



Full Length Article

Comparative Efficacy of New and Old Insecticides for the Control of Mango Mealybug (*Drosicha mangiferae*) in Mango Orchards

HAIDER KARAR¹, M. JALAL ARIF[†], H.A. SAYYED[‡], M. ASHFAQ[†] AND M. ASLAM KHAN[¶]

Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad, Pakistan

[†]Department of Entomology, University of Agriculture, Faisalabad, Pakistan

[‡]Institute of Biotechnology, Bahaudin Zakariya University, Multan, Pakistan

[¶]Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan

¹Corresponding author's e-mail: jalalarif807@yahoo.com; haider853@gmail.com

ABSTRACT

Mango mealybug (*Drosicha mangiferae* Green) is destructive pest of mango plants. In an attempt to control this pest, eleven formulations of insecticides viz., profenofos (Curacron 500 EC, 30 mL), bifenthrin (Talstar 10 EC, 100 mL), triazophos (Hostathion 20 EC, 100 mL), chlorpyrifos (Lorsban 40 EC, 50 mL), lambdacyhalothrin (Karate 2.5 EC, 50 mL), imidacloprid (Confidor 200 SL, 100 g), buprofezin (Starter 20 SP, 500 g), deltamethrin (Decis 2.5 EC, 50 mL), cypermethrin (Ripcord 10 EC, 100 mL), acetamiprid (Mospilan 20 SP, 100 g) and methidathion (Supracide 40 EC, 150 mL) were tested for the control of mango mealybug under field conditions on mango trees against 1st instar nymphs of mango mealybug in the month of February, 2006 and the same dose of insecticides were sprayed against 2nd and 3rd instar in the month of March, 2006 and against adult female in the month of April, 2006. The maximum mortality of 1st instar mango mealybug was observed in those treatments, where Mospilan were applied with 80, 85 and 91% after 24, 72 and 168 h of spray. However, in case of 2nd and 3rd instar, Decis and Curacron gave maximum mortality 71 and 70, 24 h after spray. After 72 and 168 h Mospilan proved best with 78 and 81% mortality. Supracide the most effective insecticides for the control of adult female at all the post treatment intervals i.e., 60, 72 and 73% mortality under field conditions. © 2010 Friends Science Publishers

Key Words: Mango; Mango mealybug; Insecticides; Pakistan

INTRODUCTION

Mango (*Mangifera indica* L.), a member of family Anacardiaceae (Singh, 1968; Litz, 1997), is known as "king of fruits". It is one of the most significant trees on earth and is now eaten worldwide (<http://mgonline.com/mango.html>). The mango crop is attacked by a number of insect pests that deprive the trees of its nutrients. Mango mealybug (*Drosicha mangiferae* Green) is the most destructive pest in Indo-Pakistan (Prasad & Singh, 1976; Yousuf, 1993). It is a polyphagous insect, which has been recorded to feed on numerous plant species. Insecticides should only be used when all other methods of control become ineffective for the control of insect pests. As Stern *et al.* (1959) argued that pesticides tend to be highly disruptive to overall crop management, so their use should be limited to situations, where the benefit (to the overall crop production) outweighs the cost. Chemicals are also an important part of integrated pest management (IPM) program and have a number of advantages over alternative methods for insect control. For example, insecticides are always in ready form, easily

accessible and a wide range of insecticides are available in the market for the control of insect pest. Intensive, high-agricultural production systems have traditionally used synthetic pesticides to eliminate pests as the main tool and sustain the lowest amount of economic damage to the crop. Insecticides are considered to be the rapid method for the control of insect pests to overcome losses caused by insect pest to crop. Despite various environmental problems caused by the use of pesticides, it is still single most widely used method of insect pest control.

The specific aim of present study was to identify a best insecticide used for the control of mango mealybug, which saves the crop from the damage of this pest.

