Nat. Volatiles & Essent. Oils, 2022; 9(2): 852-861

NVEO
Natural Volatiles &
Essential Oils

Bio-Efficacy Of Botanical And Chemical Insecticide Against Whitefly (Bemisia Tabaci, (Genn) And Its Effect On Yield Of The Okra

Riaz Hussain[1*] , Amanullah[2] , Muhammad Arabi awan[2] , Muhammad Kiramat Shah[2] , Afsar Ali[2] , Arshad Ali[3] , Shahid Ali[4] , Muhammad Adnan Khan[5] , Khitab Ullah[6] , Muhammad Salman[7] , Shahab Ahmad[8] , Muhammad shakur[9]

1. Department of Entomology, The University of Agriculture Swat, 19120 Pakistan.
2. Department of Entomology, The University of Agriculture Peshawar, 25100 Pakistan.
3. Agriculture Research Institute Swat, 19120 Pakistan.
4. Department of Entomology, Bacha Khan University Charsada, 24631 Pakistan.
5. Department of Agronomy, The University of Agriculture Swat, 19120 Pakistan.
6. Department of Soil and Environmental Sciences, The University of Agriculture Swat, 19120 Pakistan.
7. Sericulture Branch, Pakistan Forest Institute (PFI), Peshawar, 25100 Pakistan.
8. Department of Pant breeding and genetics, The University of Agriculture Peshawar, 25100 Pakistan.
9. Department plant protection, Technical Director Pest Management and Landscape MSR Groupme UAE.

Abstract

The aimed of the study to evaluate the effect of botanicals and chemical insecticide against whitefly (Bemisia tabaci). Whitefly is the most destructive pest and reduce a significant losses in yield of the crop. Experiment was randomized complete block design with three replications. The insecticides were used in experiment viz, Garlic bulb (200kg/liter), Imidacloprid (25 EC), Onion bulb (200kg/liter) and Neem oil. Botanical extracts and chemical insecticide shows significant results against whiteflies. The minimum population of whiteflies per leaf was observed in plot treated with Imidacloprid (0.35) while followed by Onion bulb, Neem oil and Garlic bulb (1.79, 1.86 and 2.27 respectively). While maximum population of whitefly per leaf was recorded in control plot (6.91). The maximum percent mortality was recorded in plot treated with Imidacloprid (86.10) while followed by Onion bulb, Neem oil and Garlic bulb (74.13, 73.08 and 67.71 respectively). The highest yield and highest CBR was recorded in plot treated with Imidacloprid (3516.7 kg/ha and 1:12.91). All the insecticide gave significant reduction in population of whitefly but chemical insecticide Imidacloprid (25EC) comparatively most effective. It is recommended for further researchers to used different concentrations against different sucking insect pests.

Key words. Chemical, plant extracts, Whiteflies, Okra, Swat.

INTRODUCTION

Okra, Abelmoschus esculentus (L.) Moench, in Pakistan is most important vegetable crop. It is growing in kharif season throughout the year (Dash et al, 2013) and short duration crop (Neeraja et al., 2004). In okra is present most essential nutrients of vitamins, salts, minerals and 175 calories per pound energy (Lanjar

and Sahito, 2007). It helps in reduce the risk of heart disease, lower blood cholesterol, intestinal tract healthy, decrease colorectal cancer and contain both soluble and insoluble fibers (Broek et al., 2007).

During 2018-2019 the total production of okra in Pakistan was 120.639 thousand tones and 15.713 thousand hectares area under cultivation. Total production in Punjab was 70.438 thousand tones and 5.922 thousand hectares area was cultivated. Sindh production was 19.731 thousand tones and 4.969 thousand hectares area was cultivated. Balochistan production was 15.223 thousand tones and cultivated on an area of 2.459 thousand hectares while in Khyber Pakhtunkhwa the total production was 15.245 thousand tones and cultivated on an area of 2.363 thousand hectares (Anonymous, 2019). Many insect pests attack on okra crop from the time of germination till to harvesting. The most destructive insect pests of okra are aphids, whiteflies, thrips, fruit borer and jassids (Rakesh et al., 2006). In sucking insect pests of okra Bemisia tabaci, (Genn) is most destructive due to broad range, high reproduction rate, high migratory behavior, tolerant to high temperature and have ability to transfer many viral diseases and showed resistance to insecticides (Kumar, 2017; Ellsworth and Jones, 2001). Whitefly Bemisia tabaci both nymph and adult suck cell sap from the leaves and affected photosynthesis. The affected plant is usually stunted and reduces the yield and quality of the crop (Atwal and Sing, 1990). The chemical insecticides is highly preferred to control whitefly due its quick and knock down effects. The farmers used different type chemical insecticides to get satisfactory control level of the pests. However, indiscriminate use of chemical insecticide results in several health and environmental problems (Aktar et al., 2009).

