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EFFECT OF ATTRACTOR PLANTS AND PESTICIDES ON THE INTENSITY OF *BEMISIA TABACI* (GENNADIUS.) DISSEMINATION IN IRAQI OKRA PRODUCTION AREAS

Malik H. Karem
Department Of Plant Protection, College Of Agriculture, Al-Muthanna University, Iraq.
E-mail: malik.hasan@mu.edu.iq

Abstract
whitefly, *Bemisia tabaci* (Gennadius), is a significant pest of many crops. Throughout its life cycle, it feeds on the leaves and undersides of the host plants, inflicting direct and indirect harm by piercing leaves, sucking sap, and creating honeydew (on which sooty mold forms), as well as changing growth, photosynthesis, and chemical and phenological processes. The present study evaluated the effect of planting different types of plants around the okra plant to determine the spread and numerical density of the white fly on the okra plant, and the effect of the whitefly on plant functions and physiological characteristics. The results showed that planting eggplant around an okra plant gave significant results, in terms of plant height, leaf area, chlorophyll, and number of fruits and yield per plant. It also gave the lowest number of whitefly adults and eggs. These findings might be useful for gaining a better knowledge of *B. tabaci* effect on plant growth and developing management techniques to successfully control its infestations in a cropping system.
Keywords: Attractor plants; whitefly; Okra; Decrease; Acetamiprid**.**

1. Introduction

Okra, *Abelmoschus esculentus* L. (Moench), belongs to family *Malvaceae*, one of the important summer vegetable crops that are grown in hot and warm regions in Asian and African countries [Wahyuningsih *et al.* (2017)]. Its fruits contain many carbohydrates, protein, and fiber, in addition to fats and minerals [Pitchaimuthu *et al.* (2012)]. The globally cultivated area reached 946 thousand hectares, with productivity of five million tons [FAOSTAT (2019)]. In Iraq, okra is cultivated in the months of March and April. The area planted for the okra yield for the year 2021 is about 44,000 dunams, with a productivity rate of 59,400 tons [Central Statistical Organization (2022)]. *Bemisia tabaci* (Gennadius) (Hemiptera, *Aleyrodidae*) is a worldwide species complex that is considered a severe pest for many crops, *Bemisia tabaci* is a species complex that contains around 40 species. Middle East-Asia Minor I (MEAM1, formerly known as the B biotypes) and the Mediterranean are the two most invasive members of *B. tabaci* on the planet (MED, formerly known as the Q biotypes) [Dickey *et al.* (2013)]. The milky white minute fly, nymphs, and adults cause okra harm by draining the cell sap from plants and okra plant sections. The injury is induced by decapping the plants and depositing honeydew droplets on the foliage, which offer an ideal environment for the growth of sooty mold; as a result, it prevents foliar photosynthesis and decreases crop commercial value [Oliveira *et al.* (2001)]. which causes various damage according to its age. At first, these spots expand and clamp, creating irregular yellow areas as an effect of the absence of chlorophyll, in addition to the toxic effect of the insect's spittle that it secretes during the feeding process, which works to lessen starch in the leaves and thus stops the growth of leaves

that yellow and die. Is a global pest that affects over 900 host plant varieties [Liu *et al.* (2022)]. Non-target plants cultivated within or around the target crop can be used in a "attract and reward" paradigm to reduce insect populations while simultaneously attracting additional natural enemies to the crop. Also, when it absorbs plant saps and transmits many viral diseases [Venkataravanappa et al. (2017)].

This prompted farmers to make excessive use of pesticides found in local markets, and many of these pesticides are from poor industries and are not subject to government control and examination, which leads to an imbalance in the environment and the emergence of insects that carry resistance [Karem, et al. (2022)]. This study aimed to find clean and safe solutions to the problem of the whitefly on the okra plant in Iraq. .

