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Insecticide Application Tactics to Suppress Population of *Drosicha Mangiferae* (Green)

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Abstract:

The experiment was conducted in mango orchard at Tando jam Pakistan during mango season 2011-2012. The insecticides viz. Lorsban™ (Chlorpyrifos 50EC), Talstar (Bifenthrin 10EC) and Confidor (Imidacloprid 200SL) were applied on trunks of Chunsa variety of mango before upward movement of newly hatched 1st instar nymphs of mango mealy bugs with the following tactics: spraying with banding at 2 days interval, spraying with banding at 7-day interval, spraying without banding at 2 and 3-day interval and control (untreated control) with three replications. The results indicated that spraying of insecticides at 2-day interval of with bending on brought maximum reduction in mealy bug population on mango plant as compared to other tactics. Lorsban™ was found the most effective insecticide as compared to Confidor and Talstar. Cost/ benefit ratios revealed that spraying at 2 days interval of Lorsban™ on tree with bending during upward movement of mealy bug to mango plant found more effective and economical because least quantity of insecticides

was used as compared to spraying whole mango plant to control mealy bug after completion of their upward movement to mango plants. Beside that it reduced the possible threat to the environment and natural enemies of insects.

Key words: insecticide, application tactics, mango plant, mealy bugs, population.

Introduction

Mango (*Mangifera indica* L.) an important tropical fruit of family Anacardiaceae is known as king of fruits for its sweetness, excellent flavor, delicious taste and high nutritive value (Singh, 1968; Litz, 1997) is being grown in more than 100 countries (Sauco, 1997). Pakistan is ranked third in the world for production (Anonymous, 2007) and earns 9012 million rupees in foreign exchange per year by exporting mangoes to many countries *i.e.* Dubai, Saudi Arabia, UK, Germany, France, Holland, Switzerland, Italy, Singapore and Malaysia (FAO, 2011; MINFAL, 2011). Mango mealybug (*Drosicha. mangiferae* Green.) is most serious pest of mango in Pakistan. The nymphs and female bugs suck sap from inflorescence, tender leaves, shoots and fruit peduncles (Karar *et al*., 2006). As a result, the affected inflorescences are shriveled and get dried. Severe infestation affects the fruit set and causes fruit drop. They secrete honey dew over, which sooty mould develops (Tandon & Lal, 1978). According to Ahmad *et al*. (2003) integrated pest management of mealy bug could be the safest and cheapest method for the pest control. However, insecticidal use is inevitable to mealy bug outbreak as compared to predators and parasitoids (McKenzie, 1967; Joshi *et al.,* 2010). Insecticides belonging to different groups also have been documented to be effective against mealy bug e.g, Suresh *et al.,* (2010) recommended profenofos 50EC 2ml/L, chloropyriphos 20 EC 2ml/L, dimethoate 2ml/L, imidacloprid 0.6 ml/L and

thiamethoxam 0.6 g/L on need based application. Insecticides like buprofezin are also used against nymphal and adult population of mealy bug (Muthukrishan *et al.,* 2005), besides insect growth regulators and nicotine based insecticides in some vineyards (Danne *et al*., 2006)

The management of this pest is more effective when the pest is in initial than later instars, so it would be useful to adopt the management strategies when mango mealy bug is in early instars, it has been already reported by previous research workers who worked on management of this pest. The spray of insecticides parathion, Benzene Hexa Chloride (BHC) and Dichlorodiphenyltrichoroethane (DDT) was found effective against 1st , 2nd instar, whereas for 3rd instar nymphs and adult females Folidol, malathion Nematox, Hanane, Diazinon and pestox proved effective (latif and ismail,1957; Bindra 1967;Azim1985), diazinon, quinalphos and parathion-methyl (methyl-parathion) were highly effective against 1st instar nymphs (Lakra *et al*.,1980). Decis, LorsbanTM, Mospilan and Supracide gave maximum mortality adult female under field conditions (Karar *et al*., 2010). Keeping in view the losses caused by the pest and to find out the best control through use of insecticides, the current study is planned to use insecticides with different tactics to manage population of mealy bug on mango plants.

