Bio-efficacy of newer insecticides on major insect pests of rice (*Oryza sativa L.*)

ABSTRUCT-Present study was carried out at the Farm of Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during 2022-23. In order to study the bio-efficacy of insecticides; field experiment was laid with six treatments *viz*., chlorantraniliprole 0.53%G @ 29.81 g a.i/ha,chlorantraniliprole 0.53%G@39.75g a.i/ha, chlorantraniliprole 0.53%G@49.69 g a.i/ha, chlorantraniliprole 0.4G@ 40 g a.i/ha and fipronil 0.3G @75 g a.i/ha including the untreated control. In case of stem borer and leaf folder chlorantraniliprole 0.53%GR @39.75g a.i/haprovided significantly better control followed by chlorantraniliprole 0.53% GR @ 49.69g a.i/ha, Fipronil 0.30% GR@ 75g a.i/hachlorantraniliprole 0.53%G @ 29.81 g a.i/ha and Chlorantraniliprole 0.40% GR@ 49.69g a.i/ha. It was concluded that the Bio-efficacy of insecticidal treatments against major pests of paddy showed that chlorantraniliprole 0.53%G 39.5g a.i/ha was first best insecticidal treatment against both Lepidopteran insect pests of paddy.

KEYWORD- Chlorantraniliprole, sucking pests, Fipronil, etc

INTRODUCTION

Rice (*Oryza sativa L.)* is a monocotyledonous crop, which belongs to the family Poaceae and genus Oryza.Among different insect pests, yellow stem borer(YSB), *Scirpophagaincertulas*(Walker) is the most destructive and widely distributed monophagous pest in the Indian subcontinent (Forssell 2008). It has assumed the number one pest status. These insect pests infest all plant parts and in all growth of paddy and few also transmit viral diseases (Pathak and KHAN 1994). The rice leaf folder *Cnaphalocrocismedinalis (Guenee),* was previously considered a minor pest but in the last two decades, it has gained major pest status. The use of high quantities of nitrogenous fertilizers and the use of insecticides without proper dosage lead some minor pets to develop major pest status. The larvae fold the leaves and scrape the green tissues of the leaves and cause scorching and leaf drying. The yield loss caused by leaf folder was reported to the extent of 5 to 25% (Kulgagod*et. al*,.2011). These two pests are major pests among lepidopterans infesting rice. The yellow stem borer *S. incertulas* (Walker) has assumed the number one pest status and attacks the crop at all growth stages. Yellow stem borer is distributed all over India and is regarded as the most dominating and destructive pest causing about 25-70% reduction in the yield and it causes 27.34% losses annually (Pasulu*et al.* 2002) Despite various chemical control measures, varietal resistance in rice has provided a highly practical approach to controlling insect problems. Attempts to control these pests with indiscriminate use of chemical methods have given rise to many problems viz. resurgence, insecticidal resistance and destruction of natural enemies [9,10]. The use of chemicals to control this pest is beyond the capacity of marginal farmers. In turn, many insecticidal combinations were used to manage pest problems. Judicious use of insecticides and alternation of chemicals with different modes of action is suggested to reduce insecticide resistance (Mehrotra,1992). So, the newer insecticides with diversified modes of action against these pests will significantly play a vital role in insect resistance management.

MATERIALS AND METHODS

A field trial was set up between 24° 56’ N Latitude and 82° 14’ E to 83° 24’ E Longitude in the Varanasi region using a Randomized Block Design (RBD) with three replications and nine treatments, including an untreated control, during the period from 23 SMW to 48 SMW in the Kharif season of 2022.To evaluate the bio-efficacy of certain insecticides against insect pests in rice crops and following crop production practices were followed to raise and maintain the crop as per package of practices. The soil in the research plot is sandy clay loam with a neutral pH. The experimental plot is a medium fertile land with assured irrigation and drainage facilities. In the present experiment, pests

were monitored at regular intervals and when the pest population reached ETL (Economic Threshold Level), insecticides were applied as per the scheduled dates

All the insecticides were in granular form and were mixed with sand and applied by using hand gloves. To avid intermixing of the treatment, about 20 to 30cm false bund boundaries were prepared all around the plots. All insecticides were directed towards the bottom of the plant. To study the seasonal incidence and efficacy of insecticide, pest population was recorded in different phases i.e. before and after spray. In the case of yellow stem borer, at the vegetative stage number of dead hearts were counted whereas at the reproductive stage number of white ears were counted on 5 randomly selected hill in each treatment at 5th, 10th,15th day after spray. For counting the population of the rice leaf folder total number of affected leaves to that of the total number of leaves in each hill of individual treatment was recorded. The data for the leaf folder was collected on the 5th,10th,15th day after spray.Counts were taken on the number of dead hearts/white ears and the total number of tillers/panicles from 5 randomly selected hills. The damaged leaves and total leaves from 5 randomly selected hills were observed in each plot.

