International Journal of Agriculture, Environment and Biotechnology
Citation: IJAEB: 9(4): 667-671 August 2016
DOI Number: 10.5958/2230-732X.2016.00087.5

ENTOMOLOGY

Field screening of different rice entries against different insect-pests of rice during kharif season

Sitesh Chatterjee[1], Mousumi Ghose[2]* and Chirasree Gangopadhyay[1]

[1]Rice Research Station, Government of West Bengal, Department of Agriculture, P.O.-Chinsurah (R.S.) -712 102, District - Hooghly, West Bengal, India
[2]Department of Agriculture, Government of West Bengal, Barasat II Block, Ranipark, Madhyamgram, Kolkata-700129, India

*Corresponding author: mosumighose1973@gmail.com

Paper No. 490 Received: 27-2-2016 Accepted: 20-8-2016

Abstract

The different rice entries were screened out against stem borer, leaf folder and whorl maggot of rice during *kharif*, 2014 at Rice Research Station, Chinsurah, Hooghly, West Bengal. The experiment was carried out to note the reaction of promising advanced cultures with four check varieties viz. DRRH 2, Surakha, IR 64 and Taichung Native 1 (TN 1) against insect-pests of rice with a view to identify multiple resistant varieties. The lowest dead heart infestation was recorded in RP 5163-200-5-4-2 (0.70%) followed by RNT 14-1-1-2-2 (0.83%), IR 64 (0.49%) and RP 5588-B-B-B-B-76 (1.08%). Lowest white heads was observed in CR 1898-32-69-CN-12-2 (0.90%) followed by RP Bio 4918-142 (1.45%) and RP 2068-18-3-5 (1.60%). The lowest leaf folder infestation was noticed in RP 5588 (0.57%) followed by DRRH 2 (0.76%), CR 2274-2-3-3-1 (0.88%) and RP 5588-B-B-B-B-116 (0.93%). The minimum whorl maggot incidence was observed in RP 5587-B-B-B-267-1 (4.78%) followed by RP 5588-B-B-B-B-76 (5.09%), RP 5588-B-B-B-258-1 (5.16%) and RP 5588-B-B-B-133 (5.29%) entries. This experiment resulted that CN 2008-3-2, CN 2017-3-2 and W 1263 are the multiple resistant entries against all the test insect-pests, CR 2274-2-3-3-1, RP 5587-B-B-B-305-13, CN 2015-5-4, IET 23148 and CN 1233-33-9 against stem borer and leaf folder and RP 2068-18-3-5, RP 5588-B-B-B-B-76 and RNT 14-1-1-2-2 against stem borer and whorl maggot.

Highlights

- CN 2008-3-2, CN 2017-3-2, W 1263 - stem borer, leaf folder, whorl maggot
- CR 2274-2-3-3-1, RP 5587-B-B-B-305-13, CN 2015-5-4, IET 23148, CN 1233-33-9 - stem borer, leaf folder
- RP 2068-18-3-5, RP 5588-B-B-B-B-76, RNT 14-1-1-2-2 - stem borer, whorl maggot

Keywords: Rice-insect, multiple resistant, YSB, leaf folder, whorl maggot

Rice (*Oryza sativa* L.) is the most widely consumed stable food crop of Poaceae family for a large part of the worlds human population, especially in Asia and over half of the global population depends on it for their feed (Singh *et al*. 2014 and Lal *et al*. 2014). India, the second largest rice growing country has a production of 104.32 million tonnes and cultivation area of about 44.6 million hectares with an average productivity of 2.34 tonnes per hectare (Anonymous, 2013 and Rajasekar and Jeyakumar, 2014).

West Bengal ranks first in area and production of rice in India. About 78% of total area under rice in the state is concentrated under high and medium productivity groups, which accounts for nearly 84% of total production of rice in the state. A critical analysis of the gap between the potential and actual rice yields across the nation would reveal that several factors act as yield constraints. Among these factors, insect-pests contribute substantially to yield loss in rice production and productivity. In India,

approximately 100 insect species feed on rice and 20 of these are considered to be major pests, causing 30% yield loss. Among these, yellow stem borer *Scirpopagha incertulas* Walker and rice leaf folder, *Cnaphalocrocis medinalis* Guenee are the dominant and the most destructive insect-pest occurring throughout the country causing the yield loss of about 10-60 per cent (Chatterjee and Mondal, 2014).