Materials and Methods

During present investigation different application tactics of insecticides were used to manage population of mango mealy bug in mango orchard. Since, females of mango mealy bugs lay their eggs in soil and emergence of 1st instars also takes place in the soil, thereafter, they access to mango trees panicles by upward through tree trunk. Their upward movement may take few days; therefore, different insecticides with different application tactics were planned to control mealy population on

mango plants. The experiment was conduct at Tandojam during the 2011-2012.The following insecticides were used to examine the efficacy of Lorsban™ (Chlorpyrifos 50EC), Talstar (Bifenthrin 10EC) and Confidor (Imidacloprid 200SL) on Chuansa variety of mango. For this purpose, a total of 18 trees were selected at random in the orchard. Application of pesticides was carried out for the period when the 1st instars crawlers started their upward movement from soil to plant canopy. The spraying on the plants was stopped when upward movement of all 1st instars was completed. Hand operated knapsack sprayer was used to spray the trunk portion after spraying of each insecticide the spray tank was washed carefully to avoid mixing of pesticides Application of insecticides was made on the trunk mango plant at its base up to the height 3 feet with following tactics:

I. Spray with banding at 2-day interval (SWBA2DI).
II. Spray with out banding at 3-day interval (SWBA3DI).
IV. Spray with banding at 7-day interval (SWOBA2DI).
III. Spray without banding at 2-day interval (SWBA7DI).
V. Spray without banding at 3-day interval (TWOBA3DI).
VI. Control (untreated trunk).

After upward moment, the data on population of mealy bugs were taken on 5 panicles randomly selected from each plant. The plants were kept under observation from 2nd week of December to 3week of May. The population on treated plant was then compared with the population of mealy bugs on the control plants (untreated). The data thus collected were subjected to analysis of various to test the superiority of treatment mean LSD test was applied as per the method outlined by Gomez and Gomez (1984). For this purpose a Microsoft computer package "MSTATC" was used.

Results

The data of the experiment are presented in Tables 1, 2 and 3. The efficiency of different pesticide application tactics are presented as under:

Spray with bending at 2-day interval

Through this strategy maximum population (3.67±1.45) per 5 panicle were recorded twice i.e. on 6-2-2013 and 6-3-2013, respectively on the plant treated with Lorsban™ The plants sprayed with Confidor had maximum 9.00± 2.30 mealy bug per 5 panicles on 27-02-2012 in comparison of the above insecticides. Talstar was found least effective because the plants sprayed with Talstar had more mealy bugs (19.30±1.45) per 5 panicles on 20-02-2012. During the period 6-2-2012 to 27-2-2013 maximum emergence of 1st instars was recorded and their population on panicles of untreated plants was ranged from 329.33±13.77 to 445.00 ±14.15 per 5 panicles.

Spray with bending at 3 day interval

Spray at 3 day interval with banding also found effective, however, the mealy bug population was not reduced that much as reduced through strategy I. The trees sprayed with Lorsban™ had least population (7.33±0.88) per 5 panicles on 27-02-2012 as compared to Confidor (12.70±0.88) and Talstar (24.00±1.53) on 06-03-2013, respectively.

Spray with bending at7 day interval

At 7 day interval with banding was not found much effective because population of mealy bugs reached as (35.30±2.33) per 5 panicles on 20-02-2013 when mango plant trunk was sprayed with Talstar. The population of mealy bug appeared with a little variation (32.00±2.70) on 27-02-2013 on those plant which were sprayed with Confidor in the same situation at 7 day interval. Lesser population (23.70±0.88) was recorded on those

trees treated with Lorsban™ on 27-02-2013. This showed that the strategy of applying insecticides at 7 days interval with banding on trunk could not check upward movement of 1st instars as much as it was seen in strategy I&II.

Spray without bending at 2 days interval

Spray with out banding at 2 days interval was not found effective as much as spraying on the trunk with bending at 3 day interval. The avoidance of pesticides by mealy bug was recorded by counting their population on mango trees. The trees sprayed with Lorsban™ had 14.00±0.70 mealy bug per five panicles on 20-2-2012, whereas trees sprayed with Confidor had (17.00± 2.00) on 20-2-2013 and Talstar had (30.30±2.33) mango mealy bug population per plant on 27.2-2012.

Trunk without bending at 3 day interval

Application of insecticides on trunk without bending at 3 days interval resulted (42.00±1.30) mealy per 5 panicles when trunks were sprayed by Confidor. Applications of Lorsban™ and Talstar have reduced mealy bug population to 37.00± 1.15 and 38.67± 1.45 as compared to mealy bugs population (445.00±14.15) on control panicles.

