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Research Article

Screening of Different Varieties of Brinjal against Insect Pests and their Natural Enemies

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ABSTRACT

The experiment on screening the brinjal varieties against pests and their natural enemies was carried out at the Latif Farm of SAU, Tandojam. Nine varieties viz. Long-12, Zar-1, Sarwan, Hybrid eggplant, long botanist, round Pakistan, Dil nashhen, Purple king and Tarnab of brinjal varieties were grown on one acre of land. The results revealed that whitefly, jassid, mites, maxican bean beetle and fruit borer appeared on all the varieties of brinjal. The predators like spiders and *Brumus sutralis* were recorded on all varieties. The results further showed that less whitefly mean population of (7.70± 0.80) per plant was found on Long-12 comparatively resistant, whereas Zar-1 received maximum whitefly population (10.19 ± 0.92) and was found susceptible among all varieties. The comparatively minimum mean population was observed in Long-12 (5.58± 0.77) per plant. Comparatively proved resistant, whereas Dil nasheen received the maximum population of jassid (8.32 ± 0.83) and was found susceptible among all varieties. Minimum Mites mean population was recorded in Tarnab (2.34±0.32) per plant comparatively resistant whereas the maximum mean number was recorded on Sarwan (3.77±0.39) per plant and was found susceptible among all varieties. The minimum mean population of Maxican Bean beetle was recorded in Logn botnist (0.37 ± 0.06) per plant, and the maximum population was found on Zar-1(1.21 ± 0.21) per plant as such Zar-1 was found susceptible among all varieties. The less population of fruit borers was recorded in long -12 (19.39 ± 1.56 5) per plant, and the maximum mean population was recorded on Dil nasheen variety (32.07 ± 2.02%), and Dil nasheen was comparatively susceptible against borer among all varieties. The *Pardosa* sp. and *Agriolis* sp. Spider (natural enemies) was found on Round Pakistani (1.36 ± 0.31) per plant. And maximum population on Zar-1 with mean of with mean of (1.80 ± 0.28) per plant and the minimum population *Brumus sutralis* was recorded on Hybrid eggplant (0.36± 0.24) per plant and the Maximum overall mean number of (0.63 ± 0.23) per plant was recorded on Zar-1 variety.

Keywords: Brinjal, Varietal resistant, Insect pests, Natural enemies.

INTRODUCTION

Brinjal (eggplant) is one of the most important vegetable crops. It is widely consumed by all sections of the population and is relatively inexpensive, and is available throughout the year. Though brinjal is a summer crop, it grows throughout the year under in-gated conditions. Hence, it is subjected to attack by number of insect pests right from the nursery stage till harvesting (Iqbal et al., 2011). Many insect pests are attacking on the brinjal crop for example whitefly, *Bemisia tabaci* (Genn.), leaf lopper, *A. biguttula biguttula* (Ishida) and non-insect pest, red spider mite, *Tetranychus macfurlanei* (Baker and Pritchard), among them the shoot and fruit borer *Leucinodes orbonalis* (Guen.) is the serious and most noxious insect pest