Host plant resistance is a relationship between the plant feeding insects and their host plants (Painter, 1951). Host plant resistance enables plants to avoid, tolerate or recover from the effects of insect pest attack and has proved to be a successful tool against insects in many crops (Felkl *et al.* 2005). Plant genotypes, either due to environmental stress or genetic makeup, possess physiological and biochemical differences which alter the nutritional value (primary metabolites) for plant feeding insects (Alvim1 *et al*. 2004). In some cases, the combined nutritional and allelochemical alterations either improve the quality of the host plant as a source of food and can therefore be considered favorable to herbivorous insects or make the quality of host plant as source of food unfavorable to phytophagous insects (Stadler *et al.* 2002).

This investigation was conducted to determine the level of resistance against *S. incertulas, C. medinalis* and *Hydrellia* sp. and also to find out the multiple resistance/tolerant rice entries. The identification of resistant/tolerant rice entry will help breeders for future use in developing multiple resistant new breeding rice lines.

Materials and Methods

The different rice entries was screened out against stem borer, leaf folder and whorl maggot of rice during kharif, 2014 at Rice Research Station, Chinsurah, Hooghly, West Bengal. The experiment was carried out to note the reaction of forty rice entries including four checks viz. DRRH 2, Surakha, IR 64 and Taichung Native 1 (TN 1) (Table 1) with a view to identify multiple resistant varieties of different insect-pests. The rice entries including checks were transplanted in two rows of ten hills each with one skip row between entries with spacing of 15 × 20 sq. cm. The fertilizers doses were applied as $N:P_2O_5:K_20$ @ 80:40:40 and also applied additional urea @ 40 kg /ha on 30, 40 and 50 DAT to get higher infestation of insect-pests. No insecticide was applied in the screening plots. Level of pest infestation was determined by the proportion of affected hills showing dead heart, white ear head or damaged and folded leaves in each unit area fixed for variety/line. The observations were taken at active tillering stage for dead heart, folded leaves and damaged leaf by whorl maggot while white ear head was recorded at latter stages of reproductive period of the crop. The total number of tiller/hill, total number of damaged tiller/hill, total number of leaves/hill and total number of damaged and folded leaf/hill were recorded randomly from 10 hills in each observation. For recording the white ear, only panicle bearing tillers were considered.

Table 1: Entries with check varieties of rice used for screening against different insect-pests of rice

Sl. No.	Category	Name
1.	Rice entries	CR 1898-32-69-CN 12-2, CR 2274-2-3-3-1, CR 3006-8-2, JGL 19618, RP 4918-228 , RP 5163-200-5-4-2, RP 5203-112-5-2-3, RP 5587, RP 5587-B-B-B-133, RP 5587-B-B-B-258-1, RP 5587-B-B-B-267-1, RP 5587-B-B-B-305-13, RP 5588, RP 5588-B-B-B-B-116, RP 5588-B-B-B-B-177-2, RP 5588-B-B-B-32, RP2068-18-3-5, RP 5588-B-B-B-B-63, RP 5588-B-B-B-B-76, RP 5715-322-3-1-1, RP Bio 4918-142, RP Bio 4918-24K, RP Bio 4918-50-13, RNT 14-1-1-2-2, RNT 42-1-1-1, RTN 604-9-2-1, RTN 605-111-1-2, W 1263, CN 2008-3-2, CN 2017-3-2, CN 2015-5-4, CN 2007-2-1, CN 2009-4-3, IET 23148, CN 1231-11-7 and CN 1233-33-9
2.	Check varieties	DRRH 2, Suraksha, IR 64 and TN 1

Results and Discussion

The result revealed that no dead heart incidence was noticed in DRRH 2 followed by RP 5163-200-5-4-2 (0.33%) and RP 5587-B-B-B-305-13 (0.49%) in 35 DAT, whereas in 70 DAT, RNT 14-1-1-2-2 resulted no infestation followed by RP Bio 4918 (0.91%), IR 64 (0.99%) RP 5715-322-3-1-1 (1.02%), RP 5588-B-B-B-B-76 (1.03%) and RP 5163-200-5-4-2

