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EFFECT OF PHYSICO-MORPHIC CHARACTERS AND ENVIRONMENTAL FACTORS ON INFESTATION OF THRIPS (*THRIPS TABACI*) ON FIVE ONION CULTIVARS

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ABSTRACT

Resistance to plants is frequently associated with physical, morphological, physiological, biochemical, molecular and genetic characteristics of the plants. As very little information is available on the effects of physico-morphic characteristics and environmental factors on thrips (*Thrips tabaci*) infestation, therefore, in the present study such effects were evaluated on the infestation of thrips on five onion cultivars. Maximum number of adults and infestation of thrips was recorded on Marvi followed by Golden Orb while the adults and infestation was the minimum on Red Orb. Significant variations were observed in plant heights and girths among five onion varieties after 40, 70 and 100 days. Similarly, maximum yield was observed in case of Red Orb followed by F1 Mustang while the minimum yield was obtained with cultivar Marvi. The low temperature, high temperature and average temperature showed significant and positive correlations among all the cultivars. However, the average relative humidity showed negative and non-significant correlation for all the varieties. The correlation between physico-morphic characteristics and adult population was found significant for plant girth after 40 days while the correlations were non-significant for all the other factors. It is concluded from the present studies that Red Orb is comparatively resistant cultivar harboring the minimum thrips population. The highest yield was also recorded in case of Red Orb as compared to other tested cultivars and recommended for cultivation to enhance economic returns of farmers.

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INTRODUCTION

Onion (*Allium cepa L.*) belongs to the family Alliaceae which is also known as Amaryllidaceae and is a biennial herbaceous crop (Malik et al., 2010). Onion is known as a major horticultural cash crop in Pakistan (Hassan and Malik, 2002). Onion contains high amount of phosphorus, calcium and carbohydrates and is a rich source of energy. It is pungent because of sulphuric compound and is also used as appetizer (Anonymous, 2012).

In India, onion is cultivated on large area for the consumption of domestic purpose as well as for export (Brewster, 1994). Onion is seriously attacked by

different insect pests including thrips, maggots, head borer and cutworm etc. which are main yield reducing factors. Among these, *Thrips tabaci*, is the major pest of onion (Lorbeer et al., 2002; Malik et al., 2010). *T. tabaci* causes damage to onion directly by feeding and indirectly by transmitting viruses (Whitfield et al., 2005). As compared to other insect pests of onion, *T. tabaci* is the most serious pest in tropical areas (Duchovskiene, 2006; Richter et al., 1999).

The number of thrips increases from bulb initiation and attacks all stages of crop growth (Ibrahim and Adesiyun, 2009). As compared to adult, nymph does more damage usually in peculiar feeding behavior in fruit as well as in flower of onion (Kawai, 1988). During the last two decades, it has become a globally recognized pest of onion (Diaz-Montano et al., 2011). Onion thrips is known as the most economically important pest of onion all over the world (Trdan et al., 2005). Thrips causes damage to onion crop and yield reduction may reach up to 59% (Waiganjo et al., 2008). In many cases, the yields of onion reduce up to 40-60% (Fournier et al., 1995; Khan et al., 2015). They also reported 43% yield loss in yellow onions and recorded 149-172 adults per leaf. It has wide host range and can transfer from one crop to others depending upon the environmental conditions (Shelton et al., 1987). Al-Faisali (1981) reported that thrips population in onion fields may fluctuate depending on environmental conditions, plant age, time and amount of rainfall and temperature. The highest density in onion field may occur during the months of March and April.

To minimize damage, cultivars resistant to the insect pests must be used (Sinha et al., 1993). The onion varieties are regarded as resistant or susceptible to onion thrips on the basis of leaf color while the length of 'days to maturity' is not the best way to indicate resistant and susceptibility of onion crop (Diaz-Montano et al., 2010). Various studies on onion resistance against *T. tabaci* have been reported which has been found to be associated with onion bulb color (Verma, 1996). There are also reports that thrips has developed resistance to commonly used of insecticides (Martin et al., 2003).

Insect pests are mainly controlled by synthetic pesticides which have adverse side effects and resulted in resurgence of secondary pests, environmental pollution, elimination of beneficial fauna, pest resistance to specific insecticides and various human health problems. The overreliance on pesticides can be avoided by using alternative approaches. The use of resistant cultivars can be one of the feasible options to replace harmful pesticides. The resistant cultivars can be economically feasible, environmentally benign, and secure and can minimize yield losses.

Resistance to plants is frequently associated with physical, morphological, physiological, biochemical, molecular and genetic characteristics of the plants. As very little information is available on the effects of physico-morphic characteristics and environmental factors on thrips infestation, therefore, in the present study such effects were evaluated on the infestation of thrips on five onion cultivars.

MATERIALS AND METHODS

The study was carried out at the University Research Farm Koont of Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Pakistan. Randomized Complete Block Design was followed to evaluate five onion cultivars viz. Marvi, Golden Orb, F1 Mustang, White Pearl and Red Orb for different parameters. The nursery of these varieties was raised at the greenhouse of Plant Breeding and Genetics, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi. Seedlings were transplanted 60 days after emergence at University Research Farm Koont in the micro plots measuring 20 × 25 m. A distance of 10 cm and 15 cm was maintained for plants and rows respectively. Each variety was replicated three times. Irrigation was done at 7-10 days interval. Thrips populations was observed from five randomly selected plants of each replication of each variety on weekly basis. Heights and girths of five randomly selected plants from each replication of each treatment were measured with the help of measuring tape and Vernier caliper at an interval of 40, 70 and 100 days after transplanting of onion. The yield of each plot of each variety was recorded at the harvesting of onion. To study correlation between environmental factors and adult population of thrips on five onion cultivars, weather data were collected from Meteorological Research Station Rawalpindi. The adult population was correlated with different environmental factors. Data related to population of *T. tabaci* on different cultivars of onion and physico-morphic characters of various cultivars were subjected to Analysis of Variance and means were compared with Duncan's Multiple Range Test at 5% level of probability and for simple correlation.

