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EFFICACY OF INSECTICIDES AGAINST GRAPEVINE MEALYBUG *MACONELLICOCCUS HIRSUTUS* (GREEN)

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ABTRACT

Grapevine mealy bug, *Maconellicoccus hirsutus* (Green) is one of the destructive pests and seven insecticides were evaluated against this under field conditions. It was observed that acetamiprid 20 SP @ 0.3 g/l was significantly superior but at par with thiamethoxam 25 WG @ 0.6g/l. Remaining treatments in their descending order of efficacies were lambda cyhalothrin 5 EC 1ml/l, buprofezin 25 SC @ 1.5ml/l, triazophos 40 EC @ 2ml/l, diafenthiuron 50 WP @ 2g/l and fipronil 5 SC @ 2ml/l. Also, acetamiprid 20 SP @ 0.3 g/l gave significantly highest fruit yield (25.10 t/ha) followed by thiamethoxam 25 WG @ 0.6 g/l (24.23 t/ha). Acetamiprid 20 SP @ 0.3 g/l and lambda cyhalothrin 5 EC @ 1ml/l recorded the higher incremental cost benefit ratio of 1:40.9 and 1:36.4, respectively.

Key words: *Maconellicoccus hirsutus*, acetamiprid, thiamethoxam, lamda cyhalothrin, cost benefit ratio.

Extensive and intensive cultivation of grapevine tend to attract various kinds of pests. Bournier (1977) listed 132 insects and according to Butani (1979) over 85 species are known to occur in India. Of these, mealy bug, *Maconellicoccus hirsutus* (Green) is a major pest and Azam (1983) reported yield losses ranging from 50 to 100% and Manjunath (1985) reported 90% loss. Lower (1968) termed the mealybug as "hard to kill pest of fruit trees" and various pesticides had been tried either alone or in combinations for its control. In the present study some new insecticides have been evaluated for their efficacy.

MATERIALS AND METHODS

The field experiment was laid out in Randomized Block Design with three replications and eight treatments in the farmer's orchard naturally infested with mealy bugs during January, 2012. The orchard selected was well established, 6 years old, located at the Ausa tahsil of Latur district (Maharashtra) with Manik Chaman variety planted at a spacing of 10 x 5ft. It was bower system of trailing and four arm, and pruned in October and April every year and all other recommended cultural practices were followed. The spray solution required was estimated each time by considering 1000 l/ha water, and applied with knapsack sprayer, with three sprays given at ten days intervals. Seven vines were selected from each treatment and observations on colonies were recorded from main stem and side branches from five vines in each. Pre treatment count was recorded at one day before treatment, with subsequent observations at five and ten day's interval after each spraying. Similar observations were made on bunches also. The observation recorded on tenth day after first spray served as pre-treatment count for second spray. Fruits after maturity were harvested separately and weighed, and yield expressed in ha. The data on efficacy and fruit yield were statistically analyzed through ANOVA (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The data on the efficacy of treatments presented in Table 1 revealed non significant variations in the pre-count recorded at one day before spray and population ranged from 35.97 to 38.10 colonies per vine. There was a significant reduction in all the treatments after five days of first spray; acetamiprid 20 SP @ 0.3g/l (33.23) was significantly superior while thiamethoxam 25 WG @ 0.6g/l (33.87) and lambda cyhalothrin 5 EC @ 1ml/l (33.70) were at par. Buprofezin 25 SC @ 1.5 ml/l (35.00) showed maximum reduction while triazophos 40 EC @ 2ml/l (35.70) and fipronil 5 SC @ 2ml/l (35.50) were at par with buprofezin 25 SC @ 1.5ml/l. Diafenthiuron 50 WP @ 2g/l (36.13) recorded lowest reduction in colonies. This reduction in colonies at ten days after first spray reflected significant differences among the

