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Efficacy of insecticides against shoot and fruit borer, *Leucinodes orbonalis* (Guen.) in brinjal

Among the major insect pests of brinjal, the shoot and fruit borer, *Leucinodes orbonalis* (Guen.) is considered as the main constraint as it damages the crop throughout the year.The yield loss due to the pest is to the extent of 70 to 92 per cent (Eswara Reddy and Srinivas, 2004). Though farmers are taking up 25-30 insecticidal sprays to manage this pest the control is not satisfactory, because of development of resistance to insecticides. Among the several avenues to overcome the insecticidal resistance problem, replacement with new insecticide is one of the important considerations. Evaluation of newer molecules for their efficacy against *L. orbonalis* is a continuous process as newer molecules having novel mode of action are being added every year. In view of this, the present study was undertaken to know the efficacy of newer insecticides against brinjal shoot and fruit borer.

A field trial was conducted using brinjal variety, Mahyco-10 during *kharif*, 20013-14 at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to evaluate the efficacy of insecticides. The trial was laid out in randomized block design with two replications and 15 treatments (Table 1). The plot size was 4.5 x 3.6 m, with spacing of 75 x 60 cm. The crop was managed by following recommended package of practices except for plant protection for insect pests. All the treatments were imposed by using high volume knapsack sprayer @ 500 litres of spray solution per hectare. First spray was given at 30 days after transplanting and the remaining three sprays were given at an interval of 15 days between each spray. Number of infested shoots in each plot at one day before spray and 7 and 15 days after spray were recorded from five randomly selected plants from each treatment. The per cent shoot damage was worked out and converted to angular values and the data were subjected to statistical analysis.

At each picking, observations were recorded on number of infested fruits/marketable fruits from five randomly selected plants and the per cent fruit damage was worked out. The data were transformed into angular values and subjected to statistical analysis. Fruits were harvested from each plot separately and yield (kg) per plant at each picking was recorded. The total

Table 1. Efficacy of insecticides against shoot and fruit borer, *Leucinodes orbonalis* and cost economics in brinjal during *kharif* 2013-14

Treatments	Dosage	Per cent shoot infestation	Per cent fruit infestation	Yield of marketable fruits (q/ha)	Total cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	BC ratio
Flubendiamide 480 SC	0.10 ml/l	11.83 (19.37)$^{c-f}$	11.66 (19.26)$^{f-i}$	192.00	35397	192000	156603	5.42
Spinosad 45 SC	0.10 ml/l	11.26 (18.89)$^{d-f}$	10.65 (18.42)$^{g-i}$	194.65	36897	194650	157753	5.28
Cyantranilprole 10 OD	0.30 ml/l	10.24 (18.00)^{f}	8.89 (16.79)^{i}	198.20	37097	198200	161103	5.34
Bifenthrin 10 EC	1.0 ml/l	14.49 (21.46)$^{b-e}$	17.75 (21.46)$^{b-d}$	156.45	34697	156450	121753	4.51
Profenophos 50 EC	2.0 ml/l	15.69 (22.32)$^{b-c}$	19.61 (24.94)^{bc}	144.00	34017	144000	109983	4.23
Thiodicarb 75 WP	0.60 g/l	12.84 (20.18)$^{b-f}$	13.22 (20.53)$^{e-i}$	183.15	36401	183150	146749	5.03
Indoxacarb 14.5 SC	0.30 ml/l	13.24 (20.50)$^{b-f}$	14.41 (21.42)$^{d-g}$	178.65	35357	178650	143293	5.05
Neemcake	250 kg/ha	16.21 (22.70)^{b}	21.1 (25.87)^{b}	107.55	35397	107550	72153	3.04
Thiacloprid 240 EC	0.25 ml/l	13.66 (20.83)$^{b-f}$	15.46 (22.19)$^{c-f}$	172.40	34182	172400	138218	5.04
Emamectin benzoate 5 SG	0.20 g/l	12.28 (19.73)$^{b-f}$	12.58 (20.01)$^{e-i}$	188.30	36337	188300	151963	5.18
Rynoxypyr 20 SC	0.15 ml	10.60 (18.34)^{ef}	9.71 (17.59)$^{h-i}$	197.15	37997	197150	159153	5.19
Carbaryl 50 WP	4.0 g/l	14.95 (21.79)$^{b-d}$	19.26 (24.74)$^{b-c}$	152.05	36977	152050	115073	4.11
Carbosulfan 25 EC	0.30 ml/l	15.30 (22.04)$^{b-d}$	18.5 (24.26)$^{b-d}$	146.40	37145	146400	109255	3.94
Chlorfenpyr 2 SC	3.0 ml/l	14.08 (21.15)$^{b-f}$	16.72 (23.09)$^{b-e}$	163.65	45497	163650	118153	3.60
Untreated check	-	28.16 (29.66)^{bc}	36.02 (33.77)^{a}	95.90	32497	95900	63403	2.95
S.Em.±	-	0.94	1.01	11.17	-	-	-	-
C.D. at 5 %	-	3.97	4.25	47.01	-	-	-	-

