International Journal of Science, Environment and Technology, Vol. 5, No 2, 2016, 525 – 532

ISSN 2278-3687 (O)
2277-663X (P)

EFFICACY OF NEW MOLECULES AGAINST YELLOW STEM BORER (YSB) SCIRPOPHAGA INCERTULAS WALKER NDER RICE CROP ECOSYSTEM OF MANIPUR VALLEY

P.R. Devi and K.I. Singh*
Department of Environmental Science
Calorx Teacher's University, Ahmadabad – 382481
*College of Agriculture, Central Agricultural University
Imphal – 795004, Manipur

Abstract: The field tails were experimented during *Kharif* 2013 and 2014 at the research farm of College of Agriculture, Central Agricultural University, Imphal to investigate the efficacy of new molecules against yellow stem borer (YSB) *Scirpophaga incertulas* walker, under rice crop ecosystem of Manipur Valley. Among the various molecular insecticides field evaluated against the yellow stem borer (YSB). Flubendiamide 39.35 SC @ 24g a.i. ha^{-1} was found quite effective against YSB recording mean per cent dead heart (DH) and white ear head (WEH) of 3.48 and 1.32 respectively, followed by Fipronil 80WG@ 40g a.i. ha^{-1} (3.51 DH% and 1.32 WEH %), Imidacloprid 17.8 SL @25g a.i. ha^{-1} (4.92% DH and 1.66% WEH), Imidacloprid 70 WG @ 25g a.i. ha^{-1} (4.37% DH and 1.66% WEH) respectively during 2013. During 2014 also Flubendiamide 39.35 SC @ 24g a.i. ha^{-1} was found to be most effective recording 3.49%DH and 1.33% WEH, closely followed by Imidacloprid 17.8 SL @25 g a.i. ha^{-1} 4.93% DH and 1.68% WEH, Imidacloprid 70 WG @25 g a.i. ha^{-1} (4.39% DH and 1.66% WEH), Thiamethoxam 25 WG @ 25 g a.i. ha^{-1} (4.19% DH and 1.67% WEH). The highest mean grain yield 6.03 t ha^{-1} during 2013 and 6.02 t ha^{-1} during 2014 was accrued from the plots treated with Flubendiamide 39.35 SC @ 24g a.i. ha^{-1}. While the lowest mean grain yield 4.36and 4.35 t ha^{-1}Was harvested from the plots treated with Spinosad 2.5 SC @ 50g a.i.ha^{-1} as against 4.12 and 4.11 t ha^{-1} in untreated control plots during kharif 2013 and 2014, respectively.

Keywords: *S. incertulas*, Flubendiamide, *Kharif*, KD-2-6-3, dead heart, white ear head.

INTRODUCTION

Rice is mainly grown during the *Kharif* season in Manipur covering an area of 168,78 hectares, producing 377.37 thousand tones with a productively of 2235.89 kg/ha (Anon 2013) The average per hectare yield higher than that of national average in comparison to other major rice growing state the *Kharif,* rice productivity in Manipur is still low. To meet the challenge of producing more rice from suitable conditions we need co-ordinated and concentrated effort by the farmers and scientists in order to satisfy the growing demand without affecting the resource based adversely. Quite a good number of biotic, abiotic and

*Received Mar 9, 2016 * Published April 2, 2016 * www.ijset.net*

socio-economic constraints in production of major limiting factors. Seven out of 20 major challenges in rice production, of which insect pest and disease attack is the main constraints in rice production (Herdt, 1991). About 300 species of insect pests attack the paddy crop at various stages and among them only 23 species cause notable damage (Pasalu and Katti 2006) Insect pests are the major constraints in enhancing rice productivity besides disease and weeds (Behura *et al* 2011). Among the insect of rice yellow stem borer (YSB), *Scirpophaga incertulas* Walker is considered as the most nuisance of rainfall, low land and flood prone rice ecosystem (Deka. 2010). In India YSB is regarded as the most dominating destructive pest species. (Mahar *et al* 1985). Globally YSB alone causes yield loss of 10 Million tones and 50 per cent of the insecticides are used for their management in the rice field (Huesing, 2004). In Manipur, altogether 32 insect species ravaging the crop, out of which, the yellow stem borer (*S. incertulas*) is considered as major importance since it causes an extensive yield loss. To combat these pests although IPM practices have been developed, but the farmers usually opted for synthetic organic insecticides as the first line of defense. The recommended such insecticides in the past are now become absolute keeping these points in mind, the present investigation was proposed to study the efficacy of new molecules against yellow stem borer under rice –crop- ecosystem of Manipur valley.