MATERIALS AND METHODS

Eleven formulations of insecticides viz., profenofos 500 EC, 30 mL, bifenthrin 10 EC, 100 mL, triazophos 20 EC, 100 mL, chlorpyrifos 40 EC, 50 mL, lambdacyhalothrin 2.5 EC, 50 mL, imidacloprid 200 SL, 100 g, buprofezin 20 SP, 500 g, deltamethrin 2.5 EC, 50 mL, cypermethrin 10

EC, 100 mL, acetamiprid 20 SP, 100 g and methidathion 40 EC, 150 mL were tested for the control of mango mealybug under field conditions on mango trees against 1st instar nymphs of mango mealybug. These formulations were sprayed in the field on mango trees against 1st instar nymphs of mango mealybug in the month of February, 2006 and the same dose of insecticides were sprayed against 2nd and 3rd instar in the month of March, 2006 and against adult female in the month of April, 2006. Four branches of 30 cm in length on two mango trees (having maximum population of mango mealy bug) were selected, tagged and the population of nymphs were counted from these branches including leaves, twig and inflorescence. Each branch showed one replication, so there were four replications. The data were recorded before spray and then 24, 72 and 168 h after spray. On the soil below each of the selected branches, a square meter soil was leveled and cleaned. The number of nymphs falling out of the tree and onto the ground was also checked regularly for their mortality from this square meter. The 'Black Chaunsa' variety of mango was selected for chemical control. Calibration was done before spray for measuring the quantity of water used by each treatment. Each tree was labeled with iron sheet fixed with nails. The date of spray, treatment and replication were written on iron sheet. The trees were sprayed with hand knapsack sprayer. The data was compiled and percent mortality was calculated through formula:

$$\% \text{mortality} = \frac{\text{Population recorded before spray} - \text{Population recorded after spray}}{\text{Population recorded before spray}} \times 100$$

The data were analyzed through Randomized Complete Block Design on an IBM-PC Computer using M. Stat Package. Means were separated by Duncan's New Multiple Range Test (DMRT) (Duncan, 1955).

RESULTS AND DISCUSSION

Mortality of 1st instar nymphs of mango mealybug 24 h after spray: The data regarding mortality of 1st instar nymphs of mango mealybug 24 h after spray are given in (Table I). Highly significant differences were found between treatments. The maximum mortality of the pest was observed with the spray of Mospilan and Decis (80 & 78% mortality, respectively) and did not show significant difference with each other. Followed by formulations were Supracide, Karate and Curacron with 75, 75 and 74% mortality, respectively. The minimum mortality of the pest (5%) was observed in those trees, where cypermethrin was sprayed. The effect of other insecticides in descending order was: Confidor > Lorsban > Talstar > Starter > and Hostathion with 70, 67, 66, 64 and 53% mortality of the pest, respectively 24 h after spray.

Mortality of 1st instar nymphs of mango mealybug 72 h after spray: Variations were found to be significant among treatments after 72 h of spray (Table I). The highest mortality of the pest was 85% in the trees sprayed with Mospilan, which did not differ significantly from Karate and

Table I: Comparison of chemical control of mango mealybug 1st instar under field condition during 2006-2007 (average of both years)

Insecticide		Dose/ 100 L water	1 st instar		
Trade name	Common name		% mortality after spray		
			24 h	72 h	168 h
Curacron 500EC	Profenofos	30 mL	74.42 b	83.35 a	83.68 c
Talstar 10EC	Bifenthrin	100 mL	65.80 de	73.48 e	74.11 e
Hostathion 20EC	Triazophos	100 mL	52.94 f	61.27 g	68.00 f
Lorsban 40EC	Chlorpyrifos	50 mL	66.70 d	76.25 cd	77.68 d
Karate 2.5EC	Lambdacyhalothrin	50 mL	74.85 b	84.98 a	86.32 b
Confidor 200SL	Imidacloprid	100 g	70.47 c	75.22 de	77.50 d
Starter 20SP	Buprofezin	500 g	63.57 e	66.19 f	72.26 e
Decis 2.5EC	Deltamethrin	50 mL	77.93 a	80.91 b	85.20 bc
Ripcord 10EC	Cypermethrin	100 mL	4.80 g	60.05 g	64.92 g
Mospilan 20 SP	Acetamiprid	100 g	79.72 a	85.17 a	90.57 a
Supracide 40EC	Methidathion	150 mL	75.48 b	77.76 c	86.18 b
Control			0.00 h	0.00 h	0.00 h
LSD @ 5 %			2.3723	2.066	2.3723

Table II: Mean comparison of chemical control of mango mealybug second and third instar under field condition during 2006-2007 (average of both years)

