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DEVELOPMENT OF BIO-RATIONAL BASED IPM PACKAGES AGAINST THRIPS IN GARLIC

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ABSTRACT

Hossain MM, Khalequzzaman KM, Alam MS, Hossain MM, Mondal MTR (2014) Development of bio-rational based IPM packages against thrips in garlic. *Int. J. Sustain. Crop Prod.* 9(3), 10-14.

The field experiment was conducted at SRC, Bogra during Rabi season of 2013-14 to evaluate the effectiveness of several bio-rational based IPM packages against thrips in garlic. The treatments were five bio-rational based IPM packages and one untreated control. Spraying of Spinosad (Tracer 45SC) @ 0.4ml/litre of water + White sticky trap @ 40traps/ha resulted the lowest thrips population (3.20, 3.11, 3.74 thrips/plant after 1st, 2nd and 3rd treatment application respectively) with highest marginal benefit cost ratio (19.94). The highest percentage of thrips population (82.60) reduction (after 3rd treatment application) over control and the highest garlic bulb yield (8.77 t/ha) was also obtained from Spinosad (Tracer 45SC) + White sticky trap treated plot. So, installation of sticky white trap along with spraying of Spinosad (Tracer 45SC) may be recommended for effective management of thrips in garlic.

Key words: *IPM package, bio-control agents, thrips, yield, garlic*

INTRODUCTION

Garlic (*Allium sativum* L.) is one of the important spice crops in Bangladesh. The total production of garlic in Bangladesh is about 3.88 lakh metric tons against the estimated demand of 3.42 lakh metric tons (AIS 2012). Garlic is attacked by a number of insect pests among which thrips (*Thrips tabaci* Lind.) are most serious. It is a cosmopolitan pest and is considered as a major pest of garlic and onion. Damage is caused by the nymphs and adults with their rasping and sucking mouth parts (Atwal 1976). *T. tabaci* feeding on onion and garlic leaves may aid in development of purple blotch disease (Arantha 1980). Thrips prefers to feed on newly emerged leaves in the center of neck, therefore, majority of thrips are found at the base of the youngest leaves in the lower center of the neck. In case of severe infestation, the bulbs remain undersized and distorted (Butani and Verma, 1976). The pest is responsible for curling of leaves, low yield, and poor quality of bulbs. Leaf curling reduces the activity of photosynthesis and thus reduces the crop yield. The loss of mesophyll cell contents reduces the photosynthetic ability of plants and also interferes with the translocation of nutrients to bulbs (Molenaar 1984). Extensive feeding results in plant growth retardation and if this occurs during the onset of bulb formation, results in reduced bulb weight and size up to 60% yield loss (Reuda *et al*. 2007; Waiganjo *et al*. 2008). According to Changela (1993), losses of 15.35 to 46.82% in garlic bulb yield was recorded due to infestation of this pest. *Thrips tabaci* is currently the principal confirmed vector of Irish Yellow Spot Virus (IYSV) is an economically important tospovirus that can cause up to 100% crop loss (Pozzer *et al*. 1999; Gent and Schwartz, 2008). The use of synthetic chemical pesticides for the control of pests and diseases is generally avoided due to their detrimental side effects on human body and his environment.

There are some alternative measures to conventional methods; one of which is the use of biopesticides. Biopesticides contain microorganisms as the active ingredients. These biopesticides are extracted from living organisms using various processes that do not alter their chemical composition (Lee *et al.* 2000). Botanicals are now emerging as a viable component of integrated pest management (IPM) strategies for all crops due to their efficacy to managing pest, environmental and public health safety, eco-friendly nature, and cost effectiveness. Botanical pest control is a distinct possibility in subtropical countries, which are endowed with the biodiversity of such plants. The repeated application of synthetic insecticides has resulted in development of insecticide resistance in pest populations (Natarajan and Chidambaram, 1986; Mahrotra and Phokela, 1992). Some plant products have pesticide properties against sucking pests (Parmar 1995; Schmutterer and Singh, 1995; Haris 2001; Sharma 2007). This type of research works so far have not been conducted in Bangladesh. So, the present study was designed to assess the efficacy of bio-rational based IPM packages against thrips infestation and on yield of garlic.