2. Materials and methods

2.1 Experimental design

The field tests were conducted during the growing season of 2021–2022. The experiment was designed in a randomized full-block format (RCBD). Use the local-Hussainawya okra variety. The rows were 3 meters long, and every third row was considered a replication. rows spaced 1.0 m, with 0.50 between-plant spacing. The transactions were as follows:

Table 1: Treatments used and information.

treatment	detail
T0	Okra plant without whiteflies (Conditions of the Court).
T1	Okra plant has grown singly without the use of pesticides..
T2	Okra plant with the use of insecticide (Acetamiprid 20% SL).
T3	Cucumber is placed around the okra plant.
T4	eggplant is placed around the okra plant.
T5	watermelon is placed around the okra plant.
T6	sweet pepper is placed around the okra plant.

Table 2: the attractor plants used in the study.

Common Name	Scientific Name	C.V	Family
Cucumber	*Cucumis sativus* L.	Wessam F1	*Cucurbitaceae*
Eggplant	*Solanum melongena* L.	Dumbito F1	*Solanaceae*
Watermelon	*Citrullus lanatus* L.	TOP CAN F1	*Cucurbitaceae*
Sweet Pepper	*Capsicum annuum* L.	ALESIA F1	*Solanaceae*

2.2 Estimated population trend of *B. tabaci* with different treatments.

2.2.1 Mean number of eggs and adults:

The numbers of eggs and adults were calculated by taking three leaves from different heights of the plant, and the numbers were calculated in cm^2, taking five plants from each replicate.

2.2.2 Studied Adjectives in Okra plant.

Height (cm): Plant height was measured from the ground level to the tip of the longest stem of five plants in centimeters, and a mean value was determined. Each replication was measured 120 days after sowing.

Leaf area (cm^2): The data was collected using the Model-LI-3000 Plant Canopy Analyzer. Each replication was measured 120 days after sowing.

Indirect chlorophyll content (SPAD): The chlorophyll content of okra leaves from each replication was measured using a SPAD meter, and each replication was tested 70 days after seeding.

Number of fruits (fruit/plant): For the whole growth period, the number of fruits produced per plant was tallied from the sample plants, and the average number of fruits produced per plant was recorded and reported as the number of fruits per plant.

Yield per plant (gm): The yields from the beginning to the end of the season were estimated in grams.

% decrease:

$$\% \text{ decrease} = \frac{\text{Value of uninfested plants - Value of infested plants}}{\text{Value of uninfested plants}}$$

The experiment was designed in a randomized complete block design (RCBD). The data was statistically analyzed using GenStat Version 18. (LSD, 0.05).

3. Results and Discussion

3.1 Mean number of eggs and adults

In this study, we investigated how different types of plants planted surrounding okra fields affected the spread and dispersion of whitefly among the target plants. Besides, our study indicates To compare the use of pesticides and the use of insects' preferred plants (non-target plants) as attractive plants, to reduce their spread in the target fields.

The results showed Fig. 1 the density of the number of adult whiteflies was lowest on the okra plant in Treatment T4 when planting eggplant around the okra plant, and either the highest density or there was no significant difference when planting sweet pepper plants around the okra plant. The treatment using cucumber also gave significant results similar to the treatment T4, while the treatment of melon cultivation around the okra plant did not give significant results compared to the two treatments T4 and T3.

While the results of Fig. 2 showed that the rate of egg number of whitefly on okra leaves, decreased significantly in T4 and T3 treatments, T5 and T6 treatments did not give significant results, and the decrease in egg count on okra did not appear clear.

As for the periods, the period after 30 days had the lowest mean number of insects and eggs, then the insect density began to increase for all treatments until it reached its maximum in the period after 75 days, until the numbers declined during 90 days.