MATERIALS AND METHODS

The Rice Research Farm, College of Agriculture, Central Agricultural University, Imphal is situated at 24^0 45/N latitude and 93^0 56/ E longitude with an elevation of 790 m above the mean sea level. The soil type was clay loam in texture and acidic in reaction having P^H value of 5.5. The meteorological data recorded during the period experimentation are taken from ICAR, Lamphelpat, Imphal.

The high yielding variety “KD-2-6-3” was used for the experiment. The trail was carried out at Randomized Block Design (RBD). Altogether there were eleven treatments (eight new molecules, Spinosad, Monocrotophos and one untreated control) and each treatment replicated thrice. The experimental crop was grown by adopting locally accepted agronomical practices at 10 cm x 15 cm spacing in the plot size of 4 m x 5 m. Observation on YSB infestation was recorded as dead heart (DH) at vegetative stage and white ear head (WEH) at reproductive stage after 30, 50, 70 and 90 DAT from 20 randomly selected hills per plod. The grain yield per plot was recorded and finally converted to tones per hectare. The percentage infection was determined by using the following formula.

$$\text{Infestation \%} = \frac{\text{Number of dead heart or white ear head per hill}}{\text{Total number of tillers per hill}} \times 100$$

Mean value of data obtained from various experiments were subjected to statistical analysis after suitable transformation to test significance as par suggested by Gomez and Gomez (1984) for results interpretation.

RESULTS AND DISCUSSION

The pooled mean data of two sprays' on the incidence of *S. incertulas* showed in Table 1and Figs. 1 and 2 revealed that the mean dead heart (DH) incidence significantly differed among the treatments throughout the experimental periods of *Kharif*, 2013 and 2014, respectively. Untreated control plots recorded 16.64 (2013) and 16.65% DH (2014). The treatment with Flubendiamide 39.35 SC @ 24 g a.i. ha^{-1} was found to be most effective with minimum DH incidence of 3.48% (2013) and 3.49% DH (2014) as against 16.64 (2013) and 16.65% DH (2014) in the untreated control. The effectiveness of Flubendiamide was at per with the treatment with Fipronil 80 WG @ 40 g a.i. ha^{-1} recording the lower DH incidence of 3.51% (2013) and 3.52% (2014). The lower dead heart incidence were also recorded in the treatments with Thiamethoxam 25 WG @ 25 g a.i. ha^{-1} (4.18% DH during 2013) and 4.19% DH in 2014. Imidacloprid 70 WG @ 25g a.i. ha^{-1} (4.37% DH during 2013 and 4.39 % DH during 2014), Thiacloprid 21.70 SC @ 120 g a.i. ha^{-1} (4.52 % DH in 2013 and 4.55% DH in 2014) and Imidacloprid 17.8 SL @ 25 g a.i. h^{-1} (4.92% DH in 2013 and 4.93% DH in 2014) which differed significantly except between Thiamethoxam and Imidacloprid 70 WG. The maximum DH incidence was noticed in the plots treated with Spinosad 2.5 SC @ 50 g a.i. ha^{-1} and monocrotophos 36 WSC @ 500g a.i. h^{-1} each recorded 6.12% DH during 2013 and 6.13% during 2014, respectively. The rest two insecticides namely Imidacloprid 1.8 SP @ 25 g a.i. ha^{-1} and Fipronil 0.3 G @ 50g a.i. ha^{-1} were also showed inferior in reducing the dead heart incidences each recording in the mean DH of 5.25% during 2013 and 5.27% during 2014 respectively in compared with other insecticidal treatments except Imidacloprid 1.8 SP and Spinosad 2.5 SC treatments.

