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COMPARATIVE EFFECTIVENESS OF NEEM EXTRACTS AND SYNTHETIC ORGANIC INSECTICIDE AGAINST MUSTARD APHID

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Abstract

Effectiveness of different doses of neem extracts and a synthetic organic insecticide against mustard aphid was studied in the experimental farm of the Oilseed Research Centre, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, during two consecutive years 2010-2011 and 2011-2012 for the control of mustard aphid. Eight treatments were evaluated against mustard aphid under field condition. The maximum aphid population was (180 per plant) observed at the pod formation stage of mustard crop. Among the treatments, Malataf (Malathion 57EC) @ 2ml/l significantly reduced the highest aphid population (93.75%) over pretreatment which produced the highest seed yield (1440 kg/ha) of mustard. The neem leaf extracts reduced 63.16-72.55% aphid population in mustard while neem seed extract reduced 73-81% aphid population over pretreated plants in both the years. Among the different doses of neem extracts, the highest aphid population reduction over pretreatment (81%) was recorded from 50g neem seed per litre of water treated plots with high MBCR (3.88) followed by 75g neem seed/l treated plots having reduction of 80% and MBCR 3.78.

Keywords: Effectiveness, neem extracts, doses, synthetic insecticide, mustard aphid.

Introduction

Mustard, *Brassica* spp., is a major and the most important oilseed crop in Bangladesh. It contributes a lion's share of the total edible oilseed production in this country. During 2010-11 crop season, it covered about 0.48 million hectares of land and the production was about 0.53 million metric tons seed (DAE, 2011). Mustard aphid, *Lipaphis erysimi* Kalt., is the most destructive pest of rapeseed and mustard and a major limiting factor for successful cultivation of the crop in this country (Biswas *et al*., 2000; Biswas and Das, 2000). The pest is also serious in other countries of South-East Asia and USA (Atwal and Dhaliwal, 2007; Biswas, 2008). Both the nymphs and adults suck sap from leaves, inflorescence, stems, flowers and pods; as a result, the plant shows stunted growth, flowers wither and pod formation is hindered. The losses of mustard due to aphids varied from 35 to 90 percent depending upon the seasons (Biswas and Das, 2000; Rohilla *et al*., 2004). Chemical insecticides still remain the key tool for the control of this pest. Farmers spray insecticides in their fields indiscriminately. So it causes phytotoxicity, resistance of the pest, destruction of beneficial organisms,

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disruption of agro-ecosystem, human health hazzard and environmental pollution (McIntyre *et al.*, 1989). Botanicals are comparatively less toxic, less expensive, and also safe for beneficial organisms. Ahmed (1984) listed about 221 plant species possessing insecticidal properties in this country. The neem tree, *Azadirachtin indica*, a source of several insecticidal alkaloids is a sub tropical tree native to the arid areas of Asia and Africa (Saha *et al*., 2006). Azadirachtin is the main pesticidal component of neem. Neem products are naturally available materials, cheaper, and also safe for beneficial organisms. It is distasteful and repells insects and may reduce the insect infestation (Sarode *et al.*, 1995). It is necessary to determine the most effective dose of neem extract (both leaf and seed) for the control of mustard aphid. Information using different doses of neem extract for the control of mustard aphid in Bangladesh are scanty. Therefore, the present study was undertaken to find out the most effective dose of neem extract for eco-friendly management of mustard aphid.

Materials and Method

The experiment was conducted at the Oilseed Research Centre (ORC), Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, during Rabi seasons of two consecutive years 2010-2011 and 2011-2012. Seeds of mustard variety BARI Sarisha-15 were sown on 15 November of each year in 4m × 2m size plots following RCB design with 3 replications. Fertilization and other intercultural operations were done uniformly for raising the crop as per recommendation of Mondal and Wahhab (2001). Eight treatments, namely T_1= neem leaf extract (NLE) @ 25g/l, T_2= NLE 50g/l, T_3=NLE 75g/l, T_4= Neem seed extract (NSE) 25g/l, T_5= NSE 50g/l, T_6= NSE 75g/l, T_7 = Malataf (Malathion) 57 EC @ 2ml/l, and T_8= untreated control treatments were evaluated against mustard aphid under field condition.

Preparation of different plant extracts/ solution

Fresh green neem leaf was collected from the neem tree and weighed (25g, 50g, and 75g, respectively). Then the leaf was crushed (smashed) and extracted in 250 ml organic solvent (ethanol) and stirred for 30 minutes and the solution was filtered through filter paper. From the stock solution, 100 ml mixed with 1 (one) litre of water. Then the solution was ready for spray. Similarly, fresh ripe neem seed were sundried for 5 days and then dried in an oven at 80^0 C for an hour. Endosperm was separated from the seed and weighed (25g, 50g, and 75g, respectively). Then the crushed seeds were extracted in ethanol and water. Similar procedure was followed for neem seeds extraction. A total of 1.50 litre of organic solvent was used for both leaf and seed extraction.

Botanicals and insecticide were applied with the help of knapsack sprayer on 20 & 27 January 2011 and 2012 at 7 days intervals at the pod formation stage.