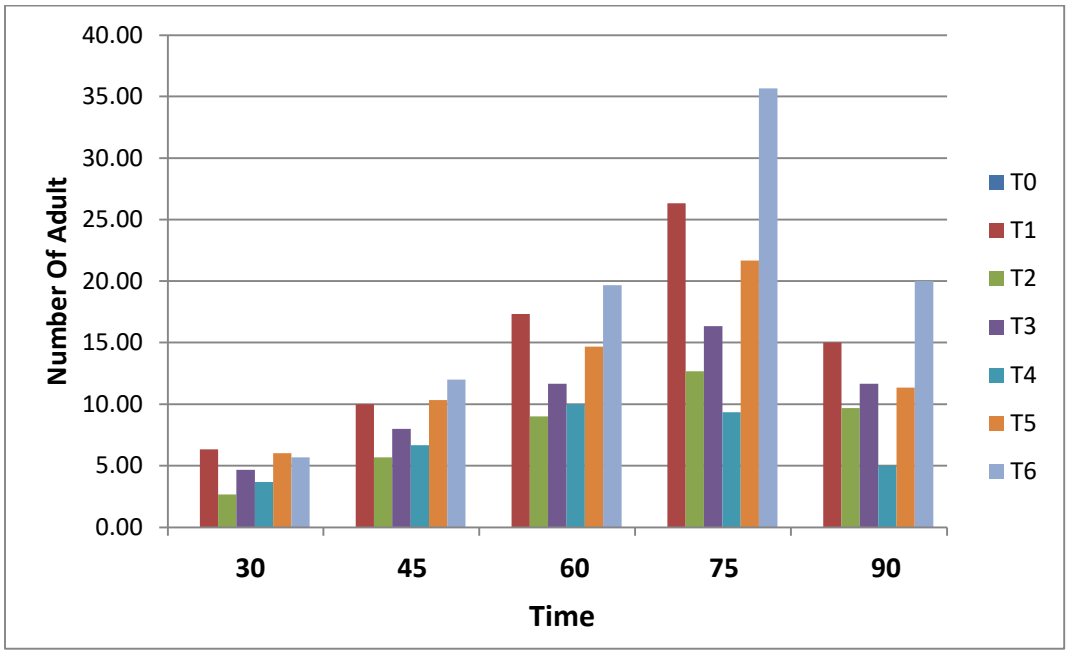


Fig. 1: Mean number of adult of each of three selected leaves per plant. LSD $_{0.05}$ Treatment= 0.849, LSD $_{0.05}$ Time= 0.718, LSD $_{0.05}$ Interaction= 1.898.

