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Host plant preference of sucking pest complex to different tomato genotypes

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Abstract
Background: Different strategies have to be involved for keeping the pests in check and stabilizing the productivity of cropping system. Screening of varieties is one of the key strategies for selecting the least susceptible variety against pest attack to get higher crop yields despite pest incidence.
Materials and Methods: The present study was conducted to observe the population dynamics of sucking pests on various tomato genotypes at Quetta, Balochistan during 2015. Six tomato genotypes i.e., Rutgar, Eden Oblong, Rio Granade, Nagina, Pakit and Roma were used in the study. Among sucking pests, population of aphids, thrips, whiteflies, jassids and mites were recorded since the early growth of various tomato genotypes.
Results: Nagina genotype was more susceptible to attack of all sucking pests recorded, whereas Rutgar and Eden Oblong genotypes were the least susceptible against various sucking pests.
Conclusion: It is therefore suggested that Rutgar and Eden Oblong genotypes should be grown to obtain higher fruit yield of tomato with lower densities of sucking complex pests.

Keywords: Tomato, genotype, susceptible, sucking complex, population fluctuation

1. Introduction
Tomato (*Lycopersicon esculentum* Mill.) is one of the important vegetable crops that have a high appealing for farmers because of its greater yield and comparatively short growing period [1, 2]. One of the reasons of its high importance among vegetables is due to its greater nutritional value and reasonably affordable market price. Tomato is the rich source of vitamin A and C, beside it also contains lycopene which is an antioxidant that gives protection from cancer [3]. In Pakistan, tomato is the second leading growing vegetables [4] and during 2011, 0.53 million tons was produced from 0.05 million hectares with per hectare production of 10 tons [5]. In comparison to advanced countries, the obtained yield per hectare production is still quite low and could be increased to its potential yield if appropriate production measures may adopt.
There are numerous factors of low yield and one of the most important is sucking pest complex [6, 7] including foliage and fruit feeding species [8]. They damage the crop by sucking plant cell sap with the help of their needle like mouth parts commonly called stylets. The infestation of sucking pests, results in changing leaf morphology that further lead to falling of leaves and earlier fruit dropping which ultimately affect the yield and quality of tomato fruit and fetch low market price [9]. The most common sucking pests of tomato are aphid, jassid, whitefly, mites and thrips [10] throughout the world. For controlling these pests, the farmers mainly rely on chemical control which leads to problems like resistance of pests towards pesticides, resurgence and environmental hazards [11].
Alternatively, insect pests can effectively be controlled using integrated pest management (IPM) strategy and the planting of pest resistant varieties is one of the key parts of IPM to control pests. The use of pest resistant varieties and the pest preference to host plants [12] are important to know under field conditions to make further depth study because the use of chemicals with planting of pest resistant varieties can effectively reduce the cost of insecticides and would be environment friendly. Therefore, this study presents a preliminary research regarding different genotypes of tomatoes to evaluate their effect on incidence of sucking pest complex in environmental condition of district Quetta, Balochistan.

2. Materials and Methods

A field study was conducted at Directorate of Agriculture Research (Vegetable Seed Farm), Agriculture Research Institute Sariab Quetta Balochistan during 2015. Six tomato genotypes i.e. Rutgar, Eden Oblong, Riogrande, Nagina, Pakit and Roma were selected for the study and all genotypes were grown in plot size of 10.0 m x 8.0 m. The raising of nurseries and preparation of land for transplanting were ensured according to the standard procedures. The incidence of insect pests as a function of genotypes was studied in the form of population dynamics of thrips (*Scirtothrips dorsalis* Hood), whiteflies (*Bemisia tabaci* Genn.), aphids (*Aphis gossypii* Glover), jassids (*Amrasca biguttula biguttula* Dist.) and mites (*Eriophyes sheldoni* Iatus Banks). The pest population were recorded at weekly intervals during the morning hours of 6:30 am to 8:30 am. The samples were taken from five randomly selected plants from each replication of every treatment. The pest population were observed from 1st week of April to 4th week of August 2015. The experiment was conducted in a Randomized Complete Block Design (RCBD) and each genotype was considered as a separate treatment that replicated three times. The collected data were statistically analysed by using software program Statistix 8.1.

3. Results

3. Population fluctuation of sucking pests

The population of sucking pest including aphid, thrips, whitefly, jassids and mites were recorded during the study and presented below.

