RESEARCH ARTICLE

STUDY OF BIO-MORPHOLOGICAL CHARACTERS OF GARLIC PLANT IN RELATION TO THRIPS *THRIPS TABACI* LINDEMAN POPULATION

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Abstract: The investigation on Bio-morphological characters of garlic plant in relation to thrips populationwas carried out at Horticulture farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur during 2020-2021. From the foregoing investigation it becomes clear that among the 20 genotypes the maximum plant height was recorded in the genotypes Yamuna safed-4 (38.43cm) and minimum plant height was recorded in genotype GN-20-08 (28.32) and the correlation of thrips with plant height (r =-0.52*), highest neck diameter was observed in the genotype GN-20-50 (6.65cm) whereas, the lowest neck diameter was observed in GN-20-52 (4.68cm) and the correlation of thrips with neck diameter (r =-0.47*), the maximum angle between leaves was observed in the genotype GN-20-41 (17.53º). and the minimum angle observed in GN-20-52 (8.1º) and the correlation of thrips with leaf angle found (0.70**) and the maximum number of leaf/plant recorded in the genotype GN-20-43 (6.63) and the minimum number of leaf/plant observed in GN-20-62 (4.92) and the correlation of thrips with plant height (r =-0.48*). Bio morphological character *i.e.*, plant height, neck diameter, leaf angle and number of leaf /plant found significant but negatively correlated.

Keywords: Bio-morphological, Garlic, Leaf angle, Neck diameter, Plant height, Thrips

INTRODUCTION

Garlic is the most important bulb crop in India after onion. Botanically it is known as *Allium sativum* and belongs to Alliaceae family (Iciek *et al*., 2009). Garlic is native of central Asia. India is the 2nd largest producer of garlic after China. The main garlic producing states in India are Rajasthan, Madhya Pradesh, Gujrat, Uttar Pradesh, Maharashtra, Himanchal Pradesh, Karnataka, Tamil Nadu, Chhattisgarh. In India garlic occupies an area of 3.91 lakh ha, with production of 18.62 million tons in India (National horticulture board, 2019). Several factors affecting the production and productivity of garlic, the key one of which is insect pest infestation. According to Hill (1983), there are various major insect pests attacking garlic *viz.* onion thrips (*Thrips tabaci* Lineman), groundnut thrips *(Caliothrips indicus* Bagnall), onion fly (*Delia antique* Meigen), cut worm (*Agrotis ipsilon* Roth) and armyworm (*Spodoptera exigua* Hubner) etc. It is known that pest infestation is depends on climatic condition, crop growth stages, time of cultivation, plant morphological characters and natural enemies of pest at a time. Development of resistant variety is an ideal component against build-up of pest population at no additional cost, compatible with other methods of pest control with no environmental pollution. Every plant has an inbuilt mechanism to resist the attack of the pest constituting various bio-morphological characters. Plant characteristics that reduce plant attractiveness to *T. tabaci* adults may inhibit oviposition resulting in less larval feeding and development.

MATERIALS AND METHODS

Experiment was conducted to study the response of 20 genotypes against garlic thrips. Various plant growth parameters such as plant height, number of leaves, leaf angle, leaf colour, neck diameter were also studied to know the various factors responsible in imparting resistance. For measurement of different attributes five plants were selected randomly from each genotype in each replication and measurement was done at 60 days after transplanting (bulb formation stage). Thrips population was recorded from randomly selected and tagged five plants from each plot and no. of thrips/plant was recorded by shaking of plant on oily white paper sheet followed by counting them with the help of magnifying lens. The techniques followed for each character was as follows:

1. Leaf angle
Leaf angle between top most two opened leaves was assessed by using protractor.

2. Leaf colour
Visual observation was made on the leaf colour of different genotypes and categorized as light green, green and dark green.

3. No. of leaves
Number of leaves counted manually.

4. Neck diameter
Neck diameter of plant assessed by Vernier callipers.

5. Plant hight
Plant hight was measured by Normal Scale.

The population data of various insect pests was correlated with plant bio morphological characters.

