EFFICACY OF DIFFERENT INSECTICIDES AGAINST MAIZE STEM BORER *CHILO PARTELLUS* (SWINHOE) AND MAIZE APHID *RHOPALOSIPHUM MAIDIS* (FITCH) INFESTING MAIZE

Zewar Hussain Bhat and Zahoor Ahmad Baba
Department of Entomology, University of Agriculture, Srinagar, Kashmir

ABSTRACT

Studies on efficacy of different insecticides against maize stem borer *Chilo partellus* (Swinhoe) and maize aphid *Rhopalosiphum maidis* (Fitch) infesting maize revealed that whorl application with granular formulations of chlorpyrifos 10 G @0.75 k.g a.i/ha and carbofuran 3G @ 0.3 kg a.i/ha was effective against *C. partellus* as the young larvae before gaining entry into the stem feed on the leaf whorl and get exposed to the insecticide placed in leaf whorls leading to their increased mortality, whereas the foliar applications with imidacloprid and cypermethrin were effective against maize aphid *Rhopalosiphum maidis* (Fitch). These two treatments recorded significantly highest yield than rest of all the treatment applications and resulted in maximum net returns. Hence these two treatments can be suggested best for effective management of these pests infesting maize.

INTRODUCTION

Maize (*Zea mays* L.) is the third most important cereal crop after wheat and rice in the world. The area planted under maize crop in the state (Govt. Jammu Kashmir, Srinagar) is nearly 3.32 lakh hectares (Anonymous, 2005) and of this area 1.10 lakh hectares fall in Kashmir Division and 2.22 lakh hectares in Jammu Division. Analysis of statistics pertaining to production and productivity of maize suggests that despite occupying the highest acreage in the state, Kashmir region produced only 12.44 lakh quintals on an average as against 42.46 lakh quintals by Jammu region. Thus productivity in Kashmir region is only about 11.31 Q ha^{-1} in comparison to more than19.13 Q ha^{-1} in Jammu region (Anonymous, 2005). The insect pests are one of the constraints for this low productivity. The maize stem borer *Chilo partellus* (Swinhoe) is one of the most destructive pests causing an average yield loss ranging between 24-75 percent. The other economically important pest is corn leaf aphid *Rhopalosiphum maidis* (Fitch) causing considerable yield loss (Siddiqui and Marwaha, 1993). Keeping in view, the status of these pests and the damage inflicted by them, an attempt was made to study the efficacy of different insecticides against these major pests infesting maize.

MATERIALS AND METHODS

The present study was carried out at experimental field of Faculty of Agriculture, wadura, Sopore, SKUAST-K during kharif 2006 and 2007. The experiment was laid in a Randomized Block Design (RBD) with C_{15} variety, replicated thrice with eight treatments including control. The crop was sown in last week of Aril, which is the normal sowing date being practiced at farmers fields with a plot size of 6 m^2 (2x3 m), spacing of 0.6x0.3 m between row to row and plant to plant. All the agronomic practices were followed as per the recommendations of SKUAST-K. The test insecticides viz, imidacloprid 17.8 SL @ 0.0045%, chlorpyrifos 20 EC @ 0.04%, endosulfan 35 EC @ 0.07% and cypermethrin 10 EC @ 0.01%were applied as foliar sprays. Where as chlorpyrifos 10G @ 0.75 kg a.i./ha, carbofuran 3G @ 0.3 kg a.i./ha and fipronil 0.3 G @ 0.06 kg. a.i./ha were applied as whorl applications. The treatments were given at 30 and 45 days after germination of the crop, when moderate level of infestation of stem borer (5-8 larvae per plant) and aphids (25-30 aphids per plant) were observed in the field. While spraying, the nozzle was focused to the apical parts of the plant, so that the spray fluid @ 500 litter/ ha could pass into the central whorl, the granular formulations were applied using a plastic spoon.

Pretreatment count was taken one day before application, while post treatment counts were taken at second, fourth and eight days after application. The total number of insects per five plants was recorded by destructive sampling of five randomly selected plants at five different locations in each plot. The selected plants were uprooted and all

leaves were removed to count the total number of aphids per plant (Borle *et al*., 1976). Then the stems were split open to count the number of larvae or pupae per five plants. The total number of dead hearts per five plants and total number of damaged leaves with shot holes per plant were also recorded at second, fourth and eighth days after treatment application. The cumulative data were taken for statistical analysis. The percentage of dead hearts and leaf injury were calculated as devised by (Srinivas and Panwar, 2003).

