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Research Article

Comparative Efficacy of Pre-Tank Insecticides Combination against *Bemisia tabaci* Genn. on Two Cotton Varieties at Layyah

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ABSTRACT

Whitefly is a serious threat to the cotton production. To find out the most suitable control measure a field experiment was conducted at District Layyah, to compare the efficacy of different pre-tank mix insecticides., viz. Legand (spiromesifen + abamectin), Actify (Isoprocarb + etiprole), Bila (Pyriproxyfen + acetamaprid), Best Guard (buprofezin + nitenpyram), Jeera (Pyriproxyfen + acetamaprid), Rugra (nitenpyram + chlorfenapyr), Editor (acetamaprid + ibiocydam), and Concept Plus (acephate + phenoxaprop) on BT-886 and Non-BT (Shahkar) cotton varieties. Maximum population reduction of adult whitefly after first application of insecticides was found in Legand on BT and Non-BT cotton crop exhibited, 24.37 and 37.66 after 2 days, 53.08 and 55.31 after 4 days and 73.29 and 68.17 after 6 days respectively. Maximum population reduction of nymph whitefly was found in Legand on BT and Non-BT cotton crop exhibited 33.85 and 34.07 after 2 days, 55.10 and 54.49 after 4 days and 74.66 and 75.28 after 6 days respectively. Maximum population reduction of adult whitefly after second application of insecticides was found in Legand on BT and Non-BT cotton crop exhibited, 24.56 and 39.57 after 2 days, 30.29 and 55.97 after 4 days and 71.34 and 69.62 4after 6 days respectively. Maximum population reduction of nymph whitefly was found in Legand on BT and Non-BT cotton crop exhibited 34.07 and 40.52 after 2 days, 54.49, after 4 days and 75.28 and 74.92 after 6 days respectively.

Keywords: *Bemisia tabaci Genn., Insecticides, Nymph, Legand, Papulation.*

INTRODUCTION

Cotton (*Gossypium hirsutum* G.) belongs to Malvaceae family. It has been used as fiber in spinning and weaving for over 5,000 years. Cotton prefers long hot summer with low humidity and long hours of sunshine (Cheema & Nasreem, 1999).

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Cotton (*Gossypium hirsutum* L.) is considered one of the important fibres as well as cash crop of our homeland (Murtaza & Ibrahim, 2008). Cotton contributes 0.8% to GDP and 4.1% of total value addition in agriculture. Cotton has been sown on area of 2.527 million hectares with expected 9.178 million bales (Pakistan Economic Survey, 2019-20). Cotton is also an important source of edible oil and many other biproducts like textile and animal feeds (Ali et al., 2011; & Ahmad et al., 2009).

Cotton production is reducing in Pakistan significantly due various factors and insect pests are main the problem in this crop. It is estimated that about 20% to 40% of annual losses are due to various cotton pests (Abbas, 2010). Among important sucking insect pests, whitefly play main role in sucking the sap of plants reducing the quality and quantity of cotton (Khattak et al., 2001; & Makwana et al., 2018). It is also involved in transmission of cotton leaf curl virus which decrease the 20-40% cotton production (Ali & Aheer, 2007). Whitefly attacks on cotton crop in different growth phases i.e., from early stage to maturity (Alvi et al., 2021). Plant damage is caused greatly due to its sucking effect and boll yield is reduced to 50% (Gogi et al., 2021). Among various other methods, chemical control is the best way to controlling whitefly (Gogi et al., 2006). A number of research trials have been performed to evaluate the effectiveness of various insecticides which are used against whitefly of cotton (Saleem et al., 2001; Aslam et al., 2004; Khattak et al., 2006; & Shah et al., 2007).

Whiteflies and sucking insect pests were usually controlled by organophosphate (OP) and pyrethroids during 1970s and 1980s respectively. Due to indiscriminate use pesticides, whitefly developed resistance against these pesticides in Pakistan in early 1990s. After that, pesticide combinations of pyrethroids and organophosphate in pre-tank combine formation became very popular to overcome pest resistance in mid-1980s. In the mid-1990s, selective pesticides with novel mode of action and highly effective in affection white fly papulation, such as; pyriproxyfen, imidacloprid, buprofezin, diafenthiuron, acetamiprid and thiamethoxam, were introduced in Pakistan for management of whitefly (Ellsworth et al., 1997; & Ahmad et al., 2002).

Insecticide combination involves exposing arthropod pest population to each insecticide simultaneously (Hoy, 1998). Pesticide combinations are more effective against certain insect life stages including the eggs, larvae/caterpillars, nymphs and adults of insect pests than alone applications and their effectiveness depends upon ratio and formulation percentage of insecticides used (Blümel & Gross 2001; & Khajehali et al., 2009). Mainly two or more pesticides are combined together to target the specific pest population (Cloyd, 2009). The main objective of present research was therefore to determine the efficacy of pre-tank mixing of various insecticides on reduction of whitefly papulation.

MATERIALS AND METHODS

The trials were laid at district Layyah, Punjab, Pakistan in randomized complete block design (RCBD). There were nine treatments including a control (T_0) with three repeats. The insecticides pre-tank mixed in eight different treatment formations as shown in Table. 1. Varieties of cotton, BT-886, Non-BT (Shahkar) were sown in the field according to recommendation given by Agri. Extension Department. The spray of insecticides was done when *B. tabaci* (Genn.). population reached at ETL level i.e., 5 adult/leaf. Insecticides spraying insecticides were done in the morning. The insecticides were sprayed with knapsack hand sprayer. The data on nymph and adult whiteflies from each plot was noted 24 hours before, 2 days, 4 days and 6 days after insecticide application from 10 plants in each treatment which were randomly be selected. For taking data one leaf from upper portion one leaf from middle portion and one leaf from bottom of one plant was selected and *B. tabaci* population was recorded. Analysis of variance was used for analysis of variance of data and appropriate mean analysis was conducted by using the procedure of Steel et al. (1997).

Table 1: Pre-tank mixing formulation treatments of various insecticides

Sr. No.	Trade Name	Active Ingredient	Field Rate	Treatments
1	Actify	Isoprocarb + Ethiprole	200gm/acre	T1
2	Bila	Pyriproxyfen + Acetamaprid	250ml/acre	T2
3	Legand	Spiromesifen + Abamectin	100ml/acre	T3
4	Best guard	Buprofezin + Nitenpyram	200gm/acre	T4
5	Jeera	Pyriproxyfen + Acetamaprid	250ml/acre	T5
6	Editor	Acetamaprid + Ibiocydam	200gm/acre	T6
7	Rugra	Nitenpyram + Chlorfenapyr	200gm/acre	T7
8	Concept Plus	Acephate + phenoxaprop	100ml/acre	T8

RESULTS AND DISCUSSION

Adult whitefly (1st Application): The population of adult whitefly on BT-886 was recorded 24 hrs before first application of insecticides. Comparison of population reduction showed that there was nonsignificant difference in adult whitefly per leaf in all the plots. The results of comparison of population reduction after 2 days of application showed that highest adult whitefly per leaf 24.357% was given by T3 (Legend), which differ significantly from the remaining treatments, while lowest results 8.177% were obtained from T8 (Concept Plus) as shown in Fig. 1. The mean comparison of papulation reduction of adult whitefly per leaf 4 days after first application of insecticides on BT-886 revealed that highly significant difference present among all treatments as T3 (Legand) gave maximum control of 53.08% while T8 (Concept Plus) gave minimum 23.43% control per leaf as shown in Fig. 2. The same mean comparison of insecticide application after 6 days showed that T3 (Legand) gave best control of 73.29% and T1 (Actify) gave minimum 35.17% results which are significantly different from each other as shown in Fig. 3.

