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EVALUATION OF DIFFERENT MANAGEMENT APPROACHES AGAINST SUCKING PESTS OF BRINJAL

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ABSTRACT

The present study aimed to evaluate the effectiveness of several management approaches against sucking pests of brinjal during 2013-14 at Bangladesh Agricultural Research Institute (BARI), Gazipur. Bioneem plus 1EC (Azadirachtin) + white & yellow sticky traps treated plots showed significantly lowest whitefly (4.03/five leaves) and thrips (6.02/ five leaves) population although this was statistically at par with Fytomax 3EC (Azadirachtin) + white & yellow sticky traps and white & yellow sticky traps + Fytoclean (Potassium salt of fatty acid) treated plots. Actara 25WG (Thiamethoxam) + white & yellow sticky traps treated plots although provided lowest population of aphid (2.04/five leaves) and jassid (4.21/five leaves), but induced spider mite resurgence providing highest (38.02/leaf) and nearly 4 times higher mite population than the untreated control plots. However, spraying Bioneem plus 1EC along with installation of white and yellow sticky traps appeared as the best approach providing highest yield (18.32 t/ha) and Marginal Benefit-Cost Ratio (3.06).

Keywords: Brinjal, sucking pests, management approaches, mite resurgence.

INTRODUCTION

Brinjal or egg plant (*Solanum melongena* L.) occupies an important place among the vegetable crops in Bangladesh. The crop is subjected to attack by a number of insect pests from nursery to harvesting stage. Although, brinjal shoot and fruit borer is the key pest, some sucking pests such as aphids, jassids, white fly, thrips and mites etc. are gaining tremendous importance in the recent years due to their devastating damage. Apart from the direct damage caused by sucking the cell sap and prohibiting the normal crop growth, several of the sucking pests also act as vectors of virus disease. The loss caused by sucking pests varies from 10-15 percent depending on the intensity of infestation (Munde *et al.* 2011).

Both nymphs and adults of Jassid (*Amrasca biguttula biguttula* Ishida) suck the sap from the lower leaf surfaces. While sucking the plant sap, they also inject toxic

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saliva into the plant tissues, which leads to yellowing. When several insects suck the sap from the same leaf, yellow spots appear on the leaves, followed by crinkling, curling, bronzing, and drying, or "hopper burn" (Yousafi *et al.* 2013). Aphid (*Aphis gossypii* Glover) and white fly (*Bemisia tabaci* Gennadius) suck the cell sap and preventing normal crop growth (Konar *et al*. 2011, Jones 2003). Their nymphs secret honeydew, on which black sooty mould grow, reducing the photosynthetic capabilities of plants. The adults and larvae suck the plant sap. Thrips (*Thrips palmi* Karny) prefer to feed mostly on foliage, sometimes on fruit. In severe infestations, the leaves turn yellow or brown and dry on the lower leaf surfaces. Infested fruit is scarred and deformed (Srinivasan 2009). Red Spider mites (*Tetranychus urticae* Koch) usually extract the cell contents from the leaves using their long, needle- like mouthparts. This results in reduced chlorophyll content in the leaves, leading to the formation of white or yellow speckles on the leaves. In severe infestations, leaves will completely desiccate and drop off (Ghosh & Chakraborty 2014).

Attempts to control sucking pests in brinjal currently entail excessive use of chemical pesticides by the farmers. Intensive pesticide use in brinjal increases the cost of production, making this vegetable expensive for poor consumers. Pesticide misuse and residues pose serious risks to the health of growers, consumers, and the environment (Srinivasan 2009, Rashid *et al*. 2003). However, the indiscriminate use of chemical pesticides can impair the performance of natural enemies, causing consequently the emergence of other population pests as tetranychid mites (Reddy 2001, Kumral & Kovanci 2005, Van Driesche *et al*. 2009). Cost effective crop production requires combination of optimum use of chemicals and non-chemical techniques of pest management. In recent times, different bio-rational based management options have shown promise against different crop pests. With these view in mind, the present study was designed to develop an environment friendly management approach against sucking pests attacking brinjal.

MATERIALS AND METHODS

The experiment was conducted in the research field of Entomology Division, BARI, Gazipur during 2013-14. Brinjal seedlings of BARI Begun 8 were transplanted in a plot of 4m x 5.5m. The experiment was laid out in RCBD having three dispersed replications and 6 treatments including control. Manures and fertilizers were applied as per recommended dose. Common agronomic practices were followed to raise a good crop.