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of the brinjal crop. This insect pest is found in all brinjal cultivation zones of the world (Eswara and Srinivasa, 2001). The brinjal fruit and shoot borer is mostly found attacking on the shoot, leaves and fruits of the brinjal during its development; usually 60-90 % of damage occur due to this insect pest (Eswara Reddy and Srinivas, 2004). Lit et al. (2002) screened one hundred and seventeen eggplant genotypes for resistance against cotton jassid and reported that 28 entries were resistant, 69 were moderately resistant, 15 were intermediate, and one (Acc 544 White) was the most susceptible to leafhopper. Although host plant resistance alone or in combination with other methods is environmentally safe and compatible with IPM, however this strategy is practical only when resistant varieties of crops are available and identified. Even a moderate level of resistance in a crop can have a positive impact and can reduce the number of pesticide applications. Morphological characters of plant, leaf and fruits of 28 brinjal varieties/lines (entries) were evaluated for their antixenosis against the brinjal shoot and fruit borer (Ali et al., 1994). They observed that entries with hairy leaves and prickles on the stem, leaves, and fruit stalks had a lower percentage of fruit infestation than those without hairs and prickles. Entries with small-sized fruits, ovals, slightly long, intermediate long and long shaped fruits with purple and greenish white to green coloured fruits showed lower percent of fruit infestation than those with larger-sized, round-shaped shaped and purple black and black coloured fruits. Brinjal crop is attacked by a lepidopteran insect called brinjal shoot and fruit borer (BSFB), which causes extensive damage to the growing shoot tips and fruits. due to the attack of this insect pest, the quantity and quality of the brinjal are adversely reduced. Its mode of damage is that it first burrows in the fruit and then starts to eat inside the fruit, so after entering the fruit, it's very difficult to manage (control). Resistant and tolerant plant varieties are a basic component of integrated pest management (IPM). Host plant resistance may contribute to IPM in two ways: It reduces the rate of insecticide use and improves the efficiency of natural enemies (Peterson et al., 2016). Even a low level of tolerance in plants may have a dramatic effect, which in fact reduces the need of insecticides (Srivastava, 1993). Along with host plant resistance natural enemies can play an important role in insect pest management. Among predators, *Coccinella septempunctata* L. is an important biocontrol agent of *Lipaphis erysimi* in crops (Sinha et al., 1982). Many quantitative evaluations have indicated that coccinellids can substantially reduce aphid density (Michels et al., 2001; Snyder et al., 2004, 2008; Thies et al., 2011). Prey density is an important aspect of a coccinellid response (Nilsson and Brönmark, 2000). It has been reported that the lady beetle response depends on initial aphid densities (Fan and Petitt, 1994) and the distribution of the prey (Dixon and Agarwala, 1999). Not much work has been reported on simultaneous population fluctuations of aphids and lady beetles on brinjal in Pakistan. Thus, the present study was carried out to investigate the varietal resistance of different brinjal cultivars in response to populations of insect pests and natural enemies.

MATERIALS AND METHODS

The present research work on screening the different varieties of brinjal against pests and their natural enemies was carried out at Latif Farm of Sindh Agriculture University Tandojam on during 2013. Nine varieties viz Long-12, Zar-1. Sarwan, Hybrid Eggplant, Long Botanist. Round Pakistani, Dilnasheen, Purple King, and Tarnab of brinjal varieties were grown; each variety was grown separately in a plot size of 60x60 sq ft. with randomized complete block design. The growing varieties of the brinjal was sown in 05 August 2013. The weekly observations were recorded from September to December. The population of pests jassid, whitefly, mite, maxican beetle, and fruit/shoot borer, along with their natural enemies such as spiders and coccinellid beetles, were recorded till harvest. Ten plants and 5 leaves/plants were observed randomly at weekly intervals. Predators (spiders and coccinellids) per plant were recorded. The ANOVA of data was done, and correlations with temperature and humidity were determined through the statistical program Statistix-8.1.

RESULTS

The data in figure 1 indicate that all the varieties were infested by the jassid, and the jassid population increased gradually from September to 1st week of October on all varieties. There the jassid population reached its peak (10.46-11.62) per plant during the 3rd week of October to the first week of November. Again, the population declined (7.79-9.11) up to harvest on all varieties. With regards the varieties attacks maximum over all mean was recorded on Tarnab variety (8.32 ± 0.83) per plant followed by Dil nasheen (8.10±0.85), Purpal King (7.87±0.87), Sarwan (7.80±0.82) Zar-1(7.31±0.81), Hybrid eggplant (7.19±0.86), Long botanist(6.80± 0.73), Round Pakistani (6.63±0.86) and Long-12 (5.58± 0.77) per plant. ANOVA of jassid data showed that treatments mean all varied significantly from each other at 0.05 levels.