treatments. The least number of colonies were observed in acetamiprid 20 SP @ 0.3g/l (28.63) and it was at par with thiamethoxam 25 WG @ 0.6g/l (29.70) and lambda cyhalothrin 5 EC @ 1ml/l (30.28). Five days after second spray revealed minimum number of colonies with acetamiprid 20 SP @ 0.3 g/l (21.47) and it was significantly superior. The next best were thiamethoxam 25 WG @ 0.6g/l (22.60) and buprofezin 25 SC 1.5ml/l (23.90). Significantly lowest numbers of colonies at ten days after second spray was seen in acetamiprid 20 SP @ 0.3 g/l (13.40) and it was at par with thiamethoxam 25 WG @ 0.6g/l (13.80). The next in order was lambda cyhalothrin 5 EC @ 1ml/l (18.60) and buprofezin 25 SC @ 1.5ml/l (19.53) followed by triazophos 40 EC @ 2ml/l (20.27), diafenthiuron 50 WP @ 2g/l (21.27) and fipronil 5 SC @ 2ml/l (22.07) which were at par. After five days after third spray, acetamiprid 20 SP @ 0.3g/l and thiamethoxam 25 WG @ 0.6g/l recorded least number of colonies and were at par.

The reduction in colonies at ten days after third spray showed significantly minimum colonies in acetamiprid 20 SP @ 0.3 g/l. However, it was at par with thiamethoxam 25 WG @ 0.6g/l.

The data on number of colonies per bunch at one day before spray and five and ten days after first, second and third spray are presented in Table 2. The pre-count recorded at one day before spray revealed non-significant differences and population ranged from 9.93 to 11.20 colonies per bunch. The number of colonies per bunch did not show any significant difference at five days after first spray, and it ranged from 8.95 to 11.63 colonies per bunch. At ten days after first spray there were significant differences with least number of colonies observed in acetamiprid 20 SP @ 0.3g/l (7.47) which was at par with thiamethoxam 25 WG @ 0.6g/l (7.70), lambda cyhalothrin 5 EC @ 1ml/l (8.20), triazophos 40 EC @ 2ml/l (8.07) and buprofezin 25 SC @ 1.5ml/l (8.33). Diafenthiuron 50 WP @ 2g/l (8.53) and fipronil 5 SC @ 2ml/l (8.67) recorded least number of reductions in colonies. At five days after second spray statistically significant difference was observed in acetamiprid 20 SP 0.3 g/l (4.27). It was at par with thiamethoxam 25 WG @ 0.6g/l (5.17). Buprofezin 25 SC @ 1.5ml/l (6.87), lambda cyhalothrin 5 EC @ 1ml/l (6.80), triazophos 40 EC @ 2ml/l (7.00) and diafenthiuron 50 WP @ 2g/l (7.13) were the next and at par with each other. Fipronil 5 SC @ 2ml/l (7.43) recorded highest number of colonies per bunch. At ten days after second spray too there were significant differences with least number of colonies in acetamiprid 20 SP @ 0.3 g/l (2.87) which was at par with thiamethoxam 25 WG @ 0.6g/l (3.37). The data at five days after third spray too were statistically significant, with acetamiprid 20 SP @ 0.3g/l and thiamethoxam 25 WG @ 0.6g/l recording least number of colonies per vine (1.80 and 2.03, respectively). At ten days after last spray significantly lowest number of colonies was in acetamiprid 20 SP @ 0.3 g/l (1.07) which was at par with thiamethoxam 25 WG @ 0.6g/l (1.20).

The data on yield and cost economics presented in Table 3 revealed that the yield ranged between 18.33 to 25.10 t/ha. Acetamiprid 20 SP @ 0.3 g/l gave significantly highest fruit yield (25.10 t/ha) and recorded maximum increase in yield (6.77 t/ha). This was followed by thiamethoxam 25 WG @ 0.6 g/l (24.23 t/ha) and at par. The latter best was lambda cyhalothrin 5 EC @ 1ml/l (22.24 t/ha), buprofezin 25 SC at 1.5ml/l (21.95 t/ha) and triazophos 40 EC 2ml/l (21.45 t/ha) and these were at par. The lowest yield was in fipronil 5 SC 2ml/l (19.72 t/ha) which was at par with diafenthiuron 50 WP 2g/l (20.23t/ha).