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Statistical analysis

The population of thrips correlated with plant bio morphological characters on the basis of following formula given by Gomez and Gomez:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[\, n\sum x^2 - (\sum x)^2 \,][\, n\sum y^2 - (\sum y)^2 \,]}}$$

Where,

$\sum x$ = Total value of first factor(variable)

$\sum y$ = Total value of second factor (variable)

$\sum xy$ = sum of multiply of factor 1 and factor 2

$\sum x2$ = Sum of square of 1st factor

$\sum y2$ = sum of square of 2nd factor

n = Total no. of observations

r = Correlation coefficient

After correlating significant and non-significant findings, t-test value n-2 degrees of freedom were calculated on the following formula:

$$t = \frac{r_{xy}\sqrt{n-2}}{\sqrt{1 - r_{xy}^2}}$$

t- t value n-2 d. f.

The calculated t-value obtained was compared with tabulated t-value at 5% and 1% level of significance.

RESULTS AND DISCUSSION

The effect of plant Various plant growth parameters such as plant height, number of leaves, leaf angle, leaf colour, neck diameter and their correlation with thrips population at bulb formation stage were recorded of twenty genotypes to determine the various morphological factors responsible for developing resistance.

Plant height (60 DAS)

There was significant difference in plant height of 20 garlic genotypes. The maximum plant height was recorded in the genotypes Yamuna safed-4 (38.43cm) and GN-20-41(36.86) which was at par with each other while the minimum plant height was recorded in genotype GN-20-08 (28.32) and GN-20-54 (28.65) which were at par with each other. The plant height of the remaining genotypes was lies in between maximum and minimum value.

The relationship between mean number of thrips/plant and plant height of garlic genotype was significant but negatively correlated. The correlation coefficient was r =-0.52** and regression equation showed Y = 73.168-1.6546x1. The regression equation indicated that with the increases 1cm plant height there will be infestation decreases in -1.654 per cent. Similar trend was also recorded by Patel and Patel (2012) who observed that plant height was significantly and negatively correlated with thrips population. Hossain *et al*. (2014) also concluded on their experiment that the relationship between mean number of thrips/plant and plant height under garlic genotypes was negatively correlated.

Neck diameter (60 days)

There was significant difference in neck diameter of 20 garlic genotypes. The highest neck diameter was observed in the genotype GN-20-50 (6.65cm). Whereas, the lowest neck diameter was observed in GN-20-52 (4.68cm). The neck diameter of the remaining genotypes was varied in between maximum and minimum value.

The relationship between mean number of thrips/plant and neck diameter of garlic genotype was significant but negatively correlated and the correlation coefficient was r = -0.47**, as with increase in neck diameter of plant resulted decrease in thrips population and tended to be linear as indicated by regression line equation Y = 69.252 - 8.5562x. The regression equation indicated that with the increases 1 cm neck diameter there will be infestation decreases in 8.556 per cent. Similarly, Satyanarayan *et al*. (2016) who observed on onion cultivar that with increases of neck diameter the population of thrips decreases.

Leaf angle (60 DAS)

There was significant difference in leaf angle of 20 garlic genotypes. The maximum angle between leaves was observed in the genotype GN-20-41 (17.53º). Whereas, the minimum angle observed in GN-20-52 (8.1º). The leaf angle of the remaining genotypes was varied in between maximum and minimum value of leaf angle.

The relationship between mean number of thrips/plant and leaf angle of garlic genotype was significant but highly negatively correlated and the correlation coefficient was r = -0.70*. The corelation analysis indicated that as with increase in angle between top most 2 leaves, the population of thrips were found to be decreases. The tended to be linear as indicated by regression line equation Y = 49.275-2.1648x3. The regression equation indicated that with the increases 1º leaf angle there will be infestation decreases in 2.164 per cent. Similarly, Martin *et al*. (2006) found that cultivars with a wider central angle suffer fewer infestations by *T. tabaci* due to the non-preference of the insects for these leaves.