Table 2: Dead Heart, white ear head, leaf folder and whorl maggot infestation per cent on different rice entries

Sl. No.	Designation	DH% 35 DAT	DH% 70 DAT	Mean DH%	WE%	LF% 35 DAT	LF% 70 DAT	Mean LF%	WM% 35 DAT
	CR 1898-32-69-CN 12-2	1.75	2.87	2.31	0.90	0.00	3.45	1.73	9.57
	CR 2274-2-3-3-1	1.31	1.97	1.64	11.72	0.30	1.45	0.88	11.26
	CR 3006-8-2	1.26	10.92	6.09	20.46	0.32	4.29	2.31	10.45
	JGL 19618	3.08	6.20	4.64	7.96	0.52	3.06	1.79	8.45
	RP 4918-228	2.07	6.36	4.22	3.31	0.25	3.57	1.91	9.76
	RP 5163-200-5-4-2	0.33	1.09	0.71	6.90	0.38	1.98	1.18	7.23
	RP 5203-112-5-2-3	3.44	5.79	4.62	9.81	0.26	3.62	1.94	8.86
	RP 5587	1.84	3.21	2.53	3.68	0.36	2.13	1.25	9.13
	RP 5587-B-B-B-133	1.38	1.89	1.64	11.32	0.41	4.26	2.34	5.29
	RP 5587-B-B-B-258-1	2.18	3.20	2.69	6.07	0.34	2.18	1.26	5.16
	RP 5587-B-B-B-267-1	1.25	3.07	2.16	9.67	0.21	4.04	2.13	4.78
	RP 5587-B-B-B-305-13	0.49	2.59	1.54	6.70	0.12	2.08	1.10	6.65
	RP 5588	0.85	4.57	2.71	5.62	0.13	1.01	0.57	6.99
	RP 5588-B-B-B-B-116	2.35	2.96	2.66	14.17	0.12	1.74	0.93	7.36
	RP 5588-B-B-B-B-177-2	1.42	1.30	1.36	6.07	0.12	3.14	1.63	9.27
	RP 5588-B-B-B-B-32	1.36	3.52	2.44	2.25	0.22	2.76	1.49	9.19
	RP2068-18-3-5	2.12	4.67	3.40	1.60	0.82	1.51	1.17	5.56
	RP 5588-B-B-B-B-63	2.70	3.48	3.09	19.70	0.36	2.62	1.49	7.74
	RP 5588-B-B-B-B-76	1.13	1.03	1.08	5.36	0.68	2.71	1.70	5.09
	RP 5715-322-3-1-1	2.66	1.02	1.84	4.39	0.99	2.72	1.86	11.79
	RP Bio 4918-142	1.59	10.81	6.20	1.45	0.10	2.99	1.55	7.62
	RP Bio 4918-24K	1.37	0.91	1.14	2.64	0.48	2.54	1.51	8.88
	RP Bio 4918-50-13	1.45	5.25	3.35	12.45	0.11	3.19	1.65	7.73
	RNT 14-1-1-2-2	1.66	0.00	0.83	8.83	0.31	2.78	1.55	5.36
	RNT 42-1-1-1	1.06	1.92	1.49	21.07	0.26	3.46	1.86	11.05
	RTN 604-9-2-1	0.86	4.70	2.78	22.65	0.31	5.50	2.91	10.40
	RTN 605-111-1-2	1.32	5.52	3.42	18.70	0.51	2.52	1.52	6.25
	W 1263	0.93	1.89	1.41	8.75	0.45	1.71	1.08	5.77
	CN 2008-3-2	0.98	1.22	1.10	3.02	0.35	1.86	1.11	5.55
	CN 2017-3-2	1.05	1.56	1.31	3.49	0.21	2.04	1.13	5.80
	CN 2015-5-4	1.27	1.47	1.37	4.05	0.20	1.79	1.00	6.37
	CN 2007-2-1	1.38	1.53	1.46	3.59	0.31	2.44	1.38	5.90
	CN 2009-4-3	1.49	2.87	2.18	4.67	0.42	1.90	1.16	7.42
	IET 23148	1.39	1.38	1.39	5.02	0.30	1.76	1.03	6.18
	CN 1231-11-7	0.96	1.22	1.09	4.16	0.28	2.20	1.24	7.44
	CN 1233-33-9	1.08	1.40	1.24	3.55	0.36	1.78	1.07	6.08
	DRRH 2	0.00	4.81	2.41	13.15	0.00	1.52	0.76	6.77
	Suraksha	1.68	2.01	1.85	14.08	0.12	4.82	2.47	8.87
	IR 64	0.98	1.00	0.99	4.33	0.25	2.89	1.57	8.59
	TN 1	2.00	2.91	2.46	6.70	0.85	1.48	1.17	7.81