The population of adult whitefly on Non-BT (Shahkar) was recorded 24 hrs before first application of insecticides. The mean comparison of papulation reduction of adult whitefly per leaf 2 days after first application of insecticides on Non-BT (Shahkar) revealed that highly significant difference present among all treatments as T3 (Legand) gave maximum control of 37.67% while T5 (Jeera) gave minimum 8.03% control per leaf as shown in Fig. 4. The maximum papulation reduction of whitefly after 4 days of insecticide application was recorded 55.31% in T3 (Legand) and minimum papulation recorded 20.66% in T1 (Actify) which is significantly different from others as shown in Fig. 5. The mean comparison of papulation reduction of adult whitefly per leaf 6 days after first application of insecticides on Non-BT (Shahkar) revealed that highly significant difference present among all treatments as T3 (Legand) gave maximum control of 68.17% while T1 (Actify) gave minimum 32.26% control per leaf as shown in Fig. 6.

Nymph whitefly (1st Application): The population of nymph whitefly on BT-886 was recorded 24 hrs before first application of insecticides. Comparison of population reduction showed that there was nonsignificant difference in nymph whitefly per leaf in all the plots. The results of comparison of population reduction after 2 days of application showed that highest nymph whitefly per leaf 33.85% was given by T3 (Legend), which differ significantly from the remaining treatments, while lowest results 11.34% were obtained from T8 (Concept Plus) as shown in Fig. 7. The mean comparison of papulation reduction of nymph whitefly per leaf 4 days after first application of insecticides on BT-886 revealed that highly significant difference present among all treatments as T3 (Legand) gave maximum control of 55.10% while T8 (Concept Plus) gave minimum 18.75% control per leaf as shown in Fig. 8. The same mean comparison of insecticide application after 6 days showed that T3 (Legand) gave best control of 74.66% and T8 (Concept Plus) gave minimum 36.11% results which are significantly different from each other as shown in Fig. 9.

The population of nymph whitefly on Non-BT (Shahkar) was recorded 24 hrs before first application of insecticides. Comparison of population reduction showed that there was nonsignificant difference in nymph whitefly per leaf in all the plots. The results of comparison of population reduction after 2 days of application showed that highest nymph whitefly per leaf 34.07% was given by T3 (Legend), which differ significantly from the remaining treatments, while lowest results 10.04% were obtained from T8 (Concept Plus) as shown in Fig. 10. The mean comparison of papulation reduction of nymph whitefly per leaf 4 days after first application of insecticides on Non-BT (Shahkar) revealed that highly significant difference present among all treatments as T3 (Legand) gave maximum control of 54.49% while T8 (Concept Plus) gave minimum 21.32% control per leaf as shown in Fig. 11. The same mean comparison of insecticide application after 6 days showed that T3 (Legand) gave best control of 75.28% and T1 (Actify) gave minimum 38.77% results which are significantly different from each other as shown in Fig. 12.

Adult Whitefly (2nd Application): The population of adult whitefly on BT-886 was recorded 24 hrs before 2nd application of insecticides. Comparison of population reduction showed that there was nonsignificant difference in adult whitefly per leaf in all the plots. The results of comparison of population reduction after 2 days of application showed that highest adult whitefly per leaf 30.29% was given by T3 (Legend), which differ significantly from the remaining treatments, while lowest results 7.13% were obtained from T8 (Concept Plus) as shown in Fig. 13. The mean comparison of papulation reduction of adult whitefly per leaf 4 days after 2nd application of insecticides on BT-886 revealed that highly significant difference present among all treatments as T3 (Legand) gave maximum control of 58.51% while T8 (Concept Plus) gave minimum 25.42% control per leaf as shown in Fig. 14. The same mean comparison of insecticide application after 6 days showed that T3 (Legand) gave best control of 71.34% and T1 (Actify) gave minimum 37.26% results which are significantly different from each other as shown in Fig. 15.

The population of adult whitefly on Non-BT (Shahkar) was recorded 24 hrs before 2nd application of insecticides. Comparison of population reduction showed that there was nonsignificant difference in adult whitefly per leaf in all the plots. The results of comparison of population reduction after 2 days of application showed that highest adult whitefly per leaf 39.57% was given by T3 (Legend), which differ significantly from the remaining treatments, while lowest results 15.12% were obtained from T5 (Jeera) as shown in Fig. 16. The mean comparison of papulation reduction of adult whitefly per leaf 4 days after 2nd application of insecticides on Non-BT (Shahkar) revealed that highly significant difference present among all treatments as T3 (Legand) gave maximum control of 55.97% while T1 (Actify) gave minimum 22.34% control per leaf as shown in Fig. 17. The same mean comparison of insecticide application after 6 days showed that T3 (Legand) gave best control of 69.62% and T1 (Actify) gave minimum 33.28% results which are significantly different from each other as shown in Fig. 18.

Nymph Whitefly (2nd Application): The population of nymph whitefly on BT-886 was recorded 24 hrs before 2nd application of insecticides. Comparison of population reduction showed that there was nonsignificant difference in nymph whitefly per leaf in all the plots. The results of comparison of population reduction after 2 days of application showed that highest nymph whitefly per leaf 34.07% was given by T3 (Legend), which differ significantly from the remaining treatments, while lowest results 10.04% were obtained from T8 (Concept Plus) as shown in Fig. 19. The mean comparison of papulation reduction of nymph whitefly per leaf 4 days after 2nd application of insecticides on BT-886 revealed that highly significant difference present among all treatments as T3 (Legand) gave maximum control of 54.49% while T8 (Concept Plus) gave minimum 21.32% control per leaf as shown in Fig. 20. The same mean comparison of insecticide application after 6 days showed that T3 (Legand) gave best control of 75.28% and T8 (Concept Plus) gave minimum 38.92% results which are significantly different from each other as shown in Fig. 21.

The population of nymph whitefly on Non-BT (Shahkar) was recorded 24 hrs before 2nd application of insecticides. Comparison of population reduction showed that there was nonsignificant difference in nymph whitefly per leaf in all the plots. The results of comparison of population reduction after 2 days of application showed that highest nymph whitefly per leaf 40.52% was given by T3 (Legend), which differ significantly from the remaining treatments, while lowest results 17.79% were obtained from T8 (Concept Plus) as shown in Fig. 22. The mean comparison of papulation reduction of nymph whitefly per leaf 4 days after 2nd application of insecticides on Non-BT (Shahkar) revealed that highly significant difference present among all treatments as T3 (Legand) gave maximum control of 58.71% while T8 (Concept Plus) gave minimum 25.34% control per leaf as shown in Fig. 23. The same mean comparison of insecticide application after 6 days showed that T3 (Legand) gave best control of 74.92% and T8 (Concept Plus) gave minimum 34.39% results which are significantly different from each other as shown in Fig. 24.

There is significant difference present among treatments Legand (Spiromesifen + Abamectin) proved most effective against cotton whitefly followed by Editor and Bila. These results are in conformity with those of All (1997) that Legand gave better control than Concept plus against whitefly and Gupta et al. (1998) worked on efficacy of Legand for control of jassid and whitefly on cotton and concluded that Legand was effective against these insect pests. Kumar et al. (2017) studied direct and residual toxicity of spiromesifen, spinosad and abamectin was tested against *Bemisia tabaci* (Gennadius). Toxicity of abamectin however gradually declined under greenhouse conditions with time (6 days) post application. Their findings are in conformity with present research work, which also showed that efficacy of abamectin also decreased gradually with the time. Solangi and Lohar (2007) studied the efficacy of four different insecticides in order to control jassid, thrips, whitefly and mite's population. All insecticides were effective but abamectin proved to be the most effective as compared to nitenpyram, Polo and Milon. This result also resembles with present research which showed that abamectin gave better control as compared to Polo.