The treatment with Flubendiamide 39.35SC @ 24 g a.i.ha^{-1} was observed as the most effective with minimum WEH incidence of 1.32 % (2013) and 1.33% (2014). Which was at per with the treatment with Fipronil 80WG @40g a.i.ha^{-1} recording the lower WEH incidence of 1.32% (2013) and 1.33% (2014) the treatment with Thiameth oxam 25 WG @ 25 g a.i.ha^{-1} 1.68% WEH (2013) and 1.67% WEH (2014) was observed as lower with ear head.

Imidacloprid 70WG @ 25 g a.i. ha^{-1} Imidocloprid 17.8SL @ 25 g a.i. ha^{-1} were observed with same value as 1.66% WEH (2013) and 1.68% WEH (2014).

The highest mean grain yield 6.03 t/ha (2013) and 6.02 t/ha (2014) was harvested from the plots treated with Flubendiamide, the plots of Fipronil 80WG, 5.96 t/ha (2013) and 5.95 t/ha (2014), Thiamethoxam 25WG, 5.69 t/ha (2013) and 5.67 t/ha (2014) and Thiocloprid 21.70SC, 5.52 t/ha (2013) and 5.51 t/ha (2014) whereas Spinosad 2.5 SC @ 50g a.i.ha^{-1} treated plots accrued significant lowest grain yield of 4.36t/ha (2013) and 4.35t/ha (2014).

The pooled mean data presented in Table 1 illustrated in Fig. 1and 2 further indicated that Flubendiamide 39.35 SC and Fipronil 80 WG proved to be the most effective insecticidal treatments in reducing white ear head (WEH) incidence with a record of 1.32% WEH (2013) and 1.33 % WEH (2014) each as against 6.32 % WEH (2013) and 6.33 % WEH (2014) in untreated control. These two insecticides were closely followed by Thiamethoxam 25 WG, Thiocloprid 21.70 SC, Imidacloprid 70 WG and Imidacloprid 17.8 SL each recorded the mean WEH of 1.66% (2013) and 1.68% (2014), but did not differ significantly from one another. Monocrotophos 36 WSC and treatment was found to be least effective treatment against *S. incertulas* with a record of maximum percentage of white ear head incidences of 2.32 % (2013) and 2.31% (2014).

The present finding are in agreement with the results of Bhushan *et al* (2012), Dhawan *et al* (2010), Mohal *et al* (2008), Singh *et al* (2005), Sentakke and Dash (2000) who reported the efficacy of Fipronil 80 % GW for the control of stem bores. Das and Mukherjee (2003) reported that Fipronil @ 0.075 kg / ha controlled the stem borer most effectively. Panda *et al* (2004) studied the efficacy of Fipronil @ 100 g a.i. ha^{-1} and 75 g a.i. ha^{-1} and observed effective control of yellow stem borer which conforms with the present findings.

The result of the present investigation showed that the Flubendiamide 39.35 SC was most effective control against dead heart (DH) incidence. The present findings are in agreement with the result of *Sekh et al* (2007) who reported that Flubendiamide 480 SC @ 24 and 30g a.i ha^{-1} provided effective control against yellow stem borer. However, all the insecticidal treatments recorded significantly lower white ear head incidence than untreated control. In order to efficacy of each of treatments along with the test of significance is depicted below:-

Flubendiamide 39.35 SC > Fipronil 80 WG > Thiamethoxam 25 WG > Thiacloprid 21.70 SC > Imidacloprid 70 WG > Imidacloprid 17.8 SL > Imidacloprid 1.8 SP > Fipronil 0.3 G > Spinosad 2.5 SC > Monocrotophos 36 WSC > *Untreated* control.