Insecticide		Dose/ 100 L water	2 nd and 3 rd instar		
Trade name	Common name		% mortality after spray		
			24 h	72 h	168 h
Curacron 500EC	Profenofos	30 mL	70.02 a	72.52 c	78.84 b
Talstar 10EC	Bifenthrin	100 mL	51.12 e	55.50 h	58.71 g
Hostathion 20EC	Triazophos	100 mL	47.34 e	57.66 g	62.03 f
Lorsban 40EC	Chlorpyrifos	50 mL	61.94 bcd	66.39 e	70.11 d
Karate 2.5EC	Lambdacyhalothrin	50 mL	63.43 bc	64.87 f	74.88 c
Confidor 200SL	Imidacloprid	100 g	57.89 d	64.02 f	67.76 e
Starter 20SP	Buprofezin	500 g	26.95 g	28.59 j	33.86 i
Decis 2.5EC	Deltamethrin	50 mL	70.72 a	74.55 b	77.22 b
Ripcord 10EC	Cypermethrin	100 mL	37.61 f	42.65 i	45.83 h
Mospilan 20 SP	Acetamiprid	100 g	65.25 b	77.99 a	81.42 a
Supracide 40EC	Methidathion	150 mL	60.23 cd	69.86 d	74.02 c
Control			0.00 h	0.00 k	0.00 j
LSD @ 5 %			4.507	1.516	1.969

Table III: Mean comparison of chemical control of mango mealybug adult female under field condition during 2006-2007 (average of both years)

Insecticide		Dose/ 100 L water	Adult female		
Trade name	Common name		% mortality after spray		
			24 h	72 h	168 h
Curacron 500EC	Profenofos	30 mL	50.11 c	62.24 c	64.44 c
Talstar 10EC	Bifenthrin	100 mL	26.15 i	29.83 h	33.37 h
Hostathion 20EC	Triazophos	100 mL	30.12 h	33.39 g	35.55 g
Lorsban 40EC	Chlorpyrifos	50 mL	35.19 f	46.77 e	52.99 e
Karate 2.5EC	Lambdacyhalothrin	50 mL	31.89 g	42.35f	52.54 e
Confidor 200SL	Imidacloprid	100 g	40.28 e	45.26 e	48.61 f
Starter 20SP	Buprofezin	500 g	6.36 k	11.50 j	16.36 i
Decis 2.5EC	Deltamethrin	50 mL	45.44 d	54.02 d	61.58 d
Ripcord 10EC	Cypermethrin	100 mL	21.87 j	25.12 i	32.96 h
Mospilan 20 SP	Acetamiprid	100 g	58.13 b	69.39 b	70.57 b
Supracide 40EC	methidathion	150 mL	59.89 a	71.64 a	72.71 a
Control			0.001	0.00 k	0.00 j
LSD @ 5 %			1.660	1.993	1.828

Means sharing similar letters are not significantly different by DMR Test at P = 0.05

LSD = Least Significant Difference Value

* = Significant at P ≤ 0.05

** = Significant at P ≤ 0.01

Curacron (85 & 83%) mortality of 1st instar nymphs of mango mealybug 72 h after spray. The lowest mortality of the pest (60 & 61%) was observed with the spray of Ripcord and Hostathion, respectively. The application of Decis, Supracide, Lorsban, Confidor, Talstar and Starter resulted in 81, 78, 76, 75, 73 and 66% mortality of 1st instar nymphs of the pest, respectively.

Mortality of 1st instar nymphs of mango mealybug 168 h after spray: Significant differences were found between treatments means regarding mortality of 1st instar nymphs of mango mealybug 168 h after spray (Table I). The results reveal that Mospilan the most effective showing maximum mortality (91%) and differed significantly from those of observed in all other treatments. Supracide, Karate and Decis showed similar response with 86, 86 and 85% mortality of 1st instars nymphs of mango mealybug and ranked second in their effectiveness after Mospilan. The mortality of the pest observed in those treatments, where Decis was applied also showed no significant difference with those observed with Curacron. The mortality of the pest with Lorsban and Confidor was 78 and 78% in those treatments, respectively. Ripcord was the least effective (65% mortality of the pest) and differed significantly from all other treatments. Non-significant difference existed between Talstar and Starter resulting in 74 and 72% mortality of the pest.

Mortality of second and third nymphal instars of mango mealybug 24 h after spray: Highly significant differences were found in the data regarding mortality of second and third nymphal instars of mango mealybug at 24 h after spray during 2006 and 2007 (Table II). The maximum mortality of second and third nymphal instar was recorded to be 71% with Decis spray followed by Curacron (70%) mortality of second and third nymphal instars of mango mealybug. Mospilan was found to be the next effective treatment with 65% mortality of the pest followed by Karate and Lorsban (63 & 62% mortality). The later mentioned treatments also showed non-significant difference with Confidor and Supracide showed 58 and 60% mortality of the pest, respectively. No significant difference existed between Talstar and Hostathion application (51 & 47% mortality, respectively). Starter was the least effective with 27% mortality of second and third nymphal instars of mango mealybug. Similarly the application of Ripcord also showed no promising results (with 38% mortality of the pest). Results showed that Supracide was the most effective causing the greatest mortality (78%) after 72 h of all insecticides tested. Decis was the most effective resulting in 74% mortality of the pest. The mortality of all other treatments was Curacron > Supracide > Lorsban > Karate = Confidor > Hostathion > Talstar > Ripcord > and Starter with 73, 70, 66, 65, 64, 58, 56, 43, and 29%, respectively.