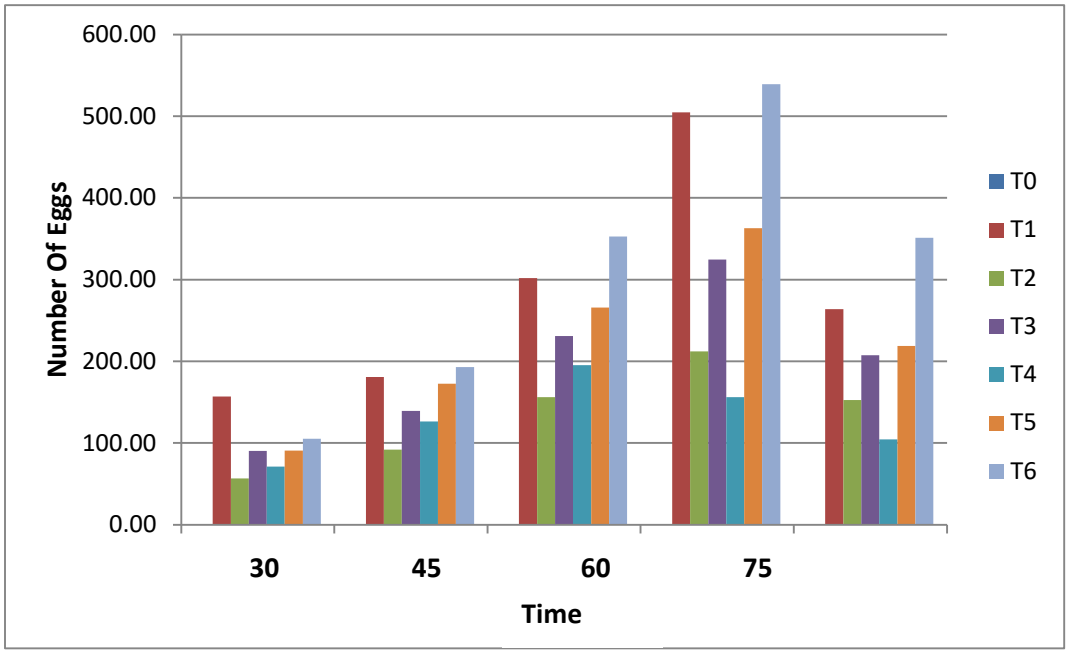


Fig. 2: Mean number of eggs of each of three selected leaves per plant. LSD $_{0.05}$ Treatment= 4.25, LSD $_{0.05}$ Time= 3.592, LSD $_{0.05}$ Interaction= 9.504.

3.2 Studied Adjectives in Okra plant

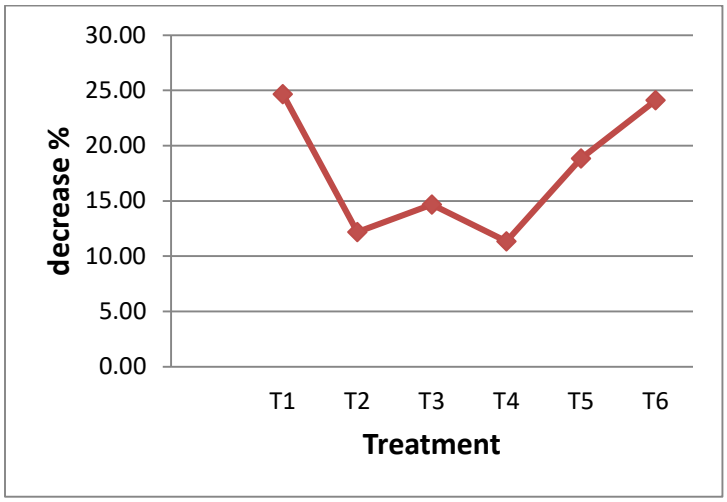
The results of the study of the plant traits in Table 3 showed that for the trait "height," treatment T4 had a significant difference compared to the rest of the treatments, and compared to the control treatment T0 without whitefly, it gave the highest plant height. As for the remaining

transactions, next came the cultivation of cucumbers around okra. As for the leaf area (cm2), treatments T0, T2, and T4 gave the highest leaf area compared to the rest of the treatments. As for chlorophyll content, treatments T0, T2, and T4 gave the highest amount of chlorophyll content. The number of fruits also gave treatment T0 the highest amount, followed by treatments T2 and T4, and the lowest treatment was T6. As for the yield per plant, treatment T0 gave the highest rate, followed by treatments T2, T3, and T4. It is generally understood that leaves are the primary organ for solar radiation absorption and photosynthetic sources in plants; in reality, plant growth and physiological processes determining yield and dry matter production are strongly dependent on their health and activity. *B. tabaci* is one of the most dangerous insect pests because of its direct and indirect plant injuries, which reduce production and quality [Al-Aloosi et al. (2020), Padilha et al. (2021)]. The current research shows the effect of the whitefly on some plant attributes, such as plant height, leaf area, chlorophyll, and yield [de Lima et al. (2021)]. They observed that *B. tabaci* significantly affected several plant-growth parameters of three eggplant cultivars, with a highest reduction percentage of plant height equal to 20.6% in the "Dafeng" variety [Li et al. (2013)]. Contextually, whitefly females' eggs placed on the lower surface of the leaves greatly reduce stomatal conductance because they cover the stomata and prevent their access to light and carbon dioxide [Chand et al. (2018)].

