SUSCEPTIBILITY OF DIFFERENT GARLIC GENOTYPES/CULTIVARS TO THRIPS (*Thrips tabaci* LINDMAN)

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ABSTRACT

A field experiment was conducted to check the susceptibility of different garlic genotypes/cultivars to thrips (*Thrips tabaci* Lindman) at Main Vegetable Research Station, Anand Agricultural University, Anand during *rabi* 2009-10. Out of twelve genotypes/cultivars (AGS 05-5, AGS 06-5, AGS 06-6, AGS 06-7, AGS 06-16, AGS 06-19, AGS 06-23, AGS 06-1-1, AGS 06-13-3, AGS 05-7-2, G-282 and GG-4), AGS-06-1-1 and GG-4 recording less than 3.68 thrips per plant were caractorized as highly resistant. AGS-06-1-1 (7.96 t/ha) and GG-4 (7.11 t/ha) also registered significantly higher bulb yield than rest of the genotypes except AGS-06-13-3 (6.64 t/ha), G-282 (6.62 t/ha) and AGS 06-23 (6.56 t/ha) with which they were at par. Genotypes, AGS-05-7-2, AGS-06-16 and AGS-06-19 recorded higher thrips population of more than 6.92 thrips/ plant and low bulb yield were grouped into highly susceptible. Among the morphological characters studied, plant height at 30 DAS (-0.9477), 60 DAS (- 0.7917**) and 90 DAS (-0.8474**) conferring the mechanism of resistance.**

KEW WORDS: cultivars, garlic, genotypes, susceptibility, thrips, *Thrips tabaci*

INTRODUCTION

Garlic [*Allium sativum* (L.)] is the second most important bulb crop grown throughout the plains of India for spices and condiments. It is mostly used for culinary purposes and as a condiment for different food items. The raw garlic can also be used in the manufacturing of powder, paste, oil and dehydrated garlic *etc*. Besides these, it is also well known for having numerous valuable medicinal properties. In the world, the production of garlic ranks 1st in China (12.09 lakh tones) followed by India (6.45 lakh tones) and South Korea (3.25 lakh tones) (Anon., 2008). In India, it is cultivated in 2.09 lakh hectares with a production of 12.64 lakh tones and a productivity of 6.04 tons/ha of which, Gujarat contributes 21.74 per cent of the total production (Anon., 2010a). In Gujarat, it is mainly cultivated in 0.40 lakh hectare with total production of 2.75 lakh tons and a productivity of 6875 kg/ha (Anon, 2010b).

Many factors affecting the production and productivity of garlic, of which infestation of insect pests is major one. Of the various insect pests, thrips, *Thrips tabaci* Lindman is an important and major biological constraint in garlic production causing heavy economical loss, if infestation starts at bulb initiation stage. According to Changela (1993), losses of 15.35 per cent to 46.82 per cent in garlic bulb yield was recorded due to infestation of this pest at Junagadh in Gujarat. Thrips was first observed in North America in 1872; then after in early 1900s, it spreaded throughout the United States and Southern Canada (Capinera, 2001). In India, thrips was recorded for the first time by Dyadechko (1977). 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).

Resistant varieties provides insect control without any additional cost, acts as preventive measure against buildup of insect with other method of pest control and are free from environmental pollution problems (Atwal and Dhaliwal, 1999). The varietal susceptibility of garlic was studied by Tiwari *et al*. (2002) and Srivastava *et al*. (2005). However, the work on this aspect in relation to *T. tabaci* in garlic is lacking in middle Gujarat condition. Hence, the present investigations were carried out to screen different genotypes/cultivars to thrips infesting garlic at Main Vegetable Research Station, Anand Agricultural University, Anand during the *rabi* season of 2009-10.

MATERIALS AND METHODS

Twelve different garlic genotypes/cultivars (AGS-05-5, AGS-06-5, AGS-06-6, AGS-06-7, AGS-06-16, AGS-06-19, AGS-06-23, AGS-06-1-1, AGS-06-13-3, AGS-05-7-2, G-282 and GG-4) were evaluated for their susceptibility to *T. tabaci* under field condition in a randomized block design replicated thrice in a plot size of 1.5 x 2.0 m with a spacing of 15 x 10 cm. Genotypes/cultivars were evaluated based on thrips population and bulb yield. For recording observations, five plants were selected randomly in each net plot and observations on absolute thrips population were recorded at weekly interval in the morning hours as per the method suggested by Mote (1981). The observations were started from first week after germination and were continued till to the harvesting of the crop at the beginning of each standard meteorological week. The whole experimental plot was kept free from spraying of any insecticides. The bulb yield of each genotype/cultivar was recorded at harvest from each net plot.

