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MANAGEMENT TECHNIQUES FOR SUPPRESSING HOGPLUM BEETLE BY USING SOME CHEMICALS AND CULTURAL APPROACH

M. M. H. Khan

Department of Entomology, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh

Abstract: Experiment on hogplum beetle, *Podontia 14-punctata,* was carried out to find out the suitable technique(s) for suppressing both larvae and adults of hogplum beetle. Results revealed in field trial that the highest mortality (98.56%) was found in all larval instars and adult stages of hogplum beetle after 24 hours by the effect of spading + Superior 505 EC (Chlorpyriphos + Cypermethrin) @ 10 ml/10 liter of water (T_2) and lowest mortality was recorded in T_3 (83.85%) treated leaves. The highest infestation reduction over control was obtained from T_6 (62.75%) treated plant compared to other treated plants. In laboratory trial, the highest mortality (96.62%) was found in all larval instars and adult stages of hogplum beetle after 24 hours by the treatment of superior 505EC (T_2) followed by T_4 (88.00%) and lowest mortality was in T_3 (69.70%) treated leaves. No mortality was observed in control treatment (T_5).

Key words: Hogplum, management technique, chemical, superior 505 EC.

INTRODUCTION

The fruit of hogplum (*Spondias mangifera* Wild.) is locally known as Amra which is a popular fruit in Bangladesh. The fruit is delicious and source of vitamin C and carotene (Mondal and Amin 1990). It is consumed in most cases in green stage and is also used as prickle, chattni, murabba, etc. (Ahmad 1969). It is extensively used as fodder in different parts of India like Assam, Madhya Pradesh, Maharashtra, Punjab and Uttar Pradesh (Singh 1982). The hogplum is a deciduous perennial tree with thick succulent leaves and it grows all over the country, but the quality fruits are produced only in the southern districts of Bangladesh (Sarder and Mondal 1983), especially in Barisal and Patuakhali districts. Its cultivation is seriously hampered by hogplum beetle or 14 spotted leaf beetle. The 14 spotted leaf beetle, *Podontia quaturdecempunctata* or *Podontia 14-punctata* L. (Chrysomelidae: Coleoptera) is distributed throughout South East Asia and feeds on *S. mangifera* Wild. (Anacardiaceae) in Bangladesh (Husain and Ahmad 1977, Howlader 1993).

*Author for correspondence: mohasin1965@pstu.ac.bd

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In Bangladesh, the beetles appear in June, abundant during July to September and disappear in October. The peak period of defoliation is August and September (Beeson 1941, Baksha 1997). The beetles cause serious damage to the crop from March to August with two generations in a year (Mondal 1975). Both adults and grubs of this beetle feed on the leaves of the hogplum (Beeson 1941, Ahmed 1969, Mondal 1975, Sarder and Mondal 1983) and heavy infestation often cause complete defoliation of the tree during peak period. Their attack resulting in stunted growth of the plant and eventually reduces the fruit size and yield (Mondal 1975). During severe infestation the larvae devour the old leaves, tender parts of stems, and even the green barks of the plants (Howlader 1993).

At present suitable control measure against this pest is not available in the country. People usually spray insecticides to control this pest. There is no recommended insecticide with proper doses of application. For suppressing this pest and other beetle and weevil pests, some authors tested a few number of chemical insecticides (Hoffmann *et al*. 2000, Elzen *et al*. 2000, Singh and Misra 1989), of them malathion was found to be effective against these pests. As this pest is external feeder it is easier to suppress them by using malathion or related insecticides with an appropriate dose(s). But the studies on the determination of suitable insecticides with appropriate doses were not systematically done in laboratory or in field condition so far. Therefore, two doses of Chlorpyrifos, Setap and Superior (Chlorpyriphos + Cypermethrin) were tested to find out the suitable insecticide(s) with proper dose which can effectively suppress the larvae and adult stages of this pest in the laboratory and in field condition.

To develop management technique(s) for suppressing hogplum beetle by using some chemicals and cultural approach at hogplum orchards or farmer's homestead garden of Patuakhali and Barisal districts.