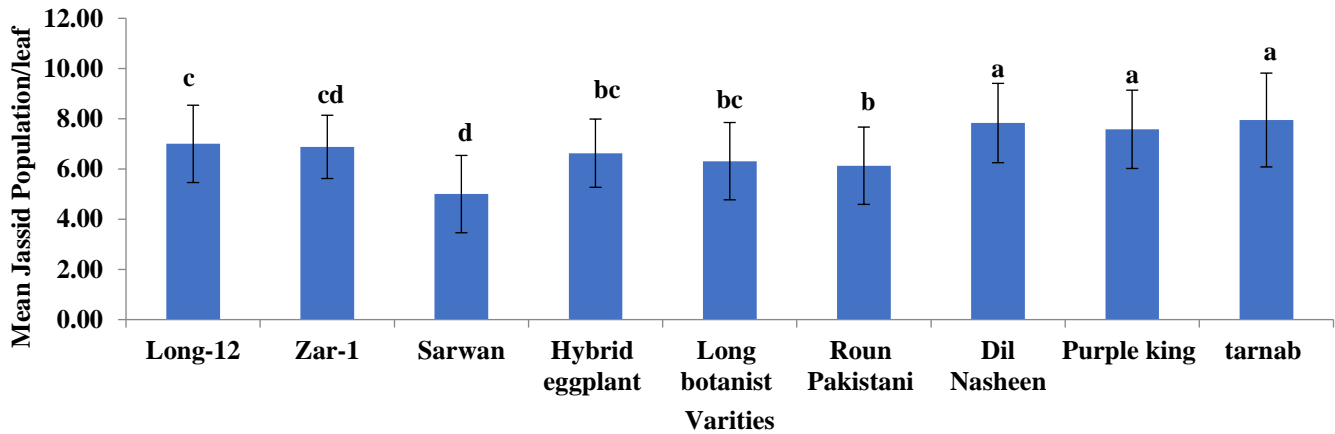


Figure 1. Weekly mean Population of Jassid on different brinjal varieties.

Whitefly (*Bemisia tabaci*)

The data in the figure indicate that all the varieties were infested by the pest whitefly. maximum mean numbers of whitefly were recorded during first two week of September with range of 12.84 to 16.63 per plant on all varieties. Thereafter after the whitefly population declined on all varieties. With regards the varieties maximum over all mean population was recorded on Zar-1 (10.19 ± 0.92) per plant followed by Hybrid eggplant (9.88 ± 0.90), Long botanist (9.86 ± 0.91), Dilnasheen (9.05 ± 0.86), Sarwan (8.83 ± 0.85), Round Pakistani (8.01 ± 0.81), Purpal King and Tarnab (7.70 ± 0.80) and Long-12 (7.24 ± 0.77). ANOVA results showed that treatments mean of all varieties were found non-significant at $P=0.05$ level, indicating that almost whitefly population behind similar on all varieties of brinjal.