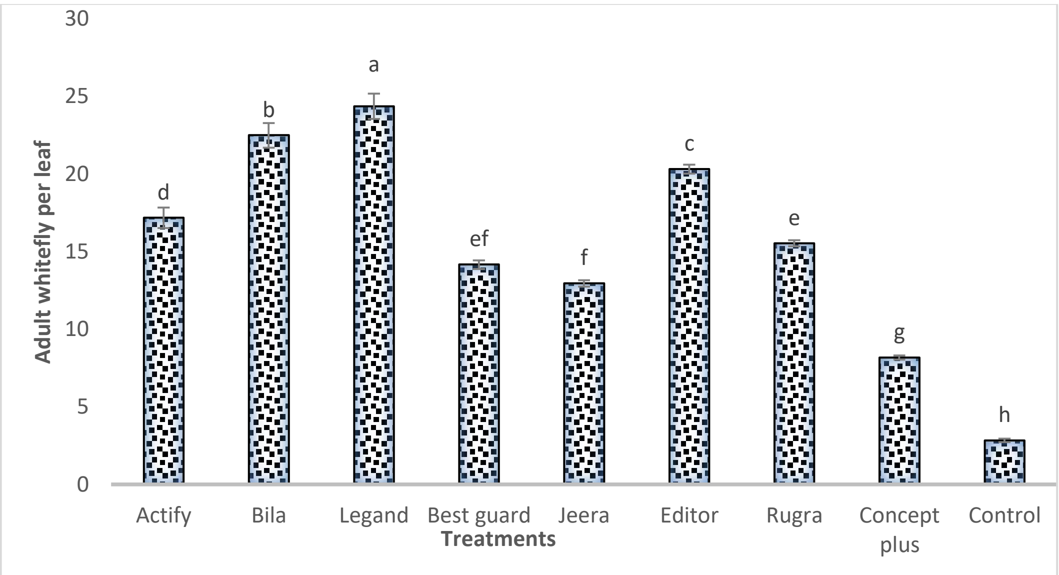

Fig. 1: Adult Whitefly 2 days after 1st application on BT-886

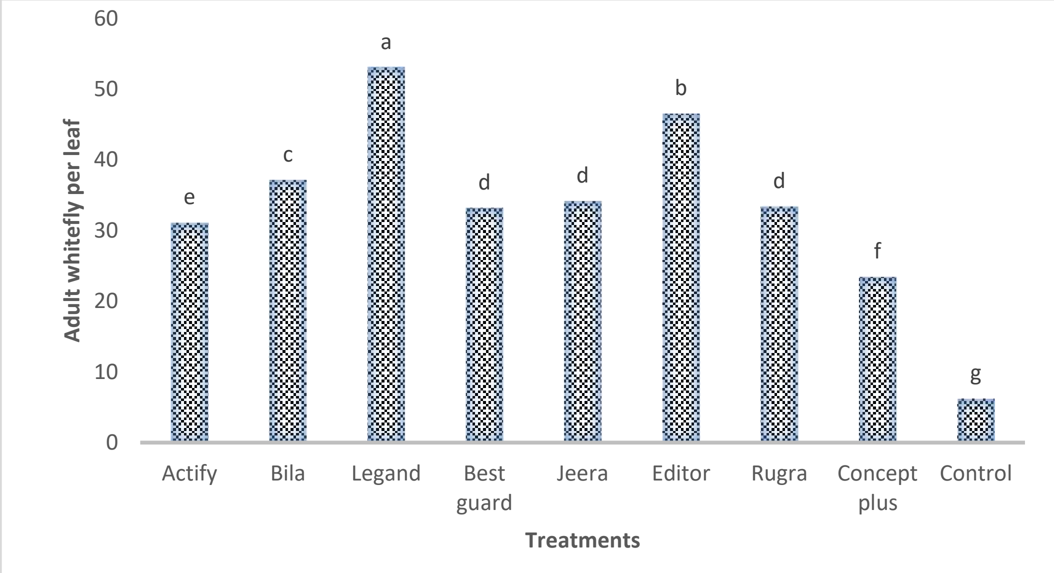

Fig. 2: Adult Whitefly 4 days after 1st application on BT-886

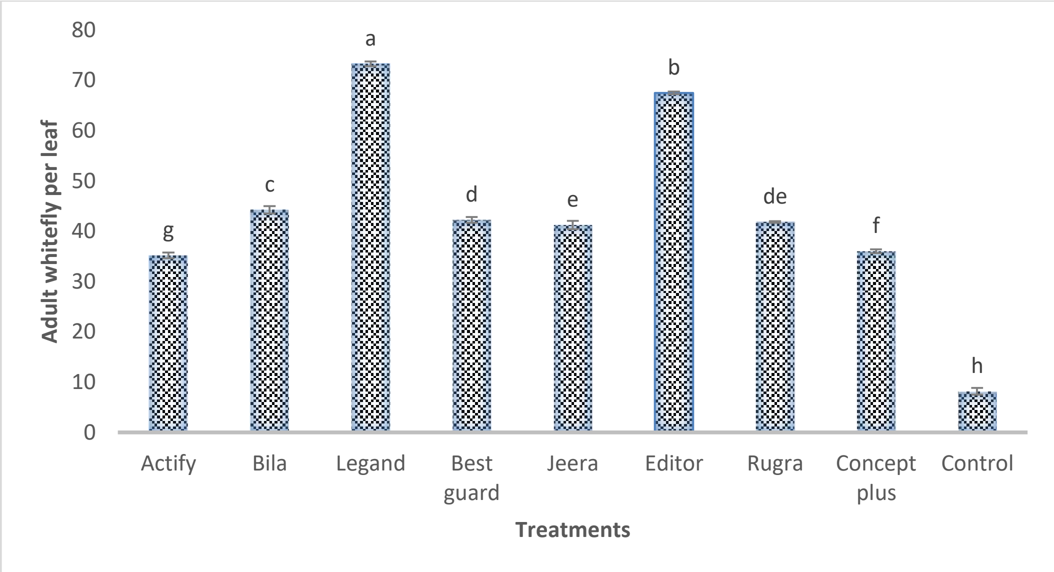

Fig. 3: Adult Whitefly 6 days after 1st application on BT-886

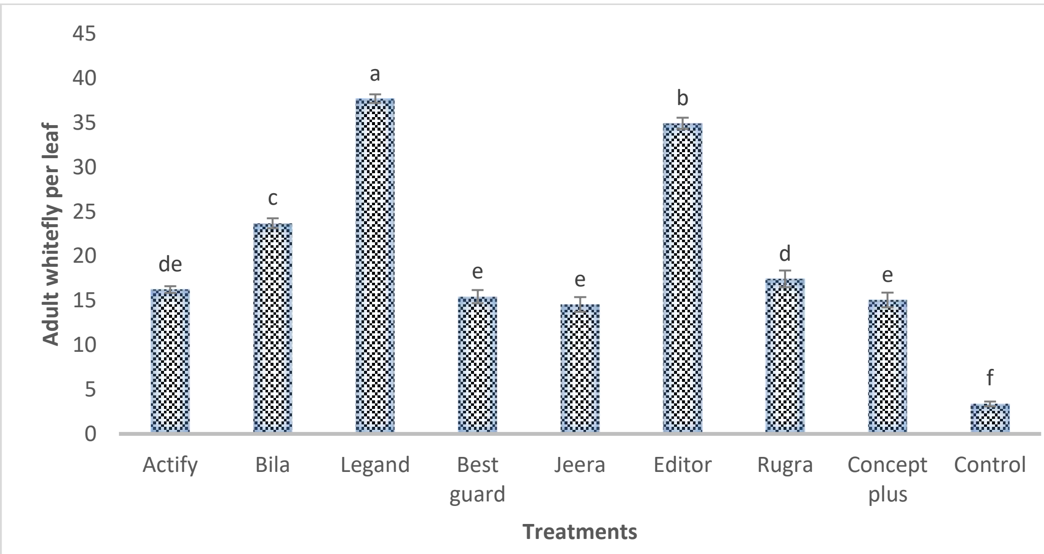

Fig. 4: Adult Whitefly 2 days after 1st application on Non-BT (Shahkar)