3.2 Aphid, *Aphis gossypii* Glover

The Figure 1 showed the weekly mean population trend of aphids on various tomato genotypes. The aphid population appeared on RIO Grande, Nagina and Pakit genotypes during the 1st week of April, however aphids population started to appear with infestation on Eden Belong, Roma VFN and Rutgar Sala genotypes during the 3rd and 4th week of April, respectively. Later, the aphid population showed a gradual increase on all the genotypes and reached at peak on each variety during the month of June 2015. Subsequently, the population showed a declining trend in all genotypes towards the maturity of the crop. Accordingly, the highest population of 2.40 aphids / leaf were recorded on Nagina genotype during the 2nd week of June. Moreover, the least population of 0.01 aphids / leaf was recorded during the 4th week of August on RIO Grande, Nagina and Pakit genotypes.

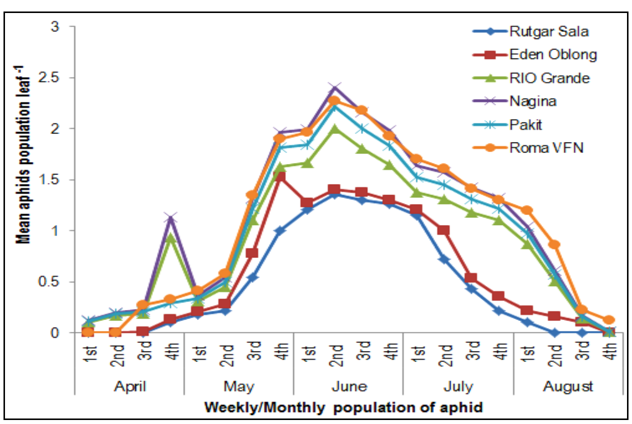

Fig 1: Seasonal population trend of aphid

The results regarding the incidence of aphid population were overall observed significantly different ($p<0.05$) among the various tomato genotypes. The highest mean population of aphids (1.11±0.15 aphids / leaf) was recorded on Nagina followed by Roma VFN (1.08±0.15 aphids / leaf) and Pakit (0.99±0.14 aphids / leaf) genotypes (Figure 2). However, the overall least aphid population (0.49±0.11 aphids / leaf) was observed on Rutgar Sala genotype.

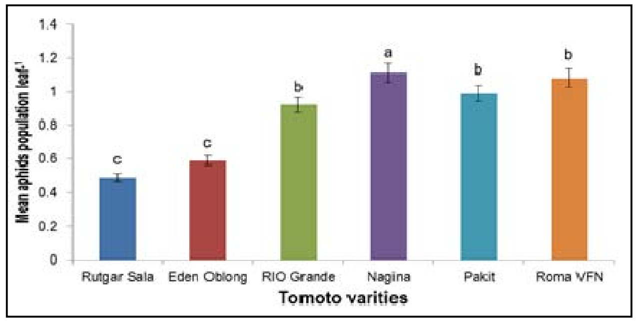

Fig 2: Overall mean aphid population per leaf on different tomato genotypes.

3.3 Thrips, *Scirtothrips dorsalis* Hood

The population of thrips started to appear on various tomato genotypes after the 2nd week of April 2015 and then continued until the maturity of plant. A gradual rise in population of thrips was recorded during the month of May 2015 that further increased abruptly during the month of June 2015 and then remained stable in July 2015. However, the population declined sharply in August until the end of study period. Accordingly, the highest thrips population (3.14 thrips / leaf) was recorded on Nagina genotype during the 2nd week of June 2015 followed by 2.87 thrips / leaf on RIO Grande genotype in the 3rd week of June, 2015. Moreover, the least thrips population (0.01 thrips / leaf) was recorded on Rutgar Sala genotype during the 4th week and the 3rd week of April and August 2015, respectively (Figure 3).

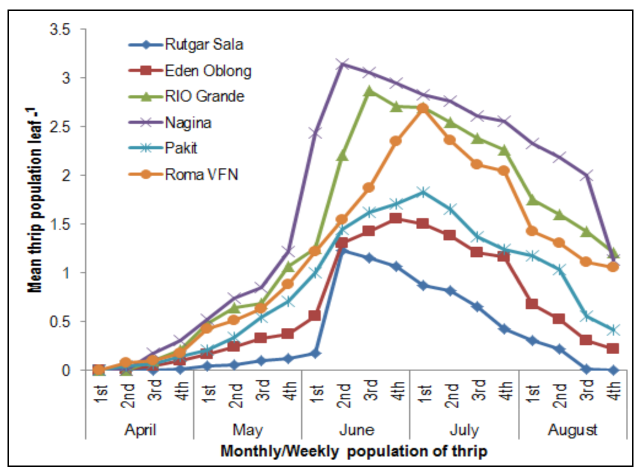

Fig 3: Seasonal population trend of thrips

The overall mean population of thrips (Figure 4) on selected tomato genotypes showed a significant difference ($p<0.05$). The lowest mean population was recorded on Rutgar Sala (0.36±0.10 thrips / leaf) and highest (1.69±0.22 thrips / leaf) on Nagina genotypes.