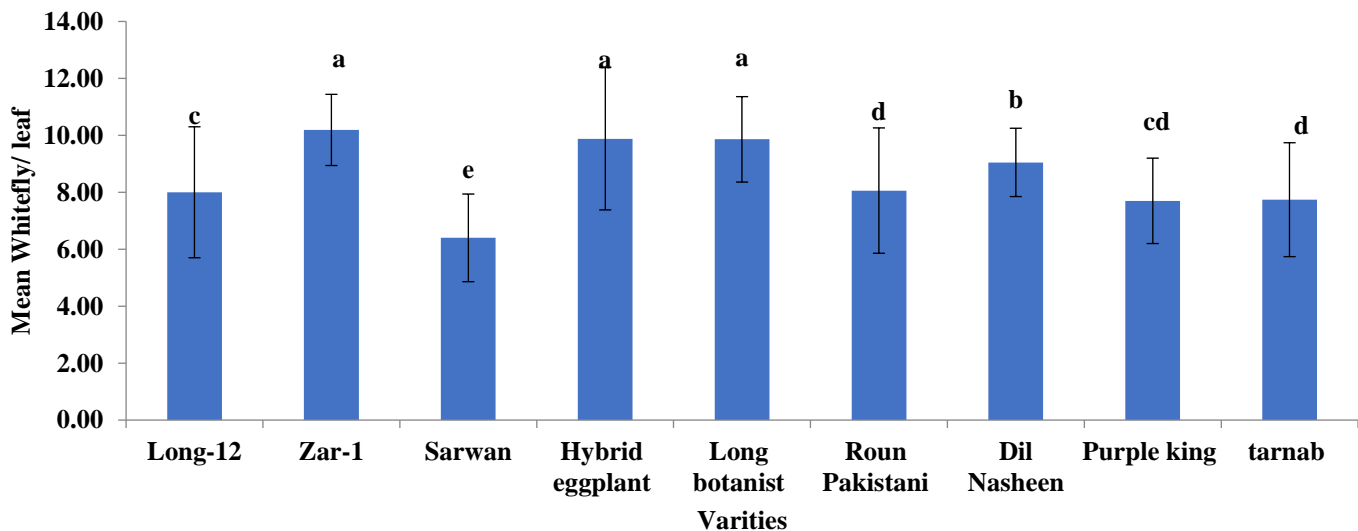


Figure 2. Weekly mean Population of white fly on different brinjal varieties.

Mites (*Tetranychus spp*)

The data in figure 3 reveals that all brinjal varieties harbored units around the season. However, maximum mean numbers on all varieties were (3.83- 8.09) per plant during the month of September. There after the population declined and continued up to harvest with regards to mite population on different varieties the maximum mean number was recorded on Sarwan (3.77 ± 0.39) per plant followed by Round Pakistani (3.46 ± 0.58), Zar-1 (3.24 ± 0.50), Dilnasheen, (2.96 ± 0.52), Long-12 (2.95 ± 0.57), and (2.84 ± 0.35) Long Botnist, (2.83 ± 0.51), Hybrid eggplant (2.82 ± 0.45) and Tarnab (2.34 ± 0.32) per plant. The ANOVA results showed that the varietal mean varied significantly at ($P=0.05$) levels.

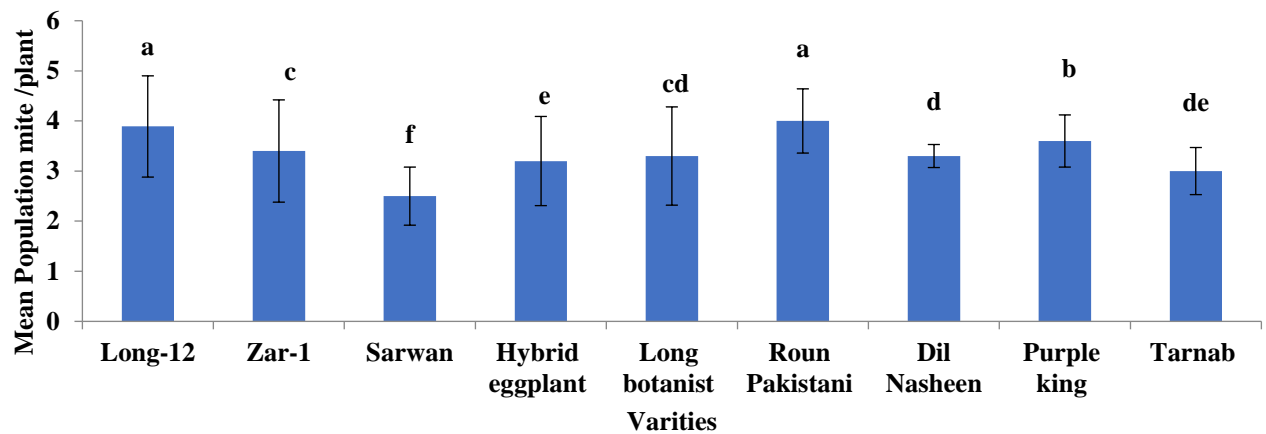


Figure 3. Weekly mean Population of mite on different brinjal varieties.

Maxican Bean Beetle

The data in figure 4 indicates that all the varieties harbored the attacks of the pests. The variety means remained higher with a range (0.75-1.78) per plant in the month of September. Then the population declined up to harvest on all the varieties with regard to varietal behavior of maxican bean beetles, maximum mean was recorded on Zar-1(1.21±0.21) per plant followed by long-12(0.81±0.21), Sarwan (0.72±0.21), Purple king(0.69± 0.71), Round Pakistani (0.61 ±0.20), Hybrid eggplant (0.60± 0.12) Tarnab (0.52±0.09), Dil Nasheen (0.46±0.12) and long botanist (0.37± 0.06).

