV, Raipur (C.G.) during Kharif, 2017-18 and the treatments are like camphor oil, cedar wood oil, eucalyptus oil, lemongrass oil, neemazal and a chemical insecticides i.e., Dinotefuran and Rynaxypyr were evaluated against stem borer in the field conditions. As per the performance of different treatments, treatment involving Rynaxypyr @ 0.3 ml/l was most effective with overall mean 12.17 percent dead heart and 18.38 percent white ear head. It was closely followed by Neemazal @ 2.0 ml/l overall mean 16.94 percent dead heart and 25.86 percent white ear head.

Keywords: rice, essential oil, neemazal, rynaxypyr, Dinotefuran *Scirpophaga incertulas*

1. Introduction
Rice (*Oryza sativa* L.) occupies the prominent place in Indian agriculture and it is regarded as an important food crop supporting food security for 5 percent of the global population (FAO, 2011) [5]. In Asia, about 3 billion people depends on rice as principal food source. In India, Rice continues to remain as the staple food for more than 65 per cent Indian population. In India rice area (million/ha), production (million metric tons) and productivity (metric tons/ha) is 43.79, 112.91 and 3.87, respectively (world agricultural production-USDA). Chhattisgarh is popularly known as a "Rice bowl of India" and the area, and productivity is 3745.29 (thou. ha.), and 2212 (kg/ha) (Krishi darshika, 2018) [9]. The rice plant is attacked by more than 128 species of insects, 20 of them can cause serious economic loss (Kalode, 2005) [8].Yield losses due to yellow stem borer are estimated 27-34 per cent every year (Prasad *et al.* 2007) [12]. Yellow stem borer causes 1 percent to 19 percent yield loss in early planted and 38 percent to 80 percent in late transplanted rice crops (Srivastava *et al.*, 2003) [17]. The use of synthetic insecticides in agriculture has increased rapidly and has over shadowed the traditional methods used to protect crop damages due to insects. The indiscriminate uses of insecticides have resulted in a number of undesirable side effects such as the development of resistant strain of insects, environmental pollution and health hazards to farmers (Hassall, 1990) [7]. Therefore, it has now become necessary to search for the alternative means of pest control, which can minimize the use of synthetic pesticides. Essentials oils remain an important tool to manage certain pest problems on different crops and vegetable plants. Some oils have been tested and recommended for use in crop to suppress a variety of insect pests and they have a multiple mode of action, including larvicidal, repellent and ovicidal activities (Sarwar and Salman, 2015) [15]. Certain essential plant oils, widely used as fragrances and flavors in the perfume and food industries, have long been reputed to repel insects. Recent investigations in several countries confirm that some plant essential oils not only repel insects, but have contact and fumigant larvicidal actions against pests (Murray, 2000) [10]. In view of this, the present study was undertaken to evaluate the bio-efficacy of essential oils and chemical insecticides against rice yellow stem borer.

2. Materials and Methods
Field experiment was conducted in randomized block design (RBD) replicating thrice with a plot size of 5x4 m2 and spacing of 15x20cm at Research cum Instructional Farm of IGKV, Raipur (C.G.) during Kharif, 2017-18. The experimental site was located at 21 °6 North latitudes and 18°36 East longitudes with an altitude of 289.56 meters above the mean sea level. The susceptible rice variety swarna was used as test variety for the experiment. Experimental material was comprised of four essential oils (Camphor oil, Cedar wood oil, Eucalyptus oil and Lemongrass oil) and neemazal along with recommended insecticides, Dinotefuran (Token) and Rynaxypyr (Coragen) against yellow stem borer of rice. There was an untreated control in each replication for the comparative evaluation of the efficacy of different treatments. The treatments were applied with the help of a knapsack sprayer and care was taken to avoid spray drift on adjacent plants. All the control plots were sprayed with water. The pretreatment observation of stem borer was recorded on 5 randomly selected plants a day prior to application while, post treatment observation was recorded at 10 days after spraying.
The percentage dead hearts and white heads were computed by following formula

$$\text{Dead heart per cent} = \frac{\text{Number of dead hearts}}{\text{Total no. of tillers}} \times 100$$

$$\text{White ear head per cent} = \frac{\text{Number of white ear heads}}{\text{Total no. of panicles}} \times 100$$

3. Statistical analysis
The data were analyzed statistically using appropriate transformation. The data were analyzed by using arcsine transformation. Wherever necessary. Standard statistical procedure were followed as per Gomez and Gomez (1985).