Percent Incidence of stem borer = $\frac{Number\ \ of\ dead\ \ hearts\ or\ white\ ears}{total\ \ number\ \ of\ tiller\ \ or\ panicle}$ X 100

Per cent Incidence of leaf folder = $\frac{Number\ \ of\ damaged\ \ leaves}{total\ \ number\ \ of\ leaves}$X 100

RESULTS AND DISCUSSION

The field bio-efficacy of certain insecticides against major insect pests of rice during kharif 2022 was assessed. The crop received two sprays during the crop period according to ETL level of pest population. The pretreatment data was recorded one day prior to spraying and the post treatment data at 5TH, 10th, 15th day after each spray. The mean reduction in the population was calculated for analysis.

After the first spray, among all insecticidal treatments chlorantraniliprole 0.53%G @39.75 a.i/ha considerably reduced (4.56 dead hearts/5hills) the yellow stem borer population compared to the control(6.53 dead hearts/5hills). The most effective treatment was chlorantraniliprole 0.53%G @39.75g, which reported the lowest yellow stem borer population, ie.,5.1,4.6,4 dead hearts/5hills at 5, 10, 15 DAS respectively which was much better than all othertreatments followed by chlorantraniliprole 0.53%G @ 49.69 g a.i/ha i.e 5.3,5.01,4.3dead hearts/5hills at 5, 10, 15 DAS respectively was found to be significantly superior to all other treatments followed by fipronil 0.30%G 5.2,4.7,4.5 deadhearts/5hills at 5, 10, 15 DAS respectively. The least effective pesticide was chlorantraniliprole 0.40%GR @40g a.i/ha which showed mean 5.73 dead heart /5hills as compared to 6.53dead hearts/5hills in control. Similar result was obtained by Dhawan and Suri, (2011)whentheyfoundthatchlorantraniliprole@40ga.i/hatreatedplotshownleastpopulation of stem borer.

Similar observations were also found in leaf folder affected paddy. Results of impact of insecticidal treatments against *C. medinalis* after first insecticidal application were, least population was observed in chlorantraniliprole 0.53%G @39.75g a.i/ha which showed 5.77% leaf damage as compared to control 8.87% leaf damage.it was found to be most effective treatment because it showed 5.8,5.56,5.97% damage at 5,10,15 DAS respectively,followed by chlorantraniliprole 0.53%G @ 49.69 g a.i/ha which showed 6.84,6.58,6.19%leaf damage and fipronil 0.30%GR showed 7.15, 6.94, 6.33% leaf damage at 5, 10, 15 DAS respectively.least effective among all was chlorantraniliprole 0.53%G @ 29.81 g a.i/ha which showed mean leaf damage of 7.10% damage as compared to control 8.87% leaf damage. TheseresultsareinagreementwithJaglan*etal*.,(2023)whoconfirmedthesuperiorityofchlorantraniliprole 0.4%@40g over the other doses of chlorantraniliprole.They alsofound that chlorantraniliprole 0.4%GR was found below the limit of quantificationppmin riceseedgrains,soil paddystraw andhuskindicatingits safetyto humans.

In the second spray, among all insecticidal treatments chlorantraniliprole 0.53%G @ 39.75 g a.i/ha considerably reduced (3.93 dead hearts/5hills) the yellow stem borer population compared to the control(6.67 dead hearts/5hills). Effective treatment was chlorantraniliprole 0.53%G @39.75g, which reported the lowest yellow stem borer population, ie.,4.8,4,3dead hearts/5hills at 5, 10, 15 DAS respectively which was found the best among all othertreatments followed by chlorantraniliprole 0.53%G @ 49.69 g a.i/ha i.e, 5,4.5,4deadhearts/5hills at 5, 10, 15 DAS respectively wasfound to be significantly