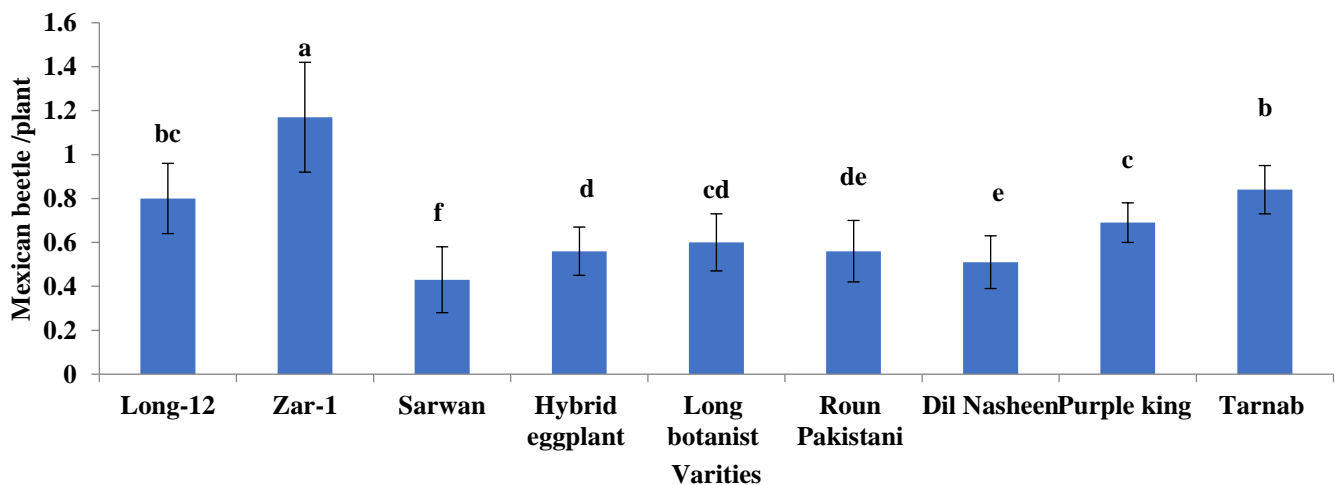


Figure 4. Weekly mean Population of Mexican beetle on different brinjal varieties.

Fruit Borer (*Leucinodes orbanalis* G.)

The data in figure 5 indicates that the borer infestation was recorded in all the varieties. However, the maximum infestation % was recorded in the month of November. The picking of fruits at the experimental from was continuous therefore the healthy and infested fruits varied during October and November with regards two varietal behavior two fruit borer infestation % maximum infestation was recorded in Dil Nasheen with mean of (32.07 ± 2.02%) followed by the Round Pakistani (29.80 ± 1.93 %) Purple King(29.78± 1.93%)Sarwan(29.73± 1.93) Long Botanist (29.44± 1.92%) Zar- 1 (28.73 ± 1.90) Hybrid Eggplant (26.17± 1.81%) Tarnab(23.36± 1.71 %) and long -12 (19.39 ± 1.56 5). The ANOVA of data shows that treatment varietal means varied significantly at (P=0.05) level. The correlation between the mean % infestation of fruit borers with temperatures was significant and negative with ($r^2 = 0.81$) value, and with R.H % was non-significant and negative with $r^2 = 0.0425$ value.

