Effect of insecticides against *Chilo partellus* (Swinhoe) damaging *Zea mays* (maize)

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Abstract- The maize stem borer *Chilo partellus* (swinhoe) is one of the most destructive pests of maize. This species is most important at altitudes below 1500 meters above sea level .It's magnitude of damage ranges from 26.7 to 80.4. In young plants the shoot can be killed, causing a "dead heart". In older plants the upper part of the stem usually dies as a result of the boring of the caterpillars. Several contact and systematic insecticides are being used for its managemen. Therefore, it necessitated evaluating the relative persistence of insecticides and neem based formulations commonly used against this borer pest for devising its economically effective management programme.
Keywords: cypermethrin, endosulphan, stemborer, achook

Introduction

In India, maize is emerging as third most important crop after rice and wheat. Maize has its significance as a source of a large number of industrial products besides its uses as human food and animal feed. To meet the growing demand, per hectare yield of maize is estimated to rise to 2.36 tonnes as against 1.7 tonnes currently by the end of 2020. In order to increase the production and productivity of maize, the new approach for area expansion for maize are to be adopted in view of serious competition from food and cereal crops9. It can only be done through transfer of improved technology through demonstration on improved crop production technology and Integrated Pest Management13 training programs, seeds production programs, insecticides, pesticides12, weedicides and other inputs, etc besides introduction of high yielding hybrids. Maize requires fine field preparation for the raising good crop. The field should be free from previous crop stubble in order to avoid carrying of previous crop pathogens and pests8. Diseases of maize are strongly influenced by weather conditions and are very difficult to predict. They are best controlled by the use of resistant 10,15 or tolerant hybrids and varieties and a balanced fertility program. Most of the disease causing agents / pathogens has the capacity to overcome the winter. Chemical control should only be aimed at small caterpillars (up to 5 mm). Thrips may damage crops that are stressed and not growing well. They are very small, brown/black insects measuring 1-2 mm in size.

Material and method

Seven Five insecticides and two neem based formulations namely cypermethrin 25 EC @ 0.005%, delta methrin 2.8 EC @0.002%, endosulfan 35 EC @ 0.035%, green mark @ 0.4%, achook @ 0.4%, triazophos 40 EC @ 0.04% and carbofuran 3G11. @ 7.5 kg/ha and leaf whole were evaluated under both and field condition for their relative persistency against maize stemborer4. Pure culture of *C. partellus* was used for experimental purpose.

Under Laboratory Condition

Maize variety "NAVIN" was sown in plastic pots for each treatment. The experiment was conducted in randomized block designed by replicating each treatment thrice. The plants were sprayed after 15 days of germination and after 24 hours of spraying, the whorl were cut from each treatment and placed in plastic vials. 10 freshly hatched larvae (Caterpillars) of *C. partellus* were then released in each vials containing plant role with the help of "O" size camel hairbrush. The mortality counts were taken after 24 hours of their release. Exactly the same procedure was followed 3, 5, 7,9,11,13,15,17 and 19 days after application of insecticides, and neem based formulation i.e. until the larval survival reaches equal to that of untreated control. Percent mortality of *C. partellus* larve obtained both in the treated and untreated samples was corrected following to ABBOTS formula (1925) based on the period for which toxicity persisted (P) and the average residual toxicity (T), the "PT" values were computed. The mortality data were subjected to probit analysis for determining LT50 values.

Field Condition

For each treatment sowing was done in 3 rows/plot of 2 meter row length, in field. After 15 days of germination all plants were sprayed with different insecticides and neem based formulation. Rest of the procedure followed was the same as described under laboratory condition.

Result and Discussion

Persistent toxicity data based on PT and LT50 values under laboratory (Table 1) and field condition (Table 2) indicates that maximum PT values was obtained in case of carbofuron (1163.06) followed by methrin (699.50) while minimum was achok (136.77) under laboratory conditions. On the basis of relative persistence toxicity (RPT), it can be concluded the carbofuron is most persistant (8.50), while achook was the least amongst all the insecticides. Likewise under field condition, the maximum PT value was obtained in the case of carbofuron (831.41) followed by andosulphan (382.93), while minimum in green mark (13.78). The RPT was much higher in case of insecticides compared to neem based formulation. Maximum RPT was obtained in case of carbofuron (60.33) while minimum in case of green mark and achook, which clearly indicate that persistence of neem based formulation, was very low under field conditions.

Percent Reduction in mortality

Based on the larval mortality data in subsequent days (Table 3) was found that maximum reduction in mortality during the subsequent days after the treatment was obtained in case of achook and green mark under laboratory conditions. On the other hand least reduction in mortality was recorded in case of carbofuron the toxicity in case of carbofuron was persisted upto 17 days, followed by endosulfan, cypermenthrin and deltamethrin (11 days each), while minimum persistence was recorded in case of green mark and achook under field condition the toxicity in case of carbofuron persisted for 15 days followed by endosulfan (9 days) whereas, minimum persistence in case of achook and green mark.

