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DOSE MORTALITY RESPONCES OF BLISTER BEETLES AGAINST SOME INSECTICIDES

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ABSTRACT

In view of significant damage potential of adult blister beetles, dose mortality response for number of insecticides was evaluated to find out efficacious alternative for management of blister beetles. The experiments were conducted at Insect Toxicology Laboratory, Department of Agricutural Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra). The insecticides viz., chlorpyriphos 50 EC + cypermethrin 5 EC (0.1375%), lambda cyhalothrin 2.5 EC (0.00375%), alphamethrin 20 EC (0.05%), cypermethrin 10 EC (0.01%), fenvalerate 20 EC (0.02%) and deltamethrin 2.8 EC (0.0042%) at field dose inflicted 100 per cent mortality, within 24 hours. The data on relative toxicity revealed that lambda cyhalothrin 2.5 EC, deltamethrin 2.8 EC and cypermethrin 10 EC were 188.3, 113.0 and 56.5 times more toxic with reference to chlorpyriphos dust, respectively. The order of toxicity based on LC_{50} values for insecticides under evaluation was lambda cyhalothrin (0.06 ppm) > deltamethrin (0.1 ppm) > cypermethrin (0.2 ppm) > alphamethrin (0.4 ppm) > fenvalerate (0.6 ppm) > chlorpyriphos + Cypermethrin (0.8 ppm) > methyl parathion dust (1.1 ppm) > fenvalerate dust (3.0 ppm) > chlorpyriphos dust (11.3 ppm). Lower LT_{50} values at 10^3 dilutions was recorded in cypermethrin (10.0h) and chorpyriphos + cypermethrin (13.0h). In case of dust formulations, minimum LT_{50} value was recorded with methyl parathion (83.1h), whereas, fenvalerate dust (109.2h) registered highest value. Similar, efficacy trend based on LT_{50} values was recorded at 10^4 dilutions. Synthetic pyrethroids proved efficient in inflicting mortality quickly and at lower dose, thus, suggesting their potential in management of blister beetles.

INTRODUCTION

In Maharashtra, *Mylabris phalerata* Pall. is a serious pest of greengram (Dhavan, 2012 and Shinde, 2013). Blister beetles (Coleoptera : Meloidae) extensively feed on buds and flowers, translating in drastic yield reduction. The peak activity of blister beetles is observed in the month of August which coincides with flowering of greengram. Maheshwari, 1986 and Boopathi *et al.,* 2009 reported average per cent damage of flowers by blister beetles of 80 per cent and yield loss up to 25-30 per cent, in greengram. The damage caused by adults to buds and flower is so extensive that there is no pod formation, signifying the economic importance of blister beetles.

Due to wider host range high mobility and robustness the management of blister beetle is difficult. Adult beetles also have an ability to quickly adapt to new host under crop ecosystem (Durairaj and Ganapathy, 2003). The literature also suggests very few insecticides effective against blister beetles, whereas, the collection and destruction of beetles approach is highly impractical (Sharma *et al.,* 2010).

Taking into consideration, the immense damage potential of blister beetles and economic injury inflicted in short span of time, present study was framed to evaluate efficacy and comparative toxicity of different insecticides at field dose against the greengram blister beetles adults. Bioassays were carried out to assess the dose mortality response and median lethal time by Probit analysis to find out most efficacious alternative for blister beetle management.

MATERIALS AND METHOD

Bioassays on evaluation of insecticides efficacy was carried out under laboratory condition for estimation of Mortality at field dose of insecticide, relative toxicity, Median lethal concentration (LC_{50}), Median lethal time (LT_{50}) against greengram, blister beetle.

Bioassays for assessment of mortality at field dose of insecticides

Efficacy of nine insecticides at recommended field dose was evaluated under laboratory condition. Leaf and plant bioassays are an intermediate step between artificial diet and field bioassays (Novan and Ascher, 2000). Bouquets of greengram buds and flowers along with tender succulent leaves were prepared for the bioassays. These bouquets were kept in 50 mL conical flask with water for maintaining the freshness of the experimental food material (Durairaj, 2000). The bouquets thus prepared were sprayed with 5mL of different insecticidal solution, with the help of handheld sprayer for the assessment of toxicity. In case of dust formulations, 5g of test material was dusted uniformly on the bouquets.