Table 1. Mean mealy bugs population per five mango plant panicles after application of Lorsban™ with different strategies.

Date	Lorsban™					Control
	SWBA2D	SWBA3D	SWOBA2D	SWBA7D	TWOBA3D	
02-01-2012	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
09-01-2012	0.00±0.00	0.00±0.00	1.30±0.30	2.33±0.88	5.33±1.33	136.33±8.76
16-01-2012	0.00±0.00	1.33±0.67	3.30±0.30	5.00±1.73	10.30±1.76	187.66±13.98
23-01-2012	0.67±0.67	2.00±0.58	5.00±0.00	9.33±1.45	16.30±0.88	233.66±19.75
30-01-2012	1.33±0.33	3.00±0.58	7.30±0.70	11.70±1.76	19.30±1.45	285.00±10.01
06-02-2012	3.67±1.45	3.67±0.33	8.70±0.30	14.30±1.86	21.00±2.89	329.33±13.77
13-02-2012	3.33±0.88	4.67±0.33	10.00±0.60	17.3±0.88	24.00±2.31	413.66±14.74
20-02-2012	2.00±1.00	7.00±0.58	14.00±0.70	20.30±0.88	29.70±1.76	433.66±18.52
27-01-2012	3.00±1.15	7.33±0.88	10.00±0.90	23.70±0.88	31.70±1.67	445.00±14.15
06-03-2012	3.59±1.45	6.67±0.88	7.30±0.70	14.70±1.67	37.00±1.15	350.33±12.99
13-03-2012	2.67±0.67	5.00±1.15	5.30±0.30	10.30±0.88	23.30±2.40	228.33±17.40
20-03-2012	1.00±0.58	3.67±0.88	4.00±00.0	6.67±0.67	16.70±3.18	168.33±11.66
27-03-2012	1.33±0.33	2.67±0.88	2.30±0.30	4.67±0.67	10.30±1.86	110.33±11.83
03-04-2012	0.67±0.33	1.33±0.67	1.70±0.30	2.00±0.58	6.67±1.20	58.66±16.17
01-04-2012	0.00±0.00	0.00±0.00	1.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

I Spray with banding at 2 days interval,
II Spray without banding at 3-days interval on trunk
III Spray without banding at 2 days interval
IV Spray with banding at 7-days interval
V Trunk without banding at 3 days interval.

Table 2. Mean mealy bugs population per five mango plant panicles after application of Talstar with different strategies.

Date	Talstar					
	SWBA2D	SWBA3D	WOBA2D	SWBA7D	TWOBA3D	Control
02-01-2012	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
09-01-2012	3.33±0.88	1.00±0.58	2.67±0.88	4.67±1.45	6.667±0.88	136.33±8.76
16-01-2012	4.67±1.20	4.67±0.33	6.33±1.20	11.70±1.76	13.33±1.45	187.66±13.98
23-01-2012	7.00±1.15	7.67±1.33	11.70±1.45	17.67±0.88	20.00±1.00	233.66±19.75
30-01-2012	11.30±1.45	10.70±1.86	14.30±1.76	21.00±1.15	24.00±1.00	285±10.01
06-02-2012	14.70±0.88	14.00±2.52	17.00±1.15	28.00±0.58	30.33±0.88	329.33±13.77
13-02-2012	16.30±1.45	16.00±2.52	21.70±1.45	31.70±1.33	34.33±1.20	413.66±14.74
20-02-2012	19.30±145	19.00±1.15	26.30±2.73	35.30±2.33	38.67±1.45	433.66±18.52
27-01-2012	18.00±1.53	21.70±0.33	30.30±2.33	34.00±2.65	36.67±2.96	445±14.15
06-03-2012	17.00±4.16	24.00±1.53	18.70±1.86	23.30±2.33	25.33±2.33	350.33±12.99
13-03-2012	9.67±1.12	20.00±1.53	13.30±2.33	17.70±0.88	21.33±1.85	228.33±17.40
20-03-2012	6.33±0.67	15.00±0.58	8.33±1.45	14.30±1.45	16.00±1.00	168.33±11.66
27-03-2012	4.00±0.58	8.33±0.88	6.67±1.20	8.67±0.67	10.33±0.88	110.33±11.83
03-04-2012	2.33±0.67	3.67±0.67	3.33±0.88	5.33±0.67	7.00±0.57	58.66±16.17
10-04-2012	0.33±0.33	1.00±0.58	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

Table 3. Mean mealy bugs population per five mango plant panicles after application of Confidor with different strategies.