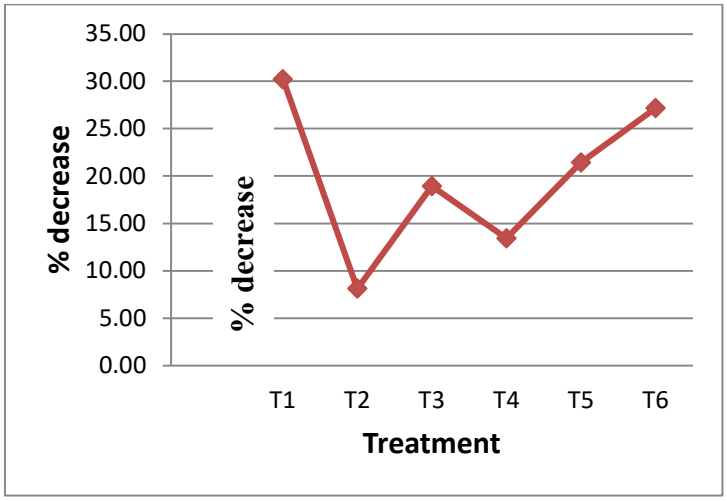
Table 3: Effect of Treatment on the Studied Adjectives

treatment	studied adjectives				
	Height (cm)	Leaf area (cm2)	chlorophyll content (SPAD)	Number of fruits (fruit/plant)	Yield per plant (gm)
T0	120.33	295.67	60.67	65.00	422.33
T1	90.67	206.33	38.33	42.67	306.67
T2	105.67	271.67	54.00	62.00	393.00
T3	102.67	239.67	45.33	54.00	388.67
T4	106.67	256.00	51.33	58.00	387.67
T5	97.67	232.33	43.67	53.33	346.67
T6	91.33	215.33	42.00	47.33	318.67
lsd 0.05	7.629	8.62	1.986	2.388	10.27

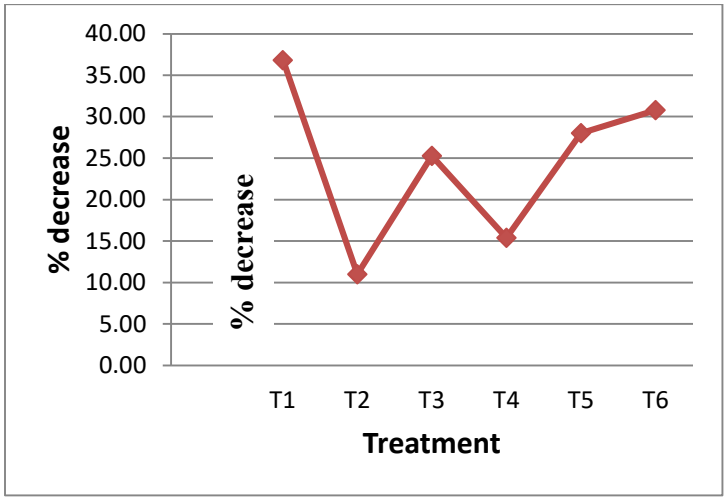
In Fig. 3, the highest level of % decrease in all studied adjectives was given by the T1 treatment, followed by the T6 treatment, which also gave the highest level of % decrease compared to the rest of the treatments.



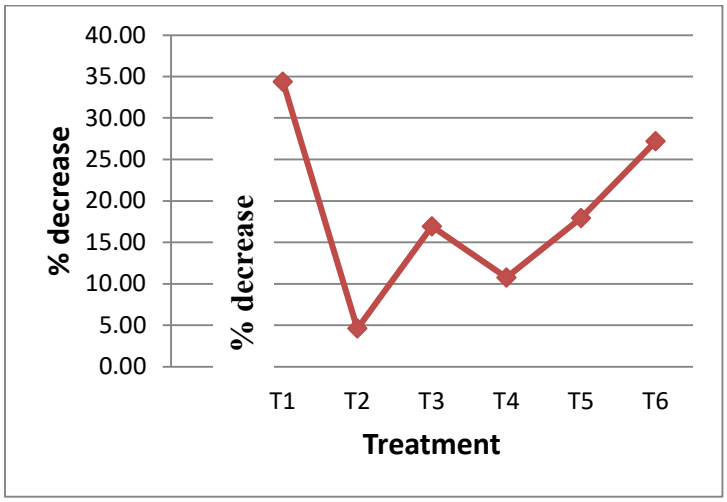
(a)