The test molecules also differ significantly in their effectiveness in yield attribute in the experimental years, which might be due to its own reaction to S. *incertulas* infestation. The highest grain yield 6.03t/ha^{-1}(2013) and 6.02t/ha^{-1}(2014) was obtained from the plot treated with Flubendiamide 39.35 SC as against 4.12t/ha^{-1}(2013) and 4.11t/ha^{-1} (2014) respectively in susceptible check variety. It was closely followed by 5.96t/ha^{-1}(2013) and 5.95t/ha^{-1}(2014) in the plot treated with Fipronil 80WG

Table 1. Relative efficacy of new molecules on the incidence of *S. incertulus* grain yield of rice var.KD-2-6-3 during 2013 and 2014

TREATMENT	Dose g a.i. ha^{-1}	[1]Mean percentage of dead heart and white ear head				Grain yield (t ha^{-1})	
		2013		2014			
		DH(%)	WEH(%)	DH(%)	WEH(%)	2013	2014
Imidacloprid 17.8 SL	25	4.92 (12.88)	1.66 (7.49)	4.93 (12.87)	1.68 (7.49)	4.86	4.85
Thiamethoxam 25 WG	25	4.18 (11.82)	1.68 (7.48)	4.19 (11.83)	1.67 (7.49)	5.69	5.67
Imidacloprid 1.8% SP	25	5.25 (13.35)	2.00 (8.12)	5.27 (13.36)	2.00 (8.13)	4.73	4.72
Imidacloprid 70 WG	25	4.37 (12.10)	1.66 (7.48)	4.39 (12.11)	1.68 (7.49)	5.06	5.05
Thiacloprid 21.70 SC	120	4.52 (12.24)	1.66 (7.49)	4.55 (12.26)	1.67 (7.49)	5.52	5.51
Flubendiamide 39.35 SC	24	3.48 (10.77)	1.32 (6.54)	3.49 (10.78)	1.33 (6.55)	6.03	6.02
Spinosad 2.5% SC	50	6.12 (14.28)	2.32 (8.71)	6.13 (14.30)	2.31 (8.71)	4.36	4.35
Fipronil 0.3 G	50	5.25 (13.30)	2.00 (8.12)	5.26 (13.31)	1.99 (8.11)	5.39	5.38
Fipronil 80 WG	40	3.51 (10.77)	1.32 (6.54)	3.52 (10.78)	1.33 (6.55)	5.96	5.95
Monocrotophos 36 WSC	500	6.12 (14.28)	2.32 (8.71)	6.13 (14.29)	2.33 (8.70)	5.15	5.14
T_0 = Untreated control		16.64 (24.03)	6.32 (14.53)	16.65 (24.04)	6.33 (14.54)	4.12	4.11
CD (P = 0.05)		0.18	1.19	0.19	1.20	0.50	0.49

Figures in parenthesis are angular transformed values.
[1]Mean of three replication based on two sprays.
Note: Nursery application of all the insecticides was made at 7 days prior to uprooting.