The treatments were assigned as follows:

T_1= Bioneem plus 1EC (Azadirachtin) @ 1ml / litre of water + installation of white & yellow sticky traps;

T_2= Bioneem 0.3EC (Azadirachtin) @ 3ml / litre of water + installation of white & yellow sticky traps;

T_3= Fytomax 3EC (Azadirachtin) @ 1ml / litre of water + installation of white & yellow sticky traps;

T_4= Fytoclean (Potassium salt of fatty acid) @ 2ml / litre of water + installation of white & yellow sticky traps;

T_5= Actara 25WG (Thiamethoxam) @ 0.2g / litre of water + installation of white & yellow sticky traps each and

T_6= Untreated control.

The chemical and bio-pesticides were sprayed 4 times on the crop at fortnight interval starting from the first initiation of the pest attack. BARI developed white and yellow sticky traps each installed @ 40 traps ha^{-1} in the experimental field alternatively at 20 days after transplantion (DAT) maintaining 12.5 m distance among the traps. The sticky traps were placed just above the crop canopy by means of bamboo support. The traps were kept in the brinjal field throughout the cropping season. However, white & yellow sticky traps treated plots were taken 200 m away from rest of the plots.

The observations on the number of sucking pest viz., aphid, jassid, thrips, whitefly and red spider mite were recorded on five randomly selected plants per treatment. On each plant, five leaves (one from bottom and two each from middle and top canopy of the plant) were observed from lower side to record the pest number. The data on surviving population were reported on the basis of mean insect population/five leaves and mean spider mite population per leaf. Percent (%) insect pest population reduction over untreated control was calculated using following formula:

$$\text{Percent insect pest population reduction over untreated control} = \frac{\text{Mean value of control- mean value of the treatment}}{\text{Mean value of control}} \times 100$$

Yield under different treatments were recorded at each harvest and yield (t ha^{-1}) was calculated. Benefit cost ratios of different treatments were also determined following Ali *et al*. (1996).

RESULTS

Effectiveness of different management options in reducing sucking pests (aphid, jassid, thrips, whitefly and mites) in brinjal: Table 1 indicated that mean aphid population was the lowest (2.04/five leaves) in T_5 (Actara 25WG + white & yellow sticky traps) and it was followed by T_4 (Fytoclean + white & yellow sticky traps). However, there was no significant differences among T_1 (Bioneem plus 1EC + white & yellow sticky traps), T_3 (Fytomax 3EC + white & yellow sticky traps) and T_4 considering aphid population. The control treatment exhibited significantly highest (18.06/five leaves) aphid population.

Similarly, the mean jassid population was significantly lowest (4.21/five leaves) in T_5 and it was followed by T_1 (6.01/five leaves). The control treatment recorded significantly the highest jassid population (19.22/five leaves).

The mean thrips population was the lowest (6.02/five leaves) in T_1 (Bioneem plus 1 EC + white & yellow sticky traps) and it was statistically similar to T_3, T_4 and

Table 1. Mean population of aphid, jassid, thrips and whitefly in brinjal as influenced by different treatment applications

Treatments	Aphid population /5 leaves	Jassid population /5 leaves	Thrips population /5 leaves	Whitefly population /5 leaves
T_1	4.21bc	6.01bc	6.02c	4.03c
T_2	8.21b	8.21b	9.21b	6.85b
T_3	4.42bc	5.98bc	6.25c	4.75c
T_4	3.98bc	6.21bc	6.91c	4.85c
T_5	2.04c	4.21c	6.82 c	4.17c
T_6	18.06a	19.22a	14.53a	10.87a
CV %	4.98	6.51	8.12	10.39

Means having same letter(s) in a column are not significantly different at P> 0.01 followed by LSD.
T_1= Bioneem plus 1 EC + white & yellow sticky traps
T_2= Bioneem 0.3 EC + white & yellow sticky traps
T_3= Fytomax 3 EC + white & yellow sticky traps
T_4= Fytoclean+ white & yellow sticky traps
T_5= Actara 25WG + white & yellow sticky traps
T_6= Untreated control

T_5. The control treatment recorded significantly the highest number of (14.53/five leaves) thrips population.

The mean whitefly population was the lowest (4.03/five leaves) in T_1 (Bioneem plus 1 EC + white & yellow sticky traps) and it was statistically similar to T_3, T_4 and T_5. The control treatment recorded significantly the highest number of (10.87/five leaves) whitefly population.

In terms of the percent insect pest population reduction over control (Table 2), the highest reduction of aphid and jassid population over control was obtained from T_5 (88.70% & 78.10% for aphid and jassid, respectively), while T_1 offered the highest reduction of thrips (58.57%) and white fly (62.93%) population over control.