MATERIAL AND METHODS

Experiment on hogplum beetle, *Podontia 14-punctata* was carried out in the laboratory of Entomology Department of Patuakhali Science and Technology University (PSTU), Dumki, Patuakhali as well as at the hogplum orchard of Regional Agricultural Research Station (RARS), BARI, Rahmatpur, Barisal, Bangladesh, during April to October, 2013. The laboratory experiment was carried out under normal room temperature (32^0C) and relative humidity (85 ± 5%) with a 14 ± 2 : 10 ± 2 light and dark cycle (L : D) following completely randomized design (CRD). The field experiment was laid out in a randomized complete block design (RCBD) with 5 treatments and 3 replications.

A total of 15 trees of around 6 years old were used for this study. One hogplum tree was considered as one treatment replication. Plant to plant distance was 20 ft × 20 ft. The evaluated treatments were T_1 = Spading + Chita 48 EC (Chlorpyriphos) @ 10 ml/10 liter of water, T_2 = Spading + Superior 505 EC (Chlorpyriphos + Cypermethrin) @ 10 ml/10 liter of water, T_3 = Spading + Seatap 50 SP @ 15g/ 10 liter of water, T_4 = Spading + Hitfen 20 EC @ 10 ml/10 liter of water and T_5 = Untreated control. Design of the trial was laid out in RCBD with three replications. A total of three sprays were made at 10 days intervals. Each spray was done by manually driven foot pump sprayer as a full cover spray for the hogplum tree. The leaves, branches and the main trunk of each tree were sprayed with spray mixture through the outlet of the nozzle. Application was made in such a way that the spray pressure would not knock down the pest from the tree. The pre-treatment data were recorded on the number of 1st, 2nd, 3rd and 4th instars larvae and adults. Field mortality data on 1st, 2nd, 3rd, 4th instar larvae and adult were recorded at 24 hours after treatment. One square meter (1 m^2) quadrat was placed in the central position of the east side canopy structure. The number of adults and larvae was also counted from inside each quadrat under different treatments at one day before the first spray and 1 week after the last spray. The number of healthy and infested leaves was counted from inside each quadrat under different treatments at one day before the first spray and one week after the last spray.

Before applying insecticidal solution, the petiole of fresh succulent mid aged hogplum leaflet was placed inside the plastic pot. Then 10 larvae or 10 adult beetles were released in each plastic pot. When the released larvae or adult beetles started normal movement then the insecticidal treatments viz., T_1 = Chita 48 EC (Chlorpyriphos) @ 10 ml/10 liter of water, T_2 = Superior 505 EC (Chlorpyriphos + Cypermethrin) @ 10 ml/10 liter of water, T_3 = Seatap 50 SP @ 15 g/10 liter of water, T_4 = Hitfen 20 EC @ 10 ml/10 liter of water and T_5 = Untreated control were applied by a hand sprayer as cover spray. Each treatment was replicated 3 times. After treating the leaflet, the mouth of the plastic pot was covered with mosquito net. After application of the treatments, the covered pots were placed on the laboratory table near opened window. Mortality data of 1st, 2nd, 3rd, 4th instar larvae and adult were noted at 24 hours after treatment.

Statistical analysis: Single factor analysis of variance (ANOVA) on different parameters was made following completely randomized design in laboratory trials and randomized complete block design in field trial. Data transformations were done wherever required. Means were compared by LSD test.

Plate 1. View of experimental field having three replications.

RESULTS AND DISCUSSION

Effect of different treatments on the mortality of Podontia 14-punctata: The mean mortality of *Podontia 14-punctata* by the application of different treatments under field condition after 24 hours is presented in Table 1. Significantly the highest mortality (98.56%) was found in 1st instar larvae after 24 hours by the effect of spading + Superior 505 EC (Chlorpyriphos + Cypermethrin) @ 10 ml/ 10 liter of water (T_2) followed by T_4 (95.53%). The lowest mortality was recorded in T_3 (83.85%) followed by T_1 (88.85%) treated leaves. No beetle was found dead in control plants (T_5). Similar trend of mortality was also observed in 2nd, 4th and adult stages of hogplum beelte by the application of the same and respective treatments. In case of 3rd instar larvae, the highest mortality was found T_2 (91.67%) followed by T_4 (86.00%) and T_3 (81.67%) treatments. The lowest mortality was recorded in T1 (80.67%) treated leaves and no mortality was observed in control treatment. The results are in agreement with the findings of Mondal (1975) and Sing (1982). Ali (2002) reported that the lower dose (0.1875%) of malathion 57 EC were effective for suppression of *Podontia 14-punctata* instead of higher dose (0.25%).