Mortality of second and third nymphal instars of mango mealybug 72 h after spray: The data regarding mortality of second and third nymphal instars of mango mealybug at 72 h after spray during 2006 and 2007 in different

treatments (Table II). The results reveal significant ($P < 0.01$) differences in the treatments. Results showed that Supracide was the most effective causing the greatest mortality (78%) after 72 h of all insecticides tested. Decis was the most effective resulting in 74% mortality of the pest. The mortality of all other treatments was Curacron > Supracide > Lorsban > Karate = Confidor > Hostathion > Talstar > Ripcord > and Starter with 73, 70, 66, 65, 64, 58, 56, 43 and 29%, respectively.

Mortality of second and third nymphal instars of mango mealybug 168 h after spray: The data relating to mortality of second and third nymphal instars of mango mealybug in different treatments at 168 h after spray are given in (Table II). The results reveal significant ($P < 0.01$) differences in the treatments. Mospilan was most effective with 81% mortality followed by 79, 77, 75, 74, 70, 68, 62 and 59% mortality of the pest in those trees, where Curacron, Decis, Karate, Supracide, Lorsban, Confidor, Hostathion and Talstar, respectively. Starter was found the least effective with a minimum mortality (34%).

Mortality of adult female of mango mealybug 24 h after spray: The data regarding mortality of adult females of mango mealybug at 24 h of post treatment intervals in different treatments during 2006 and 2007 showed significant ($P < 0.01$) difference (Table III). Supracide was the most effective causing 60% mortality followed by 58, 50, 45, 40, 35, 32, 30, 26 and 22% mortality of the pest in those treatments, where Mospilan, Curacron, Decis, Confidor, Lorsban, Karate, Hostathion, Talstar and Ripcord, respectively. Buprofezin showed the least toxic effect on the adult female of mango mealybug (6%).

Mortality of adult female of mango mealybug 72 h after spray: The data on the mortality of adult females of mango mealybug at 72 h of post treatment interval during 2006 and 2007 revealed highly significant differences among treatments (Table III). Supracide was the most effective indicating maximum mortality (72%) followed by Mospilan, Curacron and Decis 69, 62 and 54%, respectively. Lorsban and Imidacloprid showed 47 and 45% mortality, while Buprofezin was the least effective (12% mortality). The effectiveness of other insecticides in descending order was Karate, Hostathion, Talstar and Cypermethrin with 42, 33, 30 and 25% mortality of the pest, respectively.

Mortality of adult female of mango mealybug 168 h after spray: The results revealed significant ($P < 0.01$) difference for this character. Supracide was the most effective with maximum mortality (73%) among the treatments. Mospilan was the second most effective insecticide with 71% mortality of the pest. Buprofezin, with 16% mortality, was at the bottom. The mortality percentage was ranked as 64, 62, 53, 53, 49, 36, 33 and 33 with Curacron, Decis, Lorsban, Karate, Confidor, Hostathion, Talstar and Ripcord spray, respectively (Table III).

Among 11 formulations of insecticides tested for the control of mango mealybug under field conditions,

acetamiprid was found to be the most effective insecticide resulted in significantly the highest mortality of different instars and adult females. These finding can be compared to Karar *et al.* (2008), who reported that acetamiprid was effective for the control of mango mealybug. Supracide was the most effective for adult female at all the post treatment intervals. Chlorpyrifos was not as effective. These findings are partially in conformity with those of Srivastava and Tandon (1981) who reported that chlorpyrifos was toxic to mango mealybug compared with the insecticides other than those tested in the present study. The present findings cannot be compared with those of Rojanavongse and Charernsom (1984), Azim (1985), Dalaya *et al.* (1983), Rao and Barwal (1985), Khan (1985), Das and Singh (1986), Khurana and Verma (1988), Gaffar (1989), Singh *et al.* (1991), Sohi *et al.* (1992), Irulandi (2000) due to differences in methodology used in the present study.