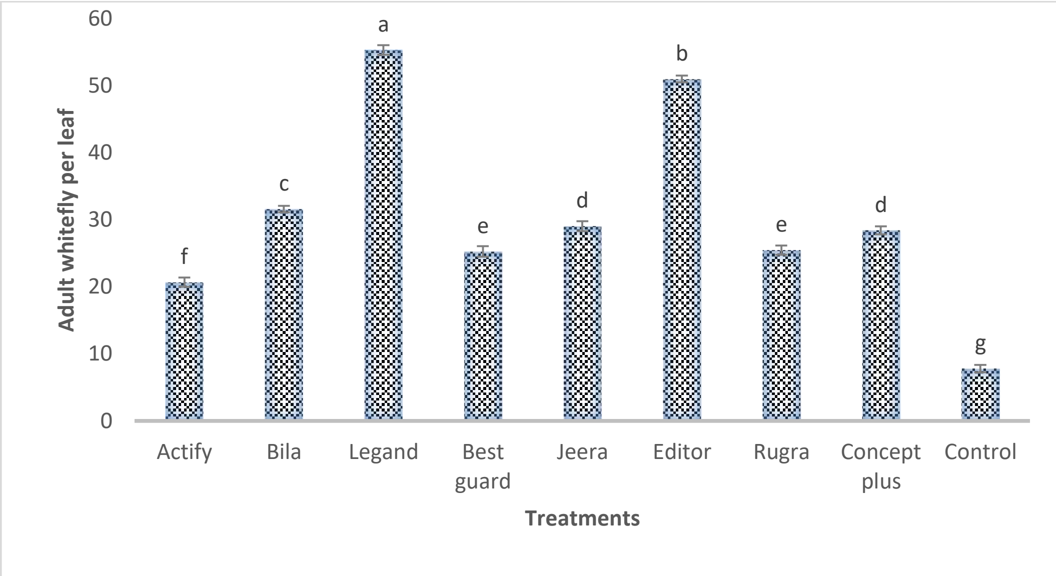

Fig. 5: Adult Whitefly 4 days after 1st application on Non-BT (Shahkar)

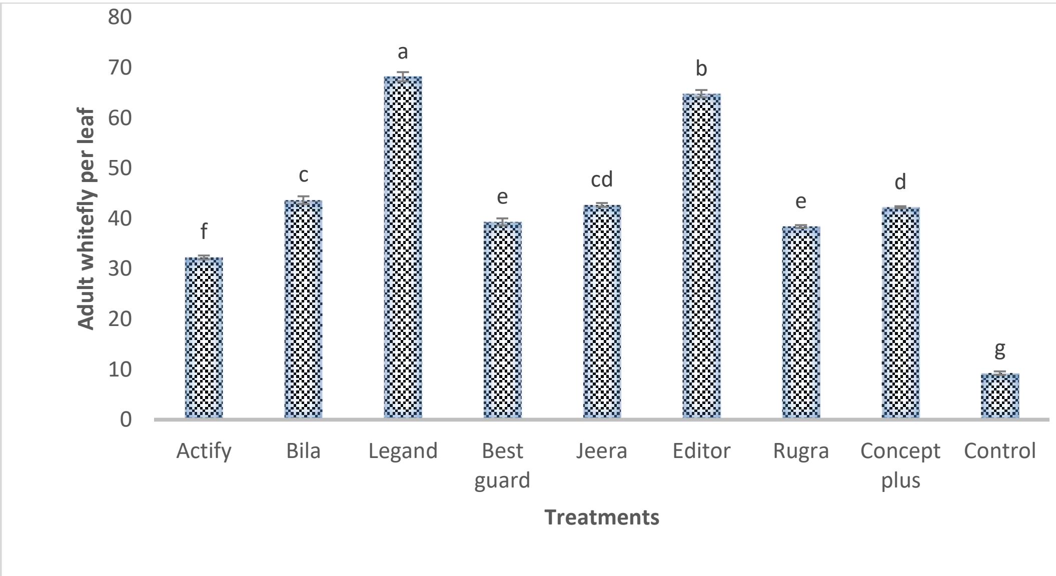

Fig. 6: Adult Whitefly 6 days after 1st application on Non-BT (Shahkar)