Randomly 10 plants were selected per plot for counting aphid populations. Both adult and nymph population was counted *in situ* on the top of 10 cm inflorescence of the plant before spray and 2, 5, 7, and 14 days after 2nd spray in all the treatments. Percent aphid population reduction over pretreatment in each treatment was calculated. The crop was harvested on third week of February in each year. Seed yield of different treatments were recorded. Data were compiled and analyzed statistically. Analysis of variance (ANOVA) was done following Mstat C and means were separated following Duncan's multiple range test (DMRT). Benefit cost ratio (BCR) of the different treatments were also calculated.

Results and Discussion

Initially aphids appeared on the unsprayed plot of mustard crop in the first week of January 2011 and 2012 at the flowering and pod formation stages of the crop (50 DAS) and their infestation continued up to 3rd week of February at the pre-maturity stage (70 DAS). The highest number of aphids was (180 and 160 aphid / plant) observed in the first week of February in both the years and then their population declined gradually (Fig. 1). Comparatively high number of aphids was observed in 2012 than 2011. Almost similar results was reported by Biswas and Das (2000) and Biswas (2008) in this country.

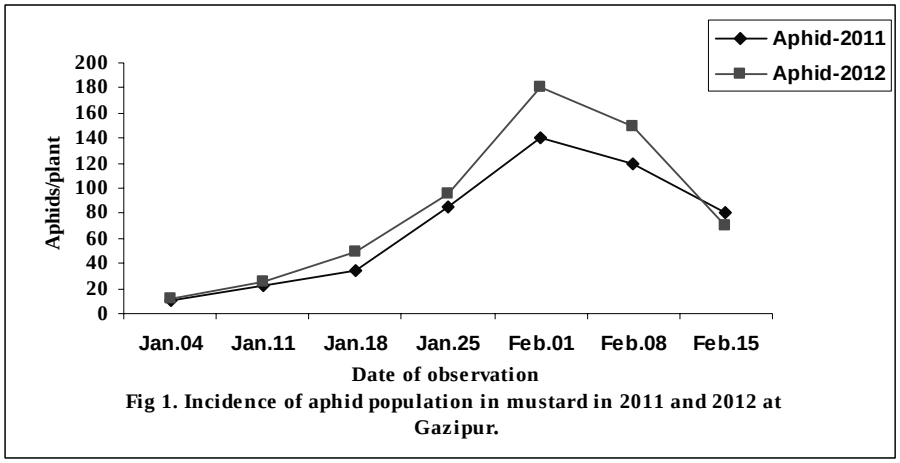

Fig 1. Incidence of aphid population in mustard in 2011 and 2012 at Gazipur.

Before spray, the mean number of aphid on the mustard crop ranged from 78-100 per plant recorded in different plots which were treated with different treatments (Table 1). After spray, aphid population was significantly decreased in all the treated plots, while significantly increased in untreated plot. After 14 days of spray, aphid population was slightly increased in neem extract treated plots (Table 1). The different doses (25g, 50g, 75g/l) of neem leaf extract reduced 63.16-72.55% aphid population over pretreatment, while neem seed extracts

reduced 73.00-80.50% aphid population over pretreatment in mustard crop (Table 2). The chemical insecticide Malataf (Malathion 57EC) @ 2ml/l significantly reduced the highest aphid population (93.75%) over pretreatment. Among the different doses of neem extracts treatments, the highest aphid population reduction was recorded from neem seed extract @ 50g/l treated plots (80.50%) followed by that of NSE @ 75g/l treated plot (79.90%) over pretreatment. But no significant reduction was observed between 50g and 75g/l of both NLE and NSE treated plots (Table 2). Neem seed extracts reduced slightly higher aphid population than the neem leaf extracts. The findings of the present study are almost similar to the findings of several authors. Saxena (1989) reported that Azadirachtin the main pesticidal component of neem extracts specially neem seed extract possessed feeding deterrent, repellent, toxic, and growth disruption properties against numerous pest species.

Table 1. Mean number of aphid per plant recorded in different treatments before and after spray (Pooled data of rabi 2010-11 and 2011-12) at ORC field, BARI, Gazipur.

Treatments	Mean no. of aphids /plant (10 cm inflorescence/plant)				
	1DBS	2DAS	5DAS	7DAS	14 DAS
T_1 = NLE@25g/l	85.30ab	50.6b	30.3b	20.6b	25.0b
T_2 = NLE@50g/l	100.00a	46.6b	25.3c	18.0b	22.6b
T_3 = NLE@75g/l	83.30ab	35.3c	20.3d	15.0d	18.6c
T_4 = NSE @25g/l	78.00c	40.3c	26.3c	16.0c	20.3c
T_5 = NSE @50g/l	95.00 ab	34.0c	20.3d	13.0c	11.6c
T_6= NSE @75g/l	80.60bc	30.6d	20.0d	11.50d	10.3d
T_7 = Malataf @2ml/l	87.60bc	10.30e	6.50e	4.2e	1.0e
T_8= Untreated control	84.00bc	132.0a	200.30a	293.0a	392.3a

Data were recorded on average of 30 plants,

Means followed by the same letters in a column do not differ significantly at 5% level by DMRT

DBS= Days before spraying, DAS= Days after spraying

ORC= Oilseed Research Centre.

