Biological Forum – An International Journal **(SI-AAEBSSD-2021) 13(3b): 173-175(2021)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Evaluation of Different Botanicals against Yellow Stem Borer (*Scirpophaga incertulas*, Walker) and Leaf FOLDER (*Cnaphalocrocis medinalis*, Guenee) of Rice

I. Paramasiva[1]*, Ch Sreelakshmi[2], U. Vineetha[1] and P. Rajasekhar[3]
[1]Department of Entomology, Agricultural Research Station, Nellore, (Andhra Pradesh), India.
[2]Department of Genetics and Plant breeding, Agricultural Research Station, Nellore, (Andhra Pradesh), India.
[3]Department of Agronomy, Agricultural Research Station, Nellore, (Andhra Pradesh), India.

(Corresponding author: I. Paramasiva)*
(Received 01 July 2021, Accepted 30 September, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Rice stem borer and leaf folder are important insect pests of rice that cause economic loss. Chemical control against these pests causing harmful effects, so it is necessary to find alternative methods. In this context a field experiment was conducted to evaluate the botanical insecticides along with chemical insecticides rynaxypyr and dinotefuran against the stem borer and leaf folder of rice. The experimental material comprised for five botanical (camphor oil, Cedarwood oil, eucalyptus oil, lemon grass oil and neemazal) along with recommended insecticides, dinotefuran and rynaxypyr. Chemical insecticide rynaxypyr 20 SC @ 0.3 ml/L was found effective to control both stem borer and leaf folder infestation. Among the botanicals tested, neemazal @ 5 ml/L was found superior in controlling the stem borer infestation where as lemon grass oil @ 2 ml/L was found effective against leaf folder incidence with highest per cent reduction over untreated check. Since these botanicals 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.

Key words: Rice Yellow stem borer, Leaf folder, *Scirpophaga incertulas*, *Cnaphalocrocis medinalis*, Botanicals.

INTRODUCTION

India leads the world in rice area with 43 million hectares with an annual production of 120.32 million tonnes. Rice being the major crop of the Andhra Pradesh, has been cultivated over an area of 42 million hectares, with an annual production of 128 lakh tones during 2019-20 but the productivity is only 2.85 t/ha. Insect pests are the major constraints in enhancing the rice productivity, besides diseases and weeds (Behura *et al.*, 2011). Rice is essentially a crop of warm, humid environment which is conductive for survival and proliferation of Lepidopteron insect pests like stem borer and leaf folder. Among different insect associated with rice, the yellow stem borer (YSB), *Scirpophaga incertulas* (Walker) and rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) are widely distributed throughout India. Rice crop is most prone to stem borer infestation at the tillering and flowering stages and inflicted 18 to 40 % damage (Yadav *et al*., 2019; Anonymous, 2006; Pasulu *et al*., 2002), rice leaf folder widely spread and damage caused from 18.30 to 58.40 % depending upon the stage of the crop at the time of infestation (Ramasamy and Jaliecksono 1996, Nugaliyaddle *et al*., 1997, Arshad *et al*., 2012). In general yield loss due to insect pests of rice has been estimated about 25% (Dhaliwal *et al*., 2010). Farmers still consider application of insecticides as the key component of integrated pest management.

Botanical insecticides have long been touted as attractive alternatives to synthetic chemical insecticides for pest management (Isman, 2006 and Parmar; Dev kumar, 1993), they are ecofriendly, economic, target-specific and biodegradable. Their greatest strength is their specificity as most are essentially nontoxic and non-pathogenic to animals and humans. Plant-based insecticides induce not only acute toxicity to pests but also deterrence and/or repellence which may contribute to overall efficacy against insect pests that cause great economic losses to the crop (Prakash and Rao, 1989; Prakash *et al*., 2003; Prakash *et al*., 1990). They are best suited for use in organic food production in industrialized countries but can play a much greater role in developing countries as a new class of eco-friendly products for controlling pests. Some of the botanicals like neem, pyrethrum, tobacco, karanj etc. have already attained the status of potential pesticides of plant origin to be used in many crops as well as storage ecosystems (Prakash and Rao, 1997).