superior to all other treatments. followed byfipronil 0.30%GR 5.2,4.7,4.2deadhearts/5hillsat 5, 10, 15 DAS respectively. Chlorantraniliprole 0.40%GR@40 g a.i/ha was found least effective among all which showed mean 5.167 dead hearts / 5hills as compared to 6.6 dead hearts /hill in control.Impact of insecticidal treatments against *C. medinalis* after second insecticidal application were, least population was observed in chlorantraniliprole 0.53%G @ 39.75g a.i/ha treated field which showed 3.70% mean leaf damage as compared to control 8.10%(mean) leaf damage.It was found to be most effective treatment because it showed 3.82,3.74,3.56% leaf damage at 5,10,15 DAS respectively,followed by chlorantraniliprole 0.53%G @ 49.69 g a.i/ha which showed 5.96,5.73,5.39%leaf damage and fipronil 0.30%GR showed 6.2,6.02,5.49% leaf damage at 5, 10, 15 DAS respectively.Least effective among all was chlorantraniliprole 0.40%G @40g a.i/ha which showed mean leaf damage of 7.5% damage as compared to control 8.1% leaf damage.

The efficacy of two sprays was compared using pooled data. The incidence of paddy yellow stem borer was reduced dramatically by all of the insecticides that were tested. It indicated that the average deadhearts before spray were in range of 5.3 to 6.5 deadhearts/plant. chlorantraniliprole 0.53%G @39.75g a.i/ha was found most significant treatment throughout the experimentation period i.e .,4.8,4,3 dead hearts/5hills at 5, 10, 15 DAS respectively after second spray. The next better treatments were chlorantraniliprole 0.53%G @ 49.69 g a.i/ha and fipronil 0.30%GR which were equally effective. Followed by chlorantraniliprole 0.53%G @ 29.81 g a.i/ha Whereas the insecticide chlorantraniliprole 0.40%G @ 39.75 g a.i/ha was comparatively least effective against paddy yellowstem borer.

Similar pattern of results were also observed in case of paddy leaf folder incidence and percentage of damage significantly reduced in chlorantraniliprole 0.53%G @39.75g a.i/ha treated plots which showed 3.70% mean leaf damage after second spray. Chlorantraniliprole 0.53%G @ 49.69 g a.i/ha and fipronil 0.30%GR which were equally effective.Butchlorantraniliprole 0.40%G @40 g a.i/ha was least effective (7.5% leaf damage) in controlling leaf folder population among all insecticides. SHurali*et. al*. (2023)alsofoundchlorantraniliprole0.40%GRtocheckeffectiveness against yellow stem borer and leaf folder but they found the mixture ofchlorantraniliprole+fipronilGR@135.37ga.i./ha.Theinfestationofbothpestswaseffectivelycheckedbyt heapplicationofchlorantraniliprole+fipronilGR@ 135.37 g a.i./ha and proved to be the most effective treatment (1.21% dead heart/hilland1.01%leaf folder/ hill).

CONCLUSION

It was concluded that the Bio-efficacy of insecticidal treatments against major pests of paddy showed that chlorantraniliprole 0.53%G 39.75g a.i/ha was first best insecticidal treatment against both Lepidopteran insect pests of paddy. It also suit well for leaf folder.Fipronil can be incorporated in integrated pest management practices as it showed persistent toxic effects and gave an effective control for all the major pests of paddy and also improved the yield. Alternatively, chlorantraniliprole 0.53%G 49.69ga.i/ha also be used both for effective management of chewing and sucking pests like stem borer and leaf folder.

Table 1 : Effect of insecticidal treatments against *S .incertulus* after 1st spray

Treatments	Dose (g a.i/ha)	Mean %WE/5hills one day before spray	Mean percent DH per 5 hills at different days after 1st insecticidal spray			
			5 DAS	10 DAS	15 DAS	Overall Mean
Chlorantraniliprole 0.53% GR	29.81	6.3* (14.54)**	5.8 (13.94)	5.6 (13.69)	5.1 (13.05)	5.5 (13.56)
Chlorantraniliprole 0.53% GR	39.75	5.3 (13.31)	5.1 (13.05)	4.6 (12.38)	4 (11.54)	4.56 (12.33)
Chlorantraniliprole 0.53% GR	49.69	5.4 (13.44)	5.3 (13.31)	5.01 (12.93)	4.3 (11.97)	4.87 (12.75)
Fipronil 0.30% GR	75	5.5 (13.56)	5.2 (13.18)	4.7 (12.52)	4.5 (12.25)	4.80 (12.66)
Chlorantraniliprole 0.40% GR	40	6.5 (14.77)	6.3 (14.54)	5.7 (13.81)	5.2 (13.18)	5.73 (13.85)
Control	-	6.8 (15.12)	6.4 (14.65)	6.5 (14.77)	6.7 (15)	6.53 (14.81)
SE (m) +/-		-	0.173	0.175	0.157	-
C.D. at 5%		-	0.553	0.554	0.500	-

