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Efficacy of eco-friendly insecticides against yellow stem borer under *kharif* rice-crop-ecosystem of Manipur valley

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Abstract
The Efficacy of botanicals was evaluated during *Kharif*, 2015 at the Entomological Research Farm of College of Agriculture, Central Agricultural University, Imphal against Yellow Stem Borer (*Scirpophaga incertulas* Walker) under *kharif* Rice-Crop-Ecosystem of Manipur valley. Among the various eco-friendly insecticides field evaluated against the Lepidoterous pest, (Acephate 50% + Imidacloprid 1.8) 51.8 SP@750 g a.i. ha^{-1} (2.11% DH) was found most effective against the yellow stem borer with a record of lowest Dead Heart damage.The maximum dead heart percent was recorded in plots treated with EMFPE @ 2500 ml/ha(3.92% DH).The pooled mean data further indicated that (Acephate 50% +Imidacloprid 1.8) 51.8 SP@750 g a.i. ha^{-1} proved to be the most effective insecticidal treatments in reducing white ear head (WEH) incidence with a record of 1.61% WEH as against 2.23% in untreated control.

Keywords: *Scirpophaga incertulas* Walker, Acephate, Imidacloprid, white ear head

1. Introduction
Rice (*Oryza sativa*), the grain of life and staple food is one of the most important crops in the world, providing food for nearly half of the global population (Khuhro, 1988; FAO, 2004) [8, 2]. Globally rice is cultivated over an area of about 163.19 million hectare with an annual production of about 719.3 million tonnes. In India rice is cultivated over an area of 42.5 million hectare with a productivity of 3507 kg/ha (FAO, 2015) [3]. The crop is also the most important staple food for about 65% of Indian population. In Manipur, Rice is cultivated over an area of 0.18 mha and is grown mainly during *kharif* season with a productivity of 2413.52 kg/ha. The rice plant is subject to attack by more than 100 species of insects, 20 species of them can cause economic damage (Arora and Dhaliwal, 1996) [4]. Stem borers are the most damaging pest species in Asia until the 1960s (Pathak, 1968; Kiritani, 1979) [12, 9], and are still causing substantial yield loss (Litsinger *et al*., 2005) [10]. The yield loss may range from 1-20% and may even reach 30-100 % during outbreak condition. The cropis damaged from seedling stage till harvest and cause complete loss of affected tillers (Salim & Masih, 1987) [13]. Farmers depend upon a great deal of insecticide applications, even though a lot of insecticide applications are not effectual (Sarwar *et al*. 2005). Islam *et al*. (2013) [6] conducted the effect of three commonly available botanical extracts and two insecticides with different concentrations in the field against yellow stem borer, *Scirpophaga incertulas*. The treatments include three botanical extracts viz., Tobacco extracts, Neem extracts, and Karonja extracts at 15ml/l concentration and two insecticides named Acephate 75 SP at 2g/l and Fipronil (Nema 50 SC) at 2 ml/l. The botanicals and chemicals caused a significant difference in their effect against the rice pest, *S. incertulas*. Maximum number of dead hearts and white heads were recorded in control plot. A highly significant result was observed in Fipronil treatment after 21 days of spraying which showed the reduction of 51.89% dead heart and 65.05% white head over control. Neem extracts reduced dead heart and white head by 38.38% and 58.08% respectively. Jeer *et al* (2015) conducted a field experiment during *kharif* and *rabi* seasons of 2014-15 to test the efficacy of premix combination, Acephate 50%+ imidacloprid 1.8% SP at four different doses against insect pests of rice along with Acephate 75% WP (750 g.a.i/ha), imidacloprid 17.8% SL (25 g.a.i/ha) and Chlorpyrifos 50% + cypermethrin 5% EC (375+38 g.a.i/ha) at Baronda research farm, ICAR-National Institute of Biotic Stress Management Raipur. Acephate 50% + imidacloprid 1.8% SP @ 621.6 g.a.i/ha was proved to be significantly superior over all other treatments with lowest dead hearts, white ear during both

