J. Bangladesh Agril. Univ. 5(2): 245–249, 2007 ISSN 1810-3030

Efficacy of chemical and mechanical control approaches in managing mango hopper, *Amritodus atkinsoni*

M.K. Khan, K.S. Islam, M. Jahan and M.S. Ullah
Department of Entomology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract

Experiment on the management of mango hopper, *Amritodus atkinsoni* Leth. (Homoptera: Cicadellidae) was conducted in the laboratory and field Department of Entomology, Bangladesh Agricultural University, Mymensingh during January to May 2007. Three botanical pesticides namely Neem oil, Mahogoni oil and Karanja oil and a chemical pesticide, cythrin 10 EC and a net barrier as a mechanical control were evaluated in controlling mango hopper. Cythrin 0.2% was found to be most effective in controlling mango hopper but percentage of fruit set was relatively lower than cythrin 0.10% and 0.15%. Among the botanicals, Neem oil (3%) showed higher efficacy while Mahogoni oil (1%) was least effective. Observation on extent of hopper damage during flowering and fruit setting period of mango showed that 80-90% fruit damage. Net barrier protected the inflorescence from the attack of mango hopper but failed to produce fruits. The effect of different control approaches in the control of mango hopper and activities of pollinators are discussed.

Keywords: Susceptibility, Management, *Amritodus atkinsoni*, Pollinator, Fruit set

Introduction

Insect pests play a significant role for the low yield and poor quality mango production in Bangladesh. As many as 30 species of insect pests have been reported as pests of mango in Bangladesh (Alam, 1962). Of them, the mango hoppers are considered to be the most destructive pests of mango in Bangladesh (Hossain, 1989a). The attack of mango hopper, *Amritodus atkinsoni* is considered as a major constraint in mango production. Perennial nature of the crop, large scale monoculture, high plant density and excessive use of fertilizer, irrigation and pesticides favors the multiplication of the pest.

Both nymphs and adults cause damage to the leaf and inflorescence and sometimes younger leaves by sucking plant sap. The pest remained active throughout the year and its abundance significantly varied with the season (Hasan *et al.*, 2004). The infested leaf dries up and panicle shrivels, turns brown and ultimately dies. During heavy infestation, honey dew excreted by the mango hoppers encourages development of black shooty mould on the surface of the leaves, inflorescence, branches and shoots. The black coating of the shooty mould growth interferes with the photosynthetic activity of the affected plant parts, ultimately resulting in non setting of flowers and dropping of the immature fruits. The mango hoppers may thus cause a loss of 20-100% of the inflorescence (Hossain, 1989b). Severely infested plants bear only a few fruits or no fruits at all.

Use of insecticides has been the common practice to reduce hopper population in different mango-growing regions of the world. To control the pest, farmers use insecticides at improper doses and indiscriminately which not only disrupt the natural ecosystem but also causes the death of beneficial biocontrol agents and natural pollinators. However, considering the adverse effect of the chemicals, emphasis has been given on the application of botanical based pesticides along with the rational use of synthetic pesticides.

Information on control of mango hopper and the use of insecticides in controlling it in Bangladesh is not sufficient. A sound knowledge on the use of different control method of mango hopper is a prerequisite for successful management of the pest. This research work on mango hopper was attempted with the objectives to evaluate a synthetic insecticide, cythrin 10 EC having short residual effect and three biorational pesticides namely neem, karanja and mahogany oil and a mechanical method, net barrier in controlling mango hopper.

Materials and Methods

The experiment was conducted in the entomology field laboratory to determine the susceptibility, extent of damage by mango hopper and the comparative efficacy of different management approaches against this pest.

Both botanical and chemical insecticides with three different doses were evaluated for susceptibility to mango hopper. The used botanicals were neem, karanja and mahogoni oil with the dose of 1%, 2% and 3% for each insecticide. The used chemical insecticide was Cythrin 10 EC with the dose of 0.10%, 0.15% and 0.20%. Among the six plants, insecticides were sprayed on the three plants but another three plants were not sprayed for control experiment.