Number of leaf/plant (60 DAS)

There was significant difference number of leaf/plant in of 20 garlic genotypes The maximum number of leaf/plant recorded in the genotype GN-20-43 (6.63), Whereas, the minimum number of leaf/plant observed in GN-20-62 (4.92).

The relationship between mean number of thrips/plant *Thrips tabaci* and number of leaf/plant garlic genotype was significant but negatively correlated. The corelation analysis showed that as with increases no. of leaves/plant, the population of thrips were found to be decreases. The correlation coefficient was r = -0.48** and tended to be linear as indicated by regression line equation regression

equation Y = 74.428-9.6368x4. The regression equation indicated that with the increases 1 leaf/plant there will be infestation decreases in 9.636 per cent. Similar result presented by Shonga *et al*. (2018) who studied morphological characters of shallot in relation to thrips and concluded a greater number of leaves bearing plant less affected by thrips.

Leaf colour

On the basis of visual observation, leaf colour or garlic genotype categorised *as* light green, green, dark green and found dark green coloured genotypes were severe affected by thrips. Ellis *et al*. (1996) reported similar findings that thrips attracted to those plants which have darker in colour.

Table 1. Thrips population correlated with various plant morphological characters in garlic genotypes (after 60 days)

Genotypes	No. of thrips/plant	Plant morphological characteristics				
		Plant height	Neck diameter	Leaf angle	No. of leaf/plant	Leaf colour
GN-20-41	6.46	36.86	5.57	17.53	6.46	LG
GN-20-43	9.86	36	5.53	14.23	6.63	LG
GN-20-45	11.13	36.92	5.88	17.1	6.4	LG
GN-20-48	14.53	29.24	6.32	15.1	6.21	G
GN-20-50	12.3	29.83	6.65	14.33	5.16	G
GN-20-52	33.27	30.47	4.68	8.1	5.34	DG
GN-20-54	35.76	28.65	5.02	9.73	5.41	DG
GN-20-57	33.63	30.98	4.86	8.23	5.53	DG
GN-20-59	11.93	35.95	5.81	14.83	5.26	LG
GN-20-62	13.68	34.21	5.12	13.01	4.92	LG
GN-20-65	11.06	29.86	5.59	11.4	5.6	LG
GN-20-67	38	29.87	5.18	8.024	5.02	DG
GN-20-20	20.9	28.98	5.82	15.66	5.44	G
GN-20-06	17.7	29.67	6.12	16.23	5.37	G
GN-20-08	18.26	28.32	6.17	14.98	6.2	G
GN-20-11	20.9	33.42	5.93	13.23	5.43	G
GN-20-13	21.6	30.21	6.56	17	5.32	G
GN-20-15	27.73333	32.12	5.99	17.43	5.893333	G
Jamnagar local	32.1	32.87	6.045	9.12	5.35	G
Yamuna safed-4	8.8	38.43	6.32	15.34	6.002	G
Correlation coefficient values (r)		**-0.52***	**-0.47***	**-0.70****	**-0.48***	
CD		**0.195**	**0.195**	**0.217**	**0.18**	
S.E.(m)		**0.068**	**0.068**	**0.075**	**0.063**	