Efficacy of different management options against red spider mite has been shown in Fig. 1. It was revealed that the lowest mite population (2.03/ five leaves) was observed in T_3 (Fytomax 3EC + white & yellow sticky traps) which was closely followed by T_1 (Bioneem plus 1 EC + white & yellow sticky traps). Spider mite population was also less in all other bio-rational pesticides treated plots. However, severe outbreak of this pest with the highest population was recorded in T_5 (Actara 25WG + white & yellow sticky traps) treated plots (38.02 mites/leaf). It is to be noted here that spider mite population in T_5 was almost four times higher than the untreated control treatment (9.82 mites/leaf).

Table 2. Percent reduction of aphid, jassid, thrips and whitefly population over control in brinjal as influenced by different treatment applications

Treatments	Percent pest population reduction over untreated control			
	Aphid	Jassid	Thrips	Whitefly
T_1	76.69	68.73	58.57	62.93
T_2	54.54	57.28	36.61	36.98
T_3	75.53	68.89	56.99	56.30
T_4	77.96	67.69	52.44	55.38
T_5	88.70	78.10	53.06	61.64
T_6	-	-	-	-

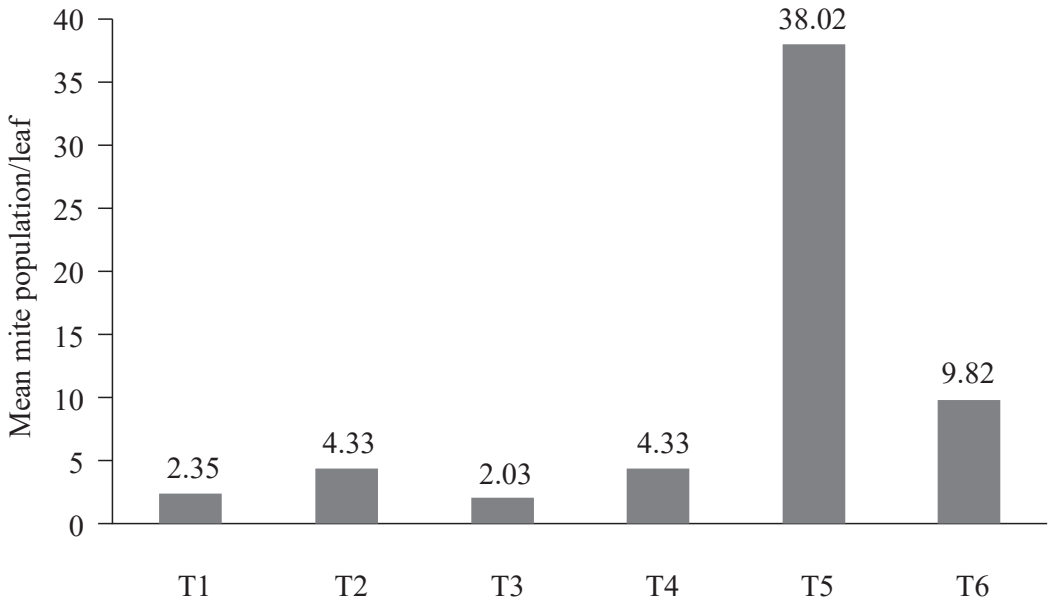

FIg. 1. Mean mite population/leaf in brinjal as influenced by different treatemnts

T_1= Bioneem plus 1 EC + white & yellow sticky traps
T_2= Bioneem 0.3 EC + white & yellow sticky traps
T_3= Fytomax 3 EC + white & yellow sticky traps
T_4= Fytoclean+ white & yellow sticky traps
T_5=Actara 25WG + white & yellow sticky traps
T_6= Untreated control

Effect of different management options on the yield of brinjal: Significantly the highest marketable fruit yield (18.32 t ha^{-1}) was recorded in T_1 (sticky white & yellow traps + Bioneem plus treated plots) and this was statistically at per with T_3 and T_4. However, the lowest yield was obtained from untreated control plots (14.05 t/ha) (Table 3). Similarly, the highest yield increase over control was calculated from sticky white & yellow traps + Bioneem plus treated plots (T_1) (30.39 %) followed by Fytocean+ white & yellow sticky traps (T_3) (27.90%).