Mortality of Podontia 14-punctata at one week after last spray: The mean number of larvae ranged from 1.5 to 7.6 per square meter of quadrate at one week after last spray (Table 2). No significant difference was observed among treatments regarding per cent leaf infestation at one day before 1st spray. The per cent leaf infestation ranged from 5.01 to 9.82 at one week after last spray. The lowest (5.87%) leaf infestation was observed in T_6 treated plants which was statistically similar to T_5 (5.91%) treated plants. The highest (15.76%) leaf infestation was found in untreated control plants (T_7) which varied significantly from other treatments. The highest infestation reduction over control was obtained from T_6 (62.75%) treated plant followed by T_5 (62.50%), T_2 (56.60%) and T_1 (53.30%) treated plants. The lowest infestation reduction over control was obtained from T_3 (40.04%) treated plant followed by T_4 (46.32%) treated plant. The findings of the present study are similar with the reports of other authors and they stated that malathion was effective against hogplum beetles (Hoffmann *et al.* 2000, Elzen *et al.* 2000, Singh and Misra 1989).

Table 1. Effect of different treatments on the mortality of *Podontia 14-punctata* after 24 hours under field condition

Treatment	Mean per cent mortality in different stage after 24 hours				
	1st instar larvae	2nd instar larvae	3rd instar larvae	4th instar larvae	Adult
T_1	88.85c	83.57c	80.67b	78.73c	75.94c
T_2	98.56a	96.47a	91.67a	90.17a	90.42a
T_3	83.85d	79.74d	81.67ab	73.04d	72.60d
T_4	95.53b	94.23b	86.00ab	83.68b	83.85b
T_5	0.00e	0.00e	0.00c	0.00e	0.00e
CV (%)	1.53	0.86	8.22	1.43	1.60
Prob. (p)	p < 0.0000	p < 0.0000	p < 0.0000	p < 0.0000	p < 0.0000

In a column, means followed by the same letter(s) did not differ significantly as per DMRT.
Values are averages of 3 replications. Treatments: T_1 = Spading + Chita 48 EC (Chlorpyriphos) @ 10 ml/10 liter of water, T_2 = Spading + Superior 505 EC (Chlorpyriphos + Cypermethrin) @ 10 ml/10 liter of water, T_3 = Spading + Seatap 50 SP @ 15g/10 liter of water, T_4 = Spading + Hitfen 20 EC @ 10 ml/10 liter of water and T_5 = Untreated control.

Mortality of Podontia 14-punctata after application of different insecticides under laboratory condition: The mean per cent mortality of *Podontia 14-punctata* treated with various insecticides under laboratory condition after 24 hours is presented in Table 3. Significantly the highest mortality (96.62%) was found in 1st instar larvae after 24 hours by the treatment of superior 505EC (T_2) followed by T_4 (88.00%) and T_1 (78.61%), respectively and the lowest mortality was in T_3 (69.70%) treated leaves. In case of 2nd instar larvae, the highest mortality (95.29%) was recorded in T_2 treated leaves followed by T_4 (91.97%) and T_1 (81.00%), respectively and the lowest mortality was in T_3 (71.34%) treated

leaves. In case of 3rd instar larvae, the highest mortality (99.81%) was noticed in T_2 followed by T_4 (89.81%) and T_1 (82.86%), respectively and the lowest mortality was in T_3 (70.89%) treated leaves.