Insecticides were sprayed for two times- first within 10 days of flowering when the flower buds were not opened and the second spraying after one month of the first application when the mango fruit was pea shaped stage. Six mango trees were selected for these experiments. The layout of the experiment was Randomized Complete Block Design (RCBD) with three replications. Three inflorescence with leaves of each plant were sprayed with every dose of insecticides. That is for each plant with four insecticides (3 doses for each) the total combination were (3×4) 12. Some inflorescences were also kept unsprayed for control. Similar procedure was followed for another two plants. The remining three plants were also kept for control observation. The insecticides were sprayed to the selected inflorescence with hand sprayer and all the necessary precautions were taken during insecticidal application.

Data were recorded in each treatment prior and after 2 hrs, 1 day, 2 days and 7 days of insecticidal application. Number of hopper per infested leaf, branch and inflorescence were counted and reduction percentage (%) was determined.

To determine the extent of damage in flowering and fruit setting the application of insecticides are same as previous and observations were made on 7, 30 and 45 days after flowering. At least 10 inflorescence per plant were observed. At each observation the data were recorded were as follows: a) Number of flowers/ inflorescence- the number of bloomed flower were counted and recorded. b) Number of fruits- After fertilization of flowers, the fertilized flowers were counted and recorded. c) Percentage of fruit set- The percentage of fruit set was calculated from the number of bloomed flowers and number of fertilized flowers using the following formula:

Percentage of fruit set = No. of fertilized flowers/ No. of bloomed flowers × 100.

In case of mechanical control, insect free, healthy and properly matured three inflorescence were selected at each plant from different parts all over the canopy. The selected inflorescences were then covered with fine nylon net bags and no honey bees or other pollinators were allowed in the nylon net bags. Observations on number of hoppers were recorded at different stages of plant. Number of flower, number of fruit set in each treated plants and control plants were made at different times such as during flowering (PFS), after one month of first spray (at pea shaped/ PSS) and 15 days after second spray (at 15 DAP/ 15 DASS).

Obtained data were analyzed statistically after appropriate transformation using computer software MSTAT and mean values were separated using DMRT.

Results and Discussion

A comparative field study on susceptibility of mango hopper to different insecticides (one chemical and three botanicals) were conducted at Entomology Field Laboratory. Insecticides applied as foliar treatment against mango hopper, *Amritodus atkinsoni* revealed a significant superiority of chemical insecticide to botanicals. The efficacy of insecticides was determined on the basis of reduction percentage of hopper at different time interval which are presented in Table 1.

It was evident from the present experiment that cythrin was more effective than botanicals. All the doses of cythrin effectively controlled mango hopper. After 2 hours of treatment, the highest reduction (85.07%) was found in cythrin 0.20% and the lowest reduction (25.54%) was found in mahogoni oil 1%. Lower doses of cythrin (0.10% and 0.15%) were also effective (75.32% and 80.82% respectively) against the pest. Among the botanicals, neem oil 3% had the best effect. The effect of neem oil 2% was statistically similar with karanja oil 2% and mahogoni oil 3%.

Table 1. Percentage reduction of mango hopper *Amritodus atkinsoni* by a chemical insecticide and three botanicals at different doses

Insecticide/ botanical	Concentration	% hopper reduction at different interval			
		2 HAT	1 DAT	2 DAT	7 DAT
Cythrin	0.10%	75.32 c	84.62 c	92.34 c	100.00 a
	0.15%	80.82 b	86.90 b	96.90 b	100.00 a
	0.20%	85.07 a	88.07 a	98.07 a	100.00 a
Neem oil	1%	33.94 h	50.85 h	53.38 h	60.23 f
	2%	42.25 gf	53.82 f	63.87 f	67.19 d
	3%	53.05 d	63.53 d	68.85 d	74.19 b
Mahogoni oil	1%	25.54 k	38.06 k	43.29 k	48.51 h
	2%	34.19 h	48.50 i	50.90 i	55.13 g
	3%	43.16 f	50.17 h	55.32 g	60.86 ef
Karanja oil	1%	30.41 i	43.04 j	49.27 j	54.67 g
	2%	41.59 g	52.63 g	54.66f g	61.33 e
	3%	50.76 e	55.42 e	65.36 e	68.30 c
LSD (0.05)		0.9213	0.7778	1.026	0.9008
CV %		1.10	0.77	0.92	1.16

Means followed by different letters in a column are significantly different (at DMRT).
Data were analyzed after arc sine transformation.
HAT= Hours after Treatment; DAT= Days after Treatment

Similarly 1 DAT and 2 DAT, the highest percentage of reduction was also found in cythin 0.20% and the lowest in mahogoni oil 1%. Neem oil 3% was always best among the botanicals.