seasons of 2014-15. The advantages of employing eco-friendly pesticides are environmentally safe and also replace the use of synthetic pesticides which results in detrimental effects to the environment and Bio agents. These considerations find essentiality of evaluating the newer pest control chemicals and their safer formulations that are being synthesized and made available from time to time. Since 2000, availability of newer molecular insecticides with novel modes of action, higher toxicity to target pests at very low doses and less toxicity to non-target organisms, low persistence in nature has further strengthen the role of such insecticides in rice IPM. Therefore, considering the above facts, the present research work entitled "Efficacy of Eco-friendly insecticides against Yellow Stem Borer under kharif Rice-Crop-Ecosystem of Manipur valley" has been proposed with the following aspect: Determination of the effect of nursery and post planting application with certain new Eco-friendly insecticides on the incidence of rice yellow stem borer.

Materials and Methods

The relevant Methods and procedures followed for the study are briefly described in this chapter. Valid and reliable data were collected to achieve a meaningful result and conclusion. The field experiment was carried-out in the Rice Research Farm of the College of Agriculture, Central Agricultural University, Iroisemba, Manipur. The study was conducted at Entomological 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.

Raising of seedlings

The seedlings were raised in the properly prepared nursery beds for all the experiments Before sowing, the seeds were soaked for two days and kept in shade after treating with Anokhi (Carbendazim 12% + Mancozeb 63%) 75 WP @ 2 g per kg of seeds in order to make the seeds disinfected from fungal diseases and were allowed to sprout by keeping in gunny bag for 24 hours. The sprouted seeds were sown on the prepared seed beds and the seedlings were uprooted when they attained 4-5 leaf stage (30 days old).

Application of Farm Yard Manure and fertilizers

One month prior to transplanting, the well decomposed Farm Yard Manure @ 10 tonnes per hectare was thoroughly incorporated into the soil. The N, P_2O_5 and K_2O were applied in the form of Urea, Single Super Phosphate and Muriate of Potash @ 60:40:30 kg per hectare, respectively. Half of the recommended quantity of Urea, and full dose of Single Super Phosphate and Muriate of Potash were applied uniformly them to all the plots as basal dose at the time of final puddling and incorporated properly with the soil. The remaining half dose of Urea was applied as top-dressing in two equal splits at 30 days (active tillering) and 65 days (panicle initiation stage) after transplanting. The thirty days old seedlings were transplanted with the inter and intra-row spacing of 15 x 10 cm at the rate of three seedlings per hill.

Observation

Observation on Yellow stem borer infestation was recorded after 30, 50, 70 and 90 DAT (Days after transplanting) and at harvest from 10 randomly selected hills per plot. The percentage dead hearts and white heads were computed by using Abbotts (1925) formulae:

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

Design of the field experiment

The field experiment was laid-out in Randomized Block Design (RBD) replicating thrice with a plot size of 5 x 4 m^2 and spacing of 10 cm x 15 cm. The high yielding susceptible variety 'Leimaphou (KD-2-6-3)' was used for the experiment. There was an untreated control in each replication.

Result and discussion

Among the insecticidal treatments evaluated against *S. incertulas* with lancergold (Acephate 50% +Imidacloprid 1.8) 51.8 SP @750 g/ha was found to be most effective with minimum DH incidence of 2.11 percent and 1.61 percent WEH as against 3.95 percent dead heart and 2.19 WEH in untreated control plots which was at par with the treatment with Achook @ 1500 ml/ha recording the lower DH incidence of 2.13 percent. The second most effective treatments were Baba (*Beauveria bassiana* formulation) @ 500 ml/ha (2.73 % DH) and Lastraw @ 1000 ml/ha (2.86% DH) which differed significantly from that of lancergold. Taking into consideration the computed mean data of two sprays of EMFPE @2500 ml/ha and pestoneem @ 1500 mll/ha showed least effective in reducing the stem borer infestation with 3.92 percent DH and 1.84 percent WEH and 3.29 percent DH and 2.05 percent WEH respectively. However all the insecticidal treatments recorded significantly lower DH and WEH incidence than untreated control. The present results generated here on the efficacy of lancergold (Acephate 50% +Imidacloprid 1.8) 51.8 SP is in conformity with the findings of Singh *et al* (2008) [14] and Pandey *et al* (2012) [11] who reported that field applications of this insecticide could check the incidence of *S. incertulas*, while the moderate effectiveness of pestoneem @1500 ml/ha against stem borer obtained here is supported by the results of Chanu and Ray (2015) [5] who reported that application of Pestoneem at the dose of 0.15g a.i/ha. & 0.3g a.i /ha proved no White Ear Heads infestation at 21DAT.