Benefit/ cost analysis: The marginal benefit-cost ratios (MBCR) of different treatments applied against sucking pests of brinjal as worked out based on the expenses incurred and value of crops is presented in Table 4. It is to be noted here that expenses incurred referred to those only on pest control. It was revealed that the highest MBCR (3.06) was calculated from Bioneem plus + white & yellow sticky traps treated plots (T_1) followed by Fytomax 3 EC + white & yellow sticky traps

Table 3. Effect of different management approaches on the yield of brinjal at BARI, Gazipur 2013-14

Treatments	Marketable yield (t ha^{-1})	% Yield increase over control
T_1	18.32a	30.39
T_2	15.87b	12.95
T_3	17.85a	27.05
T_4	17.97a	27.90
T_5	15.51b	10.39
T_6	14.05c	-
CV %	11.23	-

Means having same letter(s) in a column are not significantly different at P> 0.01 followed by LSD.
T_1= Bioneem plus 1 EC + white & yellow sticky traps
T_2= Bioneem 0.3 EC + white & yellow sticky traps
T_3= Fytomax 3 EC + white & yellow sticky traps
T_4= Fytoclean+ white & yellow sticky traps
T_5=Actara 25WG + white & yellow sticky traps
T_6= Untreated control

Table 4. Benefit cost analysis after application of different management options for controlling sucking pests of brinjal.

Treatments	Marketable yield (t ha^{-1})	[1]Gross return (Tk ha^{-1})	[2]Cost of Treatment (Tk ha^{-1})	Net return (Tk ha^{-1})	Adjusted Net return (Tk ha^{-1})	MarginalBenefit Cost Ratio (MBCR)
T_1	18.32	274800	15760	259040	48290	3.06
T_2	15.87	238050	15760	222290	11540	0.73
T_3	17.85	267750	15760	251990	41240	2.62
T_4	17.97	269550	17760	251790	41040	2.31
T_5	15.51	232650	12960	219690	8940	0.69
T_6	14.05	210750	0	210750	0	-

[1]Farmgate price of brinjal@ Tk. 15.00 per kg
[2][Cost of Actara: @ Tk 40 5g^{-1}; Cost of Bioneem plus: @ Tk 3000 L^{-1}**;** Cost of Fytomax: @ Tk 3000 L^{-1}; Cost of Fytoclean: @ Tk 4000 L^{-1}; Cost of Bioneem: @ Tk 1000 L^{-1}; Cost of installing white sticky trap: @ TK 3960 ha^{-1}; Cost of installing yellow sticky trap: @ TK 3960 ha^{-1}; Cost of spray : Two laborers spray^{-1} ha^{-1} @ Tk 180 labour^{-1}day^{-1}; Spray volume required: 500L ha^{-1}.]

(2.62) sprayed plots (T_3). In contrast, the lowest MBCR (0.69) was obtained from Actara 25WG + white & yellow sticky traps treated plots (T_5). So, considering Marginal Benefit-Cost Ratio (MBCR), Bioneem plus along with installation white & yellow sticky traps (T_1) may be recommended for effective management of sucking pests in brinjal field.

DISCUSSION

Presently, different sucking pests are of growing concern for brinjal cultivation in Bangladesh. Previous attempts to control these sucking pests were mostly toxic chemical insecticides based, thus providing no sustainable solution to the problem. The findings of the present study led to assume that white and yellow sticky traps and neem pesticide based integrated management approach would help our farmers for combating sucking pests of brinjal in a sustainable way without having particular dependence on conventional insecticides. The outcome of the study is partly comparable with Dutta *et. al*. 2012, who recommended spraying of chlorfenapyr 10 SC and installation of white and yellow sticky traps for successful and cost effective management of sucking insect pests of brinjal.

Mote & Shivu (2003) in a field experiment on brinjal for comparing the efficacy of chemical and non-chemical pesticides against pests of brinjal observed inferior performance of neem based products. Aparna & Dethe (2011) reported that Emamectin benzoate, 6.25 g a.i. ha^{-1} proved most effective against jassid, whitefly and aphid with low levels of infestation in brinjal. They also reported that crude Neem Seed Extract (5%) gave poor control of jassid, whitefly and aphid in both the seasons. However, Kalwate & Dethe (2012) reported that Cypermethrin treated plots offered relatively more yield than that noticed in Spinosad and Emamectin benzoate when applied against fruit borer and different sucking pests. Arya (2015) recommended that spiromesifen 96 g ai ha^{-1} and thiamethoxam 50 g ai ha^{-1} can be used against the sucking pests of brinjal.

Barbar (2017) reported that applications acetamiprid and deltamethrin should be avoided as they induced the resurgence of *T. urticae* populations in egg plant field. Abrol & Singh (2003) observed resurgence of mite infestation three days after spraying pyrethroid in brinjal crop. Dobson *et. al*. (2002) reported that the outbreak of mite pest is assumed to be the consequences of frequent and indiscriminate use of toxic chemicals especially pyrethroid insecticides by farmers. Therefore the overall results of the present study demonstrated the negative effects of Thiamethoxam (Actara 25 WG) as it induced the resurgence of spider mite populations.

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