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Evaluation of onion cultivars against onion thrips, *Thrips tabaci* (Lindeman) infestation on onion crop

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Abstract
The experiment to evaluate the onion cultivars against *Thrips tabaci* infestation was conducted at Agricultural Research Institute Tarnab Peshawar, Pakistan during 2011-12. Eight onion cultivars (Ambika, Swat-1, Trichmir, Barkel, Macarena, Red ball, Granada Red and Sunset were assessed to determine the most tolerant cultivar against *T. tabaci* infestation. *T. tabaci* populations were monitored on weekly basis on onion plants under natural field condition. *T. tabaci* infested all the cultivars more or less, however highest numbers of thrips plant^{-1} were recorded in Trichmer (10.99 thrips plant^{-1}) and lowest (5.98 thrips plant^{-1}) were recorded in Swat-1. Highest plant height (64.35 cm) was recorded in cultivar Trichmir and lowest (38.40 cm) was recorded in Macarena. Highest (13.07) number of leaves plant^{-1} was recorded in Trichmir and lowest (7.66 leaves plant^{-1}) was recorded in Granada red. Trichmir was (94.04%) the most succulent cultivar followed by Sunset (91.38%), Ambika (87.21%) and (86.49%) in cultivar Swat-1. The maximum yield (18.56 tons ha^{-1}) was obtained from cultivar Swat-1 and minimum was from Ambika (9.34 tons ha^{-1}). Number of leaves, plant height, high succulency and color favored high infestation.

Keywords: Cultivar, Peshawar, *Thrips tabaci*, yield

1. Introduction
Onion, *Allium cepa* L., belongs to the family Amaryllidaceae (Liliaceae) and is a major horticultural cash crop in Pakistan [7]. The onion consumed in the fresh form as well as used in a frozen and dehydrated bulbs by the low and high income community in Indo-Pakistan [2]. In Pakistan the yield of onion is low as compared to the other developing countries. There are many reasons for the low yield, among which insect pests are the important one. There are many insect pests of onion crop including thrips, maggots, head borer, cutworm and leaf minors which cause reduction in yield. Among these, onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) is a major pest of onion crop in Pakistan [11]. The feeding of *T. tabaci* causes direct damage to plant while indirectly harms the crop by transmitting viruses [16]. The nymphs do more damage than adults in a peculiar feeding behavior in flower and even in fruits [8]. *T. tabaci* feeds in a piercing-sucking manner, leaving silvery areas on leaves, flowers and fruits and consequently consume the cell substances via the feeding tube formed by the maxillary stylets [15, 3]. *T. tabaci* select new plant tissue for feeding and consequently the silvery patches or streaks are formed which can be easily seen during sun shine. In severe attack of *T. tabaci* the size of the onion bulb become reduced and in some cases up to 66% of the onion crop may be lost [13]. The objective of this study was to evaluate and select the most tolerant onion cultivar commercially grown in Khyber Pakhtunkhwa Province, Pakistan against *T. tabaci* infestation.

2. Material and methods
Evaluation of eight commercially grown onion cultivars (Ambika, Swat-1, Trichmir, Barkel, Macaria, Red ball, Granada red and Sunset) against onion thrips infestation was conducted at the Agricultural Research Institute Tarnab, Peshawar, Pakistan during 2011-12.

2.1 Cultivation of crop
Healthy seedlings 6″ in length approximately of the selected onion cultivars of onion were transplanted in different plots, each plot measuring 3 x 5 m^2. Plant to plant and row to row distance were kept at 15 cm and 30 cm respectively. Standard agronomic practices were carried out throughout the growing season of the crop for both the years.

2.2 Data collection

Data on thrips population were recorded weekly from fifteen randomly selected plants in each treatment form each replication till maturity of the crops. Plant morphological characters like color, height, number of leaves and succulency were recorded. For these, five randomly selected mature leaves were cut and carried back to the Laboratory. Color, height and the number of leaves were recorded for each treatment. For succulency plants were selected from one square meter area and took equal weight of each cultivar for recording the fresh and dry foliage weight [10]. After receiving the fresh weight, the vegetative part of each cultivar were marked and placed in an electric oven at 70±1 ºC for 48 hours to dry up. The percent plant succulency was determined with the following formula;

% Plant Succulency = 100 - (Dry Foliage weight / Fresh Foliage weight x 100)

When 70% of the foliage was dropped to the ground, the onions were dug out and the bulb yield was determined for each plot. Based on these yields, estimated yield /ha were calculated for each cultivar and were compared with other cultivars for thrips damage.

2.3 Statistical analysis of data

The experiments were laid out in Randomized Complete Block (RCB) design with three replications. Data were analyzed using the Microcomputer statistical program for experiments. ANOVA were constructed to test the significance difference between the variables. The least significant difference (LSD) tests were applied to differentiate the means.