Acetamiprid 20 SP @ 0.3 g/l recorded more fruit yield of 6.77 t/ha over the untreated check. It was followed by thiamethoxam 25 WG @ g/l (5.90 t/ha). Monetary returns from increased yield was highest in acetamiprid 20 SP @ 0.3 g/l (` 162,480/ha) followed by thiamethoxam 25 WG @ 0.6g/l (` 141,600/ha). Acetamiprid 20 SP 0.3 g/l recorded highest net profits of ` 158590/ha followed by thiamethoxam 25 WG @ 0.6g/l with ` 132480/ha. The Incremental cost benefit ratio data presented in Table 3 indicate that acetamiprid 20 SP @ 0.3 g/l and lambda cyhalothrin 5 EC @ 1ml/l recorded the higher incremental cost benefit ratio of 1:40.9 and 1:36.4, respectively. Diafenthiuron 50 WP @ 2g/l recorded lowest ICBR of 1:1.41.

Balikai (2005) and Muthukrishnan *et al.* (2005) observed that buprofezin 25 SC was the most effective in reducing number of mealy bug colonies on vines and bunches. Sunitha *et al.* (2009) found that acetamiprid 20 SP and thiamethoxam 25 WG were significantly superior against *M. hirsutus*. Karar *et al.* (2010) on mango mealy bug found that acetamiprid was the most effective which give highest mortality. Castle and Prabhakar (2011) reported that imidacloprid and thiamethoxam were the most promising against *M. hirsutus.* Thus the results indicate that neonicotinoids *i.e.*, acetamiprid and thiamethoxam can be effectively used in management of grapevine mealy bugs.

Table 1. Efficacy of insecticides against grapevine mealy bug (number of colonies/vine)

Treatments	Pretreatment count (1 DBS)	Post treatment counts after					
		I Spray		II Spray		III Spray	
		5 DAS	10 DAS	5 DAS	10 DAS	5 DAS	10 DAS
T_1 -Buprofezin 25 (1.5ml/l)	36.60[a]	35.00[bc]	32.00[cd]	23.90[abc]	19.53[b]	14.93[c]	10.07[c]
T_2 -Diafenthiuron 50 WP (2g/l)	37.07[a]	36.13[cd]	33.21[d]	26.63[d]	21.27[cd]	15.13[c]	14.57[e]
T_3 -Triazophos 40 EC (2ml/l)	36.87[a]	35.70[cd]	31.33[bd]	25.47[cd]	20.27[bc]	14.53[c]	12.07[d]
T_4 -Thiamethoxam 25 WG (0.6g/l)	38.02[a]	33.87[ab]	29.70[ab]	22.60[ab]	13.80[a]	06.73[a]	02.50[a]
T_5 -Lambda cyhalothrin 5 EC (1ml/l)	35.97[a]	33.70[ab]	30.28[abc]	24.20[b]	18.60[b]	09.93[b]	07.53[b]
T_6 -Fipronil 5 SC (2ml/l)	37.00[a]	35.50[c]	31.37[bcd]	27.57[d]	22.07[d]	16.40[c]	15.10[e]
T_7 -Acetamiprid 20 SP (0.3g/l)	38.10[a]	33.23[a]	28.63[a]	21.47[a]	13.40[a]	06.33[a]	01.97[a]
T_8 -Control	36.20[a]	37.67[d]	39.12[e]	41.53[e]	44.00[e]	46.93[d]	48.40[f]
S. E. ±	0.75	0.53	0.65	0.87	0.56	0.67	0.60
C.D. at 5%	NS	1.59	1.95	2.61	1.68	2.04	1.83
C.V. (%)	11.92	13.12	14.74	15.48	13.79	11.59	12.10

DBS= Days before spray, DAS= Days after spray, NS = Not significant. Treatment means with letter(s) in common are not significant at 5% level of significance in respective column.