After 7 days of insecticidal treatments, 100% reduction was found in the doses of cythrin while mahogoni oil 1% showed the minimum reduction (48.51%).

Efficacies of different insecticides in controlling mango hopper were reported by many authors. Singh *et al.* (1997) found the greatest reduction (97% mortality) of *Amritodus atkinsoni* with cypermethrin 0.005%. Kumar *et al.* (2005) reported that cypermethrin @ 0.003% with combination of Endosulphan @ 0.07% and Monocrotophos @ 0.04% significantly reduced *Amritodus atkinsoni.* Sarker et al. (2005) had also found similar result when mango hopper was sprayed with cypermethrin (Magic 10 EC) @ 1 ml/liters of water.

After one month of first spray, the number of hopper at fruit setting (when pea shaped) was the maximum in mahogoni oil 1% (13.40) that was statistically similar with mahogoni oil 2% and was minimum in cythrin 0.20% (7.62). But 15 days after second spray (i.e. 15 DAP), no hopper was found in all the three doses of cythrin and maximum number of hopper were also found in mahogoni oil 1% (12.62) which was statistically similar with karanja oil 1% (11.86). But among the botanicals the minimum numbers of hopper were found in neem oil 2% and 3% and karanja oil 3%.

Table 2. Efficacy of insecticides and a mechanical control measure on management and fruit setting of mango

Treatments	Average no. of hopper (adult + nymph) per inflorescence at different plant stage			Average no. of flower per inflorescence (PFS)	Average no. of fruit set per inflorescence (when pea shaped / PSS)	% fruit set per inflorescence (when pea shaped/PSS)	Average no. of fruit set per inflorescence (15 DAP/ DASS)	% fruit set per inflorescence (15 DAP/ DASS)
	Flowering (PFS)	Fruit setting (when pea shaped/PSS)	Fruit setting (15 DASS/ DAP)					
Cythrin 0.10%	13.97	9.42 g	0.00 f	54.20	8.20	15.13 a	6.00	11.07 a
Cythrin 0.15%	13.75	8.61 h	0.00 f	53.12	7.68	14.45 a	5.35	10.07 b
Cythrin 0.20%	14.01	7.62 i	0.00 f	52.40	6.82	13.01 b	4.90	9.35 c
Neem oil 1%	13.22	11.70 de	10.35 de	50.23	5.00	9.99 cde	3.24	6.45 gh
Neem oil 2%	13.02	11.23 ef	9.68 e	51.35	5.54	10.77 cd	3.75	7.30 ef
Neem oil 3%	13.48	10.57 f	9.55 e	52.21	6.24	11.91 c	4.15	7.94 d
Mahogoni oil 1%	13.98	13.40 b	12.62 b	48.25	3.79	7.80 e	2.46	5.09 i
Mahogoni oil 2%	14.07	12.72 bc	11.33 c	49.15	4.62	9.42 de	3.00	6.10 h
Mahogoni oil 3%	14.39	12.43 cd	11.10 cd	47.81	4.95	10.40 cd	3.21	6.71 fgh
Karanja oil 1%	12.99	12.25 de	11.86 bc	49.25	4.75	9.61 cde	3.08	6.25 h
Karanja oil 2%	12.85	11.72 e	10.33 de	51.15	5.66	11.29 cd	3.52	7.01 efg
Karanja oil 3%	13.56	11.35 j	9.79 e	51.26	5.82	11.31 cd	3.80	7.41 de
Mechanical (Net covering)	0.00	0.00 a	0.00 f	46.50	0.00	0.00 g	0.00	0.00 k
Control	14.42	16.25	15.92 a	44.25	1.73	3.90 f	1.12	2.53 j
LSD (0.05)	0.7199	0.7258	0.8188	3.366	1.187	2.102	0.5307	0.5910
CV %	3.38	4.05	6.07	4.01	13.12	11.86	9.30	5.29

Means followed by different letters in a column are significantly different (at DMRT).
PFS= Prior to First Spray PSS= Prior to Second Spray.
DASS=Days after Second Spray. DAP= Days after Pea Shaped.