***Significant at 5% level,** ****Significant at 1% level** LG-Light green, G-Green and DG-Dark green

Fig 1. Measuring height of garlic plant

Fig 2. Measuring leaf angle of garlic plant

Fig 3. Measuring neck diameter of garlic plant

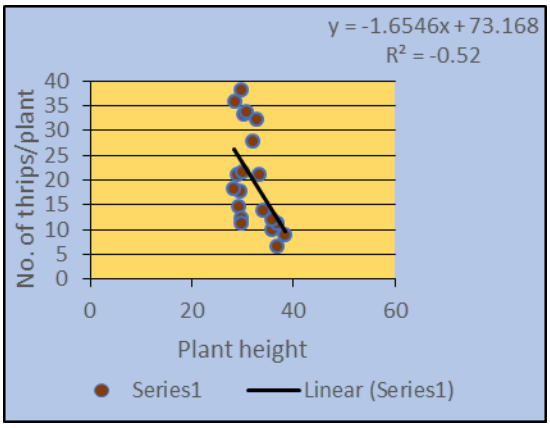

Fig 3. Regression of no. of thrips/plant on plant height after 60 days

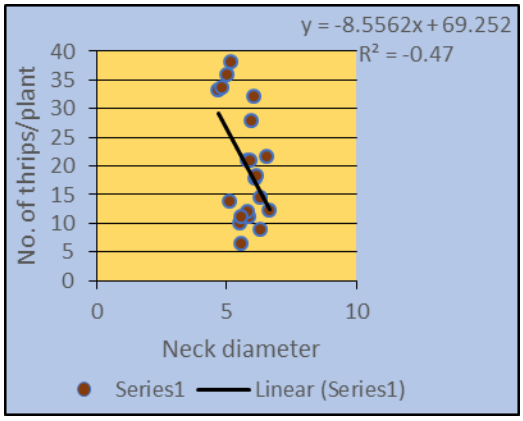

Fig 4. Regression of no. thrips/plant on neck diameter after 60 days

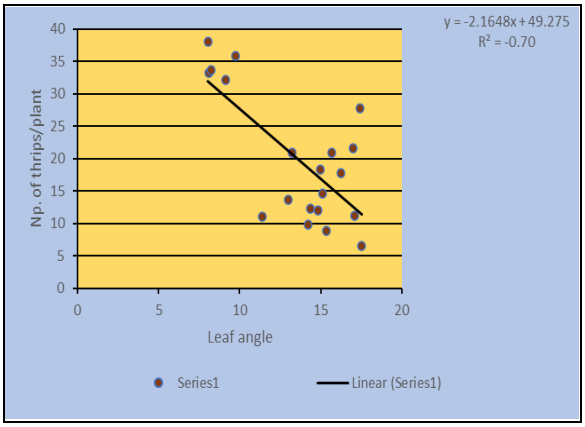

Fig 5. Regression of no. of thrips/plant on leaf angle after 60 days

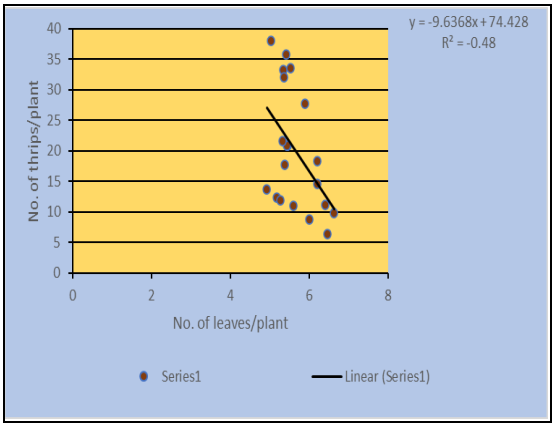

Fig 6. Regression of no. of thrips/plant on no. of leaves /plant after 60 days

CONCLUSION

Form the investigation it becomes clear that the maximum plant height was recorded in the genotypes Yamuna safed-4 (38.43cm) and minimum plant height was recorded in genotype GN-20-08 (28.32) and the correlation of thrips with plant height (r =-0.52*), highest neck diameter was observed in the genotype GN-20-50 (6.65cm) whereas, the lowest neck diameter was observed in GN-20-52 (4.68cm) and the correlation of thrips with neck diameter (r =-0.47*), the maximum angle between leaves was observed in the genotype GN-20-41 (17.53º). and the minimum angle observed in GN-20-52 (8.1º) and the

correlation of thrips with leaf angle found (0.70**) and the maximum number of leaf/plant recorded in the genotype GN-20-43 (6.63) and the minimum number of leaf/plant observed in GN-20-62 (4.92) and the correlation of thrips with plant height (r =-0.48*). Bio morphological character *i.e.*, plant height, neck diameter, leaf angle and number of leaf /plant found significant but negatively correlated.

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