Table 2. Efficacy of insecticides against grapevine mealy bug (number of colonies/bunch)

Treatments	Pretreatment count (1 DBS)	Post treatment counts after					
		I Spray		II Spray		III Spray	
		5 DAS	10 DAS	5 DAS	10 DAS	5 DAS	10 DAS
T_1 -Buprofezin 25 SC (1.5ml/l)	11.20^{a}	10.40^{a}	8.33^{ab}	06.87^{b}	05.13^{c}	03.27^{cd}	02.63^{bc}
T_2 -Diafenthiuron 50 WP (2g/l)	09.97^{a}	09.60^{a}	08.53^{ab}	07.13^{b}	05.20^{c}	04.07^{def}	03.53^{de}
T_3 -Triazophos 40 EC (2ml/l)	10.83^{a}	09.83^{a}	08.07^{ab}	07.00^{b}	04.60^{bc}	03.67^{de}	02.90^{cd}
T_4 -Thiamethoxam 25 WG (0.6g/l)	11.10^{a}	09.08^{a}	07.70^{a}	05.17^{a}	03.37^{a}	02.03^{ab}	01.20^{a}
T_5 - Lambda cyhalothrin 5 EC (1ml/l)	10.70^{a}	09.14^{a}	08.20^{ab}	06.80^{ab}	03.90^{ab}	02.80^{bc}	02.17^{b}
T_6 -Fipronil 5 SC (2ml/l)	09.93^{a}	09.20^{a}	08.67^{b}	07.43^{b}	05.70^{c}	04.73^{f}	03.97^{e}
T_7 -Acetamiprid 20 SP (0.3g/l)	11.13^{a}	08.95^{a}	07.47^{a}	04.27^{a}	02.87^{a}	01.80^{a}	01.07^{a}
T_8 -Control	10.77^{a}	11.63^{a}	11.93^{c}	12.60^{c}	13.03^{d}	13.60^{g}	15.40^{f}
S.E. ±	0.62	0.73	0.37	0.38	0.39	0.27	0.22
C.D. at 5%	NS	NS	01.10	01.20	01.21	0.82	0.67
C.V. (%)	12.42	14.31	10.40	13.35	15.32	15.27	15.09

DBS= Days before spray, DAS= Days after spray, NS = Not significant. Treatment means with letter(s) in common are not significant at 5% level of significance in respective column

Table 3. Effect of insecticides against grapevine mealy bug (yield and cost economics)

Treatments	Marketable Fruit Yield (t/ha)	Increase in yield over control (t/ha)	Returns from increased yield (`/ha)	Cost of Protection (`/ha)	Net profit (`/ha)	ICBR
T_1 -Buprofezin 25 SC (1.5ml/l)	21.95	3.62	86,880	5,880	81,300	1:14.6
T_2 -Diafenthiuron 50 WP (2g/l)	20.23	1.90	45,600	18,900	26,700	1:1.41
T_3 -Triazophos 40 EC (2ml/l)	21.45	3.12	74,880	4,020	70,860	1:17.6
T_4 -Thiamethoxam 25 WG (0.6g/l)	24.23	5.90	1,41,600	9,120	1,32,480	1:14.5
T_5 - Lambda cyhalothrin 5 EC (1ml/l)	22.24	3.91	93,600	2,520	91,080	1:36.4
T_6 -Fipronil 5 SC (2ml/l)	19.72	1.39	33,360	6,876	26,484	1:3.9
T_7 -Acetamiprid 20 SP (0.3g/l)	25.10	6.77	1,62,480	3,882	1,58,590	1:40.9
T_8 -Control	18.33	-	-	-	-	-

ICBR= Incremental Cost: Benefit Ratio. Market Rates: Grapes- ` 24,000/t

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