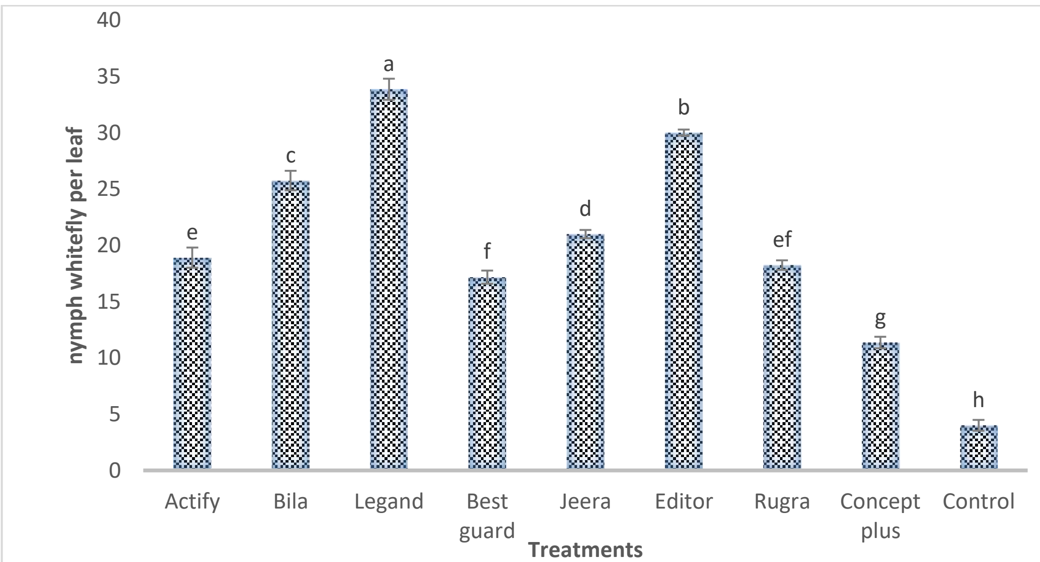

Fig. 7: Nymph Whitefly 2 days after 1st application on BT-886

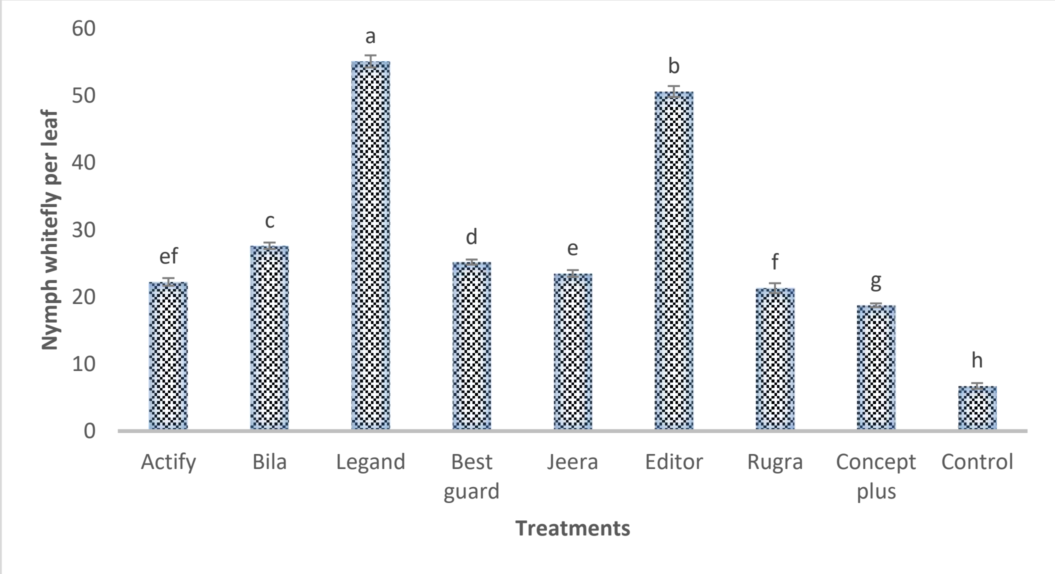

Fig. 8: Nymph Whitefly 4 days after 1st application on BT-886

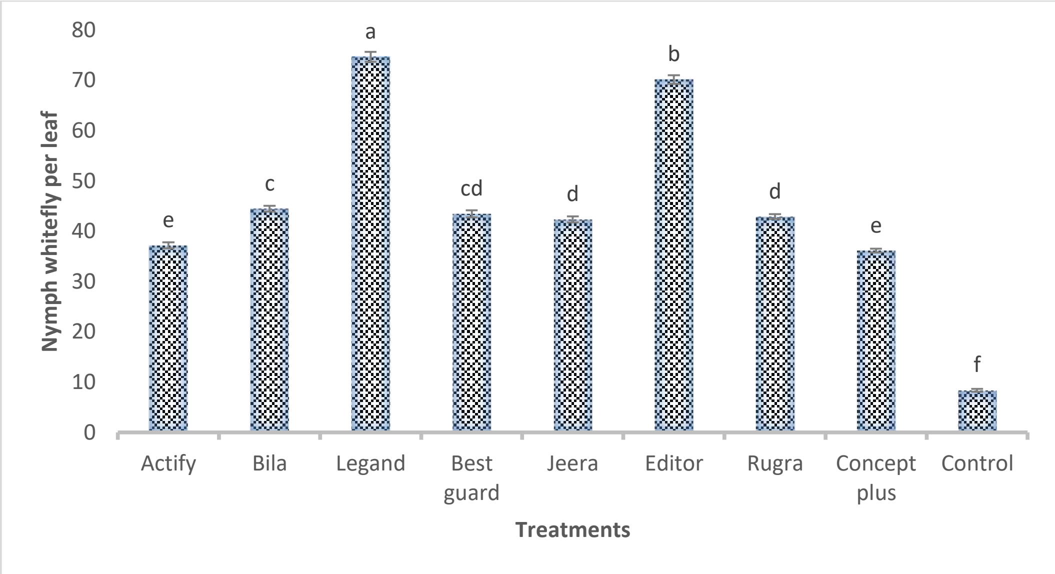

Fig. 9: Nymph Whitefly 6 days after 1st application on BT-886

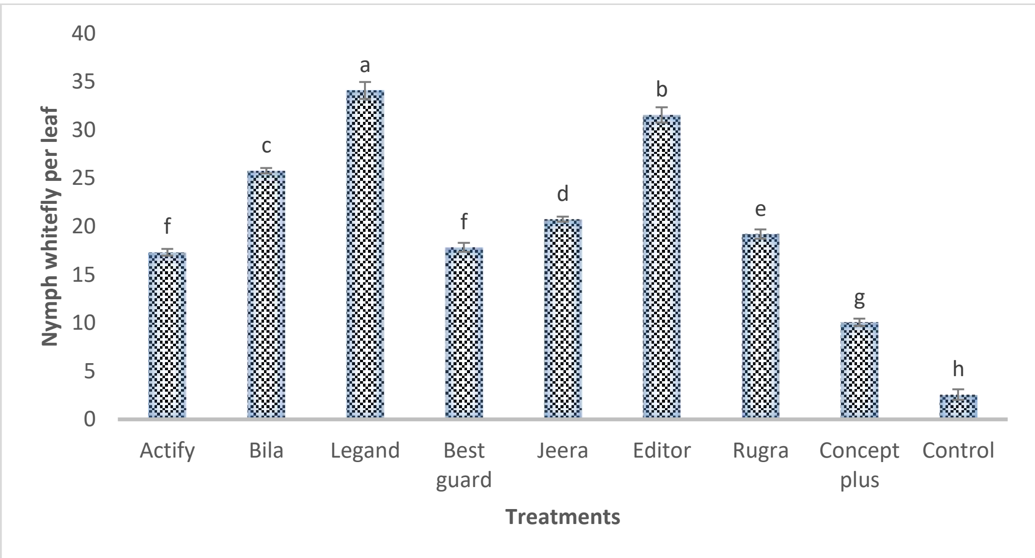

Fig. 10: Nymph Whitefly 2 days after 1st application on Non-BT (Shahkar)

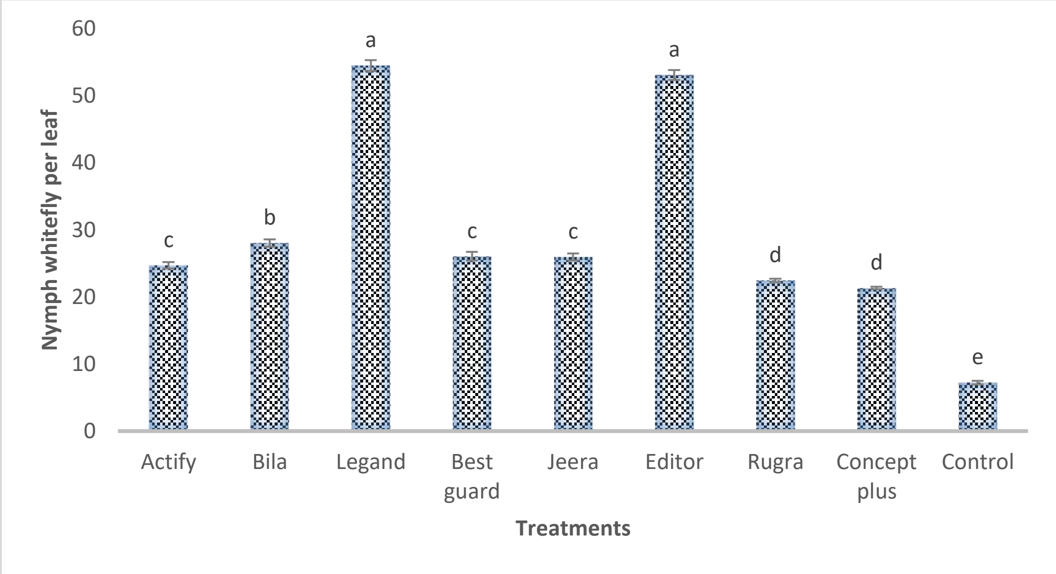

Fig. 11: Nymph Whitefly 4 days after 1st application on Non-BT (Shahkar)

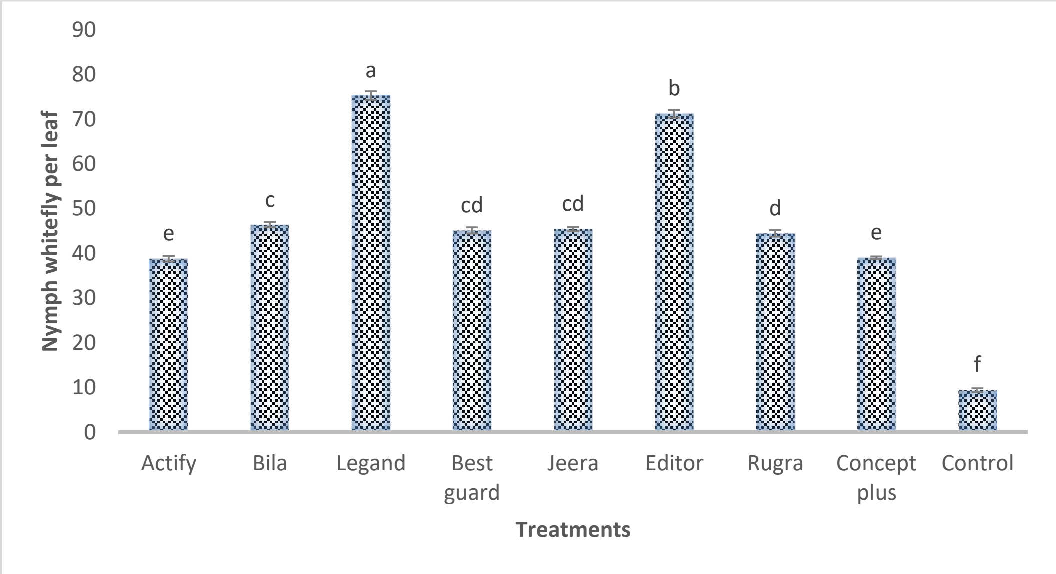

Fig. 12: Nymph Whitefly 6 days after 1st application on Non-BT (Shahkar)