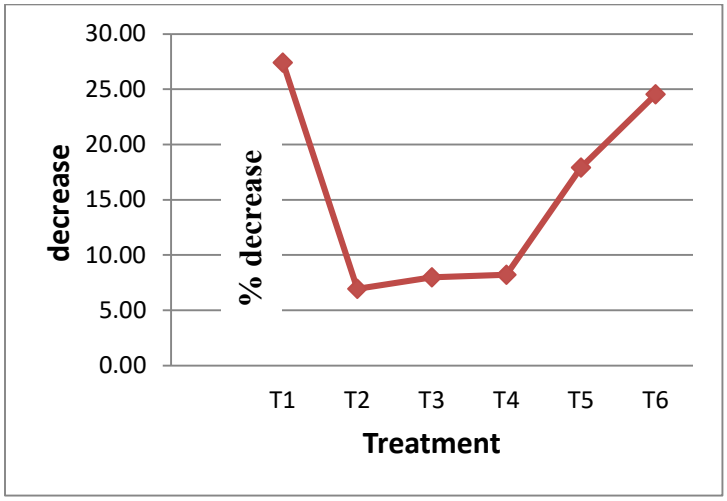
(b)



(c)



(d)



(e)

Fig. 3: % decrease in okra plant height (cm) **(a)**, leaf area (cm2) **(b)**, chlorophyll content (SPAD) **(c)**, number of fruits (fruit/plant) **(d)**, yield per okra plant (gm) **(e)**.

Concerning its host plant, *B. tabaci* is primarily influenced by the following characteristics: the external, physical characteristics of the leaf surface, such as hairiness vs. glabrousness, sticky glandular trichomes, leaf shape (okra/super okra), and likely the microclimate due to foliage density; and (ii) the internal, chemical characteristics of the leaf, including pH of leaf sap [Berlinger (1986)]. Through the results, it was found that the best plant used as an attractant by the white fly is the eggplant plant, followed by the cucumber plant. In a study conducted, the plants cucumber, eggplant, tomato, tobacco, and cotton were used eggplant and cucumber were the most preferred food for the whitefly, In this approach, eggplant can serve as a trap plant, attracting *B. tabaci* while reducing its impact to target plants [Tian et al. (2020)].

4. Conclusions

The current study indicates that the whitefly led to a decrease in the physiological processes of the plant, which was evident in the productivity even when using insecticides. But when planting some

of the plants preferred by the white fly led to a decrease in their numbers on the target plants, we recommend planting eggplant and cucumber around the okra plant, and we do not recommend planting these plants by overlapping the okra plant as it is currently adopted by farmers in Iraq.

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References

Al-Aloosi, A. N. S., Al-Anbaki, H. A. M., & Kamil, S. H. (2020). Host plant resistance, chili pepper to whitefly, *Bemisia tabaci* (Gennadius)(Hemiptera: *Aleyrodidae*) in field. *International Journal of Agricultural and Statistics Sciences*, *16*(1), 103-106.

Berlinger, M. J. (1986). Host plant resistance to *Bemisia tabaci*. *Agriculture, Ecosystems & Environment*, *17*(1-2), 69-82.