*Mean of 4 replications, ** Figures in paranthesis are angular transformed values, DH = Dead heart

Table 2 : Effect of insecticidal treatments against *S .incertulus* after 2st spray

Treatments	Dose (g a.i/ha)	Mean %DH/5hills one day before spray	Mean percent DH per 5 hills at different days after 1st insecticidal spray			
			5 DAS	10 DAS	15 DAS	Overall Mean
Chlorantraniliprole 0.53% GR	29.81	5.96* (14.13)**	5.4 (13.34)	4.9 (12.79)	4.5 (12.25)	4.933 (12.83)
Chlorantraniliprole 0.53% GR	39.75	5.23 (13.22)	4.8 (12.66)	4 (11.54)	3 (9.97)	3.933 (11.44)
Chlorantraniliprole 0.53% GR	49.69	5.42 (13.46)	5 (12.92)	4.5 (12.25)	4 (11.54)	4.500 (12.25)
Fipronil 0.30% GR	75	5.87 (14.02)	5.2 (13.18)	4.7 (12.52)	4.2 (11.83)	4.700 (12.52)
Chlorantraniliprole 0.40% GR	40	6.23 (14.45)	5.8 (13.94)	5 (12.92)	4.7 (12.52)	5.167 (13.14)
Control	-	5.9 (14.06)	6.5 (14.77)	6.8 (15.12)	6.7 (15.00)	6.667 (14.96)
SE (m) +/-		-	0.148	0.156	0.159	-
C.D. at 5%		-	0.431	0.499	0.507	-

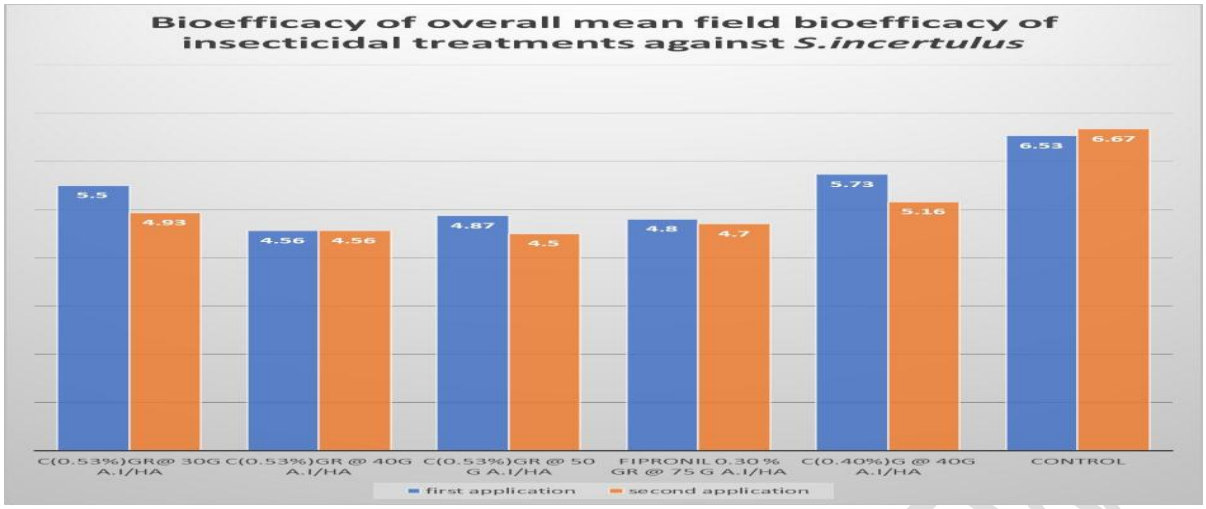

Fig 1 :Bioefficacy of overall mean field bioefficacy of insecticidal treatments on *S.incertulas*

Table 3 : Effect of insecticidal treatments against *C. medinalis* after 1st spray