MATERIALS AND METHODS

The experiment was conducted at Spices Research Centre, BARI, Bogra during Rabi season of 2013-14. The experimental plot was prepared with five ploughings and cross ploughings followed by laddering to break the clods as well as level the soil. The weeds and stubbles of previous crops were collected and removed from the soil. The unit plot size was 3 m x 1.2 m. The experiment was laid out in a randomized complete block design (RCBD) with three replications. BARI Garlic-1 was used as test crop for this trial. The cloves were planted on 07 November 2013 maintaining 10 cm x 10 cm spacing. The treatments were T_1= Biopesticide-bioneem (Azadirachtin 3EC) @ 2ml/litre of water; T_2= Spinosad (Tracer 45SC) @ 0.4ml/litre of water; T_3= White sticky trap @ 40 trap/ha; T_4= Spinosad (Tracer 45SC) @ 0.4ml/litre of water + White sticky trap @ 40 trap/ha; T_5= Biopesticide-bioneem (Azadirachtin 3EC) @ 2ml/litre of water + White sticky trap @ 40 trap/ha and T_6=

Untreated control. In addition to 5 t/ha of cow dung, the crop was fertilized with N_{100} P_{54} K_{166} S_{20} kg/ha. The entire quantity of cow dung, P, K, S and ½ of N was applied during land preparation. The rest of N was applied in to equal splits at 25 and 50 days after planting (DAP) (Anonymous 2010). Weeding was done at 25, 50 and 75 DAP. To control purple blotch disease the crop was sprayed three times with Rovral 50 WP @ 2g/l of water at 35, 45 and 55 DAP. Three irrigations were done at 10-20 days interval during vegetative growth stage. Irrigation was stopped before 20 days of crop maturity. The crop was harvested on 23 March 2014. Thrips population was counted at 10 days interval starting from the first appearance of thrips infestation. The first spray was applied when the thrips population was observed at economic threshold level (6-10 thrips per plant) (Hazara *et al*. 1999). Number of thrips (both nymphs and adults) was recorded after treatment application from 20 randomly selected plants in each plot by keeping a white paper below the plant and then shaking the plants with finger. Another data were recorded on plant height after 3rd treatment application, bulb weight and bulb yield. The recorded data were analyzed and mean values were adjusted and separated by Duncan's Multiple Range Test (DMRT) according to Gomez and Gomez (1984). Percent thrips population reduction over untreated control was calculated using following formula (Dutta *et al*. 2014):

Percent thrips population reduction over untreated control

$$= \frac{\text{Mean value of control} - \text{Mean value of the treatments}}{\text{Mean value of control}} \text{x}100$$

RESULTS AND DISCUSSION

Effectiveness of different bio-rational based IPM packages on thrips population of garlic

After first treatment application, it was evident that all the management approaches significantly reduced thrips population compared to control plot. The lowest number of thrips population (3.20 thrips/plant) was observed from Spinosad + White sticky trap treated plot followed by only Spinosad treated plot (3.54 thrips/plant). There was no significant statistical difference between these two treatments. On the other hand, significantly maximum number of thrips population (9.12 thrips/plant) was observed from control plot (Table 1). The highest percentage of thrips population reduction (64.91%) over control was observed from Spinosad + White sticky trap treated plot followed by Spinosad (61.18%) and Bioneem + White sticky trap treated plot (48.25%).