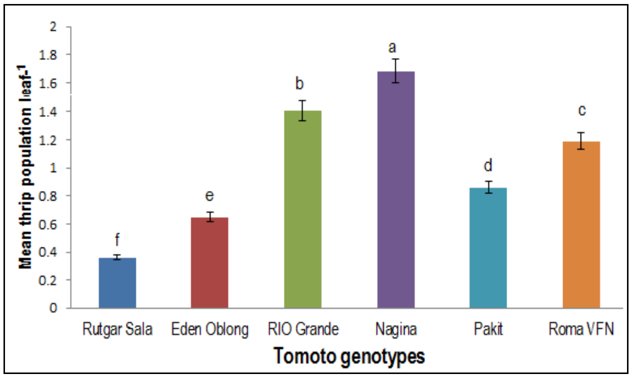

Fig 4: Overall mean thrip population per leaf on different tomato genotypes.

3.4 Whitefly, *Bemisia tabaci* Genn.

Figure 5 illustrated the results regarding population fluctuation of whitefly on various tomato genotypes. According to the results, except Rutgar Sala, whitefly population appeared during the 1st week of April 2015 rapidly raised during the month of May 2015 and then gradually declined in the following months of June, July and August 2015, respectively. Accordingly, the highest whitefly population of 2.4 whiteflies /leaf was recorded on Nagina genotype during the last week of May, 2015 and similarly population remained higher with slight declination of 2.15 whiteflies/ leaf in the 1st week of June 2015. The least whiteflies population of 0.01 per leaf was recorded on

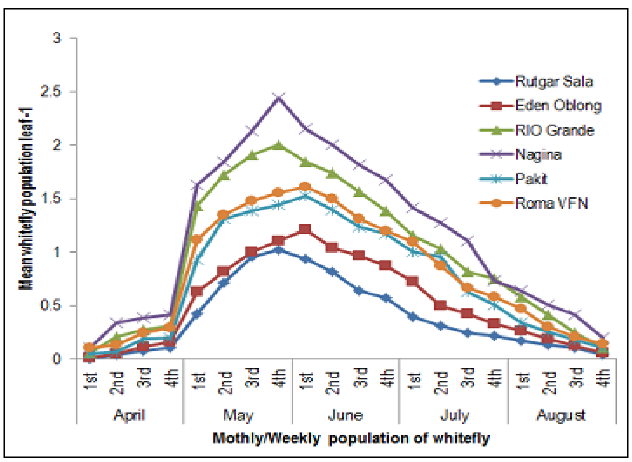

Fig 5: Seasonal population trend of whiteflies

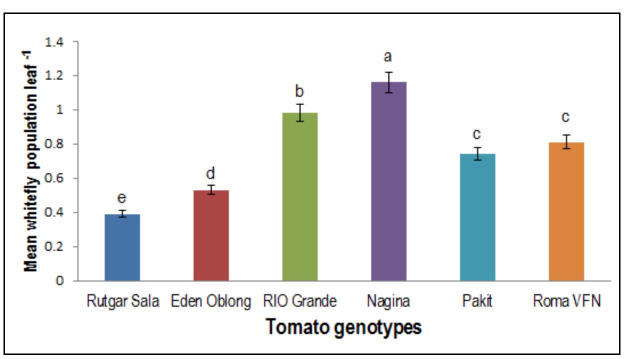

Fig 6: Overall mean whiteflies population per leaf on different tomato genotypes

Eden Oblong genotype during the 1st population of 0.01 per leaf was recorded on Eden Oblong genotype during the 1st week of April 2015. Overall, a significant difference was recorded in the population of whitefly on various tomato genotypes where Nagina genotype suffered the highest population of whiteflies (1.16±0.15 whiteflies / leaf), followed by RIO Grande (0.98±0.13 whiteflies / leaf) and Roma VFN (0.81±0.11 whiteflies / leaf). The lowest population of whiteflies (0.39±0.07 whiteflies / leaf) was recorded on Rutgar Sala tomato genotype.