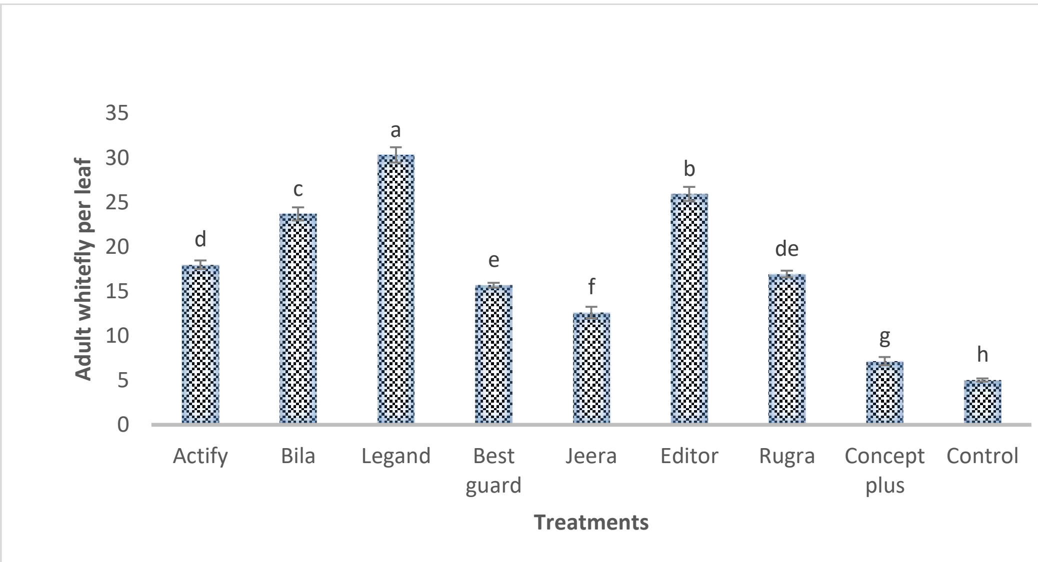

Fig. 13: Adult Whitefly 2 days after 2nd application on BT-886

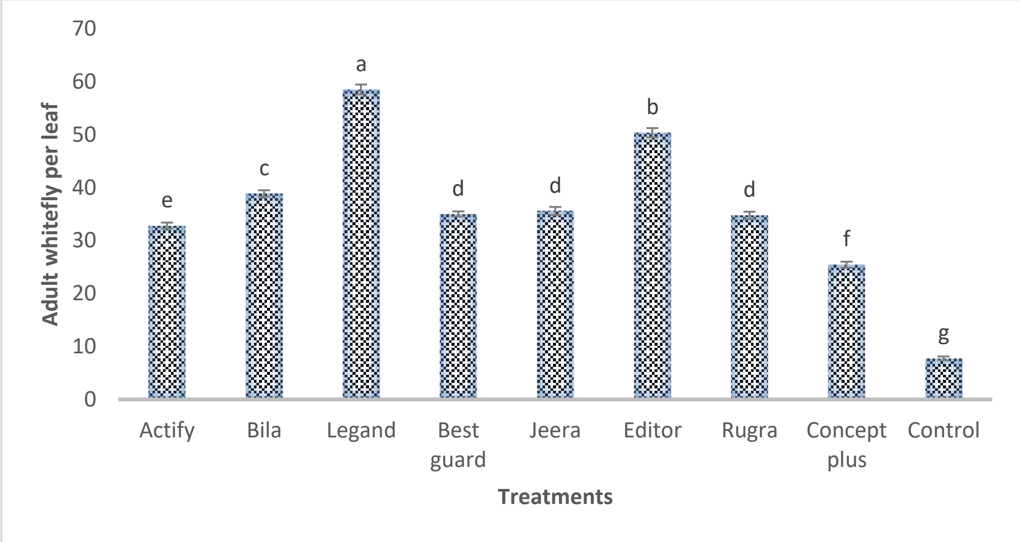

Fig. 14: Adult Whitefly 4 days after 2nd application on BT-886

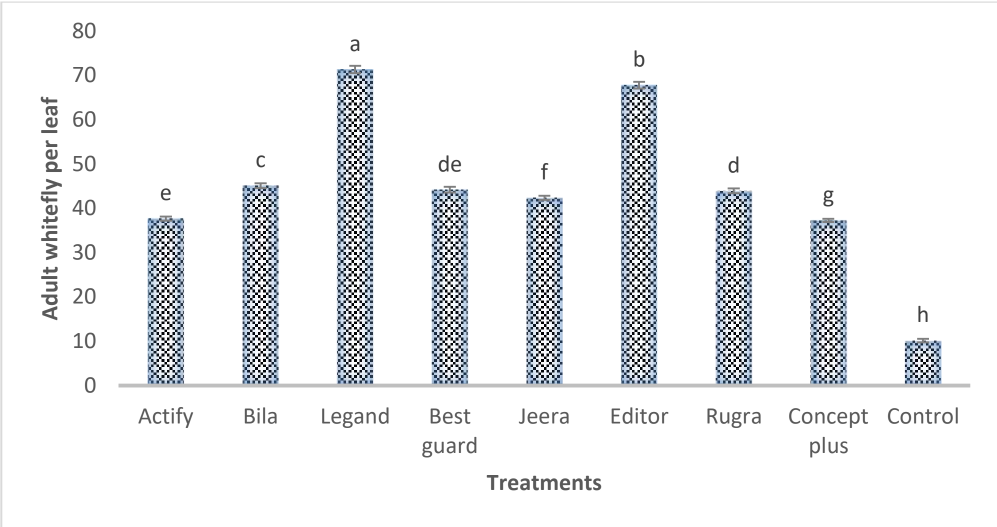

Fig. 15: Adult Whitefly 6 days after 2st application on BT-886

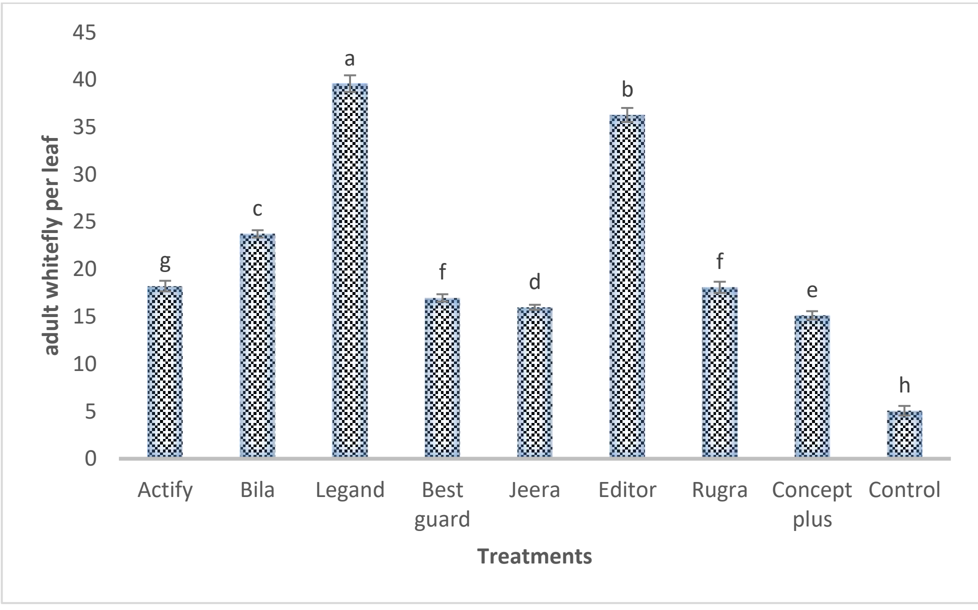

Fig. 16: Adult Whitefly 2 days after 2nd application on Non-BT (Shahkar)