Plant extracts are very affective in initial stages of different insect pest attack and less harmful, safe natural enemies and safe beneficial insects. Botanical extracts are good alternate of chemical insecticides and have low toxicity to mammalian (Rizvi et al., 2015). Plant extracts are most preferred because they are easily available from growing plants and less expensive than chemical insecticides. Keeping in view the above facts the present experiment is designed with the objective to develop an effective chemical and botanicals IPM strategy to control whitefly.

Materials and Methods

The study was conducted to evaluate the efficacy of different plant extracts and chemical insecticides against whitefly on okra crop at Swat.

Experimental design

The experiment was Randomized Complete Block Design (RCBD) with three replications. Sowing (Viraj F1 Hybrid) Okra seed in first week of March. Plant to plant distance was 10cm and row to row distance was 25cm and total plot size was 5 x 5m^2.

Insecticides

The chemical insecticides Imidacloprid 50 EC and Neem oil was purchased from the market,

Preparation of Plant Extract

Garlic (A. sativum) bulb extract

Dried garlic bulb of 20 g was crushed and added 20ml of water for 24hrs at room temperature. The solution was diluted up to 20 ml in 1 liter of water to get the formulation ready for application in the field (Sohail et al., 2012).

Onion bulb (Allium cepa) extract

Onion bulb of 20 grams was crushed and mixed with 200ml of water for 48hrs. Impurity of extract was separated from muslin cloth 200ml of water were added in one liter of water for field solution.

Whiteflies per leaf and percent mortality

Randomly two plants was selected and then each plant three leaf per plant were selected top, middle and lower leaf for counted the population of whiteflies. The data were recorded after 5, 10, 15, 30 and 60 day of three different spray application. The population of whiteflies were converted into mean population per leaf and percent mortality of whiteflies per leaf. By using the Abbot's formula: (1925) for mortality of whiteflies.

$$\%\text{Reduction} = \{1 - \frac{\text{Post treatment pop. in treated plots}}{\text{Pretreatment pop. in treated plots}} \times \frac{\text{Post treatment pop. in control}}{\text{Pretreatment pop. in control}}\} \times 100$$

Yield kgha^{-1}

Okra yield kgha^{-1} were calculated after different picking by using the following formula:

Yield kgha^{-1}= Yield plot^{-1}/ plot area (m^2) x10, 000

Cost benefit ratio

Find out the most effective treatments that gave maximum net return by using Cost benefit ratio according to the method used by (Hussain et al., 2022).

Statistical analysis:

The data were analyzed by Statistic 8.1 software and LSD used for finding mean between treatments.

Results

Population of whitefly per leaf

The results showed that before spray application the population of whitefly per leaf were nonsignificant (fig.1). After 5 day of spray application the lowest population of whitefly per leaf was recorded in plot treated with Imidacloprid (1.67). Followed by Neem oil, Garlic bulb and Onion bulb (3.20, 3.36 and 3.50

respectively). While highest population per leaf was recorded in control plot (4.61). After 10 day of application the lowest population of whitefly per leaf was observed in plot treated with Imidacloprid (0.96). Followed by Neem oil, Onion bulb and Garlic (2.09, 2.41 and 2.54 respectively). After 15 day the lowest population of whitefly per leaf was recorded in plot treated with Imidacloprid (0.57). Followed by Neem oil, Garlic bulb and Onion bulb (1.92, 2.19 and 2.41 respectively). While highest population of whitefly per leaf was recorded in control plot (5.42). After 30 day the lowest population of whitefly per leaf was recorded in plot treated with Imidacloprid (0.51). Followed by Neem oil, Onion bulb and Garlic bulb (1.49, 1.51 and 1.84 respectively). While highest population of whitefly per leaf was recorded in control plot (5.71). After 60 day the lowest population of whitefly per leaf was recorded in plot treated with Imidacloprid (0.35). Followed by Onion bulb, Neem oil and Garlic bulb (1.79, 1.86 and 2.27 respectively). While highest population of whitefly per leaf was recorded in control plot (6.91).