Persistent toxicity based on LT 50 values

Under laboratory condition the order of relative efficacy (ORE) of different insecticides and neem based formulations (LT 50 values in parenthesis) was carbofuran (271.25), cypermenthrin (176.49), endosulfan (131.60), deltamethrin (128.90), greenmark (48.59), triazophos (38.48) and achook (36.89). Therelative residual toxicity (RRT) was maximum in case of carbofuran (7.35). Under field condition, however, there was no difference in percent mortality between neem based formulations and untreated check on the second day of observation (72 hours after application), therefore LT 50 value could not be calculated for achook and green mark. Among the insecticides, the ORE was carbofuran (194.30), endosulfan (83.21) deltamethrin (74.92), cypermethrin(66.87) and triazophos (18.61). The RRT under field was maximum (10.44) in case of carbofuron. The finding of present investigation is in accordance with that of Rao and Sharma (1987)[3], who reported that amongst various formulation of synthetic pyrethroids decamethrin 0.00025 kg a.i/ha showed the highest PT valued and the period of toxicity observed was 6 days against maize stemborer, *C. partellus*.

Conclusion

It can be concluded that synthetic insecticides in comparison to neem based formulation; carbofuran was the best amongst all tested pesticides with highest PT value, minimum % reduction in mortality in subsequent days and maximum LT value.

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Table 1- Persistence of toxicity of insecticide and Neem Based Formulation To Chilo Partellus(swineHoe) Under Field Condition

Chemical	**Dose**	**Period "P"**	**Average Resuidal toxicity**	**PT**	**ORE**	**RPT**	**Regression Equation(Y)**	**LT-50**	**Fidicual Limits**	**Relative Residual toxicity (RRT)**
Cyphermerin 25 EC	0.005	7	41.14	287.99	3	20.89	4.839-3.195x	66.87	52.09/82.94±	3.59
Deltamethrin 2.8EC	0.002	7	36	252	4	18.28	5.057-2.792x	74.92	65.8/61.80±	4.03
Endosulfan 35EC	0.035	9	42.54	382.93	2	27.78	5.005-10486x	83.21	53.81/129.52±	4.47
Greenmark	0.4	1	13.78	13.78	7	1				
Achook	0.4	1	20.68	20.68	6	1.5	4.354-1.563x	18.61		1
Triazophos	0.04	5	24.05	120.26	5	8.73			1.63/32.08±	
40EC										
Carbofuran 3G	7.5Kg/ha in Whorl	15	55.42	831.41	1	60.33	5.053-2.719x	194.3	153.84/262.02±	10.44

Table 2- Persistence of toxicity of insecticide and Neem Based Formulation To Chilo Partellus(swineHoe), Under Laboratory Condition

Chemical	**Dose**	**Period "P"**	**Average Resuidal toxicity**	**PT**	**ORE**	**RPT**	**Regression Equation(Y)**	**LT-50**	**Fidicual Limits**	**Relative residual toxicity (RRT)**
Cyphermerin 25 EC	0.005	11	63.59	699.5	2	5.1	5.247-3.432X	176.5	187.89/693.24±	4.78
Deltamethrin 2.8EC	0.002	11	51.34	564.34	4	4.1	5.175-1.965X	128.9	65.8/61.80±	3.5
Endosulfan 35EC	0.035	11	51.8	569.83	3	4.2	5.133-2.233X	131.6	53.81/129.52±	3.57
Greenmark	0.4	5	42.35	211.75	6	1.6	4.997-2.446X	48.59	34.47/68.42±	1.31
Achook	0.4	3	45.59	136.47	7	1	5.050-3.282X	36.89	27.29/51.38±	1
Triazophos 40 EC	0.04	7	33.01	231.05	5	1.7	4.073-1.556X	38.48	1.63/32.08±	1.04
Carbofuran 3G	7.5Kg/ha in Whorl	17	68.41	1162	1	8.5	5.162-4.648X	271.3	270.2±	7.35

Table 3- Percent Reduction In Mortality Of CHILO PARETELLUS in Different Insecticides and Neem Based Formulation Under, Laboratory and Field Condition

Treatment Days	Cypermehrin		Deltamethrin 2.8EC		Endosulfan 35EC		Greenmark		Achook		Triazophos 40 EC		Carbofuran 3G	
	0.005		0.002		0.035		0.4		0.4		0.04		7.5Kg/ha in Whorl	
	LAB	FIELD	LAB	FIELD	LAB	FIELD	LAB	FIELD	LAB	FIELD	LAB	FIELD	LAB	FIELD
1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3	14.3	55.56	9.33	64	23.7	45.8	48.8	100	75.7	100	34.6	41.7	0	10
5	25.93	71.36	27.4	72.9	40.5	55.7	85.5	–	100	–	56.8	83.9	11	33.3
7	24.25	96	26.3	96	38	50	100	–	–	–	88.5	100	3.46	51.7
9	60.72	100	75.3	100	69.4	91	–	–	–	–	100		0	46.4
11	93.34	–	96.2		96.4	100	–	–	–	–	–	–	33.3	41.4
13	100	–	100		100		–	–	–	–	–	–	63.3	76.7
15	–	–	–	–	–	–	–	–	–	–	–	–	83.3	96.7
17	–	–	–	–	–	–	–	–	–	–	–	–	82.7	100
19	–	–	–	–	–	–	–	–	–	–	–	–	100	