3. Results and discussion

Thrips tabaci were observed regularly and the numbers of thrips plant^{-1} were recorded on each cultivar until the crops were harvested. Mean numbers of thrips were significantly more (10.99 thrips plant^{-1}) in Trichmer and lowest (5.98 thrips plant^{-1}) in Swat-1, Ambika recorded significantly more number of thrips from Macarena, Red ball, Granada red and Sunset (Table 1). Our results are comparable with the findings of Alimousavi, Diaz-Montano, Sepahvand and Yousefi [1, 4, 14 & 17] who found significant difference on number of thrips per plant between the various cultivars.

Table 1: Mean numbers of *T. tabaci* per plant on eight onion cultivars at ARI, Tarnab Peshawar, Pakistan during 2011-12.

Cultivars	Years		Means
	2011	2012	
Ambika	8.58 b	9.85 b	9.21 b
Swat-1	6.77 c	5.18 e	5.97 d
Trichmer	9.92 a	12.07 a	10.99 a
Barkel	7.77 bc	10.73 b	9.25 b
Macarena	7.87 bc	8.63 c	8.25 c
Red ball	8.39 b	7.68 cd	8.04 c
Granada Red	8.78 b	7.25 d	8.02 c
Sunset	7.90 bc	7.29 d	7.60 c
LSD	1.022	1.135	0.729

Means followed by similar letters within each column are not significantly different at 5% level of probability.

Results in the (Table 2) showed plant morphological characters observed in all the selected cultivars. Ambika, Swat-1, Barkel and Red ball were green in color while Trichmer, Macarena, Granada red and Sunset were dark green in color. Thrips prefer dark color and those cultivars having dark in color are more susceptible to thrips infestation as reported by Ellis, [5]. Sepahvand, [14] also observed a positive correlation in the number of thrips per plant with the foliage color. Trichmer cultivar was tallest having (64.35cm) followed by Swat-1 (53.57cm), while Macarena was the shortest (38.40 cm). However there were no significant different among the Barkel, Macarena, Red ball, Granada red and Sunset. Trichmer cultivar was taller amongst all the cultivars therefore, this cultivars was susceptible to have more infestation of *T. tabaci*, similar observation was made by Kibanyu, [9] that taller varieties have more chances of infestation than shorter one. Trichmer, Ambika, Barkel and Swat-1 have significantly more number of leaves than Macarena, Red ball, Granada red and Sunset, however highest number of leave (13.07) per plant were recorded in Trichmer and lowest (7.66) were recorded in Granada red. Highly leafy onion varieties have a tendency to bear a higher number of thrips as compared to less number of leaves Malik, [10]. Trichmer was the most succulent (94.04%) among the cultivars followed by Sunset (91.38%), Granada red (90.4%) and Macarena (90.13%). Swat-1 showed least succulent (86.49%) among the other cultivars. Natarajan, [12] revealed that plant succulency has a positive impact on densities of thrips as well as other sucking insect pests.

Table 2: Plant morphological characters identified in eight onion cultivars at ARI, Tarnab Peshawar, Pakistan during 2011-12.

Cultivars	Plant color	Plant Height (cm)	Number of leaves/plant	Succulency (%)
Ambika	Green	41.80 c	12.90 a	87.21 c
Swat-1	Green	53.57 b	11.48 a	86.49 c
Trichmir	Dark Green	64.35 a	13.07 a	94.04 a
Barkel	Green	42.28 c	11.91 a	87.21 c
Macarena	Dark Green	38.40 c	8.66 b	90.13 b
Red ball	Green	39.62 c	8.53 b	89.01 bc
Granada Red	Dark Green	41.98 c	7.66 b	90.94 b
Sunset	Dark Green	38.50 c	8.07 b	91.38 ab
LSD		4.31	1.558	2.77

Means followed by similar letters within each column are not significantly different at 5% level of probability.

Highest yield (18.56 tons ha^{-1}) was recorded in the cultivar Swat-1 and lowest (9.34 tons ha^{-1}) in Ambika (Table 3). Cultivar Swat-1 proved to be the most tolerant against onion thrips infestation and gave high yield in comparison to other cultivars. Similar finding was recorded by Sepahvand, [14] they found significant difference between the cultivars in relation to yield, duration of maturity and number of thrips plant^{-1}. Fournier, [6] also observed reduction on yield on the plant which were high numbers of thrips infestation. On the basis of these findings it is concluded that cultivar Swat-1 proved to be the most tolerant against thrips infestation and gave high yield in comparison to other cultivars.

Table 3: Yield tons ha^{-1} in each cultivar at ARI, Tarnab Peshawar, Pakistan during 2011-12.

Cultivars	Years		Means
	2011	2012	
Ambika	8.92 c	9.77 c	9.34 e
Swat-1	17.76 a	19.35 a	18.56 a
Trichmer	13.05 b	10.61 c	11.83 d
Barkel	12.37b	15.43 b	13.90 cd
Macarena	14.75 b	16.81 ab	15.78 bc
Red ball	13.77 b	15.93 b	14.85 bc
Granada Red	14.58 b	16.78ab	15.68 bc
Sunset	14.72 b	17.73ab	16.23 b
LSD	2.97	3.32	2.13

Means followed by similar letters within each column are not significantly different at 5% level of probability.

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