Percent mortality of whitefly per leaf

After 5 day of spray application (fig.2) the highest percent mortality was recorded in plot treated Imidacloprid (53.22). Followed by Neem oil, Garlic bulb and Onion bulb (30.21, 26.51 and 21.60 respectively). After 10b day the highest percent mortality was recorded in plot treated with Imidacloprid (73.43). Followed by Neem oil, Onion bulb and Garlic bulb (59.13, 52.29 and 49.61 respectively). After 15 day the highest percent mortality was recorded in plot treated with Imidacloprid (81.37). Followed by Neem oil, Garlic bulb and Onion bulb (65.23, 58.92 and 55.48 respectively). After 30 day the highest percent mortality was recorded in plot treated with Imidacloprid (83.44). Followed by Neem oil, Onion bulb and Garlic bulb (73.85, 73.81 and 67.80 respectively). After 60 day the highest percent mortality was recorded in plot treated with Imidacloprid (86.10). Followed by Onion bulb, Neem oil and Garlic bulb (74.13, 73.08 and 67.71 respectively).

Yield kg ha^{-1} and Cost benefit ratios

The maximum yield was observed in plot treated with Imidacloprid (3516.7 kg/ha) and followed by Neem oil (2496.71). While Onion bulb and Garlic bulb (2333.3 and 2243.3) were statistically nonsignificant. The minimum yield was recorded in control plot (1183.3). The highest cost benefit ratio was recorded in plot treated with Imidacloprid (12.91) which were followed by Neem oil, Garlic bulb and Onion bulb (9.39, 9.34 and 8.95 respectively).

Discussion

The experiment was conducted to find out the efficacy of different botanical extracts and chemical insecticide against whitefly Bemisia tabaci, (Genn) in okra at District Swat, Khyber Pakhtunkhwa in farmer field.

The infestation of whitefly start 20 days after sowing and continued last week of July. This finding are similar to the finding of Mastoi et al. (2013). The infestation of whitefly was high from May to June while nymph population was maximum in April Leite et al. (2005) was recorded same results. Before spray application the population of whitefly was nonsignificant in the treatments. This results are similar to the finding of Hussain et al., (2022). The highest percent mortality was observed in plot treated with

Imidacloprid. Similar, finding was observed by Chaitanya et al. (2018) and Pawar et al. (2016) was observed that all three applications Imidacloprid was the most effective against sucking insect pests.

The present experiment show that Imidacloprid remain effective for 14 days after application. Our finding is partially agreed with finding of kalyan et al. (2012) reported that treatment with Imidacloprid showed significantly reduction in the infestation of whitefly up to 7 days after spray application. The residual effect may varied due to abiotic factors.

The chemical insecticides Imidacloprid is harm full to beneficial insects. This finding is similar to the finding of Rondeau et al. (2014). Imidacloprid is systematic insecticide and very effective against sucking pest. Our finding is similar with Ahmed et al. (2001) reported that Imidacloprid play important role in the control whitefly Bemisia tabaci in fields condition. Dewy (2006) also reported that Imidacloprid controlled those sucking pests up to 8 weeks after sowing. Fernandes et al. (2010) reported that Imidacloprid had initial effects is very high and long residual effects against immature stage of whitefly and jassids.

The use of chemical insecticide Imidacloprid with recommended dose don't show phytotoxicity. Our result is similar with the Kar (2017) reported that Imidacloprid don't cause phytotoxicity up to 15 days after application at higher doses of spray. Salehia et al. (2013) observed that Imidacloprid was most effective first nymphal instar of whitefly.