4. Results
The bio-efficacy of essential oils and chemical insecticides against rice yellow stem borer. The damage caused by stem borer was recorded one day before 1stspraying, 10 days after 1st, 2nd, 3rd and 4th spraying and white ear-head recorded before harvesting of crop are presented in the table (4.1) and it is found that essential oils were quite effective against stem borer as compared to untreated control.

The pre-treatment observation of stem borer dead heart infestation for all the treatments differs non-significantly which ranged from 11.97 to 14.51 percent. The post treatment observation recorded at 10 days after first spray and the yellow stem borer incidence (dead heart) varied from 8.18 to 24.79 per cent. Among all the treatments maximum dead heart infestation was recorded under the untreated control *i.e.*, 24.79 per cent. The Minimum incidence was recorded in treatment Rynaxypyr @ 0.3 ml/l with 8.18 per cent dead heart. Among oils best result shown by neemazal @ 2.0 ml/l with 11.50 per cent dead heart. Which was found at par with treatment eucalyptus oil @ 2.0 ml/l with 12.25 per cent dead heart.

At 10 days after second spray the post treatment stem borer incidence (dead heart) ranged from 9.89 to 26.49 per cent. Among the treatments, minimum dead heart per cent of 9.89 was recorded in treatment Rynaxypyr @ 0.3ml/l. In botanicals the minimum dead heart was recorded in neemazal @ 2.0 ml/l with 13.21 per cent dead heart. Which was found at par with treatment Eucalyptus oil @ 2.0 ml/l with 13.94 per cent dead heart. The T_2 cedar wood oil @ 2.0 ml/l was found at par with eucalyptus oil with 15.87 per cent dead heart but significantly differs to neemazal. Maximum dead heart was recorded in untreated control plot with 26.49 per cent dead heart.

At 10 days after 3rd spray the post treatment stem borer incidence (dead heart) ranged from 13.93 to 42.17 per cent. Among the treatments, maximum dead heart per cent of 42.17 was recorded in untreated control plot. The minimum incidence was recorded in treatment Rynaxypyr @ 0.3 ml/l with 13.93 per cent dead heart. Among oils best result shown by Neemazal @ 2.0 ml/l with 19.58 per cent dead heart which was found at par with treatment Eucalyptus oil @ 2.0 ml/l with 20.82 per cent dead heart.

At 10 days after 4th spray the post treatment stem borer incidence (dead heart) ranged from 16.71 to 50.58 per cent for different treatment. The minimum incidence was recorded in treatment Rynaxypyr @ 0.3 ml/l with 16.71 per cent dead heart. Among oils best result shown by Neemazal @ 2.0 ml/l with 23.48 per cent dead heart which was found at par with treatment Eucalyptus oil @ 2.0 ml/l with 24.96 per cent dead heart. The maximum dead heart per cent of 50.58 was recorded in untreated control plot.

The per cent white ear head was calculated from the total panicle bearing tillers of hills at the maturity stage of crop. The Per cent stem borer white ear head damage ranged from 18.38 to 55.68 per cent for different treatment. Among the treatments,

Table 1: Performance of essential oils against yellow stem borer incidence

per cent damage by yellow stem borer									
S. No.	**Treatments**	**Dose/l**	**Pre-treatments**	**10 Days after 1st spray**	**10 Days after 2nd spray**	**10 Days after 3rd spray**	**10 Days after 4th spray**	**Mean Dead heart %**	**WEH before harvest**
T1	Camphor oil	2.0 ml	13.32 (21.39)*	14.61 c (22.46)*	16.32^{c} (23.81)*	24.85 ^{c} (29.88)*	29.57 ^{c} (32.93)*	21.33 (27.27)	32.81 ^{c} (34.93)*
T2	Cedar wood oil	2.0 ml	13.34 (21.35)	14.18 c (22.09)	15.87^{bc} (23.46)	24.09 ^{c} (29.37)	28.90 ^{c} (32.51)	20.76 (26.85)	31.70 ^{c} (34.25)
T3	Eucalyptus oil	2.0 ml	12.28 (20.47)	12.25 b (20.47)	13.94^{b} (21.88)	20.82 ^{b} (27.13)	24.96 ^{b} (29.96)	17.99 (24.86)	27.47 ^{b} (31.59)
T4	Lemongrass oil	2.0 ml	13.41 (21.75)	15.26 c (22.97)	16.95^{c} (24.30)	25.91 ^{c} (30.58)	31.18 ^{c} (33.93)	22.32 (27.94)	34.23 ^{c} (35.79)
T5	Neemazal	2.0 ml	12.47 (20.65)	11.50 b (19.79)	13.21^{b} (21.27)	19.58 ^{b} (26.24)	23.48 ^{b} (28.97)	16.94 (24.06)	25.86 ^{b} (30.55)
T6	Token 20 SG (Dinotefuran)	0.50 g	13.99 (21.84)	15.36 c (23.05)	17.07^{c} (24.39)	26.14 ^{c} (30.73)	31.35 ^{c} (34.03)	22.48 (28.05)	34.43 ^{c} (35.91)
T7	Coragen 20 SC (Rynaxypyr)	0.3 ml	11.97 (20.21)	8.18 a (16.60)	9.89^{a} (18.32)	13.93 ^{a} (21.90)	16.71 ^{a} (24.11)	12.17 (20.23)	18.38 ^{a} (25.37)
T8	Untreated Control	Water spray	14.51 (22.36)	24.79 d (29.84)	26.49^{d} (24.83)	42.17 ^{d} (40.47)	50.58 ^{d} (45.31)	36.00 (35.11)	55.68 ^{d} (48.25)
SE(m)			0.978	0.44	0.56	0.41	0.36	-	0.39
C.D.			NS	1.35	1.72	1.26	1.11	-	1.21