These genotypes/cultivars were also grouped into the four categories of resistance *viz.*, highly resistant, resistant, susceptible and highly susceptible based on number of thrips per plant. For the purpose, mean value of individual genotype ($\overline{X}_i$) was compared with mean value of all genotypes ($\overline{X}$) and standard deviation (sd) following the modified scale adopted by Patel *et al*. (2002). The retransformed data were used for computation of $\overline{X}$, $\overline{X}_i$ and sd in case of this parameter. The scale used for categorizing different genotypes was as under.

Category of resistance	Scale for resistance
Highly Resistant (HR)	$\overline{X}_i < \overline{X}$ - sd
Resistant (R)	$\overline{X}_i > \overline{X}$ - sd < $\overline{X}$
Susceptible (S)	$\overline{X}_i > \overline{X}$ < ($\overline{X}$ + sd)
Highly Susceptible (HS)	$\overline{X}_i$ > ($\overline{X}$ + sd) < ($\overline{X}$ + 2 sd)

The genotypes/cultivars evaluated for their susceptibility to *T. tabaci* were further studied to know the mechanism responsible for imparting the resistance or susceptibility to *T. tabaci* by recording the observations on plant height, number of leaves per plant, Bulb girth and number of cloves/bulb. For recording plant height, ten plants were selected randomly from each net plot and the plant height was measured in centimeter at 30, 60 and 90 days after sowing. For recording observations on different bulb characters, ten bulbs were selected from each plot at the time of harvest.

RESULTS AND DISCUSSION

Evaluation of genotypes/cultivars for susceptibility

The data pooled over periods for population of thrips and garlic bulb yield are presented in Table 1. The differences among the genotypes/cultivars were significant. Among the different genotypes/cultivars, AGS 06-1-1 recorded significantly lowest thrips population (3.19 thrips/plant) as compared to rest of the genotypes/cultivars screened except GG-4 (3.38 thrips/plant), with which it was at par. Genotype AGS 06-13-3 (4.47 thrips/plant) was at par with G-282 (3.99 thrips/plant) at one hand, while with AGS 06-23 (4.93 thrips/plant) and AGS 06-7 (5.11 thrips/plant) on other hand of chronological order. Genotypes, AGS 05-5 (5.45 thrips/plant), AGS 06-6 (5.45 thrips/plant) and AGS 06-5 (5.85 thrips/plant) were at par with each other. Similarly, AGS 05-7-2 (7.01 thrips/plant), AGS 06-16 (7.22 thrips/plant) and AGS 06-19 (7.97 thrips/plant) recorded significantly higher thrips population and did not significantly differ from each other. No published information is found on susceptibility while spanning the literatures except the result of Srivastava *et al.* (2005), who reported that G-282 had the lowest incidence of thrips. Thus, present findings as in case of variety G-282 recorded lower thrips is in accordance with this report.

With respect to bulb yield, AGS-06-1-1 (7.96 t/ha) and GG-4 (7.11 t/ha) registered significantly higher bulb yield than rest of the genotypes except AGS-06-13-3 (6.64 t/ha), G-282 (6.62 t/ha) and AGS 06-23 (6.56 t/ha) with which they were at par. Genotypes AGS-06-13-3, AGS 05-7-2, AGS 06-23, AGS 05-5, AGS 06-7, AGS 06-6 and AGS 06-5 were not differed significantly from each other. Similarly, AGS 05-5, AGS 06-7, AGS 06-6, AGS 06-5, AGS 05-7-2, AGS 06-16 and AGS 06-19 were at par with each other for garlic bulb yield.

Categorization of genotypes/cultivars for susceptibility

The different genotypes/cultivars of garlic were also grouped into four different categories of resistance *viz*., highly resistant, resistant, susceptible and highly susceptible. The results are presented in Table 2. Genotypes AGS-06-1-1 and GG-4 recording less than 3.68 thrips per plant found highly resistant. G-282, AGS-06-13-3, AGS-06-23 and AGS-06-7 recording thrips population less than 5.30 but more than 3.68 per plant were grouped into resistant. Genotypes AGS-05-5, AGS-06-6 as well as AGS-06-5 were found susceptible by recording thrips population more than 5.30 but less than 6.92 per plant. Genotypes AGS-05-7-2, AGS-06-16 and AGS-06-19 recording thrips population more than 6.92 but less than 8.54 per plant grouped into highly susceptible.

Mechanism of resistance

The correlation coefficient values (r) presented in Table 3 revealed that plant height at 30 DAS (r = - 0.9477**), 60 DAS (r = - 0.7917**) and 90 DAS (r = - 0.8474**) were significantly and negatively correlated with thrips population. It indicated that as plant height increases, thrips population decreases or vice versa. The remained parameters *viz.,* bulb girth, number of leaves/plant and number of cloves/bulb were non-significant indicating negligible impact on thrips incidence. Bortoli and Castellane (1990) reported that thrips population significant negatively correlated with bulb diameter. In present investigation also found negative non significant association between bulb girth and thrips population.