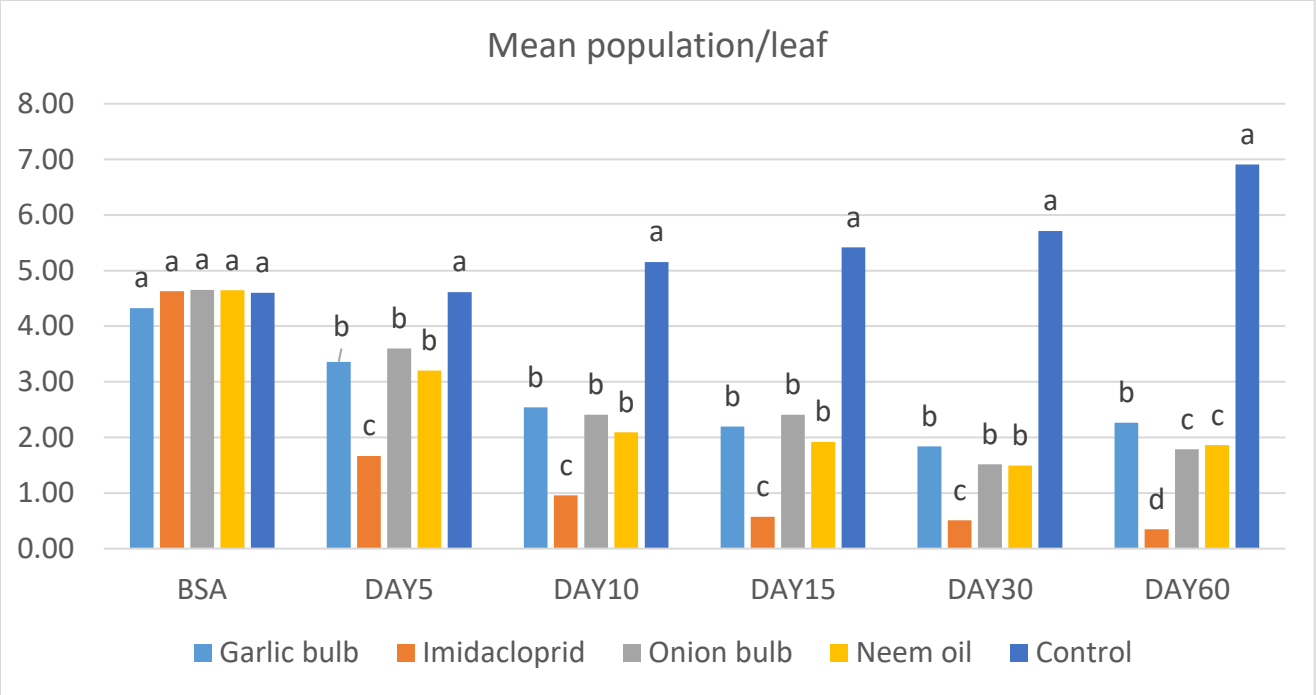
The yield of okra was varied in different treatments from ranging (1066.6 kg/ha^{-1} to 3762.3 kg/ha^{-1}). The present finding are in contractions to the finding of Rehman et al. (2015), Khan et al. (2019) and Adhikary (2009) they reported (2255.5kg/ha^{-1}), (4530.3 kg/ha^{-1}) and (5001.4 kg/ha^{-1}) respectively of okra yield in different treatment. Yield may also be varied due to difference in the okra genotype, biotic and abiotic factors. In the present experiment showed that maximum population of whitefly gave low yield and vice versa. These findings are in agreement with the findings of Shannag et al. (2007) and Mehra et al. (2018) they also reported that treatment with maximum population of whitefly gave minimum yield.

The present experiment showed that Imidacloprid (12.91) is highly profitable which were followed by Neem oil, Garlic bulb and Onion bulb (9.39, 9.34 and 8.95 respectively). The present finding cannot be compared with the findings of earlier researcher. The cost control of commodity is changing from region to region.