Acknowledgement: Current studies were conducted in Multan Punjab-Pakistan in mango orchards with the cooperation of Government of the Punjab Department of Agricultural Research. I thank Dr. Shafqat Saeed, Assistant Professor for providing me the student workers, laboratory staff and conveyance facility during period of study.

REFERENCES

- Azim, I.I., 1985. *Insect Pests of Mango and their Control in Bangladesh*, pp: 5–6. Symposium on the Problems and Prospects of Mango Production in Bangladesh, Dhaka (Bangladesh), 17-18 February
- Dalaya, V.P., S.G. Rajput, A.R. Mali and P.B. Mohite, 1983. Comparative efficacy of insecticides against guava mealybug, *Drosicha mangiferae* Green. *Indian J. Plant Prot.*, 11: 138–139
- Das, L.K. and B. Singh, 1986. Economic control of *Maconellicoccus hirsutus* Green infesting mesta. *Indian J. Agric. Sci.*, 56: 373–375
- Duncan, D.B., 1955. Multiple range and multiple F tests. *Biometrics*, 11: 1–42
- Gaffar, S.A., 1989. Chemical control of mealybug, *Drosicha dalbergiae* (Stebbing) on almond in Kashmir. *Indian J. Plant Prot.*, 17: 31–34
- Irulandi, S., P.K.V. Kumar, H.G. Seetharama and K. Sreedharan, 2000. Laboratory evaluation of imidacloprid 17.8% SL against the coffee mealybug, *Planococcus lilacinus* (Cockerell). *J. Coffee Res.*, 28: 92–94
- Karar, H., M.J. Arif, H.A. Sayyed, S. Saeed, G. Abbas and M. Arshed, 2009. Integrated Pest Management of Mango Mealybug (*Drosicha mangiferae*) in Mango Orchards. *Int. J. Agric. Biol.*, 11: 81–84
- Khan, S.M., 1985. Chemical control of insect pests of mango and its malformation by injection method. *M. Sc. Thesis*, University of Agriculture, Faisalabad, Pakistan
- Khurana, A.D. and A.N. Verma, 1988. Laboratory and field evaluation of insecticides against nymphs and gravid females of mango mealybug, *Drosicha mangiferae* (Green). *Indian J. Entomol.*, 50: 319–326
- Litz, R.E., 1997. *The Mango: Botany, Production and Uses*, p: 587. CAB International, University Press, Cambridge
- Prasad, V. and R.K. Singh, 1976. Prevalence and control of mango Mealybug, *Drosicha stebbingi* Green in Bihar. *Indian J. Entomol.*, 38: 214–224
- Rao, N.S. and R.N. Barwal, 1985. Comparative efficacy of various contact insecticides *Rastrococcus invadens* Williams (Hemiptera:Pseudococcidae) and its control with *Gyranusoida tebygi* Noyes (Hymenoptera: Encyrtidae) in Togo. *Mitteilungen Deutsch. Gesellschaft Allgemeine Angewandte Entomol.*, 7: 647–652
- Rojanavongse, V. and K. Charernsom, 1984. *Mealybug and scale insects of ornamental plants and control*. Kasetsart University, Bangkok (Thailand), p: 107. Faculty of Agriculture. Department of Entomology, Kasetsart University, Bangkok (Thailand), Research Reports
- Srivastava, R.P. and P.L. Tandon, 1981. Relative toxicity of insecticides against second instar of mango mealybug *Drosicha mangiferae* Green nymphs. *Indian J. Entomol.*, 43: 193–195
- Singh, L.B., 1968. *The Mango: Botany, Cultivation and Utilization*, p: 438. World Crop
- Singh, R., A. Singh, R.S. Verma and D.K. Singh, 1991. Relative toxicity of some insecticides to the adults of mango mealybug, *Drosicha mangiferae* Green. *Indian J. Entomol.*, 53: 525–527
- Sohi, A.S., G.S. Sandhu and R.C. Batra, 1992. Pressure injection of monocrotophos in tree trunk for control of mealybug and mango hopper. *Indian J. Hort.*, 49: 350–353
- Stern, V.M., R.F. Smith, R. Van Den Bosch and K.S. Hagen, 1959. The integrated control concept. *Hilgardia*, 28: 81–101
- Yousuf, M., 1993. Mango mealybug control with polyethylene bands. *Pakistan Entomol.*, 15: 129

(Received 05 March 2010; Accepted 05 April 2010)