Table 2. Mortality of *Podontia 14-punctata* treated with different treatments under field condition after cover spray on hogplum trees at Rahamatpur hogplum orchard during August to September, 2013

Treatments	No. of larvae at 1-WALS	Leaf infestation (%) at		Infestation reduction over control (%) at 1-WALS
		1-DBFS	1-WALS	
T_1	7.00	8.08	5.45bc	68.46
T_2	4.33	8.54	4.70d	72.80
T_3	7.00	9.55	6.72b	61.11
T_4	4.67	9.03	5.14bc	70.25
T_5	10.33	9.29	17.28a	-
LSD	-	-	0.874	-
CV (%)	-	-	4.23	-
Prob. (P)	-	NS	p < 0.05	-

DBFS = Day before first spray, WALS = Week after last spray. In a column, means followed by the same letter(s) did not differ significantly as per DMRT

Values are averages of 3 replications. Treatments: T_1 = Spading + Chita 48 EC (Chlorpyriphos) @ 10 ml/10 liter of water, T_2 = Spading + Superior 505 EC (Chlorpyriphos + Cypermethrin) @ 10 ml/10 liter of water, T_3 = Spading + Seatap 50 SP @ 15g/10 liter of water, T_4 = Spading + Hitfen 20 EC @ 10 ml/10 liter of water and T_5 = Untreated control.

Table 3. Mortality of *Podontia 14-punctata* treated with various insecticides under laboratory condition after cover spray

Treatment	Mean per cent mortality in different stage after 24 hours				
	1st instar larvae	2nd instar larvae	3rd instar larvae	4th instar larvae	Adult
T_1	78.61c	81.00c	82.86c	77.79c	76.70c
	(63.20	(69.87)	(70.44)	(61.47)	(60.36)
T_2	96.62a	95.29a	95.31a	93.67a	88.62a
	(81.20)	(78.37)	(77.48)	(76.11)	(74.63)
T_3	69.70d	71.34d	70.89d	69.32d	66.89d
	(62.36)	(63.38)	(59.21)	(57.60)	(56.21)
T_4	88.00b	91.97b	89.81b	88.00b	86.59b
	(77.21)	(85.01)	(83.44)	(76.46)	(74.96)
T_5	0.00e	0.00e	0.00e	0.00e	0.00e
LSD	0.169	0.237	0.197	0.154	0.178
CV (%)	5.45	6.20	5.80	4.81	4.54
Prob. (p)	p < 0.05	p < 0.05	p < 0.05	p < 0.05	p < 0.05

In a column, means followed by the same letter(s) did not differ significantly as per DMRT. Values are averages of 3 replications. Figure in parenthesis are transformed (Arcsine) values.

Treatments: T_1 = Chita 48 EC (Chlorpyriphos) @ 10 ml/10 liter water, T_2 = Superior 505 EC (Chlorpyriphos + Cypermethrin) @ 10 ml/10 liter of water, T_3 = Seatap 50 SP @ 15 g/10 liter of water, T_4 = Hitfen 20 EC @ 10 ml/10 liter of water and T_5 = Untreated control.

In case of 4th instar larvae, the highest mortality (93.67%) was noticed in T_2 treatment followed by T_4 (88.00%) and T_1 (77.79%), respectively and the lowest mortality was in T_3 (69.32%) treated leaves. In adult stage, the highest mortality (88.62%) was also found in treatment T_2 followed by T_4 (86.59%) and T_1 (76.70%), respectively and the lowest mortality was in T_3 (66.89%) treated leaves. No dead larvae or adult beetle was observed in control treatment. Mondal (1975) observed that metation at 0.075% active ingredient killed maximum beetles and about 93.33% of them were found dead. Singh (1989) described that 0.25% malathion is the most effective dose against adult hogplum beetle. Ali (2002) reported that the lower dose (0.1875%) of malathion 57EC may be recommended for effective suppression of *Podontia 14-punctata* instead of higher dose (0.25%). Hoffmann *et al.* (2000) and Lissy-o *et al.* (2000) found that ultra low volume of Malathion has been used as an essential tool for boll weevil, *Anthonomus grandis* Boheman eradication programme in the USA.

CONCLUSION

From the findings of this study it can be concluded that all treatments showed more or less similar toxic effects on the larvae and adult beetles of hogplum beetle. Superior 505EC (Chlorpyriphos + Cypermethrin) @ 10 ml/10 liter of water may be recommended for effective management of hogplum beetle in field and laboratory. Spading + Superior 505 EC (Chlorpyriphos + Cypermethrin) @ 10 ml/10 liter of water could be used as an effective technique for suppressing hogplum beetle in field condition.

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