After second treatment application, the minimum number of thrips population (3.11 thrips/plant) was observed from Spinosad + White sticky trap treated plot followed by only Spinosad treated plot (3.51 thrips/plant) and Bioneem + White sticky trap treated plot (6.86 thrips/plant). While significantly the highest number of thrips population (16 thrips /plant) was observed from control plot (Table 1). Similarly, the highest percentage of thrips population reduction (80.56%) over control was observed from Spinosad + White sticky trap treated plot followed by Spinosad (78.06%) and Bioneem + White sticky trap treated plot (57.13%).

After third treatment application, all of the treatments gave significant effect on percent reduction of thrips population over untreated control (Table 1). Here, the highest percentage of thrips population reduction (82.60%) over control was observed from Spinosad + White sticky trap treated plot followed by Spinosad (82%) and Bioneem + White sticky trap treated plot (60.65%).

It was evident from the result that the installation of sticky white trap along with Tracer 45SC was highly effective against onion thrips. The findings are in conformity with those of Vekaria and Patel (2000) and Chandel *et al.* (2006), who reported significant results with certain plant products for the control of bugs, beetles and aphids. Prasad and Ahmed (2009) reported that Spinosad 45SC @ 125 ml/ha was effective against thrips. In most cases, sticky white trap significantly reduced thrips population densities, but not necessarily to a level that would be considered adequate.

Table 1. Efficacy of different bio-rational based IPM packages for the control of thrips in garlic

Treatments	Mean no. of thrips /plant					
	After 1st treatment application	% reduction over control	After 2nd treatment application	% reduction over control	After 3rd treatment application	% reduction over control
Bioneem	4.75c	47.92	7.55c	52.81	9.84b	54.23
Spinosad	3.54d	61.18	3.51d	78.06	3.87c	82.00
White sticky trap	7.72b	15.35	11.43b	28.56	18.59a	13.53
Spinosad + White sticky trap	3.20d	64.91	3.11d	80.56	3.74c	82.60
Bioneem + White sticky trap	4.72c	48.25	6.86c	57.13	8.46b	60.65
Untreated control	9.12a	-	16.00a	-	21.50a	-
CV (%)	9.70	-	6.95	-	16.26	-

Mean followed by the same letter (s) in the same column did not differ significantly from each other at 5% level by DMRT

Relationship between plant height and thrips population/plant after 3rd treatment application in garlic

Relationship between plant height and thrips population/plant after 3rd treatment application in garlic are presented in Fig. 1. Plant height was significantly and negatively correlated with thrips population. The regression equation was y = 77.71-0.673x and correlation coefficient was r = -0.9412**. The figure indicates that plant height was increased with the decrease of thrips population. An observation is compatible with those of Patel and Patel (2012) who observed that plant height was significantly and negatively correlated with thrips population in garlic.

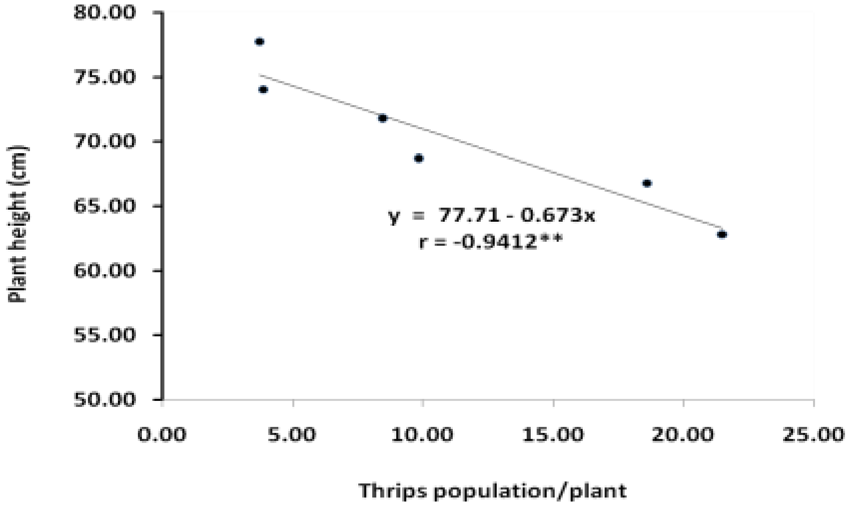

Fig. 1. Relationship between plant height and thrips population/plant after 3rd treatment application in garlic