It was also clearly noted that fruit bearing was better in inflorescence treated with synthetic insecticides while the botanical insecticides reduced fruit dropping as was found in the treatments with synthetic insecticides. Kumar and Bhatt (1999) found that best yield was produced by the synthetic insecticide treatment followed by Neemark, Indiara and Achook.

In the present study it was found that all the three doses of cythrin effectively reduced mango hopper but percentage of fruit setting was high in the inflorescence treated with cythrin 0.10%

probably because of higher doses of cythrin might have had induced high insecticidal toxicity which in turn caused certain fruit dropping and mortality of pollinator. Highest percentage of fruit set (when as pea shaped) was produced by the cythrin 0.10% (15.13%) which was statistically similar with cythrin 0.15% and the lowest percentage of fruit set was produced by the mahogoni 1% (7.80%). Among the botanicals, the highest percentage of fruit set was produced by the neem oil 3% (11.91%) which was statistically similar with other neem oil and karanja oil doses, mahogoni oil 3% and cythrin 0.20%. Similar results were also found after 15 days of second spray (at 15 DAP) but percentage of fruit retention after pea shaped was relatively high in botanicals.

The effect of mechanical control revealed that no hopper infestations occurred but number of fruit setting was zero due to lack of pollination. Eardley and Mansell (1994) reported that a total of 816 species of insects visited in a flowering mango orchard. Honeybee represented 18% of all insect visitors. The presence of pollinator was found important in fruit setting of mango. Setting of not a single fruit due to lack of pollination proved that mechanical technique like net covering was not a good method for management of hopper and production of mango fruit.

So from the above discussion, it is clear that chemical insecticide (Cythrin) can be treated as the best measure in controlling mango hopper than botanicals when they were compared alone. Among the three doses of cythrin, 0.10% was the appropriate dose because it managed mango hopper efficiently and caused high percentage of fruit set. On the other hand as the chemical insecticides are not eco-friendly with the environment and leaves many hazardous effects, the use of chemical pesticides should be minimum with proper doses for higher effectiveness.

In the case with botanicals, as neem oil showed better performance so it can also be recommended to use neem oil 3%. In addition neem oil 2% or karanja oil 3% can also be recommended at flowering stage of mango. These findings will be useful for using them in the IPM program of mango hopper.

References

Alam, M.Z. 1962. Insect and mite pests of fruit and fruit trees in East Pakistan and their control. East Pakistan Government Press. Dhaka. 1-37.

Eardley, C.D. and Mansell, M. W.1994. Report on the natural occurrence of insect pollinators in a mango orchard. South African Mango Grower's Association Yearbook 14: 65-66

Hasan, K.S., Islam, K.S., Jahan, M. and Ullah, M.S. 2004. Incidence of mango hopper *Amritodus atkinsoni* (Leth.) and its relation with weather parameters. *Journal of Asiatic Society Bangladesh, Science.* 30(1): 57-64.

Hossain, A.K.M.A. 1989a. Manual on Mango Cultivation in Bangladesh. Horticulture Division, BARI, Gazipur. p. 82.

Hossain, A.K.M.A. 1989b. A field guide on insect pests and diseases of mango in Bangladesh and their control. Bangladesh Agricultural Research. Institute, Gazipur. p. 44.

Kumar, S. and Bhatt, R.I. 1999. Field evaluation of plant leaf extracts, oil and neem products against mango hopper *(Amritodus atikinsoni* Lethierry) and thrips (*Scirtothrips mangiferae* Hood). Allelopathy J. Agriculture Experimental Station, Gujarat Agril. University, Gujarat, India. 6 (10): 271-276.

Kumar, S., Raghvani, B.R. and Bhatt, R.I. 2005. Bioefficacy of newer insecticides against hopper complex on Alphonso mango in humid tropics of south Gujarat. *Journal of Applied Zoological Research, India.* 16 (1): 64-66.

Singh, R., Chopra, S.K., Singh, R., Deddy, P.P., Kumar, N.K.K. and Verghese, A. 1997. Evaluation of insecticide against mango hopper *Amritodus atkinsoni* (Leth.) and *I. clypealis* (Leth.). Advance in IPM for Horticultural Crops. *Proceedings of the First National Symposium on pest management in Horticultural crops.* pp. 10-12.