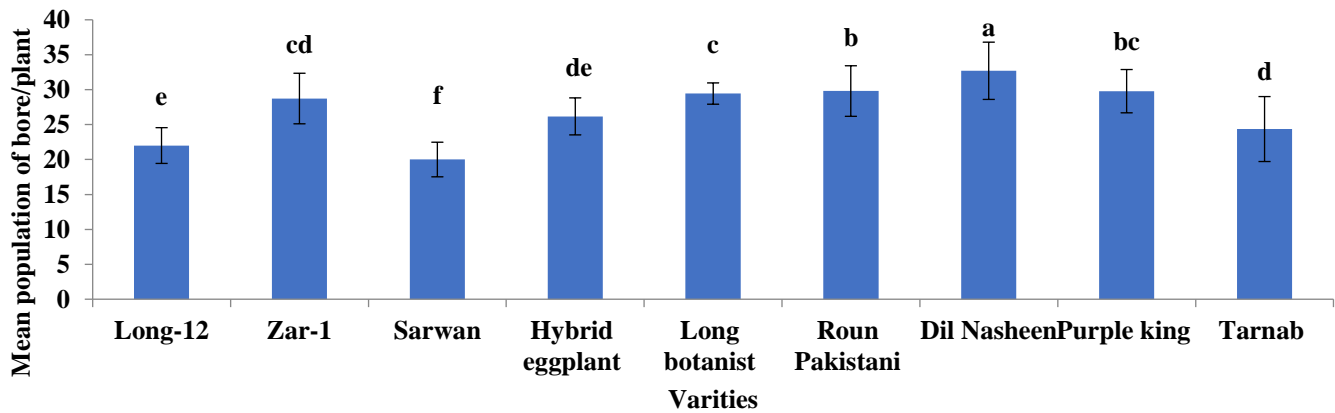


Figure 5. Weekly mean Population of borer on different brinjal varieties.

Natural Enemies

Lady bird beetle *Brumus suturalis* F

The data in figure 6 reveals the pests of all the varieties in the month of September. The mean numbers increased in October to November with a range of 0.37-0.85 per plant. The maximum overall mean number of (0.63 ± 0.23) per plant was recorded on Zar-! Followed by Dil nasheen (0.55 ± 0.26), Tarnab (0.50 ± 0.20), Long-12 (0.46 ± 0.23), Purple king (0.48 ± 0.26), long botanist (0.47 ± 0.23), Sarwan (0.45 ± 0.25), Round Pakistani (0.44 ± 0.21) and Hybrid egg plant (0.36 ± 0.24) per plant. The ANOVA of data showed that all varieties varied significantly at ($P = 0.05$) level.

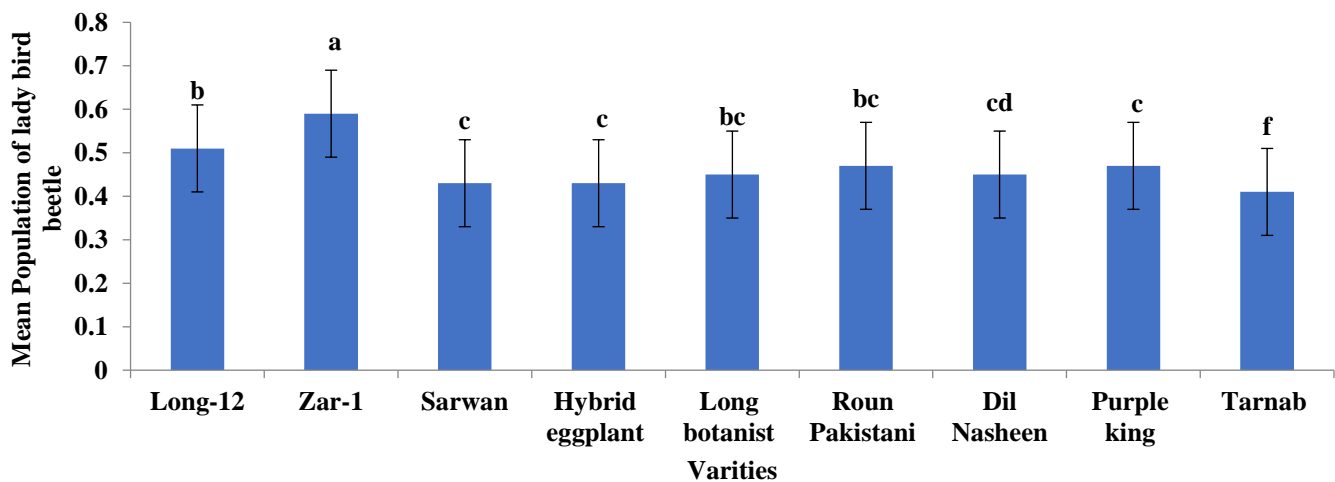


Figure 6. Weekly mean Population of lady bird beetle on different brinjal varieties.