Adult blister beetles were collected from greengram field in the morning and were pre starved for one hour. Ten adult blister beetles were released in each cage (25x15cm) on sprayed flower bouquet. Untreated bouquet served as the control to record the natural mortality. The mortality was recorded daily for three consecutive days after application of treatment. Each treatment including control was replicated thrice. The data was analysed in completely randomised design.

Bioassays for assessment of median lethal concentration (LC_{50}) and median lethal time (LT_{50})

Serial dilutions of insecticides under evaluation were prepared using distilled water. In case of dust formulations, lignite was used as the diluent. Field collected thirty adult blister beetles, pre starved for 1h were released in each cage (30x20cm) consisting of sprayed flower bouquet. Untreated bouquet served as control. Each treatment including control was replicated twice. The blister beetles mortality was recorded at 24h intervals and mortality after 120 hrs was considered as a final mortality for calculating LC_{50} and LT_{50} value of insecticide at different concentrations of insecticides. The data thus obtained, was subjected to Probit analysis for dose mortality response relationship. The values of relative toxicity of different insecticides were calculated by LC_{50} of least toxic compound (chlorpyriphos dust)/LC_{50} of more toxic compound.

RESULTS AND DISCUSSION

The data presented in Table 1 revealed that insecticides chlorpyriphos + cypermethrin (0.1375%), lambda cyhalothrin (0.00375%), alphamethrin (0.05%), cypermethrin (0.01%), fenvalerate (0.02%) and deltamethrin (0.0042%) caused 100 per cent mortality within 24h. However, mortality due to chlorpyriphos dust and fenvalerate dust at 24h was mere 56.7 and 40.0 per cent, respectively.

Synthetic pyrethroids proved most promising in inflicting higher mortality. These finding were supported by Durairaj and Ganapathy (1999) who reported that mortality in *M. pustulata* and *Mylabris sp.* was 100 per cent after 6 hours, in fenvalerate (0.02%) and cypermethrin (0.025%). Similar observations were recorded by Rolania *et al*. (2012) about cypermethrin (0.01%). Bhalani (1988) reported that toxicity of 0.02 per cent fenvalerate, 0.004 per cent cypermethrin, 0.0042 per cent deltamethrin and 0.05 per cent methyl parathion caused 28.8 to 52.8% mortality in 3h, 43.1 to 83.8 per cent in 6 hours and 48.8 to 90 per cent in 12h. Sood and Kakar, 1991 also reported cent percent mortality in plots treated with pyrethroides, indicating higher persistence on the crop, which is in line with the present findings. Sharma *et al*. (2010) reported that cypermethrin 10 EC @ 1.0 mL/L worked resonably mell.

Relative toxicity of different insecticides against adult blister beetle

Data on relative toxicity (Table-2) revealed minimum LC_{50} value. Minimum LC_{50} value of synthetic pyrethroids for adult blister beetle was recorded in treatment with lambda cyhalothrin

Table 1: Effect of different insecticidal treatments on mortality of adult blister beetle

Treatment details		Dose/conc	Per cent mortality of adult blister beetles		
			1 DAS	2 DAS	3 DAS
T_1	Chlorpyriphos 1.5% Dust	20 Kg/ha	56.7(48.9)	90.0(71.7)	93.3(71.9)
T_2	Fenvalerate 0.4% Dust	20 Kg/ha	40.0(39.6)	73.3(59.0)	86.7(68.9)
T_3	Methyl parathion 2% Dust	20 Kg/ha	100.0(89.1)	100.0(89.1)	100.0(89.1)
T_4	Chlorpyriphos 50 EC + Cypermethrin 5 EC	0.1375%	100.0(89.1)	100.0(89.1)	100.0(89.1)
T_5	Lambda cyhalothrin 2.5 EC	0.00375%	100.0(89.1)	100.0(89.1)	100.0(89.1)
T_6	Alphamethrin 10 EC	0.005%	100(89.1)	100.0(89.1)	100.0(89.1)
T_7	Cypermethrin 10 EC	0.01%	100.0(89.1)	100.0(89.1)	100.0(89.1)
T_8	Fenvalerate 20 EC	0.02%	100.0(89.1)	100.0(89.1)	100(89.1)
T_9	Deltamethrin 2.8 EC	0.0042%	100.0(89.1)	100.0(89.1)	100.0(89.1)
T_{10}	Control		0.0(0.91)	0.0(0.91)	0.0(0.91)
'F' test			Sig	Sig	Sig
SEm (+)			1.07	0.60	2.52
CD at 5%			3.65	2.06	8.58