The data on the percent population reduction, percent damaged leaves, and dead hearts by stem borers at each observation date were transformed into angular values and subjected to Analysis of Variance (ANOVA). The yield data were recorded replication wise and subjected to statistical analysis to test the significance of mean yield in different treatments (Gomez and Gomez, 1994).

RESULTS AND DISCUSSION

The mean efficacy of the three post treatment observations revealed that carbofuran 3G @ 0.3 kg a.i./ha and chlorpyrifos 10G @0.75 kg a.i./ha were most effective treatments against *C. partellus* with mean efficacy of 73.50 and 72.60%, respectively. The results subscribe to the findings of Dharmasena (1993), who also reported superior efficacy of carbofuran 3G @ 0.3 kg a.i./ha against *C. partellus* on maize. The results obtained also subscribe to the findings of Rao and Sharma (1986), who reported 6.7% leaf injury with carbofuran 3G @ 0.64 kg a.i./ha. The results obtained on superior efficacy of chlorpyrifos 10G @0.75 kg a.i./ha in the present study are also in conformity with Rajendran (1999), who reported 50.9% reduction of shoot borer incidence in sugarcane with chlorpyrifos 10G @ 1.50 kg a.i./ha. The treatment with imidacloprid 17.8 SL @ 0.0045% was the next effective treatment against *C. partellus* followed by endosulfan 35 EC @ 0.07% with mean efficacy of 65.40 and 59.10%, respectively. The efficacy of imidacloprid has previously been reported by Mishra and Singh (1994), Zewar *et al*. (2003) and Akbar *et al*. (1999) against various insect pests infesting maize.

Comparatively it was observed in this study that whorl applications of granular insecticides carbofuran 3G @0.3 kg a.i./ha and chlorpyrifos 10G @ 0.75 kg a.i./ha showed superior efficacy than foliar application. This may be attributed to the fact that young larvae before gaining entry into the stem feed in leaf whorl and before gaining entry into the stem get exposed to these insecticides. This results in their increased mortality (Table 1).

The results presented in Table 2 revealed that imidacloprid 17.8 SL @ 0.0045% and cypermethrin 10 EC @ 0.01% were the most effective treatments against *R. maidis* with mean efficacy of 76.30 and 71.90%, respectively. The results on superior efficacy of imidacloprid 17.8 SL @ 0.0045% are in close approximation with Mishra and Singh (1994), who reported effective management of white grub infesting soybean with imidacloprid like wise Sunitha (2003) reported the efficacy of imidacloprid against *Aphis gossypi* on Okra. The efficacy of cypermethrin 10 EC @ 0.01% was reported on different crops elsewhere (Mundiwale *et al.,* 1989; Khurana and Yadav, 1995).

The next effective treatments were carbofuran 3G @ 0.3 kg a.i. /ha, chlorpyrifos 10G @ 0.75 kg a.i./ha and fipronil 0.3 G @ 0.06 kg a.i./ ha. Chlorpyrifos 20 E @ 0.04% was the least effective treatment. The efficacy of chlorpyrifos 10G @0.75 kg a.i./ha and fipronil 0.3 G @0.06 kg a.i./ ha has previously been reported against various insect pests infesting different crops (Jadhav *et al*., 2004).

Conclusively among all treatment applications, imidacloprid 17.8 SL @ 0.0045% and cypermethrin 10 EC @ 0.01% were the most effective treatments against *R. maidis* than whorl applications of granular formulations viz., chlorpyrifos 10G @ 0.75 kg a.i./ha, fipronil 0.3 G @ 0.06 kg a.i./ ha and carbofuran 3G @ 0.3 kg a.i./ha.

The results presented in the Table 2 revealed that all the insecticidal treatments proved significantly superior over untreated control in recording the higher yields. The treatments of imidacloprid 17.8 SL @ 0.0045% and cypermethrin 10 EC @ 0.01% recorded the highest yield of 40.00 and 37.16 quintals / hectare, respectively, when compared to all other treatment applications. Next to these treatments highest yield was recorded in carbofuran 3 G, chlorpyrifos 20 EC and fipronil 0.3 G respectively, which recorded a yield of 34.33, 34.00, 32.66 and 30.33 quintals per hectare, respectively. Among treatment applications lowest yield of 23.83

quintals per hectare was recorded in chlorpyrifos 20 EC @ 0.04 % foliar spray.

Though the granular formulations viz., carbofuran 3 G and chlorpyrifos 10 G were found superior in their efficacy against *C. partellus*, but they were less effective against *R. maidis*. The lowest cost benefit ratio for the granular formulations may be attributed to their highest cost in spite of their better efficacy against *C. partellus*. Hence it was concluded from the study that imidacloprid 17.8 SL @ 0.0045% and cypermethrin 10 EC @ 0.01% can be used for the effective management of *C. partellus and R. maidis* due to their best efficacy and higher returns.