Conclusion

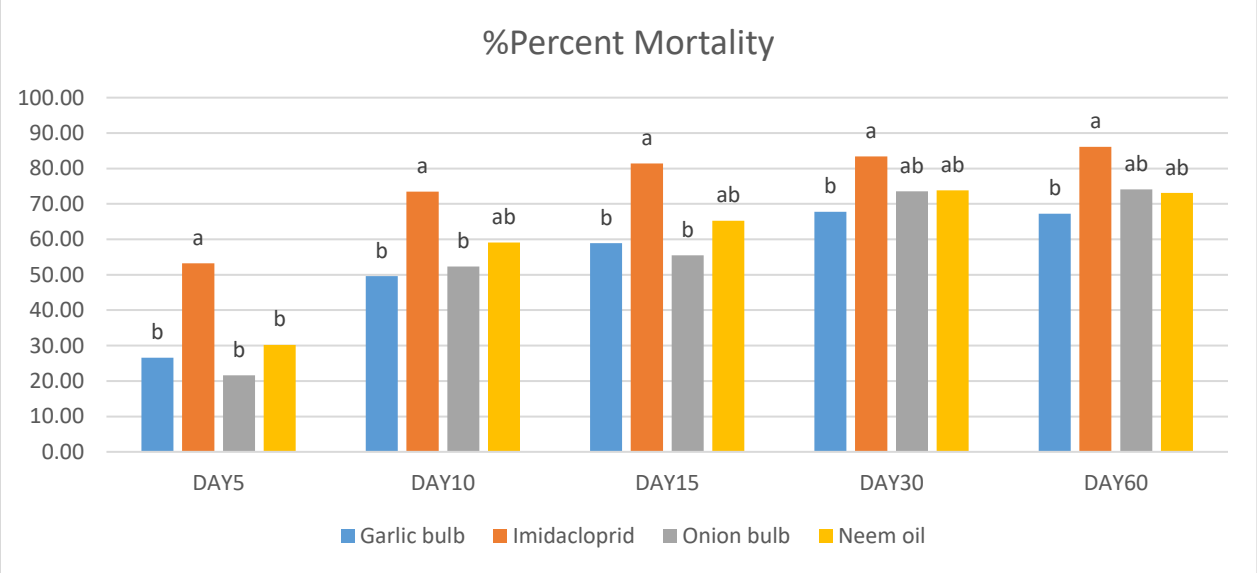
As concluded from the present study that botanical extracts and chemical insecticide give a significant reduction in the population of whitefly. Comparatively chemical Imidacloprid give better results at the rest of botanical extracts. Maximum percent mortality, highest yield and high profit was recorded in plot treated with Imidacloprid.

Fig.1. Population of whitefly per leaf at different day interval in different spray applications.



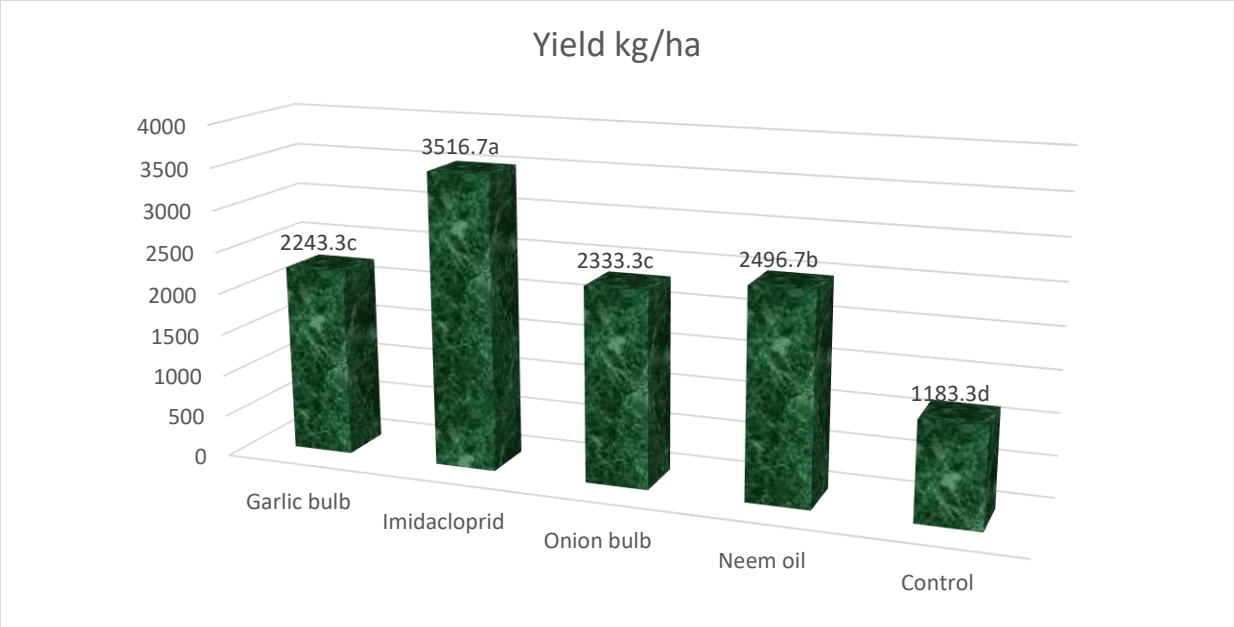
Same column bar shows that treatments were nonsignificant at P level (0.05)

Fig.2. Percent mortality of whitefly per leaf at different day interval in different spray applications.