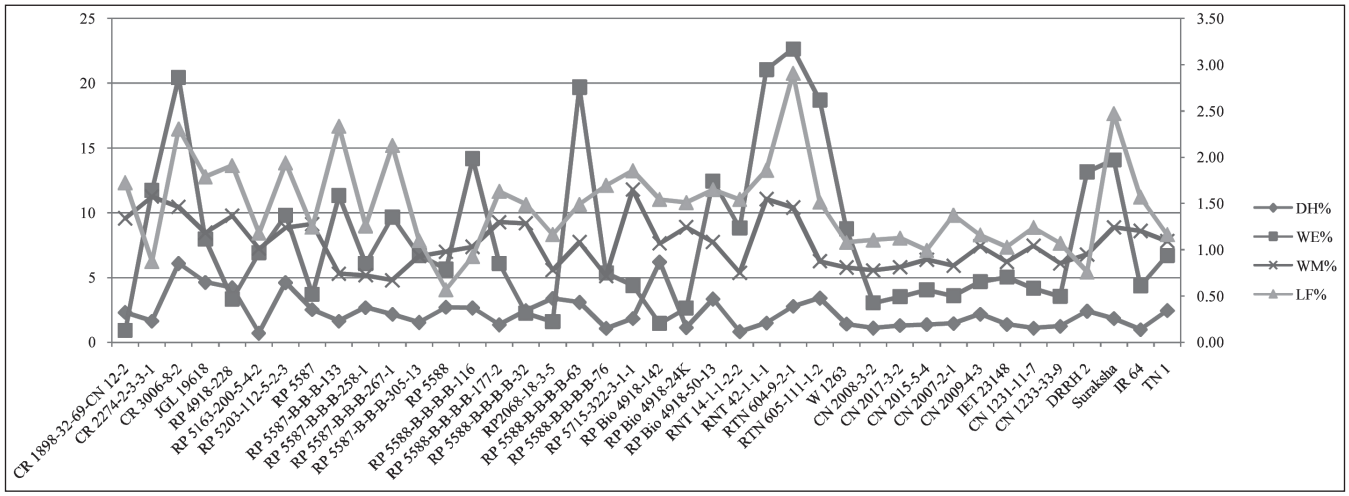

Fig. 1: Insect-pest infestation on different rice entries

(1.09%) (Table 2 and Fig. 1). The average dead heart infestation data showed that RP 5163-200-5-4-2 (0.70%) was the most resistant line against dead heart followed by RNT 14-1-1-2-2 (0.83%), IR 64 (0.49%) and RP 5588-B-B-B-B-76 (1.08%). Lowest white heads were observed in CR 1898-32-69-CN-12-2 (0.90%) followed by RP Bio 4918-142 (1.45%) and RP 2068-18-3-5 (1.60%) (Table 2 and Fig. 1). A number of scientists screened out rice lines/entries/genotypes and varieties against different insect-pests of rice and they identified many resistant/tolerant lines. Visalakshmi *et al*. (2014) screened 53 rice entries under natural field conditions to find out the resistance to stem borer and they recorded that CR 2711-76, CR 3005-230-5 and CR 3005-77-2 were moderately resistant to stem borer. Prasad *et al.* (2013) evaluated 202 semi deep water rice genotypes along with check varieties Jalpriya and Madhukar against YSB and concluded that the entries Madak 13, WAB 878-4-2-2-3-P1-HP and NDGR 268 are highly resistant to yellow stem borer and may be used as donors for yellow stem borer resistance in breeding program. Chatterjee *et al.* (2011) screened out 51 rice entries along with check varieties and recorded that dead heart tolerant promising rice entries were Anjali, Pusa RH 10, ADT 44, JKRH 10, Pant Dhan 19, Gorsa, CSR 27, IC 115737, LF 270 and after flowering CHOORAPUNDY, INRC 3021, PTB 12, CR-MR-1523, LF 256 and AGANNI were the promising tolerant rice entries against white ear head. They also concluded that CSR 23, TNAU 831311, ARC 6626, IC 115737, AGANNI, IC 155876 and ARC 5982 were tolerant to rice leaf folder. Balasubramanian *et al.* (2000) screened 178 advanced yield trial genotypes of rice for their reaction to insect pests under natural conditions. The damage score was recorded as per Standard Evaluation System (SES) of IRRI, Philippines. The genotypes, IET 15742 and IET 15072 against YSB and IET 16120 against rice leaf folder were found to be moderately resistant out of 178 total genotypes. Singh *et al.