Therefore, the present study was carried out to evaluate the effectiveness different botanicals in comparison with the insecticides against yellow stem borer and leaf folder on rice.

MATERIALS AND METHODS

Field experiment was carried out in an irrigated rice filed ecosystem at agricultural research station, Nellore under All India Coordinated Rice Improvement Project during kharif 2018-19. The experimental site was located at 14º27′N latitude and 79º 59′E longitude with an elevation of 20 m above the mean sea level, Andhra Pradesh, India. The soil of the experimental field is red soils/alluvial soils (PH: 7.9 to 8.1). The mean annual maximum and minimum temperatures are 33.6 and 25.6 ºC, respectively with annual precipitation of 1040.7mm.

The experiment was laid out in a randomized block design (RBD) with seven treatments each with three replications with a plot size of 24m^2 and spacing of 20 × 15 cm. The susceptible rice variety NLR 34449 was used as test variety for the experiment. The rice seedlings were transplanted at 30 days after sowing with inter and intra row spacing of 20 × 15 cm at two seedlings/hill in the first week of October, 2018. All other cultural practices were followed as per the recommendations. Except treatments imposition no other plant protection measures were imposed against insect pest and diseases. Experimental material was comprised of five botanical formulations (camphor oil, cedar wood oil, eucalyptus oil, lemon grass oil and neemazal) and two insecticides,

dinotefuran (token) and rynaxypyr (coragen) against stem borer and leaf folder of rice. An untreated control plot was also included in each replication for the comparative evaluation of the efficacy of five botanicals. The treatments were imposed with knapsack sprayer when the pest incidence was about to reach ETL.

Observations on stem borer infestation was recorded in terms of dead heart counts on 20 random hills per plot by counting the total number of tillers and number of dead hearts at on day before and 15 days after imposition of treatments. The leaf damage by the leaf folder was assessed by counting the total number of leaves and number of leaf folder damaged leaves on 20 random hills per plot at one day before and 7 days after imposition of treatments by leaving the border lines form sides. The per cent dead heart incidence and the per cent leaf folder damage was computed as follows.

$$\text{Per cent stem borer incidence} = \frac{\text{Number of dead hearts/hill}}{\text{Total number of tillers/hill}} \times 100$$

$$\text{Per cent leaf folder damage} = \frac{\text{Number of damaged leaves/hill}}{\text{Total number of leaves/hill}} \times 100$$

The crop was harvested when 90% of the grain matured in all the treatments. The grain yield of each plot were recorded separately by leaving the border rows and computed to kg per hectare.

Statistical analysis: The mean values of data collected were subjected to analysis of variance (ANOVA) using SPSS 13.0 and treatment means were separated by least significant difference test (LSD) at 5 % level of probability.

RESULTS AND DISCUSSION

Stem borer incidence. All the insecticidal treatments including botanicals were found effective to suppress the stem borer infestation with significant difference over the control plot. Chemical insecticide rynaxypyr 20Sc @0.3 ml/L was found to be most effective with significant lowest per cent dead hearts (4.78 %) at 15 days after spraying, which was followed by the dinotefuran @ 0.5g/L (7.57% DH).

Among the botanicals cedarwood oil @2.0 ml/L was found most effective in reducing the dead hearts incidence with 10.85% dead hearts and it was on par with the neemazal @ 5ml/L (10.67 %) and camphor oil @2.0 ml/L (10.07%) with lower dead heart incidence. Present findings were in accordance with the earlier studies of Chakraborthy (2011) and Nigam *et al*., (2010) who reported that neem based formulations were found effective in reducing the stem borer and leaf folder incidence. Islam *et al*., 2013 reported that karanj extract and tobacco extract produced statistically similar results as with acephate 75 SP in reducing the dead heart incidence.

Table 1: Efficacy of botanicals against stem borer incidence of rice.