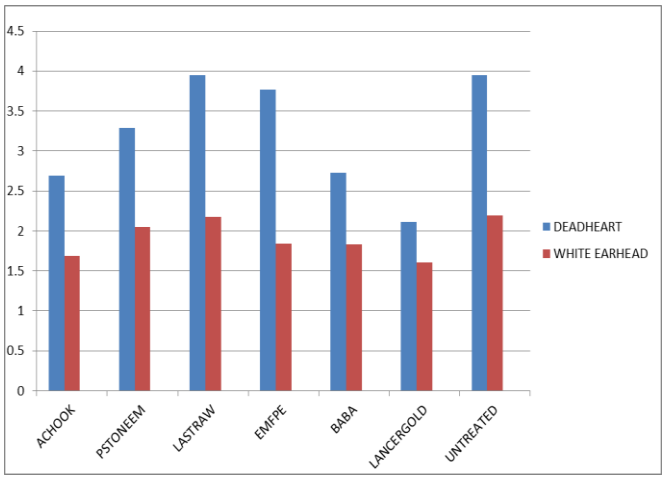

Fig 1: Mean incidence of yellow stem borer in different insecticides treated plots.

Table 1: Effect of different insecticidal treatments on the incidence of *S. incertulas* rice var. 'Leimaphou (KD-2-6-3)' during *Kharif*, 2015

Treatments	Dose ml Or g/ha	Infestation of *S.incertulas*						
		[1] Average DH (%)			[1] Average WEH (%)			
		30 DAT	50 DAT	Mean	70 DAT	90 DAT	Harvest	Mean
Achook	1500 ml	2.86 (1.83)	1.41 (1.38)	2.13 (1.62)	1.72 (1.48)	1.74 (1.49)	1.63 (1.45)	1.69 (1.50)
Pestoneem	1500 ml	3.50 (2.00)	3.09 (1.89)	3.29 (1.94)	2.08 (1.60)	2.06 (1.60)	2.02 (1.58)	2.05 (1.60)
Lastraw	1000 ml	2.95 (1.85)	2.77 (1.80)	2.86 (1.83)	2.23 (1.65)	2.05 (1.59)	2.25 (1.65)	2.18 (1.64)
EMFPE	2500 ml	4.47 (2.23)	3.07 (1.88)	3.92 (2.10)	1.87 (1.53)	1.86 (1.53)	1.79 (1.51)	1.84 (1.44)
Baba (*Beaveria bassiana)* 10 EC	500 ml	2.83 (1.82)	2.63 (1.76)	2.73 (1.79)	1.86 (1.53)	1.87 (1.54)	1.75 (1.5)	1.83 (1.45)
Lancergold (Acephate 50% + Imidacloprid1.8%) 51.8 SP	750 g	2.1 (1.61)	2.13 (1.62)	2.11 (1.61)	1.67 (1.47)	1.48 (1.40)	1.67 (1.47)	1.61 (1.45)
Water	500 ml	4.52 (2.24)	3.38 (1.96)	3.95 (2.11)	2.25 (1.65)	2.20 (1.64)	2.15 (1.62)	2.23 (1.65)
CD(P=0.05)		0.16	0.7	0.10	0.05	0.23	0.06	0.02

Figures in parentheses are $\sqrt{X + 0.5}$ transformed values
[1] Average of three replications
DH=Dead Heart
WEH=White Ear head

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