Date	Confidor					Control
	SWBA2D	SWBA3D	SWOBA2D	SWBA7D	TWOBA3D	
02-01-2012	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
09-01-2012	1.70±0.30	0.00±0.00	1.00±0.58	3.70±0.90	8.30±0.30	136.33±8.76
16-01-2012	3.00±0.00	2.00±0.00	2.67±0.88	8.30±1.80	18.00±1.80	187.66±13.98
23-01-2012	4.70±0.30	3.67±0.33	4.67±0.33	15.00±1.50	23.00±1.20	233.66±19.75
30-01-2012	5.70±0.30	4.67±1.45	6.67±1.20	17.00±1.70	27.00±0.90	285.00±10.01
06-02-2012	7.00±0.60	5.67±1.33	11.70±0.67	18.00±1.30	34.00±1.00	329.33±13.77
13-02-2012	7.30±0.70	7.33±1.20	15.00±1.15	23.00±1.20	37.00±0.90	413.66±14.74
20-02-2012	8.70±1.20	7.00±0.00	17.00±2.00	29.00±2.00	42.00±1.30	433.66±18.52
27-01-2012	9.00±2.30	9.33±0.33	13.00±1.53	32.00±2.70	42.00±4.10	445.00±14.15
06-03-2012	8.00±1.50	12.70±0.88	10.3±1.45	19.00±3.50	30.00±2.90	350.33±12.99
13-03-2012	5.70±0.90	6.33±1.20	8.00±0.58	14.00±2.10	24.00±1.70	228.33±17.40
20-03-2012	4.70±1.20	3.67±0.33	6.67±0.88	11.00±1.20	16.00±0.30	168.33±11.66
27-03-2012	2.70±0.70	2.00±0.00	4.33±0.88	7.70±0.90	13.00±1.20	110.33±11.83
03-04-2012	1.70±0.30	1.00±0.00	1.67±0.33	3.30±0.30	8.00±0.60	58.66±16.17
10-04-2012	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

Table 4. Total mean mealy bugs population per five mango plant panicles after different application with different strategies

Treatments	SWBA2DI	SWBA3DI	SWOBA2DI	SWBA7DI	TWOBA3DI	Control
LorsbanTM	1.55±0.36	3.22±0.65	5.41±1.04	9.48±1.92	17.69±3.03	225.30±38.56
Talstar	8.95±1.73	11.11±2.08	12.04±2.42	16.88±3.07	18.93±3.28	225.35±38.56
Confidor	4.66±078	4.35±096	6.84±1.42	13.4±2.55	21.48±3.61	228.04±39.92

Cost benefit ratio

Table 4 revealed cost/ benefit ratios of insecticides and mealy bug population appeared on mango panicles. The data showed that Lorsban™ was found the most effective, however, the application strategy i.e. Spray with plastic bending at 2 days interval the base of mango tree trunk was found the most effective in checking or controlling mealy bug population from upwards movement to mango plant panicles. Only 120ml of Lorsban™ that cost Rs. 70.5/= checked about 99% population of mealy bug from their upward movement to plant panicles. Similarly, Confidor was found next to Lorsban™, 120ml of Rs. 114/= had reduced mealy bug population by 97%. While Talstar was found least effective that reduced mealy bug population by 95.54% as compared to Confidor. The other insecticide application strategies were also found economical with regards to expenditure; however, these could not reduce mealy bug

population that much. Consequently, the possibility of mealy bug population threat to mango plant in the following year will remain intact. It is concluded that spray with banding at 2 days interval Lorsban™ to mango trunk with plastic bending during upwards movement of 1st and 2nd inters mealy bugs reduces the possibility of mealy bug to invade mango plant panicles. This cost / benefit ratio when compared with the farmer's practices for controlling mealy bug population through insecticides, they used the above mentioned insecticide as 25 ml/ 20 litter water per plant which costs as Rs. 190 per spray. Five to six sprays are carried out; however, their result may not be satisfactory. By this practice only 50 to 60% reduction in mealy bug population was recorded so far. With regards to yield component of mango plants, it was observed that the mango plants treated with less input of insecticides by strategy I gave, maximum yield i-e. 18 munds per plant with an earning of Rs.32400/ and the minimum i-e 6 munds per plant with an earning of Rs.10800 by untreated plants (control).