Sr. No.	Trade name	g or ml /L spray fluid	Per cent dead heart incidence		
			Pre- treat	Post –treat (15 DAI)	% reduction over control
1.	Camphor oil	2.0 ml	14.13	10.07 [c]	16.68
2.	Cedarwood oil	2.0 ml	14.51	10.85 [c]	12.52
3.	Eucalyptus oil	2.0 ml	16.68	12.80 [d]	10.25
4.	Lemon grass oil	2.0 ml	17.71	13.80 [d]	8.89
5.	Neemazal	5.0 ml	16.61	10.67 [c]	24.89
6.	Token (Dinotefuran)	0.50 g	17.02	7.57 [b]	48.02
7.	Coragen (Rynaxypyr)	0.3 ml	13.74	4.78 [a]	59.31
8.	Untreated control	—	17.34	14.83 [e]	0.00
	Sig		NS	**	
	P-value		0.830	0.000	

The botanicals lemon grace oil @ 2 ml/L and eucalyptus oil @ 2.0 ml/L were found least effective among the tested botanicals against yellow stem borer with 13.8 and 12.8 per cent dead heart incidence whereas in control 14.83 per cent dead heart incidence was recorded.

Per cent reduction in stem borer incidence over control. The per cent dead heart incidence was significantly influenced by the application of botanical extracts and insecticides at 15 days after spraying. The maximum reduction in dead heart incidence (59.3%) was observed with rynaxypyr @0.3 ml/L which was followed by dinotefuran @ 0.5 g/L with 48.02 % reduction in dead heart incidence over untreated check. The reduction in dead heart incidence over control with neemazal @ 5 ml/L (24.89%) is comparable with the insecticides. Saljoqi *et al.*, 2002 and Panda et al., 2004 also reported 15.59 % reduction in dead heart incidence with neem extract. Mayabini-Jena, 2004 found that effect of neem extract in reducing the dead heart incidence was statistically similar with Fipronil.

Camphor oil and cidar wood oil also significantly reduced dead heart incidence (16.68 & 12.52 per cent, respectively) over untreated check. Eucalyptus oil and lemon grass oil were found least effective against stem borer with 10.25 and 8.89 per cent reduction in dead heart incidence over control. Islam et al., 2013 also found that neem extracts reduced dead hearts and white ears by 38.38 and 58.08 Per cent, respectively.

Leaf folder incidence. The per cent leaf folder incidence under different treatments ranged from 13.9 to 23.4 at 7 days after imposition of treatments. Lowest per cent leaf folder incidence (13.9 %) was recorded from rynaxypyr 20 SC @ 0.3 ml/L which was on par with neemazal @ 5ml/L with 15.5 per cent leaf folder incidence and dinotefuran @0.5 g/L with 17.1 % leaf folder incidence.

Among the botanicals after neemazal, eucalyptus oil @ 2ml/L and camphor oil @ 2 ml/L were effective in reducing the leaf folder damage with 19.5 and 19.6 per cent incidence. Lemon grass oil @ 2 ml/L and cedarwood oil @2 ml/L were least effective against rice leaf folder with 23.4 % and 22.3 % leaf folder incidence, respectively. Where as in control plot 20.2 % leaf folder incidence was recorded. Kumudsingh, (2018) reported that neemazal @ 1000 ml/ha was found most effective to control the incidence of yellow stem borer and leaf folder followed by multineem @ 2500 ml/ha. Seed oil extracted from custard apple reduced infestation of rice leaf folder (Narasimhan and Mariappam, 1988). Neem cake (de-oiled) amendment in the soil @ 150kg/ha and neem oil spray at 10 days intervals were found to check the infestation of rice leaf folder (Krishnaiah and Kalode, 1990).

Table 2: Efficacy of botanicals against leaf folder incidence of rice.