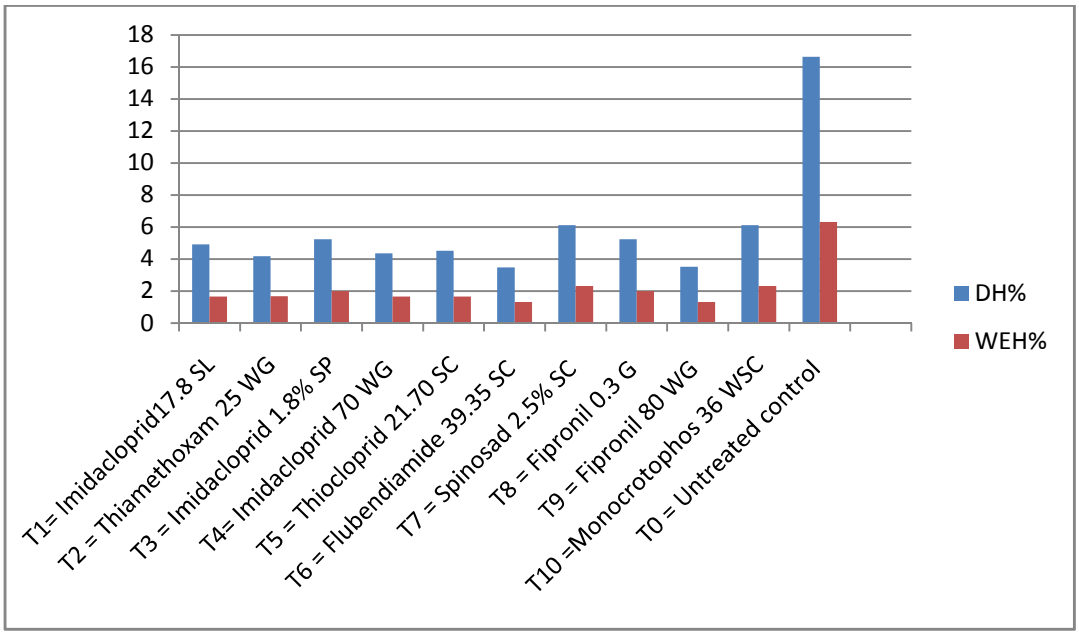

Fig. 1. Graphical representation on effect of different insecticidal treatment on the incidence of *S.incertulas* during 2013

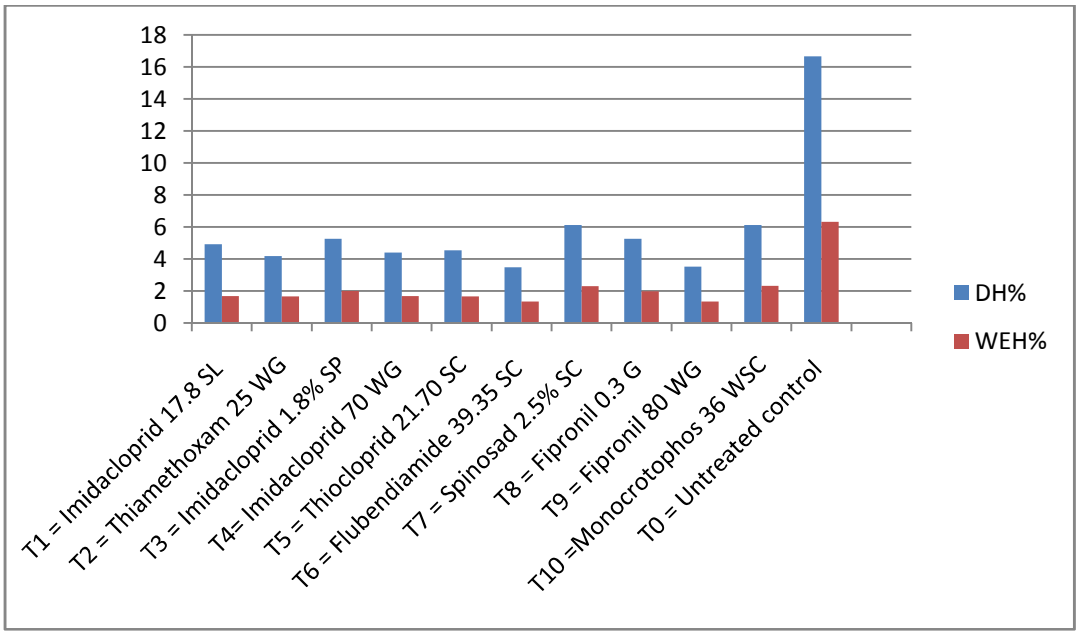

Fig. 2. Graphical representation on effect of different insecticidal treatments on the incidence of *S. incertulas* during 2014

CONCLUSION

The results of present investigations have reasonably led to conclusion that *S. incertulas* is of regular appearance on main *Kharif* rice under Manipur agro ecological situation and under prevalence of favourable conditions, flaring of this pest to epidemic proportion cannot be ruled out. Further, it may also be concluded from the present study that

as Flubendiamide 39.35 SC and Fipronil 80WG afforded more effective control of YSB. Moreover, these new insecticide molecules are comparatively safer to non-targeted organism in comparison with other conventional insecticides. However, further investigations on these aspects are necessary.