CONCLUSION

From the present investigation, it can be concluded that genotypes, AGS-06-1-1 and GG-4 recording lower thrips population and higher bulb yield were caractorized as highly resistant. Genotypes, AGS-05-7-2, AGS-06-16 and AGS-06-19 recorded higher thrips population and low bulb yield were grouped into highly susceptible. Among the morphological characters studied, plant height conferring the mechanism of resistance.

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Table 1: Performance of different garlic genotypes/cultivars against thrips population and bulb yield (t/ha)

Genotypes/Cultivars		No. of Thrips/Plant*	Bulb Yield (t/ha)
AGS-05-5		2.44[e] (5.45)	5.88[bc]
AGS-06-5		2.52[e] (5.85)	5.16[bc]
AGS-06-6		2.44[e] (5.45)	5.62[bc]
AGS-06-7		2.37[de] (5.11)	5.80[bc]
AGS-06-16		2.78[f] (7.22)	4.62[c]
AGS-06-19		2.91[f] (7.97)	4.38[c]
AGS-06-23		2.33[de] (4.93)	6.56[ab]
AGS-06-1-1		1.92[a] (3.19)	7.96[a]
AGS-06-13-3		2.23[cd] (4.47)	6.64[ab]
AGS-05-7-2		2.74[f] (7.01)	4.69[c]
G-282 (C)		2.12[bc] (3.99)	6.62[ab]
GG-4 (C)		1.97[ab] (3.38)	7.11[a]
ANOVA			
S.Em. ±	**Genotypes (G)**	0.06	0.63
	Period (P)	0.05	
	G x P	0.18	
C.D. at 5%	**Genotypes (G)**	0.19	1.84
	Period (P)	0.14	
	G x P	0.49	
C.V. %		12.85	18.40

Note: 1.Treatment means with letter(s) in common are not significant at 5 % level of significance in respective column

2.Figures in parentheses are retransformed values; those outside are $\sqrt{x+0.5}$ *transformed values*

Table 2: Categorization of different genotypes/cultivars of garlic for their susceptibility to *T. tabaci*

Category of resistance	Scale	Genotypes/cultivars	($\overline{X}_i$)
Based on population of thrips/plant : $\overline{X}$ = 5.30 and sd = 1.62			
Highly resistant	$\overline{X}_i$ < 3.68	AGS-06-1-1	(3.19)
		GG-4	(3.38)
Resistant	$\overline{X}_i$ > 3.68 < 5.30	G-282	(3.99)
		AGS-06-13-3	(4.47)
		AGS-06-23	(4.93)
		AGS-06-7	(5.11)
Susceptible	$\overline{X}_i$ > 5.30 < 6.92	AGS-05-5	(5.45)
		AGS-06-6	(5.45)
		AGS-06-5	(5.85)
Highly Susceptible	$\overline{X}_i$ > 6.92 < 8.54	AGS-05-7-2	(7.01)
		AGS-06-16	(7.22)
		AGS-06-19	(7.97)

Table 3: Morphological parameters of different garlic genotypes/cultivars and their relationship with thrips population

Genotypes/ Cultivars	No. of Thrips/ Plant	Plant Height at DAT (cm)			No. of Leaves/ Plant	Bulb Girth (cm)	No. of Cloves/ Bulb
		30	60	90			
AGS-05-5	5.45	33.6	38.5	51.1	7	6	14
AGS-06-5	5.85	31.85	37.1	49.2	8	7.5	18
AGS-06-6	5.45	32.5	39.3	48.1	9	8.5	16
AGS-06-7	5.1	34	41.85	49.75	5	6.5	14
AGS-06-16	7.22	31.1	38.95	47.33	5	7	15
AGS-06-19	7.97	30.25	37.85	46.1	7	11	18
AGS-06-23	4.93	33.75	39.5	48.5	7	10	17
AGS-06-1-1	3.19	38.7	43.5	51.2	8	12.1	16
AGS-06-13-3	4.47	34.65	41.5	50.15	7	9.8	12
AGS-05-7-2	7.01	31.89	40.1	48.98	6	10.1	15
G-282 (C)	3.99	35.85	44	51.85	8	8.5	17
GG-4 (C)	3.38	36.48	44.33	53.57	7	11	17
Infestation level (Y)	**Correlation coefficient (r)**						
No. of thrips/Plant	-0.9477**	-0.7917**	-0.8474**	-0.3876	0.9115	-0.2594	

* *Significant at 0.05% level* ** *Significant at 0.01% level*

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