RESULTS AND DISCUSSION

The thrips infestation on five onion cultivars is given in Table 1. Maximum number of adults and infestation was

recorded on Marvi followed by Golden Orb while the adults and infestation was the minimum on Red Orb. Significant variations were observed in plant heights and girths among five onion varieties after 40, 70 and 100 days (Table 2 and 3). Similarly, maximum yield was observed in case of Red Orb followed by F1 Mustang while the minimum yield was obtained with cultivar Marvi (Table 4).

Table 1: Number of adults of *Thrips tabaci* per leaf and % leaf infestation on five onion cultivars.

Cultivars	No. of adults per leaf	% leaf infestation
Marvi	3.4 a	43.04 a
Golden Orb	3.0 a	34.03 b
F1 Mustang	2.4 b	32.88 b
White pearl	2.3 b	32.27 b
Red Orb	1.6 c	22.58 c

LSD value = 0.79, Means sharing the similar letters are not significantly different by the DMR Test at P = 0.05.

Table 2: Mean plant height (cm) of onion cultivars after three time intervals.

Cultivars	Plant height after		
	40 days	70 days	100 days
Red Orb	19.94 a	25.26 a	33.76 a
F1 Mustang	17.46 b	23.31 b	26.49 b
Golden Orb	15.70 c	20.51 c	23.58 c
White pearl	15.02 c	20.05 c	22.10 d
Marvi	14.95 c	18.13 d	21.45 d

LSD = 0.79, Means sharing the similar letters are not significantly different by the DMR Test at P = 0.05.

Table 3: Mean plant girth (mm) of onion cultivars after three time intervals.

Cultivars	Plant girth (mm) after		
	40 days	70 days	100 days
Red Orb	9.84 a	23.61 a	29.50 a
F1 Mustang	9.78 ab	23.1 b	26.32 b
White pearl	9.52 abc	20.81 b	24.33 c
Golden Orb	9.21 bc	20.56 b	24.21 c
Marvi	9.02 c	20.02 b	23.40 c

LSD = 0.59, Means sharing the similar letters are not significantly different by the DMR Test at P = 0.05.

Table 4: Mean yield in gram per five plants of different onion cultivars.

Cultivars	Means
Red Orb	155.5 a
F1 Mustang	129.6 b
White pearl	123.4 c
Golden Orb	115.5 c
Marvi	100.3 d

LSD value = 5.85, Means sharing the similar letters are not significantly different by the DMR Test at P = 0.05.

The data related to correlation among weather factors and *T. tabaci* adults' population on various onion cultivars is given in table 5. The low temperature, high temperature and average temperature showed

significant and positive correlations among all the cultivars. However, the average relative humidity showed negative and non-significant correlation for all the varieties. The correlation between physico-morphic characteristics and adult population was found significant for plant girth after 40 days while the correlations were non-significant for all the other factors (Table 6).

Table 5: Correlation of adult population of onion thrips on different onion cultivars with different weather factors.

Cultivar	Minimum Temperature	Maximum Temperature	Average Temperature	Average R.H%	Average rainfall
F1Mustang	0.78**	0.73*	0.76**	-0.53 ns	-0.06 ns
Marvi	0.79**	0.83**	0.82**	-0.73 ns	-0.04 ns
White pearl	0.80**	0.82**	0.82**	-0.66*	0.03 ns
Red Orb	0.88***	0.91***	0.90***	-0.62 ns	0.07 ns
Golden Orb	0.82**	0.83**	0.83**	-0.54 ns	0.28 ns

*= Significant, ** and *** = Highly Significant, ns= Non significantly at 0.05

Table 6: Correlation of physico-morphic characteristics of different onion cultivars with adult population of onion thrips.

Physico-morphic character	Correlation with adult population
Height After 40 days	-0.816 ns
Height After 70 days	-0.625 ns
Height After 100 days	-0.77 ns
Girth of plant after 40 days	-0.96 **
Girth of plant after 70 days	-0.677 ns
Girth of plant after 100 days	-0.87 ns

Many researchers have reported number of adults and infestation of thrips on different onion cultivars. The present findings are to some extent similar to those observed by Aziz et al. (2012), Mastoi et al. (2013), Akhter et al. (2014), Afzal et al. (2015) and Afzal et al. (2015) on various crops. Earlier many researchers have studied variations in various physico-morphic characters of different cultivars of different vegetables (Farooq et al., 2002; Makhadmeh and Khalil, 2004; Shah and Khan, 2015; Singh et al., 2015).

CONCLUSION

It is concluded from the present studies that Red Orb was found comparatively resistant cultivar harboring the minimum thrips population. The highest yield was also recorded on Red Orb, as compared to other tested cultivars and recommended for cultivation to enhance economic returns of farmers.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTION

AH, HJ and KJ designed the study, AH conducted the experiments and collected data, MH analyzed the data, HJ supervised the work, AH and KJ wrote the manuscript and all the authors edited and approved the final manuscript.

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