* (2006) screened fifty three cultivars of rice against *S. incertulas* under natural infestation. Observations on the basis of per cent damage incidence of YSB were recorded and the result revealed that eighteen rice varieties were totally free from stem borer damage in terms of DH and WE. In this present experiment, on 35 DAT, no leaf folder damage was noticed in CR 1898-32-69-CN-12-2 and DRRH 2 and the lowest leaf folder damage were recorded in RP Bio 4918-142 (0.10%) and RP Bio 4918-50-13 (0.11%) whereas, at 70 DAT, the lowest leaf folder damage was noticed in RP 5588 (1.01%) followed by CR 2274-2-3-3-1 (1.45%) and TN 1 (1.48%) (Table 2 and Fig. 1). The lowest average leaf folder infestation was found in RP 5588 (0.57%) followed by DRRH 2 (0.76%), CR 2274-2-3-3-1 (0.88%) and RP 5588-B-B-B-B-116 (0.93%). Pillai *et al.* (1979) tested relative susceptibility of 491 genotypes against leaf folder and the lines *viz.* T 289, J 147, J 147, J1 45-7, Kallada chambavu and T 1340 were found to be the most tolerant ones. Sudhakar *et al.* (1991) evaluated 24 rice varieties in India for resistance against *C. medinalis* and recorded that IET 7564, ES 29-3-3-1; Pusa 2-21 and Type-3 were the least susceptible entries. On 35 DAT, the lowest whorl maggot incidence was discernible in RP 5587-B-B-B-267-1 (4.78%) followed by RP 5588-B-B-B-B-76 (5.09%),

RP 5588-B-B-B-258-1 (5.16%) and RP 5588-B-B-B-133 (5.29%) (Table 2 and Fig. 1). Therefore, this present experiment concluded that CN 2008-3-2, CN 2017-3-2 and W 1263 have multiple resistance traits against all the test insect-pests namely, stem borer, leaf folder and whorl maggot, CR 2274-2-3-3-1, RP 5587-B-B-B-305-13, CN 2015-5-4, IET 23148 and CN 1233-33-9 against stem borer and leaf folder and RP 2068-18-3-5, RP 5588-B-B-B-B-76 and RNT 14-1-1-2-2 against stem borer and whorl maggot.

Conclusion

This experiment concluded that CN 2008-3-2, CN 2017-3-2 and W 1263 are the multiple resistant entries against stem borer, leaf folder and whorl maggot of rice, CR 2274-2-3-3-1, RP 5587-B-B-B-305-13, CN 2015-5-4, IET 23148 and CN 1233-33-9 against stem borer and leaf folder and RP 2068-18-3-5, RP 5588-B-B-B-B-76 and RNT 14-1-1-2-2 against stem borer and whorl maggot.