*Figures in parentheses are arc sine transformed values. 0.0 Values were subjected to correction by 0 + ¼ (n) and 100.0 values were subjected to correction 100 - ¼ (n) where, n = no. of insects

Table 2: Relative toxicity of insecticides against adult blister beetle

S.N.	Insectscide	LC_{50}(ppm)	Fiducial limit		LC_{90}(ppm)	Slope	Heretogenity (chi^2)*	Relative toxicity
			Lower	Upper				
	Synthetic pyrethroids							
1	Lambda cyhalothrin 2.5 EC	0.06	0.02	0.10	3.2	0.745	1.180	188.3
2	Alphamethrin 10 EC	0.4	0.1	1.2	44.6	0.641	0.566	28.3
3	Cypermethrin 10 EC	0.2	0.1	0.6	11.0	0.770	1.566	56.5
4	Fenvalerate 20 EC	0.6	0.2	1.6	38.7	0.717	0.003	18.8
5	Deltamethrin 2.8 EC	0.1	0.03	0.3	11.0	0.645	0.654	113.0
	Combination product							
6	Chlorpyriphos 50 EC+ Cypermethrin 5 EC	0.8	0.2	2.0	46.8	0.719	1.037	14.1
	Insecticide dusts							
7	Chlorpyriphos 1.5% Dust	11.3	2.9	11.5	1592.1	0.599	0.556	1.0
8	Fenvalerate 0.4% Dust	3.0	0.7	56.4	424.5	0.596	0.596	3.8
9	Methyl Parathion 2% Dust	1.1	0.3	3.9	115.9	0.593	0.406	10.3

Tabular value of (chi^2)* at 0.05 level = 7.815 (In none of these cases, the data were found to be significant).

(0.06 ppm) followed by deltamethrin (0.1ppm) and cypermethrin (0.2 ppm). LC_{50} value of combination product, chlorpyriphos + cypermethrin was 0.8 ppm. In case of dust formulation lowest LC_{50} value was recorded in methyl parathion (1.1 ppm). Maximum LC_{50} was observed in treatment with fenvalerate dust (3.0 ppm) and was comparatively less toxic.

Among the synthetic pyrethroids, lowest LC_{90} value was recorded in treatment with lambda cyhalothrin (3.2 ppm) followed by deltamethrin (11.0 ppm) and cypermethrin (11.0 ppm). In case of combination product, chlorpyriphos + cypermethrin LC_{90} value was 46.8 ppm. Minimum LC_{90} value in dust formulation was recorded in methyl parathion (115.9 ppm) whereas, highest LC_{90} value was reported in treatment with fenvalerate dust (424.5) and was comparatively less toxic. In order of merit, chlorpyriphos dust was the least toxic compound, whereas, lambda cyhalothrin was the most toxic compound. Relative toxicity of insecticides were assessed by taking relative toxicity of chlorpyriphos dust as unity, which revealed that lambda cyhalotrin was 188.3 times, deltamethrin 113 times, cypermethrin 56.5 times, alphamethrin 28.35 times, fenvalerate 18.3 times, chlorpyriphos + Cypermethrin 14.1 times, methyl parathion 10.3 times and fenvalerate was 3.6 times more toxic than chlorpyriphos dust.

Order of toxicity for various insecticides under evaluation was lambda cyhalothrin > deltamethrin > cypermethrin > alphamethrin > fenvalerate > chlorpyriphos + Cypermethrin > methyl parathion dust> fenvalerate dust> chlorpyriphos dust. Evidently, synthetic pyrethroids were relatively more toxic than the insecticide dusts under evaluation.

These finding were supported by Dhingra and Sarup (1992) who reported that Lambda-cyhalothrin, alphamethrin (alpha-cypermethrin), decamethrin (deltamethrin), cypermethrin, fenvalerate and methyl parathion (parathion-methyl), were 356.6, 115.1, 101.6., 39.9, 13.2, 12.8 and 9.4 times more toxic, resp., than lindane to *Mylabris pustulata*.