Unidentified Spiders

The spider's (undefined) appeared one month after sowing when pests were present already on the crop, the data in table 8 indicate that ($0.52 - 1.03$) per plant on all varieties were recorded there after the numbers increased ($1.05 - 2.44$) per plant during month of October and declined during November with a range of ($1.54 - 1.78$) per plant on all varieties of brinjal. The ANOVA results showed that maximum numbers of spiders of was recorded on Zar-1 with mean of with mean of (1.80 ± 0.28) per plant followed by the long- 12 (1.66 ± 0.35) Dil Nasheen (1.60 ± 0.34) Sarwan (1.59 ± 0.38) Tarnab (1.55 ± 0.36) Purple King (1.52 ± 0.38) Long Botnist (1.47 ± 0.33) Hybrid eggplant (1.44 ± 0.35) and round Pakistani (1.36 ± 0.31) per plant.

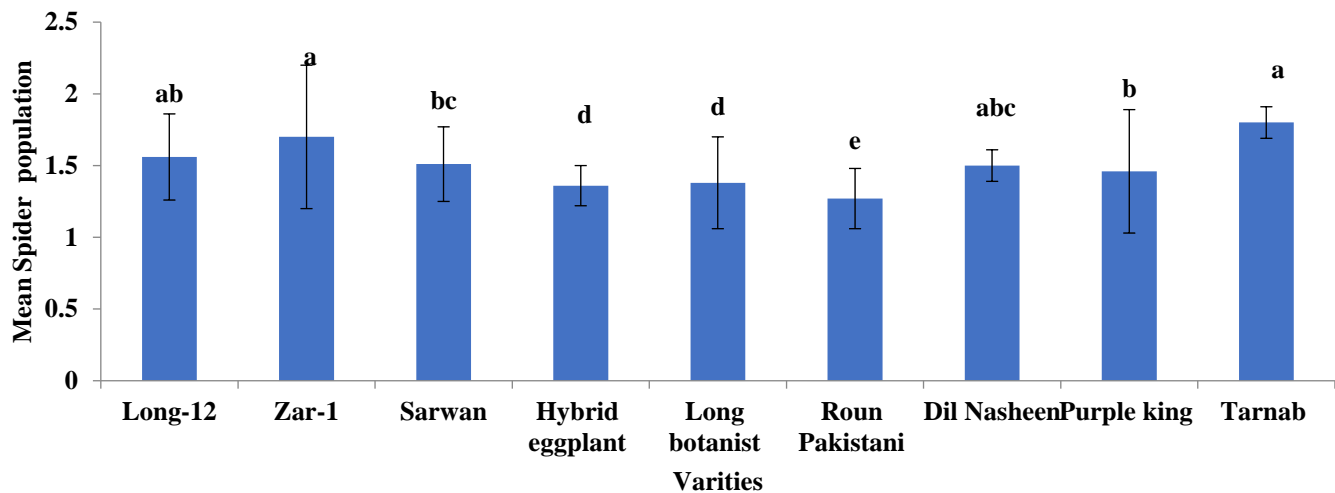


Figure 7. Weekly mean Population of spider on different brinjal varieties.

DISCUSSION

The results on the seasonal population of whitefly averages through ANOVA showed that the population of whitefly was non-significant. The results further showed that varieties Purple king and Tarnab (7.70 ± 0.80) per plant varieties were found comparatively resistance varieties followed by the Long-12 (7.24) round Pakistani (8.01 ± 0.81) whereas Zar-1 (10.19 ± 0.92) Hybrid eggplant, long botanist (9.86 ± 0.90), Dil Nasheen (9.05 ± 0.86) were found susceptible. The white fly population remained higher on all varieties with means 12.84 - 16.63 per plant during 1st second weeks of Sept 28.11-30.86 and lower varieties means of (5.49-8.66) at 22.63-24.43C indicating mature broad leaves short positive correlation the results of present study agree with those of Akram et al. (2013) who reported that maximum and minimum temperature short significant positive effect on white fly population. Whereas relative humidity exerted negative effective during 2010 with regards to thrips population on brinjal varieties on ANOVA result indicate non-significant and negative correlation with temperature.