Significantly the highest seed yield of mustard (1440 kg/ha) was obtained from Malataf @ 2ml/l treated plots followed by neem seed extract @ 75g/l treated plots (1365 kg/ha) and 50g/l treated plots (1345 kg/ha (Table 3). But no significantly different yield was produced between 50g/l and 75g/l of neem seed treated plots. Untreated plot produced the significantly the lowest seed yield (1150 kg/ha). The highest MBCR (4.80) was calculated from Malataf treated plot followed by neem seed extract @ 50g/l treated plot (3.88) (Table 3). This result revealed that neem extracts are effective in checking the aphid population in mustard up to two weeks and about 81.00% reduction may achieved. However,

Table 2. Effectiveness of different doses of neem extracts and synthetic insecticide against mustard aphid, *L. erysimi* (pooled data of rabi 2010-11 and 2011 - 12) at ORC field, BARI, Gazipur.

Treatments	Percent aphid reduction over pretreated				
	2DAS	5DAS	7DAS	14 DAS	mean
T_1 = NLE@25g/l	40.68d	64.70d	76.47c	70.80d	63.16c
T_2 = NLE@50g/l	54.00c	75.00c	82.00b	78.00c	72.25b
T_3 = NLE@75g/l	57.62c	76.13b	82.36b	78.36c	72.55b
T_4 = NSE @25g/l	48.72b	78.20c	79.48b	74.60c	73.00b
T_5 = NSE @50g/l	65.21b	78.00b	85.26b	87.36b	80.50b
T_6= NSE @75g/l	66.50b	76.20b	85.25b	88.50b	79.90b
T_7 = Malataf @2ml/l	88.50a	93.10a	95.40a	98.80a	93.75 a
T_8= Untreated control	+58	+138	+252	+185	

Data were recorded on average of 30 plants

(+) Percent increase in aphid population over pretreated

DAS= Days after spraying

Means followed by the same letters in a column do not differ significantly at 5% level by DMRT

Table 3. Economics of different doses of neem extracts and synthetic insecticide spraying against mustard aphids (pooled data of rabi 2010-11 and 2011-12) at ORC field, BARI, Gazipur.

Treatments	Yield (kg/ha)	Increased yield over untreated (Kg/ha)	Cost of insecticide & spray (Tk/ha)	Addition Income (Tk/ha)	Net income Tk./ha	MBCR
T_1 = NLE@25g/l	1220d	70	800.00	2800.00	2000.00	2.50
T_2 = NLE@50g/l	1280c	130	1100.00	5200.00	4100.00	3.72
T_3 = NLE@75g/l	1300b	150	1300.00	6000.00	4800.00	3.69
T_4 = NSE @25g/l	1280c	130	1400.00	5200.00	3800.00	2.71
T_5 = NSE @50g/l	1345b	195	1600.00	7800.00	6200.00	3.88
T_6= NSE @75g/l	1365b	215	1800.00	8600.00	6800.00	3.78
T_7 = Malataf @2ml/l	1440a	290	2000.00	11600.00	9600.00	4.80
T_8= Untreated control	1150e	-	-	-	-	-

Means followed by the same letters in a column do not differ significantly at 5% level by DMRT.

Notes: Price of Jet powder = 250 Tk/kg.

Price of mustard seed= 40 Tk./kg, Cost of neem seed = 50 Tk./Kg, cost of Malataf 57 EC=400 Tk./litre, Cost of labour=200 Tk./labour/day , Three labours and 1 litre of Malataf 57 EC @ 2 ml/I being required for 1 hectare of crop field sprayed in one time. One machine spray volume = 10 litre required 200 sqm field spraying in one time. Other variable costs were same in all the treatments.

MBCR= Net income/ Management cost

their performance was inferior to Malataf treated plots. Though neem extract reduced comparatively low aphid population than Malataf, but it is not toxic like chemical insecticides. It is safe for honeybee and other pollinators and also conserve natural enemies in the mustard fields. Biswas (2008) reported that neem extract and neem oil reduced 73-83% aphid population in mustard crop in Bangladesh. Similar results were obtained by Prasad (1997) in India. Morde and Blackwell (1993) reported that antifeedant, repellent, and insect growth regulatory effects are present in neem product which can be used for insect management in crop production. Similar finding was also reported by Saha *et al*. (2006).

Conclusion

The maximum aphid population was (180 per plant) observed at the pod formation stage of mustard crop. The effectiveness of different doses of neem extract revealed that neem seed @ 50g/l was better (about 81% aphid population reduction over pretreatment) than other doses of neem extract and also achieved the highest MBCR (3.88). Although neem extracts failed to reduce about maximum aphid population (94%) like chemical insecticides but use of neem extract is an eco-friendly management tactics of aphid. It is cheap and safe for pollinators and natural enemies, especially coccinellid predators attacking aphids and also safe for the environment. This information would be helpful to the mustard growers in Bangladesh.

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