3.5 Jassids *Amrasca biguttula biguttula* Dist.

The population of jassids on various tomato genotypes started to appear at the end of April 2015 and showed a great fluctuation throughout the study period (Figure 7). However, it declined gradually at the last week of August. The highest mean populations of 3.61 jassids /leaf was recorded on Nagina genotypes during the last week of May; however such population remained higher with slight declination of 3.45 jassids/leaf on similar genotypes in the first week of June, 2015. RIO Grande tomato genotypes also suffered from heavy populations of jassids (3.25 and 3.11 jassids / leaf) during the 4th week of May to 1st week of June 2015, respectively. The lowest mean population of jassids was recorded 0.01 jassids / leaf on Rutgar Sala genotype during the 4th week of August 2015.

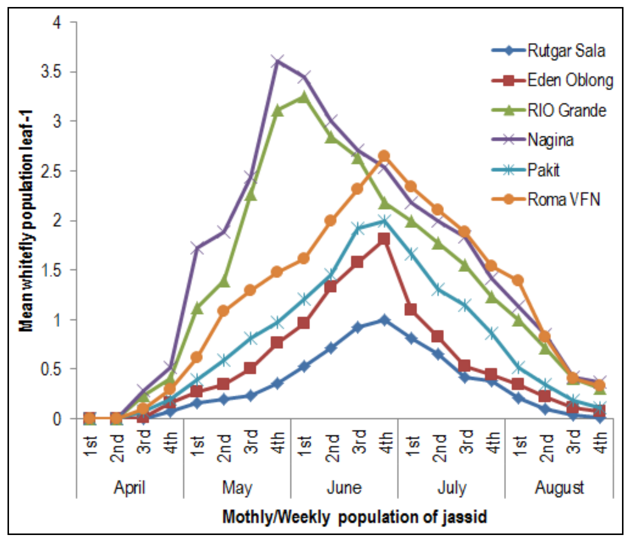

Fig 7: Seasonal population trend of Jassid

Overall, jassids population showed a significant difference ($p<0.05$) among various tomato genotypes where the highest population as illustrated in Figure 8 was recorded on Nagina genotype (1.62±0.22 jassids / leaf). The Rutgar Sala genotypes showed the lowest population of jassids (0.34±0.06 jassids / leaf), followed by Eden Oblong (0.57±0.11 jassids / leaf) and Pakit (0.79±0.13 jassids / leaf).

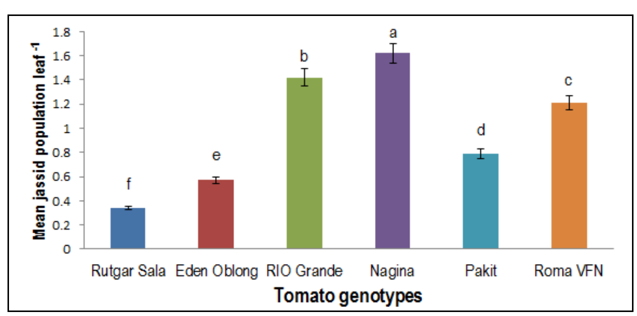

Fig 8: Overall mean jassid population per leaf on different tomato genotypes

3.6 Mites *Eriophyes sheldoni* latus Banks

The population of mites on various tomato genotypes was recorded from the 3rd week of April 2015. The population of mites showed a rapid increase in the first week of May then continued until June 2015. Later, mite population declined gradually at the end of August 2015. The highest and lowest population of mites were recorded on Nagina (3.27 mites / leaf) and Rutgar Sala (0.01 mites / leaf) genotypes during the 3rd week and 1st week May and August, respectively (Figure 9).