Sr. No.	Trade name	g or ml /L spray fluid	Per cent Leaf folder incidence			
			Pre- treat	Post –treat (7 DAI)	% reduction over control	Yield (q/ha)
1.	Camphor oil	2.0 ml	24.7	19.6 [c]	8.40	4774 [b]
2.	Cedarwood oil	2.0 ml	29.6	22.3 [d]	12.98	4964 [b]
3.	Eucalyptus oil	2.0 ml	25.7	19.5 [c]	12.68	4994 [b]
4.	Lemon grass oil	2.0 ml	33.5	23.4 [d]	19.33	4998 [b]
5.	Neemazal	5.0 ml	21.8	15.5 [ab]	17.91	4975 [b]
6.	Token (Dinotefuran)	0.50 g	34.2	17.1 [b]	42.44	4940 [b]
7.	Coragen (Rynaxypyr)	0.3 ml	28.0	13.9 [a]	42.96	5813 [a]
8.	Untreated control	—	23.3	20.2 [cd]	0.00	4708 [b]
	Sig		NS	**		*
	P-value		0.374	0.000		0.004

Per cent reduction in leaf folder incidence over control. The per cent leaf folder incidence was significantly influenced by the application of botanicals at 7 days after imposition of treatments. The maximum reduction in leaf folder incidence was recorded with insecticides, rynaxypyr @0.3 ml/L and dinotefuran @ 0.5g/L with 42.96 and 42.44 per cent, respectively over untreated check. This was followed by the application of lemon grass oil @ 2ml/L (19.33 %) and neemazal @ 5 ml/L (17.9%).

The botanicals cedar wood oil and eucalyptus oil showed similar efficacy in reducing the leaf folder incidence with 12.98 and 12.68 per cent reduction over untreated control. It was proved that camphor oil @ 2 ml/L was least effective against leaf folder with 8.4 per cent reduction in leaf folder incidence over untreated control.

Grain yield. The yield data demonstrated that efficacy of botanical formulation or insecticides tested against stem borer and leaf folder infestation in rice. Grain yield under treatments ranged from 4708 to 5813 kg/ha. Rynaxypyr 20 SC @ 0.3ml/L treated plot recorded highest grain yield of 5813 kg/ha. Remaining all treatments including botanicals, dinotefuran insecticide and untreated check plot recorded on par yields. Lowest grain yield of 4708 kg/ha was recorded in untreated check. Islam et al., 2013 reported that rice crop treated with fipronil and neem extract produced statistically on par grain yield. Kumudsingh 2018 also reported comparable grain yield than chemical insecticide treatments was recorded with the treatment of botanicals, neemazal and multineem.

CONCLUSION

Present investigation was proved that stem borer and leaf folder of rice can be managed effectively at early stages of pest infestation by using the neemazal, lemon grass oil and eucalyptus oil. Though the chemical insecticides were most effective than botanicals in controlling these pest, botanicals were eco-friendly and can be an alternative to chemical pesticides to the farmers practicing organic farming in rice cultivation.

Acknowledgements. This work is an output of the All India Co-ordinated Rice Improvement Project (AICRIP) funded by ICAR, New Delhi and the authors expressed special thanks to Principal Investigator (Entomology) and the Director, IIRR, Rajendranagar, Hyderabad for the supply of testing material and facilitating this work.

REFERENCES

Anonymous, (2015). Progress report Entomology and Plant pathology (Volume 2), All India Co-ordinated Rice Improvement Programme (ICAR), Hyderabad.

Anonymous, (2006). Hand book of Agriculture, Indian Agricultural Research Institute, New Delhi. Pp. 817-844.

Arshad, M. M., Suhail, A., Majeed, M. M., Bilal, H., Gogi, M. D. & Abdin, Z. (2012). Determination of economic threshold level (ETL) for the chemical control of rice leaf folder, *Cnaphalocrocis medinalis* Gn (*Pyralidae*: *Lepidoptera*). *Pak Entomol, 34*: 79-81.

Behura, N.& Sen Pand Kar, M. K. (2011). Introgression of yellow stem borer (*Scirpophaga incertulas*) resistance gene, into cultivated rice (*Oryza* sp.) from wild spp, *Indian Journal Agriculture Science, 81:* 359-362.

Chakraborty, K. (2011) Assessment of the efficacy of some bio-rational pesticide formulations for the management of yellow stem borer, *Scirpophaga incertulas* Wlk. in paddy field. *J. Biopest., 4:* 75-80.

Dhaliwal, G. S., Jindal, V. and Dhawan, A. K. (2010). Insect pest problems and crop losses: changing trends, *Indian J. Ecol., 37*(1): 1-7.