Same column bar shows that treatments were nonsignificant at P level (0.05)

Fig 3. Yield $kgha^{-1}$ in different treatments on okra crop



Same column bar shows that treatments were nonsignificant at P level (0.05)

Table 1. Cost Benefit Ratio of different treatments against whitefly on okra crop

Treatments	Yield (kg/ha^{-1}) A	Gross income (Rs.) B	Cost of control ha^{-1} (Rs.) C	Return over control (Rs.) ha^{-1} D	Estimated net benefit (Rs. ha^{-1}) E (D-C)	C:B F(D/C)
Garlic bulb	2243.3	67299	7200	67299	60099	9.34
Imidacloprid	3516.7	105501	8165.9	105501	97335.1	12.91
Onion bulb	2333.3	69999	7818.9	69999	62180.1	8.95
Neem oil	2496.7	74901	7971.2	74901	66929.8	9.39
Control	1183.3	35499	------	--------	--------	------

References

Abbott, S.W.1925.A method of computing the effectiveness of an insecticide. J. econ. Ent.18:265-267.

Adhikary, S. 2009. Results of field trials to control common insect pests of okra, Hibiscus esculentsu L., in Togo by application of crude methanolic extracts of leaves and seed kernels of the neem, Azadirachta indica A. Juss., J. Crop. Protec. 98: 327–331.

Ahmed, N. E., H. O. Kanan, Y. Sugimoto, Y. Q. Ma and S. Inanaga. 2001. Effect of Imidacloprid on incidence of Tomato yellow leaf curl virus. Plant Disease. 85:84-87.

Aktar, W. M., D. Sengupta and A. Chowdhury. 2009. Impact of pesticides use in Agriculture, their benefits and hazards. Interdiscip. Toxicol. 2(1): 1-12.

Anonymous. 2019. Agricultural Statistics of Pakistan. Ministry of national food security and research. Government of Pakistan, Islamabad, 1-10.

Atwal, A. S. and B. Singh. 1990. Pest population and assessment of crop losses, Indian. Agri. Res. Inst., New. Delhi..Ind. J. Entomol. 69 (3): 218-220.

Broek, R.V., G.D. Iacovino, A.L. Paradela and M.A. Galli. 2007. Alternative control of Erysiphe cichoearun on okra crop. Ecossistema. 27: 23-26.

Chaitanya, G. and A. Kumar. 2018. Efficacy of selected insecticides and neem products against whitefly (Bemisia tabaci) (Gennadius) of okra Abelmoschus esculentus (L.) Moench. J. Entomol. Zool. Studies., 6(4): 115-117.

Dash, P.K., G. Rabbani and F. Mondal. 2013. Effect of variety and planting date on the growth and yield of okra. Int. J. Bio.Sci. 3(9):123-131.

Dewy, E. 2006. Toxicological studies on some pests attacking cotton. Ph. D. Thesis, Fac. Agric., Kafr El-Sheikh. Univ. Egypt, 101.

Ellsworth, P. C. and J. S. Jones. 2001. Cotton IPM in Arizona: a decade of research, implementation and education. In Proceedings of Beltwide cotton conferences. National Cotton Council, Memphis, TN: 1088-1096.

Fernandes, F.L., L. Bacci, M. S. Fernandes.2010. Impact and Selectivity of Insecticides to Predators and Parasitoids. Entomo. Brasilis. 3(1):01-10.

Hussain, R., A. Ihsan**,** N. Ullah, A.A. Shah, S.F. Shah, M. Usman and M.A. Khan. 2022. Appraisal of Plant Extracts and Chemical Control against Whitefly Bemisia Tabaci, (Genn) and Its Effect on Associated Natural Enemies in Round Chili. Annals of the Romanian Society for Cell Biology, 26(1): 1121–1132.

Kalyan, R.K., D. P. Saini, P.P. Jambhulkar, A. Pareek.2012. Comparative bioefficacy of some new molecules against jassids and whitefly in cotton. The bioscan. 7(4):641-643.