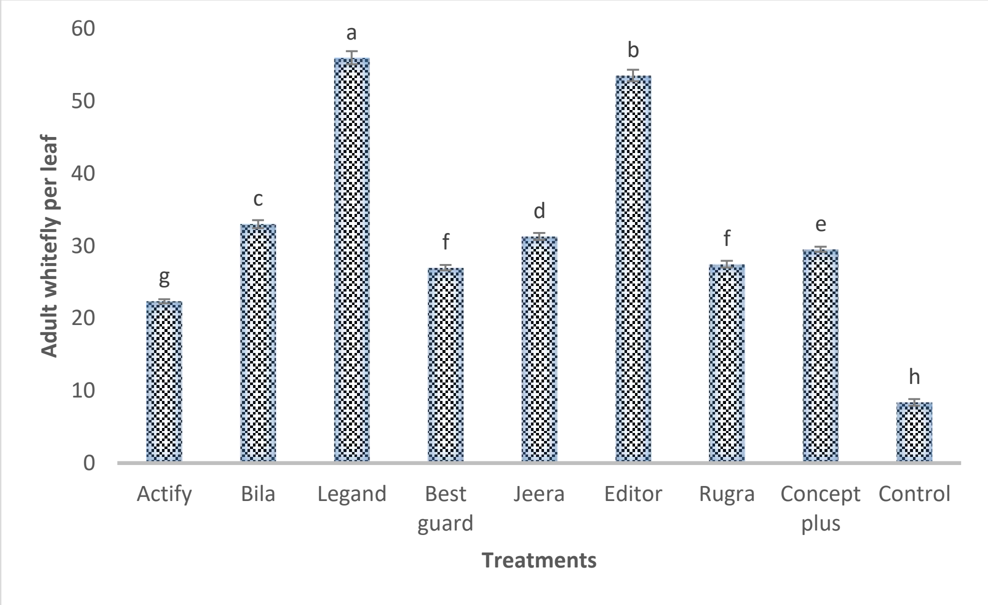

Fig. 17: Nymph Whitefly 4 days after 2nd application on Non-BT (Shahkar)

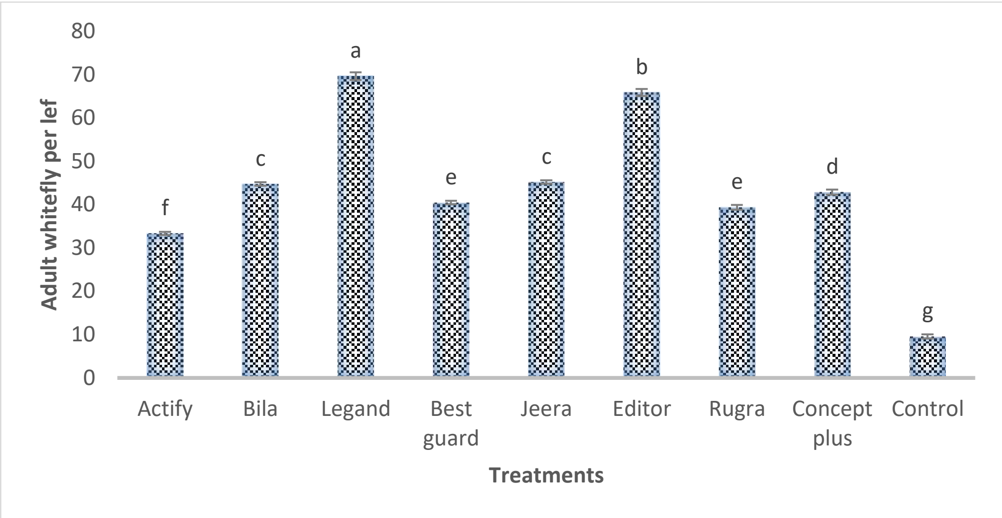

Fig. 18: Nymph Whitefly 6 days after 2nd application on Non-BT (Shahkar)