Table 1.Efficacy of different insecticides against *Chilo partellus* (Swinhoe) infesting maize

Treatments and dose	Mean no of larvae per plant one day before treatment	Percent reduction over untreated control			
		2 DAT efficacy	4 DAT	8DAT	Mean
Imidacloprid 17.8 SL 0.0045%	8.0	59.20 (50.30)^{c}	73.50 (59.0)^{c}	63.50 (52.80)^{c}	65.40 (54.00)^{d}
Chlorpyrifos 20 EC 0.04%	8.5	51.50 (45.90)^{b}	59.50 (50.50)^{b}	45.50 (42.40)^{b}	52.20 (46.30)^{bc}
Chlorpyrifos 10G 0.75 kg a.i./ha	7.5	70.00 (56.80)^{d}	77.50 (61.70)^{c}	70.30 (57.00)^{d}	72.60 (58.40)^{e}
Carbofuran 3G 0.3 kg a.i./ha	6.5	66.60 (54.70)^{d}	81.50 (64.50)^{d}	72.50 (58.40)^{d}	73.50 (59.00)^{e}
Fipronil 0.3 G 0.06 kg a.i/ha	7.5	46.50 (43.00)^{ab}	55.20 (48.00)^{a}	45.50 (42.40)^{b}	49.10 (44.50)^{ab}
Cypermethrin 10EC 0.01%	7.00	54.50 (47.60)^{c}	63.20 (52.70)^{b}	59.60 (50.50)^{c}	59.10 (50.20)^{cd}
Endosulfan 35 EC @ 0.07%	8.00	40.00 (39.20)^{a}	52.50 (46.40)^{a}	34.50 (36.00)^{a}	42.30 (40.60)^{a}
Untreated control	7.50	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
C.D (P=0.05)	**N.S**	**4.30**	**4.00**	**4.40**	**4.20**

Values in parentheses are angular transformed values; DAT= Days after treatment.
In each column values superscripted by same letter do not differ significantly

Table-2.Efficacy of different insecticides against *R. maidis* (Fitch) infesting maize

Treatments and dose	Mean no of aphids per plant one day before treatment	Percent reduction over untreated control						
		2 DAT efficacy	4 DAT	8DAT	Mean	Mean Yield Kg's/plot	Yield Quintals ha^{-1}	CBR ratio
Imidacloprid 17.8 SL 0.0045%	23.00	68.60 (55.90)^{c}	83.20 (65.80)^{e}	77.00 (61.30)^{c}	76.30 (60.90)^{d}	2.40^{d}	40.00	1:3
Chlorpyrifos 20 EC 0.04%	22.00	59.40 (50.40)^{b}	67.00 (54.90)^{bc}	61.00 (51.40)^{b}	62.50 (52.20)^{b}	1.96^{c}	32.66	1:1.45
Chlorpyrifos 10G 0.75 kg a.i./ha	23.00	60.00 (50.80)^{b}	70.00 (56.80)^{c}	65.00 (53.70)^{b}	65.00 (53.70)^{b}	2.04^{c}	34.00	1:1.40
Endosulfan 35 EC @ 0.07%	23.00	38.20 (38.20)^{a}	50.00 (45.00)^{a}	48.30 (44.00)^{a}	45.50 (42.40)^{a}	1.43^{b}	23.83	1:1.15
Fipronil 0.3 G 0.06 kg a.i/ha	22.50	53.00 (46.70)^{b}	63.00 (52.50)^{b}	58.00 (49.60)^{b}	58.00 (49.60)^{b}	1.82^{c}	30.33	1:1.50
Carbofuran 3G @0.3 kg a.i/ha	23.00	55.70 (48.30)^{b}	74.00 (59.30)^{d}	65.90 (54.30)^{b}	65.20 (53.80)^{bc}	2.06^{c}	34.33	1:1.50
Cypermethrin 10EC 0.01%	22.00	59.40 (50.40)^{b}	77.10 (61.40)^{d}	79.10 (62.80)^{c}	71.90 (58.00)^{cd}	2.23^{d}	37.16	1:2.75
Untreated control	23.50	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.00^{a}	16.66	---
C.D (P=0.05)	**N.S**	**4.60**	**4.15**	**4.75**	**4.35**	**0.24**	--	

Values in parentheses are angular transformed values; DAT= Days after treatment.
In each column values superscripted by same letter do not differ significantly.

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