*Figures in parentheses are angular transformed value

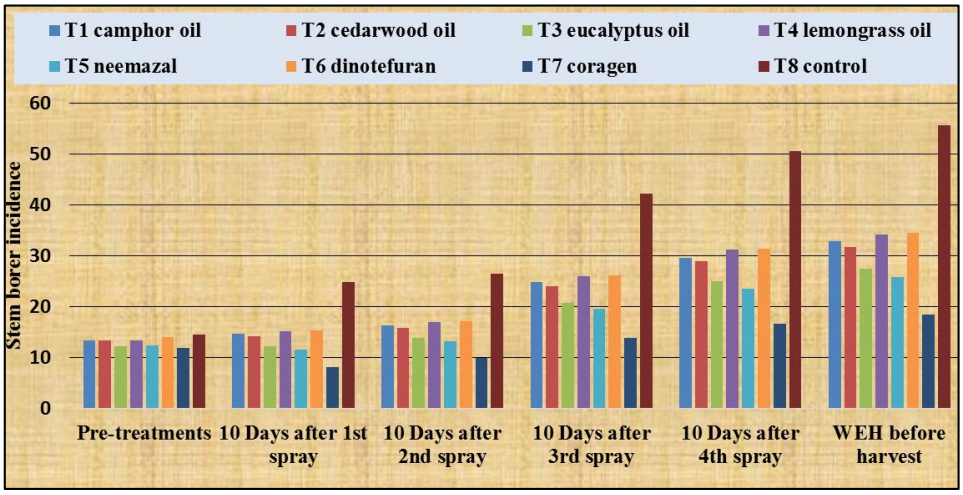

Fig 1: Performance of essential oils against yellow stem borer incidence

Minimum white ear head per cent was recorded 18.38 per cent for the treatment Rynaxypyr @ 0.3 ml/l. The maximum white ear head per cent of 55.68 was recorded in untreated control plot. Among oils neemazal @ 2.0 ml/l shown minimum white ear heads with 25.86 per cent which was found at par with treatment Eucalyptus oil @ 2.0 ml/l with 27.47 per cent white ear heads.

5. Discussion

The results of this study reveals that among chemical insecticides the plot treated with Rynaxypyr had the lowest percentage dead hearts and white ear heads incidence. Among botanicals the neemazal shown lowest percentage dead hearts and white ear heads incidence. These results are in line with the findings of Rath (2001) [14], Prasad *et al.* (2004) [13] and Bora *et al.* (2004) [1] who found Neem products to control yellow rice stem borer. Findings of the present study was in corroboration with the earlier studies of Chakraborty (2011) [3] and Nigam *et al.* (2010) [11] who reported that bio formulations based on neem were found superior in reducing the incidence of yellow stem borer, *S. incertulas* and leaf folder *C. medinalis*. Antifeedant activity of commercial formulation of neem (Nimbokil) against neonate larvae of maize stem borer was also documented by Ganguli *et al.* (1998) [6]. Mondal and Chakraborty (2016) indicates that application of neem formulation effectively reduces *S. incertulas* infestation. Choudhary *et al.* (2017) [4] Nimbicidine @ 5 ml/l was most effective with overall mean 6.36 percent dead heart and 14.00 percent white ear head. Singh (2018) [16] found that Chemical insecticide rynaxypyr 20 SC was found best to control the infestation of stem borer and leaf folder. Among botanicals Neemazal 1.0% azadirachtin was found most effective to control the incidence of yellow stem borer and leaf folder followed by multineem 0.03%.