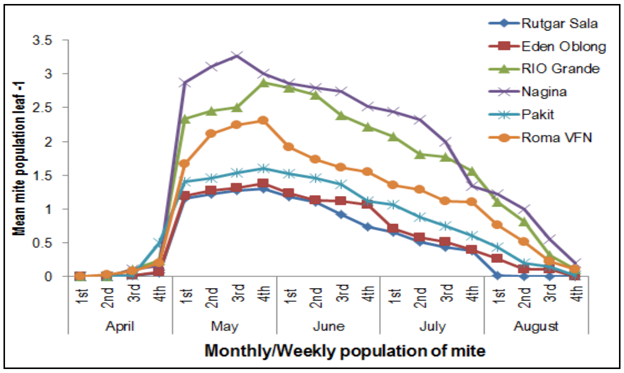

Fig 9: Seasonal population trend of mites

Overall mean population of mites exhibited a significant relationship among various tomato genotypes (Figure 10). The results confirmed that Nagina genotype suffered the highest mites population (1.73±0.24 mites / leaf), whereas, the lowest population was recorded on Rutgar Sala (0.55±0.10 mites / leaf) and Eden Oblong tomato (0.62±0.11 mites / leaf) genotypes.

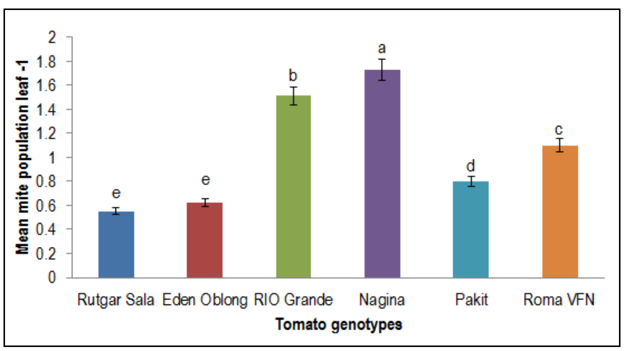

Fig 10: Overall mean mite population per leaf on different tomato genotypes

4. Discussion

It has been observed that different strategies should be involved to keep the pest populations in check and to stabilize the productivity of cropping system. Among such strategies, selection of adequate genotypes is one of the important components to be looked into to minimize the incidence of insect pests on tomato crop to obtain maximum yield. This study also highlighted the role of various tomato genotypes towards various sucking pests and the results confirmed a variable and significant effect of tomato genotypes on the incidence of sucking pests. Among the six tomato genotypes used in the study (Rutgar, Eden Oblong, Riogrande, Nagina, Pakit and Roma), Nagina genotypes suffered with the highest population of observed sucking pests (Aphids, thrips, whiteflies, jassids and mites). However, Rutgar Sala and Eden Oblong tomato genotypes suffered with the least damage that showed their resistant characters toward these insect pests. The difference in variable incidence of sucking pests on different genotypes might be due to leaf morphological traits such as low leaf hair density and short leaf hair and minimum thickness of leaf lamina (Shakoor *et al.*, 2010 [7]). Such characteristics make them vulnerable to insect pest attack infestation. Shakoor *et al.* [7] (2010) also confirmed that the morphological characters are very important in affecting the pest population such as thickness of the leaf. According to Rebe *et al.* [13] (2004) plant characters are known to contribute towards host plant resistance and similar arguments were also documented by Khanam *et al.* [14] (2003) and Mishra *et al.* [15] (1988). Some other studies have also shown the variation among the varieties for their susceptibility or response towards the pest infestation (Sarfraz *et al.*, 2007; Ashfaq *et al.*, 2010 [16, 17]). Kruger [18] (2001) demonstrated that the population of *B. tabaci* on resistant plant varieties was relatively low than that on preferred host plants. Moreover, variable resistance levels of different tomato genotypes against whitefly have been reported by Roff *et al.* [19] (2005), Akhtar *et al.* [20] (2001) and Setiawati *et al.* [21] (2009). The results regarding the difference in population of mites on various tomato genotypes are in agreement with Saber and Momen [22] (2005) who reported that leaf toughness and thickness are very important factors which affect the reproduction and development of mite population.

5. Conclusion

The conclusion of this study exhibited that the population of all sucking complex were observed to start in the month of April 2015. In selected six tomato genotypes, all sucking pests maximum attacked on Nagina and least on Rutgar Sala genotypes. The aphid and thrips population reached at peak on each variety during the month of June however whiteflies, jassid and mites population peaked at the last week of May and first week of June. The overall population of all observed insect pests were observed to decline in the month of August; however thrips population were observed more or less stable until the month of August. In addition, the host plant preference of these sucking pests displayed that Nagina genotype was more susceptible variety followed by Eden Oblong; nevertheless Rutgar Sala genotypes was evidenced much resistance genotypes. It could be due to varietal resistance of these genotypes and some other physical characteristics of host plant. Therefore, further detail studies are still required to ensure the host plant preference of these sucking insect pests and similarly the characters of the genotypes that make these plants resistant or susceptible.

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