Krishnaiah, N. V. & Kalode, M. B. (1990). Efficacy of selected botanicals against rice insect pests under green house and field conditions. *Indian Journal of Plant Protection, 18*: 197-205.

Kumudsingh. (2018). Comparative efficacy of botanicals against yellow stem borer (*Scirpophaga incertulas*, Walker) and leaf folder (*Cnaphalocrocismedinalis*, Guenee) of rice in Eastern Uttar Pradesh. *Journal of Pharmacognosy and Phytochemistry*, SPI: 474-478.

Islam, M. S., Das, S., Islam, K. S., Rahman, A., Hida, M. N. & Dash, P. K. (2013). Evaluation of different insecticides and botanical extracts against yellow stem borer, *Scirpophaga incertulas* in rice field. *International Journal of Biosciences, 3*(10): 117-125.

Isman, M.B. (2006). Botanical insecticides, deterrents, and repellents in modern agriculture and an increasingly regulated world. *Annual Review Entomology, 51*:45–66.

Mayabini-Jena. (2004). Efficacy of new insecticides as seedling root dip treatment against yellow stem borer in Rabi rice. *Indian Journal of Plant Protection, 32*(2): 37-39.

Narasimhan, V. & Mariappan, V. (1988). Effect of plant derivatives on green leaf hopper (GLH) and rice tungro (RTV) transmissions. *International Rice ResearchNewsletter, 13*(1): 28-29.

Nigam, V. D., Sharma, S. C. & Ali, S. (2010). Comparative bioefficacy of some insecticides against rice leaf folder, *Cnaphalocrocis medinalis* (Guenee). *Indian J. Entomol., 72*: 293-296.

Nugaliyadde, L., Hidaka, T. & Dhanapala, M. P. (1997). The pest management practices of rice farmers in Sri Lanka. In pest Management practices of Rice farmers in Asia. IRRI, Philippines. Pp.127-138.

Panda, B. M., Rath, L. K & Dash, D. (2004). Effect of fipronil on yellow stem borer, *Scirpophaga incertulas* Walker and certain plant growth parameters in rice. *Indian Journal of Entomology, 66*(1): 17-19.

Parmar, B. S. & Dev Kumar, C. (1993). Botanicals and Bio-pesticides. Westvill Publishing House, New delhi. Pp.199.

Pasulu, I. C. Krishnaiah, N. V. Katti, G. and Varma, N. R. G. (2002). IPM in rice, IPMnewletter, Pp. 45-55.

Praskash, A. & Rao, J. (1997). Botanical pesticides in agriculture. CRC Lewis Publs. Boca Raton, USA, pp.481.

Prakash, A. & Rao, J. (1989). Begunia leaves: a pulse grain protectant. *Indian Journal of Entomology, 51*(2): 192-195.

Prakash, A., Tiwari, S. N. & Rao, J. (1990). Exploitation of natural plant products for management of pests and diseases in rice ecosystems. Proc. Symp. Growth. Dev. Resource Conserv, Pp. 23-36.

Prakash, A., Rao, J. & Jagadiswari. (2003). Management of rice storage insect. CRRI, Tech. Bull, 17, pp.4.

Ramasamy, C. &aliecksono, T. (1996). Inter country comparison of insect and disease losses. In: Rice Research in Asia: Progress and Priorities. (Eds.) Evanson, R.E.R.W. HerdtandM. Hossain. *CAB International and International Rice Research Institute.*

Saljoqi, A. U. R., Muhammad-khan, Khalid-Abdullah, and Abdul-Latif. (2002). Evaluation of fipronil for the management of rice stem borer (*Tryporyzaincertulas*, *Lepidoptera*: *Pyralidae*). Peshawar, Pakistan: NWFP Agricultural University. Sarhad. *Journal of Agriculture, 18*(1): 59-61

Yadav, A. Gupta, P. K. and Kurulkar, U. (2019). Incidence of insect-pests on rice, *Int. J. Curr. Microbiol. App. Sci., 8* (06): 551-555.