References

Alvim, G.S.J., Collevatti, R.G. and Fernandes, G.W. 2004. Effects of genetic variability and habitat of *Qualea parviflora* (Vochysiaceae) on Herbivory by Freefeeding and Gall-forming Insects. *Annals of Botany* **94**: 259-268.

Anonymous, 2013. Directorate of Economics and Statistics. New Delhi, Govt. of India.

Balasubramanianan, V., Sadakathulla, S., Subramanian, M. and Ramanathan, S. 2000. Screening Rice Entries of AICRIP in advanced yield trial for Resistance to Insect Pests of Rice. *International Plant Resistance to Insects* **26**: 52.

Chatterjee, S., Nayak, U.S., Mandal, P. and Singh, N.J. 2011. Screening of rice cultivars against rice leaf folder (*Cnaphalocrocis medinalis*) and rice stem borer (*Scirpophaga incertulas*) during kharif season in the new alluvial zone of West Bengal. *Journal of Plant Protection and Environment* **8**(1): 125-127.

Chatterjee Sitesh and Mondal Palash (2014) Management of rice yellow stem borer, *Scirpophaga incertulas* Walker using some biorational insecticides. *Journal of Biopesticides* **7**(supp): 143-147.

Felkl, G., Jensen, E.B., Kristiansen, K. and Andersen, S.B. 2005. Tolerance and antibiosis resistance to cabbage root fly in vegetable *Brassica* species. *Ent. Experiment. Appl.* **116**: 65–71.

Lal, D., Shashidhar, H.E., Ramanjini, P.H.G., Ashok, T.H. 2014. Callus Induction and Regeneration from In vitro anther culture of rice (*Oryza sativa* L.). *International Journal of Agriculture, Environment and Biotechnology* **7**(2): 213-218

Painter, R. 1951. Insect resistance in crop plants. *MacMillan*, New-York, p. 168.

Pillai, K.B., Nair, N.R. and Thomas, M.J. 1979. Relative susceptibility of some rice varieties to infestation by rice leaf folder. *Agricultural Research Journal of Kerala* **17**: 298

Prasad S.S., Gupta P.K., Singh, R.V., Prakash, N. and Mishra 2013 Screening of semi deep water rice genotypes against yellow stem borer, Scirpophaga incertulas (Walker). *J. P. International Journal of Current Microbiology and Applied Sciences* **2**(11): 62-65.

Rajasekar, N., Jeyakumar, P. 2014. Differential response of trifloxystrobin in combination with tebuconazole on growth, nutrient uptake and yield of rice (Oryza sativa L.). *International Journal of Agriculture, Environment and Biotechnology* **6**(1): 87-93.

Singh Prakash, Singh Ravi, P., Singh, H.B., Singh, O.N., Samantray, S., Singh, M.K. and Jaiswal, H.K. 2014. Inheritance of resistance in indica rice cultivar HUR 4-3 against bacterial leaf blight (*Xanthomonas oryzae* pv. *oryzae*). *IJAEB* **7**(4): 777-785.

Singh, R.B., Singh, R.A., Dwivedi, J.L. and Chaudhary, R.K 2006. Reaction of different rice varieties/cultivars against leaf folder, *Cnaphalocrocis medinalis* Guen. and stem borer, *Scirpophaga incertulas* Walker under irrigated conditions. *Journal of Plant Protection and Environment* **3**: 4-16.

Stadler, E. 2002. Plant chemical cues important for egg deposition by herbivorous insects. In: *Chemoecology of insect eggs and egg deposition* (eds. Hilker, M. and T. Meiners). Blackwell, *Oxford*, pp. 171-197

Sudhakar, G.K., Singh, R. and Mishra, S.B. 1991. Susceptibility of rice varieties of different durations to rice leaf folder, *Cnaphalocrocis medinalis* Guen. evaluated under varied land situations. *Journal of Entomological Research* **15**: 79-87.

Visalakshmi, V., Hari Satyanarayna, N., Jyothula, D.P.B, Raju, M.R.B. and Ramana Murthy, K.V. 2014. Screening of rice germplasm for resistance to yellow stem borer *Scirpophaga incertulas* Walker. *International Journal of Plant, Animal and Environmental Sciences* **4**(2): 129-133.