The study further showed that variety Dil Nasheen receive minimum mean of (1.42 ± 0.26) followed by long-12 (1.51-0.29) and Sarwan (1.52 ± 0.16) were found comparatively resistance and varieties with a maximum population purple King (1.84 ± 0.29), Tarnab (1.76 ± 0.30) and Zar-1 (1.70 ± 0.29) receive maximum population and found comparatively susceptible however maximum mean population of (1.83-3.92) were recorded during first three weeks of sept. With higher temperatures of 28.11 - 30.86 C therefore it could be inferred that varieties Dil Nasheen, Long12, and Sarwan were comparatively resistance whereas purple king, Tarnab and Zar-1 were found comparatively susceptible the result of present study partially agree with those of Shivanna et al. (2011) who reported that simple correlation analysis revealed that maximum temperature showed significant positive effect on all the sucking pests. However, from present studies it could be concluded that Dil nasheen and long twelve proved comparatively resistance to thrips, the purple king and Tarnab found comparatively susceptible varieties against thrips. Jassid the ANOVA of relative infestation of jassid on brinjal varieties on revealed that the jassid means on all varieties were significant and negatively correlated with temperature and R.H % the results of present study agree with those of Shivanna (2011) who reported simple correlation analysis revealed that minimum temperature showed negative effect on leaf hoppers of cotton.

The brinjal varieties the results further revealed that variety long-12, Round Pakistani, and long botanist received minimum jassid population and proved comparatively resistance than all other brinjal varieties, which received maximum jassid population and comparatively susceptible. The study further showed that varieties Zar-1, Purple king and Hybrid eggplant received minimum mite population; therefore, it could be inferred that these varieties are comparatively resistant to the mites than all others tested agree with those of Khuhro et al. (2011) who reported that *Brumus suturalis* F. is a polyphagous predator on whitefly, Jassid, mites on cotton and brinjal crops. Results also agree with those of Subhash and Singh (2003), who reported the positive correlation between the population of white-backed planthoppers, *S.ferucifera* and leaf folder with *B. suturalis*, and it was the most prominent predator observed in the field.

CONCLUSIONS

It was concluded from the present study that the screening of the brinjal varieties against pests and their natural enemies, that whitefly thrips, jassid, mites, and fruit borer appeared on all the varieties of brinjal. The results further showed that less whitefly was found on Long-2, which is comparatively resistant, whereas Zar-1 received the maximum whitefly population and was found susceptible among all varieties. The comparatively minimum population was observed in Long-12 per plant. Comparatively proved resistant whereas Dil nasheen received maximum population of jassid and was found susceptible among all varieties. Minimum Mites population were recorded in Tarnab per plant comparatively resistant whereas. The maximum mean number was recorded on Sarwan per plant and was found susceptible among all varieties. The minimum population of the Mexican bean beetle was recorded in Logn botanist per plant, and the maximum population was found on Zar-1 per plant as such Zar-1 was found susceptible among all varieties. The lower population of fruit borers was recorded at -12 per plant, and the maximum mean population was recorded on the Dil nasheen variety. Dil nasheen was comparatively susceptible to borer among all varieties. Spider (natural enemies) was found on Round Pakistani and the maximum population on Zar-1 with mean of with mean of and minimum population *Brumus suturalis* was recorded on Hybrid eggplant. In view of the present studies, it is recommended that sarwan variety should be cultivated against sucking and chewing pests.

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AUTHOR CONTRIBUTIONS

All the authors contributed equally to this research.

COMPETING OF INTEREST

No conflicts of interest have been disclosed by the authors.

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