6. Conclusions

These botanicals and oils are eco-friendly and effective to control the population of rice insect pest they can be an alternative to the synthetic pesticides in eco-friendly approach of Integrated Pest Management. Application of botanicals could greatly reduce large scale use of synthetic insecticides. After taking various observations we can be to conclude that among the treatments neemazal @ 2.0 ml/l was most effective against stem borer with minimum 16.94 percent dead heart and 25.86 percent white ear head.

7. Acknowledgement

The first author expresses his heartfelt gratitude to Dr. Sonali Deole, Scientist Department of Entomology, Dr. V.K. Dubey, Scientist and Head Department of Entomology, Dr. Sanjay Sharma, Scientist, Department of Entomology and Dr. (smt) G. Chandrakar, Professor Department of Agricultural Statistics and Social Science (L), I.G.K.V. Raipur (C.G.) India for their excellent guidance, suggestions and regular encouragement during the course of investigation.

8. References

1. Bora DK, Bhuyan U, Katti G, Pasalu IC. Quantification of insect pest and natural enemy incidence vis a vis yield. Uttar Pradesh J Zool. 2004; 24(2):187-190.
2. Chakraborty K. Relative composition of egg parasitoid species of yellow stem borer, *Scirpophaga incertulas* Walk. in paddy field at Uttar Dinajpur, West Bengal, India. Current Biotica. 2008; 6(1):42-52.
3. Chakraborty K. Assessment of the efficacy of some bio rational pesticide formulations for the management of yellow stem borer, *Scirpophaga incertulas* walk in paddy field. J Biopest. 2011; 4:75-80.
4. Choudhary R, Chandrakar G, Bhardwaj JR, Khan HH, Sahu R. Assessment of the efficacy of neem based insecticides for the management of yellow stem borer, *Scirpophaga incertulas* Walk. in paddy field. Journal of Pharmacognosy and Phytochemistry. 2017; 6(5):1446-1449.
5. FAO. food and agricultural commodities production. Food and Agriculture Organization of the United Nations. 2011; pp.53.
6. Ganguli RN, Ganguli J. Residual toxicity of insecticides and neem based formulations against *Chilo partellus* (Swin.) infesting maize. Indian Journal of Agricultural Research. 1998; 32:227-232.
7. Hassall KA. Biochemistry and use of pesticides. Macmillan Press LTD. Hound mills, Basingstoke, Hampshire and London. 1990; pp.536.
8. Kalode MB. Insect pests of rice and their management in rice. Indian Perspective Today. 2005; 3:85-862.
9. Krishi Darshika. Indira Gandhi Krishi Vishwavidyaiaya, Raipur. C.G. 2018; pp.5-6.
10. Murray BI. Plant essential oils for pest and disease management. Crop Protection. 2000; 19:603-608.
11. Nigam VD, Sharma SC, Ali S. Comparative bio efficacy of some insecticides against rice leaf folder,

Cnaphalocrocis medinalis (Guenee). Indian J Entomology. 2010; 72:293-296.
12. Prasad SS, Gupta PK, Kanaujia BL. Simulation study on yield loss due to *Scirpophaga incertulas* on semi deep water. Annals of Plant Protection Sciences. 2007; 15:491-492.
13. Prasad SS, Gupta PK, Singh RB, Kanaujia BL. Evaluation of neem products was tested against yellow rice stem borer, *Scirpopapha incertulas* on deep water rice. Annals of Plant Protection science. 2004; 2:426-428.
14. Rath PC. Efficacy of insecticides, neem and bt formulation against stem borer on rice yield in West Bengal. J Appl. Zool. Res. 2001; 12:191-93.
15. Sarwar M, Salman M. Toxicity of oil formulations as a new useful tool in crop protection for insect pest's control. International Journal of Chemical and Bio molecular Science. 2015; pp. 297-302.
16. Singh K. Comparative Efficacy of botanicals against yellow Stem Borers (*Scirpophaga incertulas*, Walker) and Leaf Folder (*Cnaphalocrocis medinalis*, Guenee) of rice in Eastern Uttar Pradesh. Journal of Pharmacognosy and Phytochemistry. 2018; pp.474-478.
17. Srivastava SK, Salim M, Rehman A, Singh A, Garg DK, Prasad CS, *et al.* Stem Borer of Rice-Wheat Cropping System: Status. Diagnosis, Biology and Management. Rice-Wheat Consortium for the Indo-Gangetic Plains, New Delhi. 2003; pp.25-30.
18. WorldagriculturalproductionUSDA/foreignagriculturalservicehttps://apps.fas.usda.gov/psdonline/circulars/production