Treatments	Dose (g a.i/ha)	Mean %DH/5hills one day before spray	Mean percent DH per 5 hills at different days after 1st insecticidal spray			
			5 DAS	10 DAS	15 DAS	Overall Mean
Chlorantraniliprole 0.53% GR	29.81	7.8 (16.22)	7.6 (16)	6.9 (15.23)	6.8 (15.12)	7.10 (15.45)
Chlorantraniliprole 0.53% GR	39.75	7.9 (16.32)	5.8 (13.94)	5.56 (13.64)	5.97 (14.14)	5.77 (13.90)
Chlorantraniliprole 0.53% GR	49.69	8.1 (16.54)	6.84 (15.16)	6.58 (14.84)	6.19 (14.41)	6.53 (14.81)
Fipronil 0.30% GR	75	8.6 (17.05)	7.15 (15.51)	6.94 (15.27)	6.33 (14.57)	6.80 (15.12)
Chlorantraniliprole 0.40% GR	40	9.2 (17.66)	8.07 (16.50)	7.8 (16.22)	7.37 (15.75)	7.74 (16.15)
Control	-	9.6 (18.05)	9.35 (17.80)	9.08 (17.54)	8.2 (16.64)	8.87 (17.33)
SE (m) +/-	-	-	0.266	0.273	0.189	-
C.D. at 5%	-	-	0.85	0.871	0.603	-

Table 4 : Effect of insecticidal treatments against *C .medinalis* after 2nd spray

Treatments	Dose (g a.i/ha)	Mean %leaf damage/5hills one day before spray	Mean percent DH per 5 hills at different days after 1st insecticidal spray			
			5 DAS	10 DAS	15 DAS	Overall Mean

Chlorantraniliprole 0.53% GR	29.81	6.9 (15.23)	6.68 (14.98)	6.49 (14.76)	6.10 (14.30)	6.42
Chlorantraniliprole 0.53% GR	39.75	6.1 (14.30)	3.82 (11.27)	3.74 (11.15)	3.56 (10.88)	3.70
Chlorantraniliprole 0.53% GR	49.69	6.5 (14.77)	5.96 (14.13)	5.73 (13.85)	5.39 (13.42)	5.6
Fipronil 0.30% GR	75	6.9 (15.23)	6.20 (14.42)	6.02 (14.20)	5.49 (13.55)	5.9
Chlorantraniliprole 0.40% GR	40	8.1 (16.54)	7.87 (16.29)	7.64 (16.05)	7.19 (15.55)	7.5
Control	-	8.6 (17.05)	8.58 (17.03)	8.34 (16.79)	7.60 (16.00)	8.1
SE (m) +/-	-	-	0.208	0.202	0.187	-
C.D. at 5%	-	-	0.664	0.644	0.597	-

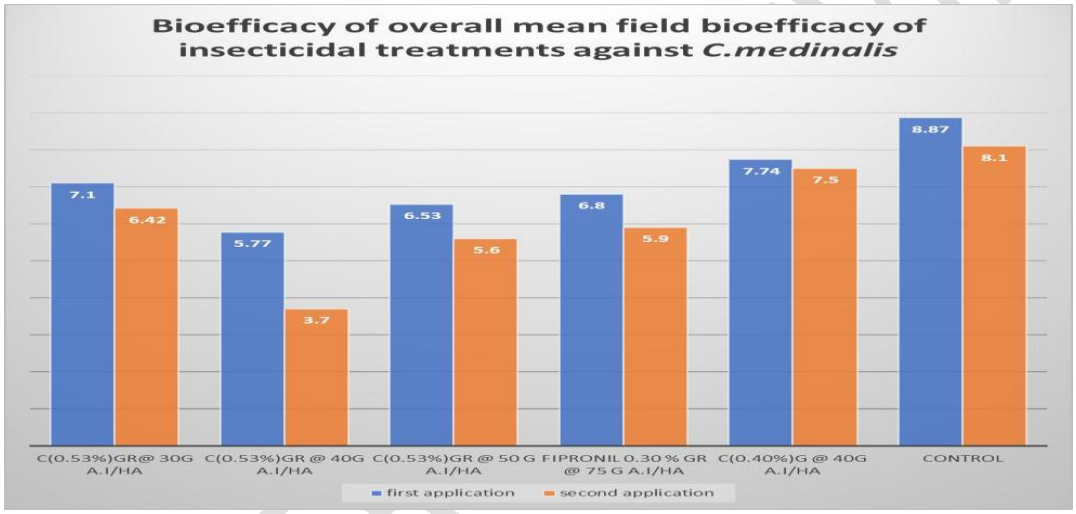

Fig2: bioefficacy of different insecticidal treatments on *C. Medinalis*

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