REFERENCES

[1] Anonymous (2013). Statistical year book Manipur. Directorate of economics & statistics government of Manipur Imphal, P.143-147.

[2] Behura, N., P. Sen and M.K. Kar (2011). Introgression of yellow stem borer (*Seirphophaga incertulas*) resistance gene, into cultivated rice (Oryza sp) from wild Spp. *Indian. Agric. Sci*., **81**: 359 – 362.

[3] Bhushan S, Singh RP, Shanker R. (2012). Biopesticidal Management of yellow stem borer (*Scirpophaga incertulas* walker) in rice. *The Bioscan*., **7** (2). 317 – 319.

[4] Dash A.N. and Mukherjee S.K. (2003). Insecticidal Control of major insect pests of rice. *Pest Mgmt. Econ.Zool*., **11**: 147 – 151.

[5] Deka S, Barthakur S. (2010). Overview on current status of Biotechnical intervention on yellow stem borer. *Scirpophaga incertulas* (Lepidoptera : Crambidae) resistance in rice. *Biotechnol Adv*., **28** (1): 70 – 81.

[6] Dhawan, A.K., M.S. Mahal, P.S. Sarao, J.S. Virk, K.S. Suri, P. Singh and R. Singh (2010). Relative efficacy of new granular formulation against stem borer.

[7] Gomez A.K. and A.A. Gomez (1984). Statistical procedure for Agricultural Research. *John Willey and Sons. New York*, *USA* P. 680.

[8] Heinrichs EA, Medrano FG, Rapusas H (1985). Genetic evaluation for insects resistance in Rice (Eds). *IRRI, Los Banos, Philippines*.

[9] Herdt, R.W. (1991) Research priorities for Rice Biotechnology. In Rice Biotechnology (ed. Khush G.S. and Toenniessen GH). *International Rice Research Institute*. *Los Banos, Philippines*.

[10] Huising S, English L. (2004). The impact of pest crops on the developing world. *Ag Bio. Forum.,* **7** (1 – 2) : 84 – 95.

[11] Mahal, M.S., P.S. Sarao and M.L. Singla (2008). Bio efficacy of *Fipronil* 80% WG for the control stem borer and leaf folder in Basmati rice. *Indian J. Pt. Prot*., **36**: 260 – 262.

[12] Mahar, M.M., I.M. Bhatti and A.R. Dhuzo (1985). Stem borer infestation and yield loss relationship in rice and cost benefits of control paper presented at 5th National Sem. On rice and production. *Kalashakaku*, April 23 – 25.

[13] Panda, S.K., Nayak, S.K. and Behera, V.K. (2004). Bio-efficacy of *Fipronil* 0.4 G against insects pests of rice Oryza, **41** (1 & 2): 32 – 34.

[14] Pasalu IC, Katti G. (2006) Advances in eco-friendly approached in rice 1PM. *J. Rice Res*., **1** (1) : 83 – 90.

[15] Sekh, K., Nair, N., Gosh, S.K. and Somachoudhury, A.K., (2007) Evaluation of Flubendiamide 480 SC against stem borer and leaf folder of rice and effect on their natural enemies. *Pestol.*, **31** (1): 32 – 34.

[16] Singh, J.K.S. Suri and P.S. Sarao (2005). Efficacy of granular insecticides against rice stem borer on basmati rice in Punjab. *Indian J. Ento*.,**67**. 234 – 237.

[17] Sontakke, B.K. and Dash. A.N. (2000). Field Efficacy of some new granular insecticides against major pest of rice. *Indian. J. Ento*., **62**: 353 – 357.