Efficacy of different bio-rational based IPM packages on yield and yield contributing characters of garlic

All of the treatments gave significant effect on plant height, bulb weight and yield of garlic over the untreated control plot (Table 2). The increase of plant height and bulb weight in Spinosad + White sticky trap were 23.77 % and 72.72 %, respectively, higher over control which was followed by Spinosad, and Bioneem + White sticky trap treated plot. The highest bulb yield was obtained from Spinosad + White sticky trap treated plot (8.77 t/ha) which increase 149.15% over untreated control, that indicated better thrips control compared to other treatments. The lowest yield (3.52 t/ha) was recorded from untreated control plot. Mandal *et al.* (2008) reported 16.91 to 27.07% increase in yield of cotton over control due to use of biopesticides.

Table 2. Efficacy of different bio-rational based IPM packages on yield and yield contributing characters of garlic

Treatments	Plant height (cm)	% increase over control	Bulb weight (g)	% increase over control	Bulb yield (t/ha)	% increase over control
Bioneem	68.67bc	9.35	15.00ab	36.36	6.25bc	77.56
Spinosad	74.07ab	17.94	17.67a	60.64	8.01ab	127.56
White sticky trap	66.80bc	6.37	15.33ab	39.36	5.78c	64.20
Spinosad + White sticky trap	77.73a	23.77	19.00a	72.72	8.77a	149.15
Bioneem + White sticky trap	71.77ab	14.28	16.00a	45.45	6.65bc	88.92
Untreated control	62.80c	-	11.00b	-	3.52d	-
CV (%)	6.52	-	15.89	-	14.29	-

Mean followed by the same letter (s) in the same column did not differ significantly from each other at 5% level by DMRT

Economic analysis of different bio-rational based IPM packages against thrips in garlic

The marginal benefit-cost ratio (MBCR) as worked out based on the expenses incurred and value of crops obtained from the treated plot for the control of thrips in garlic is presented in Table 3. It was noted that expenses incurred referred to those only on pest control. It was revealed that the highest marginal benefit-cost ratio (19.94) was obtained from the plots treated with Spinosad (Tracer 45SC) + White sticky trap followed by only Spionosad treated plot (19.52) and Bioneem + White sticky trap (9.53) treated plot.

Table 3. Economic analysis of different bio-rational based IPM packages against thrips in garlic

Treatments	Yield (t/ha)	Gross income (Tk)	Additional yield over control (t/ha)	Additional income over control (Tk/ha)	Pest management cost (Tk/ha)	Net income (Tk/ha)	MBCR
Bioneem	6.25	375000	2.73	163800	17200	146600	9.52
Spinosad	8.01	480600	4.49	269400	13800	255600	19.52
White sticky trap	5.78	346800	2.26	135600	9200	126400	14.74
Spinosad + White sticky trap	8.77	526200	5.25	315000	15800	299200	19.94
Bioneem + White sticky trap	6.65	399000	3.13	187800	19700	168100	9.53
Untreated control	3.52	211200	-	-	-	-	-

MBCR= Marginal benefit-cost ratio

[Price of garlic bulb = 60 TK/kg, Cost of Bioneem @200Tk/100ml, Cost of White sticky trap @60 Tk/trap, Cost of Spinosad (Tracer 45SC) @1750Tk/75ml; Cost of spray: Two labours/spray/ha @180Tk./labour/day; Spray volume required: 500L/ha]

CONCLUSION

From the above study, it may be concluded that installation of sticky white trap along with spraying of Spinosad (Tracer 45SC) showed better performance against thrips control in garlic with higher yield and economic return.

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