Table 5. Mean mealy bug population on 5 panicles of mango plant after application of insecticides through different strategies and their cost/ benefit ratios.

Strategy	Dose	Quantity of pesticide required	Max. Mealy bug population after insecticide application (Expenditure Rs.)		
			Lorsban™	Confidor	Talstar
I SWBA2D	5ml/1 lit.water	120ml	3.67±1.45(Rs.70.5/=)	9.00±2.30(Rs.114/=)	19.30±1.45(Rs.114/=)
II SWBA3D	5ml/1 lit.water	90ml	7.33±0.88(Rs.153/=)	12.70±0.88(Rs.85.5/=)	24.00±1.53(Rs. 85.5/=)
III3 SWOBA2D	5ml/1 lit.water	120ml	14.00±0.70(Rs.70.5/=)	17.00±2.00(Rs. 114/=)	30.30±2.33(Rs.114/=)
IV SWBA7D	5ml/1 lit.water	90ml	23.70±0.88(Rs.153/=)	32.00±2.70(Rs.85.5/=)	35.30±2.33(Rs.85.5/=)
V TWOBA3D	5ml/1 lit.water	90ml	37.00±1.15(Rs.153/=)	42.00±4.10(Rs. 85.5/=)	38.67±1.45(Rs. 85.5/=)
Control	-----		445.00±14.15	445.00±14.15	445.00±14.15
Farmers practices	25ml/20 lit.water	1875 ml	3187.5 (70-80%) suppression	1781.25(60-70%)	1781.25(60-70%)

Discussion

The present investigations on application strategies indicated that the pesticides applied along with banding on trunk of mango plant with short interval was the most effective and rapid tool for suppressing mealy bug population. Azim (1985) reported that the mango pests for example mango mealybug, mango hoppers, mango shoot psyllid, mango fruit weevil and mango stem borer could be controlled through the application of insecticides like lebaycid, dimecron or melathion. During persent studies it was found that LorsbanTM was the most effective insectide to control mealy bug population as compared to Conficdor and Talastar. Karar *et al.* (2009) used the chemical practice to kill the 1st instar nymphs. The maximum mortality of 1st instar mango mealy bug 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 Lorsban™ 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. Hussain *et al*. (2012) mentioned that Profenofos revealed maximum percent mortality as 93.3% and 86.67% of the 1st and 2nd instar mango mealy bug. It adds that triazophos showed to be an effective insecticide for the control of the 4th instar mango pest by showing 64.0 and 100% mortality in foliar application and leaf dip method. During present study the application of insecticide with plastic bending at the bottom of tree trunk at 2 days interval was found one of the effective IPM strategies that reduced the upwards movement by 98% of newly emerged 1st istars from soil to tree turnk. Application through this mechanism has enhanced benefit ratio in the quantity of insecticides required and in return it gave huge benefit in reducing population and also

insecticidal threat to beneficial insects and non- insects as well. Tandon (1980) mentioned that first-instar nymphs of the mango pest *Drosicha mangiferae* (Green) emerged from soil and approached the mango trees by upward movement through tree trunk. The best time for applying the compounds was a few days before the nymphs started to hatch in soil. Ishaq *et al*. (2004) reported the mango mealy bug are serious pests of mango and are difficult to control by insecticides. Testing several treatments developed an IPM strategy. The sticky bands along with burning and burying treatments significantly reduced the incidence of infestation by mango mealy bug (0.00-15.79%). Anonymous (2013) pesticides negatively impact the natural ecosystem in various ways which affect both the farmer and the rest of the society. The wide spread use of pesticides in modern farming has led to the termination of many beneficial insects that do not fall into the category of pests. Pimentel (2005) pesticide impacts on public health; livestock and livestock product losses; increased control expenses resulting from pesticide-related destruction of natural enemies and from the development of pesticide resistance in pests; crop pollination problems and honeybee losses; crop and crop product losses; bird, fish, and other wildlife losses; and governmental expenditures to reduce the environmental and social costs of the recommended application of pesticides.

Conclusion:

It is concluded from the results that:

I. Lorsban™ was found the most effective insecticide followed by Confidor.

II. Spray on mango trunk with bending at 2 days interval the ground up to 3 ft high reduced mealy bug population on mango plants more than 98%

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