Lethal time (LT_{50}) of insecticides against adult blister beetle

Data in Table 3 revealed the LT_{50} value of insecticides at different concentration. Lowest LT_{50} values of synthetic pyrethroids at 10^3 dilution was recorded with cypermethrin (10.0 hrs) followed by combination product, chorpyriphos + cypermethrin (13.0h). In case of dust formulation minimum LT_{50} value at 10^3 dilutions was recorded with methyl parathion (83.1h). Highest LT_{50} values at 10^3 dilution was recorded in fenvalerate dust (109.2h).

Table 3: Lethal time (LT_{50}) of insecticides against adult blister beetle

Insecticide	Dilution	Concentration (ppm)	LT_{50} (hour)	Fiducial limit Lower	Upper	Slope	Heterogenity (chi^2) *
Synthetic pyrethroids							
Lambda cyhalothrin 2.5 EC	10^3	250	13.6	2.5	20.7	3.221	1.037
	10^4	25	17.1	0.7	31.3	1.231	0.473
	10^5	2.5	43.2	3.0	71.5	0.955	0.071
Alphamethrin 10 EC	10^3	100	16.3	5.7	23.4	2.943	4.235
	10^4	10	25.6	5.6	39.7	1.372	0.269
	10^5	1.0	65.0	37.2	120.2	1.159	0.409
Cypermethrin 10 EC	10^3	100	10.0	0.1	18.8	3.181	0.425
	10^4	10	12.7	0.1	26.7	1.159	1.260
	10^5	1.0	28.9	2.2	46.5	1.098	0.081
	10^6	0.1	77.0	53.4	144.7	1.342	6.433
Fenvalerate 20 EC	10^3	200	18.6	8.2	25.8	2.849	2.806
	10^4	20	36.3	16.4	50.6	1.524	0.066
	10^5	2.0	93.6	63.4	190.4	1.195	0.087
Deltamethrin 2.8 EC	10^3	28	14.8	4.1	21.8	3.132	1.892
	10^4	2.8	23.7	5.7	36.7	1.468	0.599
	10^5	0.28	47.5	0.01	92.8	0.851	0.005
Combination product							
Chlorpyriphos + Cypermethrin 50 + 5 EC	10^3	550	13.0	1.0	20.0	3.539	0.336
	10^4	55	15.6	0.7	29.2	1.264	1.109
	10^5	5.5	35.4	3.5	55.8	1.053	0.193
Insecticide dusts							
Chlorpyriphos 1.5 % Dust	10^3	15	94.5	76.7	131.9	2.441	1.235
	10^4	1.5	140.5	109.4	255.6	2.802	1.074
	10^5	0.15	152.6	105.8	293.6	2.903	1.009
Fenvalerate 0.4 % Dust	10^3	4	109.2	87.1	166.9	2.412	0.266
	10^4	0.4	147.7	119.8	288.3	4.311	1.304
	10^5	0.04	161.1	125.8	424.4	4.121	0.996
Methyl Parathion 2 % Dust	10^3	20	83.1	65.7	116.7	1.415	2.079
	10^4	2	123.2	92.8	237.3	2.021	0.802
	10^5	0.2	136.0	108.0	231.8	2.993	0.740
	10^6	0.02	164.8	124.7	523.3	3.454	2.570

Table value of ($\div^2$) at 0.05 level = 7.815 (The data set was non-significant for heterogeneity).

Synthetic pyrethroids were quicker in inflicting mortality and registered minimum LT_{50} values at 10^4 dilutions with cypermethrin as most potent insecticide (12.7h). It was followed by combination product, chorpyriphos + cypermethrin (15.6h). Least LT_{50} value of insecticide dust at 10^4 dilutions was methyl parathion (123.2h). Maximum LT_{50} values at 10^4 dilutions was recorded in fenvalerate dust (147.7h). Similar trend was found in case of 10^5 dilution of each insecticide. Mortality time could be shortened by increasing insecticides concentration.

CONCLUSION

Thus, for the management of adult blister beetles with an immense damage potential and ability to inflict economic injury in short span of time especially in short duration crops like greengram, pyrethroids will prove most efficacious alternative for blister beetle management.

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