Market rate of brinjal: ₹ 10/kg   Cost of insecticides: as per market rate yield was worked out by adding the yield of all the pickings. The plot yield was converted to quintals per ha. Finally, the cost economics of each chemical treatment was computed. To eliminate the influence of sucking pests and mites, spraying of dimethoate 30 EC @1.70 ml + dicofol 18.5 EC @ 2.50 ml/l of water was given two times as blanket sprays (Need based).

Among the insecticides tested, cyantranilprole 10 OD @ 0.3 ml/l (10.24% shoot damage, 8.89% fruit damage and 198.20 q/ha fruit yield), rynaxypyr 20 SC @ 0.15 ml/l (10.60% shoot damage, 9.71% fruit damage and 197.15 q/ha fruit yield) and spinosad 45 SC @ 0.1 ml/l (11.26 % shoot damage, 10.65% fruit damage and 194.65 q/ha fruit yield) proved to be the most effective insecticides by recording significantly maximum reduction in shoot and fruit infestation with high yield (Table 1). The results are in line with Dattatray *et al.* (2012) who also recorded the lowest fruit damage of 8.8 per cent (number basis) and 8.4 per cent (weight basis) with high yield (528.5 q/ha) by chlorantraniliprole 18.5 SC Rajavel *et al.* (2011) also reported that chlorantraniliprole @ 60 g a.i./ha was effective which record the lowest fruit damage (4.99 %) with yield of 13.22 t/ha followed by its lower dosages *i.e.,* 50 and 40 g a.i.ha^{-1}. Similarly, Naik *et al.* (2011) opined that, rynaxypyr resulted in lowest shoot (1.80%), fruit damage (8.20%) and highest marketable fruit yield (63.7 q/ac) followed by flubendiamide (2.30% shoot damage, 8.50% fruit damage and 63.3 q/ac fruit yield) and spinosad (2.30% shoot damage, 8.30% fruit damage and 63.2 q/ac). The findings of Tayde and Sobita (2010) revealed that spinosad 45 SC @ 0.01% recorded lower shoot infestation (9.84%), fruit infestation (6.87% on number basis and 07.35% on weight basis) and increased fruit yield (239.30 q/ha). Similarly, Mishra (2008) recorded significantly lowest shoot damage in rynaxypyr 20 EC @ 40 and 50 g a.i./ha in winter (0.08-0.18%) and summer (0.14-0.27).

Next in the order of effectiveness were flubendiamide 480 SC @ 0.1 ml/l, emamectin benzoate 5 SG @ 0.20 g/l, thiodicarb 75 WP @ 0.6 g/l, indoxacarb 14.5 SC @ 0.3 ml/l, thiacloprid 240 EC @ 0.25 ml/l and chlorfenpyr 2 SC @ 3 ml/l and were statistically on par with each other. Whereas, neem cake @ 250 kg ha^{-1} (16.21% shoot damage, 21.10% fruit damage and 107.55 q/ha fruit yield) was less effective in reducing the shoot and fruit damage compared to other insecticidal applications (Table 1). The results are in line with Sandip Patra *et al.* (2009) who also recorded the lowest mean shoot as well as fruit infestation (7.47 and 9.88%) in spinosad 2.5 SC (50 g a.i./ ha) followed by indoxacarb 14.5 SC @ 50 g a.i./ha (8.89 and 13.13%) and emamectin benzoate 5 SG @ 15 g a.i./ha (10.95 and 16.66%), respectively. Flubendiamide 480 SC @ 0.1 ml/l recorded the highest BC ratio (1:5.42) followed by cyantranilprole 10 OD @ 0.3 ml/l (1:5.34), spinosad 45 SC @ 0.1 ml/l (1:5.28), rynaxypyr 20 SC @ 0.15 ml/l (1:5.19) and emamectin benzoate 5 SG @ 0.2 g/l (1:5.18), while the lowest BC ratio was obtained in neem cake (1:3.04).

From the present findings it can be concluded that, to manage brinjal shoot and fruit borer, flubendiamide 480 SC @ 0.1 ml, cyantranilprole 10 OD @ 0.3 ml/l and spinosad 45 SC @ 0.1 ml/l of water were found to be the most effective insecticides, as they recorded lowest damage to shoots/fruits and registered higher yield and more benefit cost ratio.

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