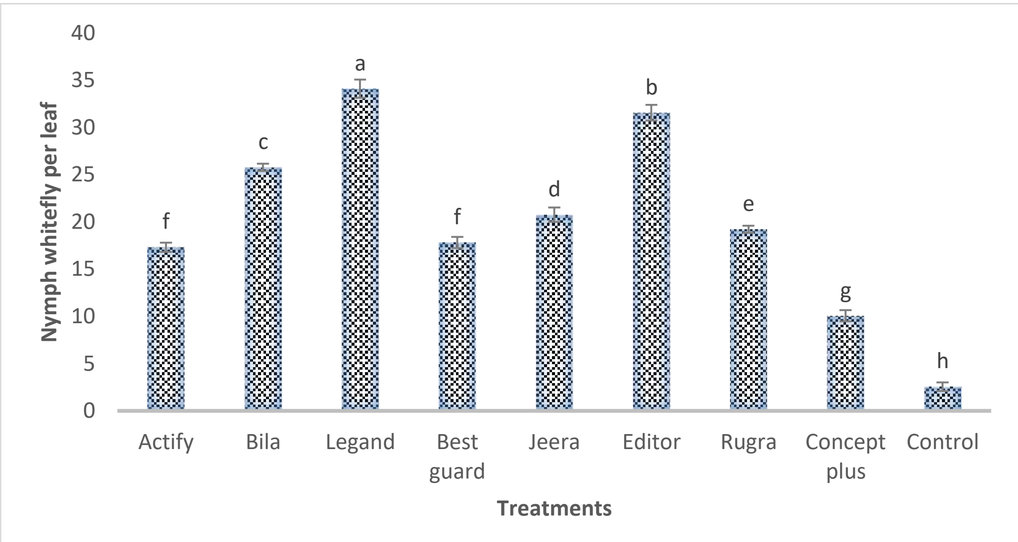

Fig. 19: Nymph Whitefly 2 days after 2nd application on BT-886

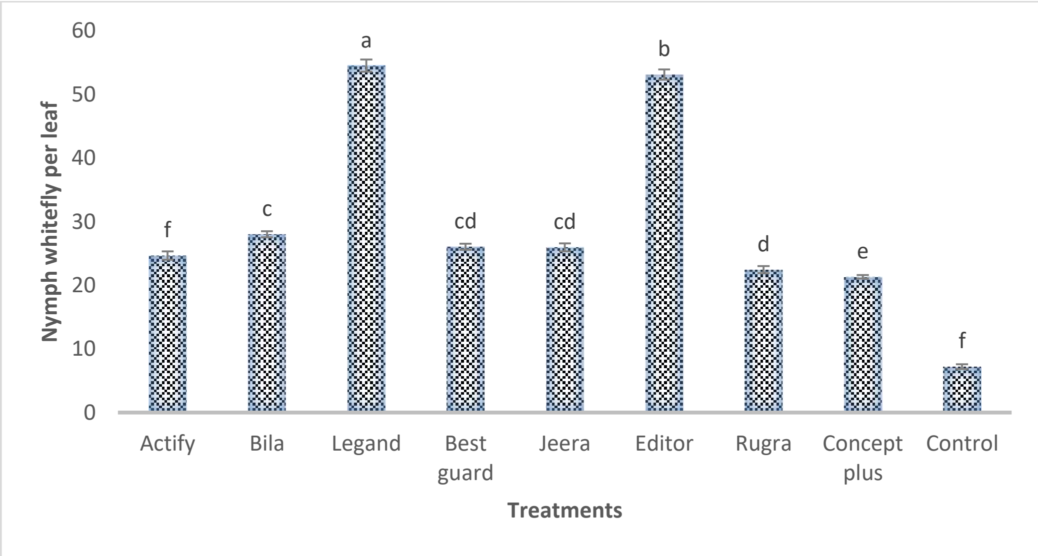

Fig. 20: Nymph Whitefly 4 days after 2nd application on BT-886

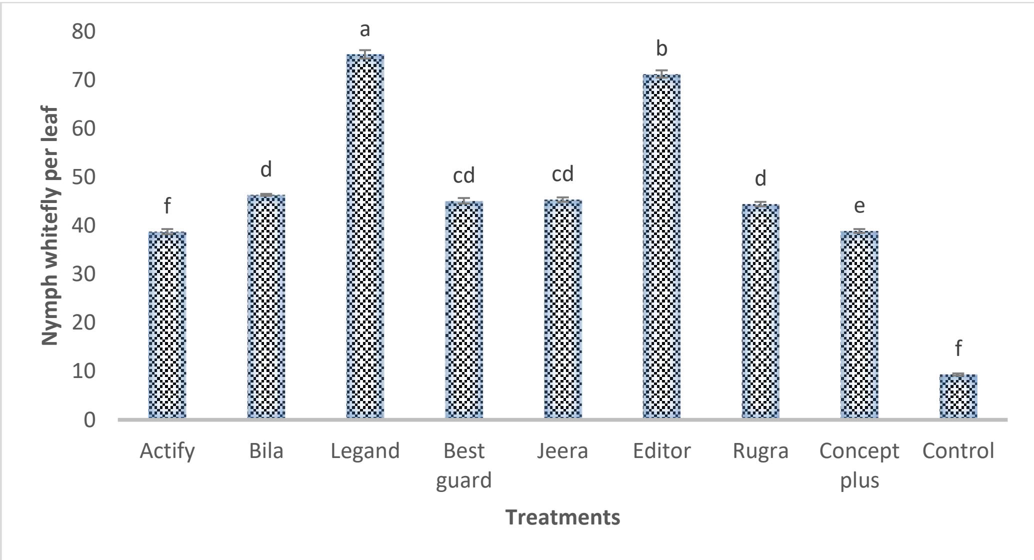

Fig. 21: Nymph Whitefly 6 days after 2nd application on BT-886

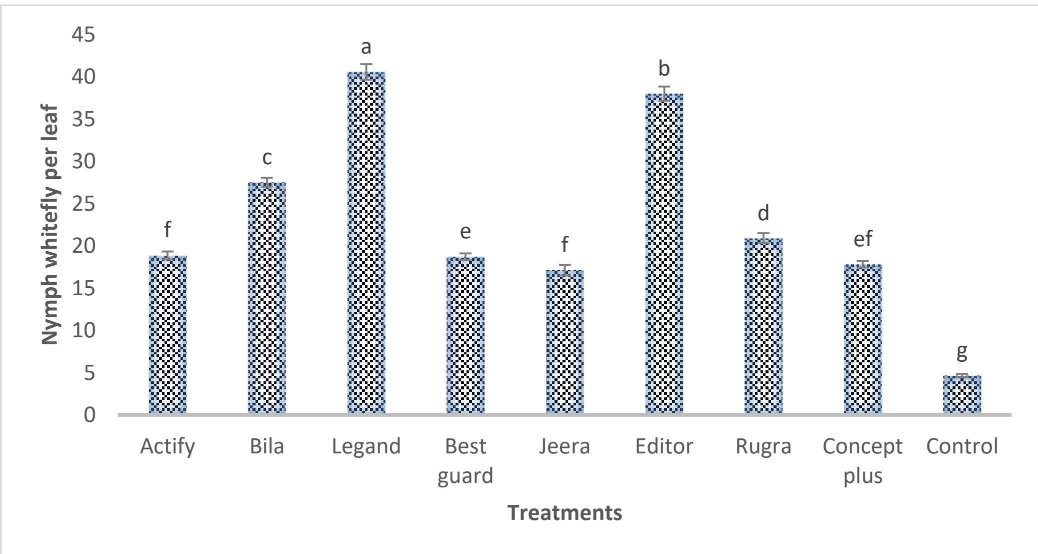

Fig. 22: Nymph Whitefly 2 days after 2nd application on Non-BT (Shahkar)

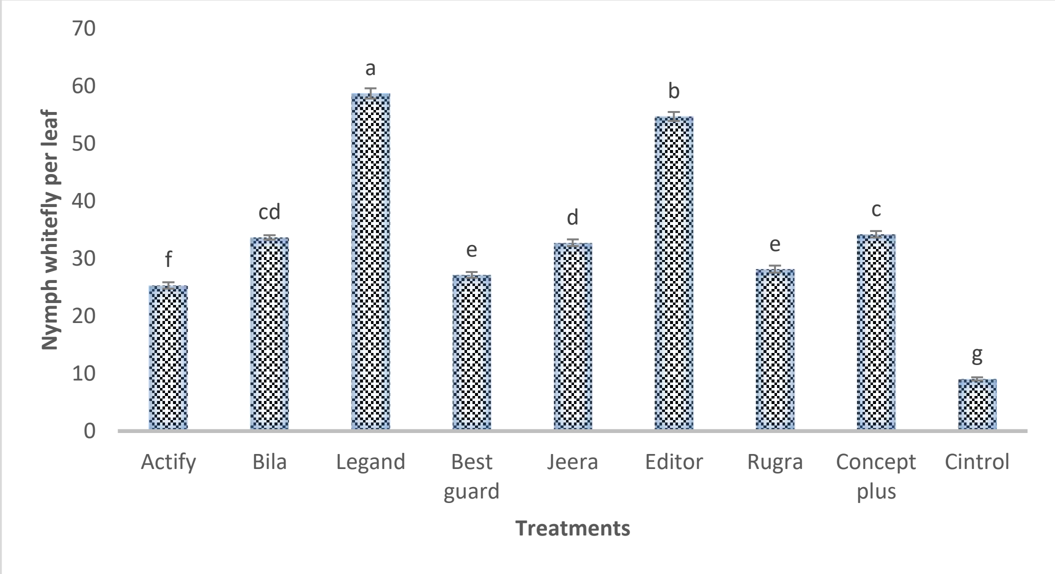

Fig. 23: Nymph Whitefly 4 days after 2nd application on Non-BT (Shahkar)

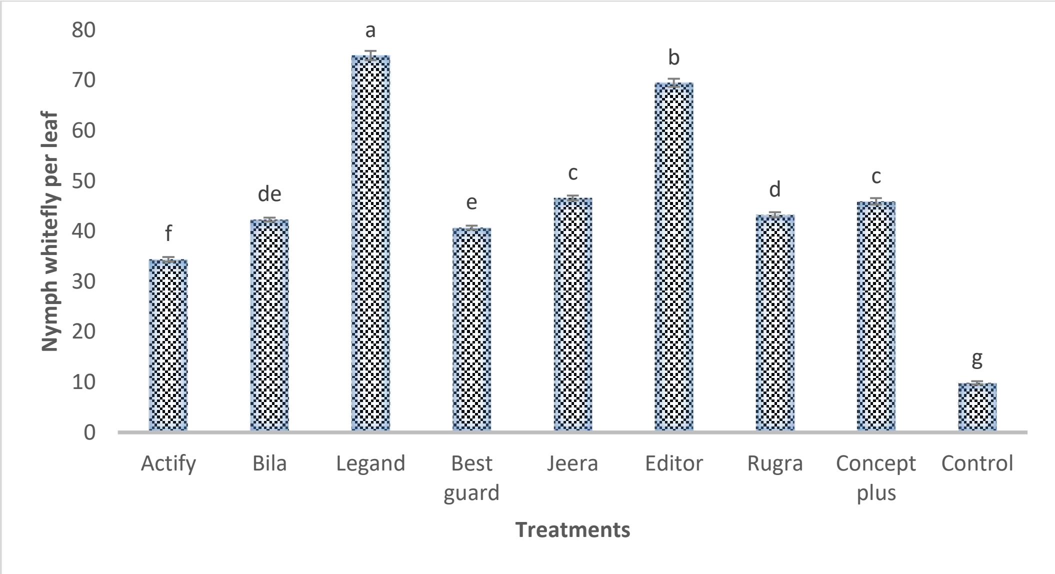

Fig. 24: Nymph Whitefly 6 days after 2nd application on Non-BT (Shahkar)

CONCLUSION

In present findings treatments showed significant difference with respect to whitefly population and highest population of whitefly was given by control which significantly differs from remaining treatments. T3 (Legand) gave the maximum control for adults along with nymphs of whitefly in both cotton varieties BT-886 and BT-Shahkar and papulation significantly further reduce at 2nd application of insecticide. While treatments T1(Actify) and T8 (Concept Plus) reduced the minimum papulation of both nymph and adult whitefly in all treatments.

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