Kar, A. 2017. Bioefficacy evaluation of imidacloprid 17.8% SL and thiamethoxam against whitefly on tomato and their effect on natural enemies. J. Entomol. Zool. Studies., 5(3): 1064-1067.

Khan, M. A. and A. Rub. 2019. Plant spacing affects the growth and seed production of okra varieties. Sarh. J. Agri. 35(3): 751-756.

Kumar, P. and A.Kumar. 2017. Efficacy of Selected Insecticides against Sucking Insect Pests [Amrasca biguttula (Ishida) and Bemisia tabaci (Gennadius)] of okra [Abelmoschus esculentus (L.) Moench]. Int. J. Curr. Microbiol. App. Sci. 6(8): 3256-3259.

Lanjar, A. G. and H. A. Sahito. 2007. Impact of weeding on whitefly, Bemisia tabaci (Genn). Pak. J. Weed. Sci. Rec. 13 (4): 209-217.

Leite, G. L. D., M. Picanco, G. N. Jham and M. D. Moreira. 2005. Whitefly population dynamics in okra plantations. Pesq. Agropec. Bras. 40 (1): 19-25.

Mastoi, A. H., S. A. Memon and W.U. Haq. 2013. Varietal resistance of okra against whitefly (Bemisia tabaci) and fruit borer (Earias spp). J. Agri. Sci. 3 (3): 78-82.

Mehra, S., K. Rolania and M. Rathee. 2018. Management of cotton whitefly Bemisia tabaci (gennadius) (Hemiptera: Aleyrodidae). Ind. J. Entoml. 80(3): 1-4

Neeraja, G., G. Vijaya, C.H. Chiranjeevi and B. Gautham. 2004. Screeening of okra hybrids against pest and diseases. Ind. J. Pl. Protec. 32 (1): 129-131.

Pawar, S.A., P. R. Zanwar, S. G. Lokare, R. P. Dongarjal and M. M. Sonkamble. 2016. Efficacy of newer insecticides against sucking pests of okra. Ind. J. of Entomol. 78(3):257-259.

Rakesh, M., P. Dhawan and B. Vinod. 2006. Evaluation of okra varieties against viral diseases. Ind. J. Virol. 17(2):61.

Rehman, H., M. Nadeem, M. Ayyaz and H. A. Begum. 2015. Comparative Efficacy of Neem Oil and Lambda cyhalothrin against Whitefly (Bemesia tabaci) and Jassid (Amrasca devastanse Dist.) in okra Field. Russian. Agri. Sci. 41(2-3): 138-145.

Rizvi, S. A. H., S. Hussain, S. Rehman, S. Jaffar and M. F. Rehman. 2015. Efficacy of ecofriendly botanical extracts of Ginger (Zingiber officinale), Garlic (Allium sativum) and Tobacco (Nicotiana tabacum L.) for the control of cabbage looper (Trichoplusia binotalis) under agro ecological conditions of Peshawar, Pakistan. J. of Entomol. Zool. 4(1): 88-90.

Rondeau, G., F. S. N. Bayo, H. A. Tennekes, A. Decourtye, R. R. Romero and N. Desneux. 2014. Delayed and time-cumulative toxicity of imidacloprid in bees, ants and termites. Scientific Report. 1-8.

Salehia, B., M. Zarabi and M. Saber. 2013. Toxicity of abamectin and imidacloprid on different life stages of Trialeurodes vaporariorum (Westwood) reared on two different host plants under greenhouse conditions. Archives. Phytopathology. Pl. Protec. 46(20): 2428-2435.

Shannag, H.K., J. M. Al- Qudah, I. M. Makhadmeh and N. M. Freihat. 2007. Differences in growth and yield responses to Aphis gossypii G. between different okra (Abelmoschus esculentus L. Moench) varieties. Pl. Protec. Sci. 43: 109- 116.

Sohail, A., F.S. Hamid, A. Waheed, N. Ahmed, N. Aslam, Q. Zaman, F. Ahmed and S. Islam. 2012. Efficacy of different botanical Materials against aphid Toxoptera Aurantii on tea (Camellia sinensis L.) cuttings under high shade nursery. J. Mater. Environ. Sci. 3(6): 1065-1070. ISSN: 2028-2508