Central Statistical Organization (CSO) (2022). Statistics of Area, Yield And Production For Crops And Vegetables For The Year 2019. Available from internet: https://mop.gov.iq/min_publications/view/list?id=22&lastcontent=485#

Chand, R., Jokhan, A., & Prakash, R. (2018). Egg deposition by Spiralling whiteflies (*Aleurodicus dispersus*) reduces the stomatal conductance of cassava (*Manihot esculenta*). *The Wētā*, *52*, 55-60.

de Lima Toledo, C. A., da Silva Ponce, F., Oliveira, M. D., Aires, E. S., Seabra Júnior, S., Lima, G. P. P., & de Oliveira, R. C. (2021). Change in the Physiological and Biochemical Aspects of Tomato Caused by Infestation by Cryptic Species of *Bemisia tabaci* MED and MEAM1. *Insects*, *12*(12), 1105.

Dickey, A. M., Osborne, L. S., Shatters Jr, R. G., Hall, P. M., & McKenzie, C. L. (2013). Population genetics of invasive *Bemisia tabaci* (Hemiptera: *Aleyrodidae*) cryptic species in the United States based on microsatellite markers. *Journal of Economic Entomology*, *106*(3), 1355-1364.

FAOSTAT Database . (2019). Okra world production statistics https://www.fao.org/faostat/en/#data/QCL.

Karem, M. H., Jubair, A. F., Aljabry, S. M. E., & Al-Jayashi, M. T. (2022). Population assessment of whitefly (*Bemisia tabaci* (Genn.)) for ten tomato genotypes. *Texas Journal of Agriculture and Biological Sciences*, *8*, 101-106.

Li, Q., Tan, W., Xue, M., Zhao, H., & Wang, C. (2013). Dynamic changes in photosynthesis and chlorophyll fluorescence in *Nicotiana tabacum* infested by Bemisia tabaci (Middle East–Asia Minor 1) nymphs. *Arthropod-Plant Interactions*, *7*(4), 431-443.

Liu, Z., Chen, W., Zhang, S., Chen, H., Su, H., Jing, T., & Yang, Y. (2022). Behavioral Responses of *Bemisia tabaci* Mediterranean Cryptic Species to Three Host Plants and Their Volatiles. *Insects*, *13*(8), 703.

Oliveira, M. R. V., Henneberry, T. E., & Anderson, P. (2001). History, current status, and collaborative research projects for *Bemisia tabaci*. *Crop protection*, *20*(9), 709-723.

Padilha, G., Pozebon, H., Patias, L. S., Ferreira, D. R., Castilhos, L. B., Forgiarini, S. E., ... & Arnemann, J. A. (2021). Damage assessment of *Bemisia tabaci* and economic injury level on soybean. *Crop Protection*, *143*, 105542.

Pitchaimuthu, M., Dutta, O. P., & Swamy, K. R. M. (2012). Studies on inheritance of Geneic Male Sterility (GMS) and hybrid seed production in okra [Abelmoschus esculentus (L.) Moench.]. *Journal of Horticultural Sciences*, *7*(2), 199-202.

Tian, M., Xu, L., Jiang, J., Zhang, S., Liu, T., & Xu, Y. (2020). Host plant species of *Bemisia tabaci* affect orientational behavior of the ladybeetle Serangium japonicum and their implication for the biological control strategy of whiteflies. *Insects*, *11*(7), 434.

Venkataravanappa, V., Kodandaram, M. H., Lakshminarayana Reddy, C. N., Shankarappa, K. S., & Krishna Reddy, M. (2017). Comparative transmission of *Bhendi yellow vein mosaic virus* by two cryptic species of the whitefly, *Bemisia tabaci* (Hemiptera: *Aleyrodidae*). *3 Biotech*, *7*(5), 1-13.

Wahyuningsih, S. P. A., Pramudya, M., Putri, I. P., Savira, N. I. I., Winarni, D., Suhargo, L., & Win Darmanto, N. I. D. N.(2017). Okra polysaccharides improves spleen weight and B-lymphocytes proliferation in mice infected by Staphylococcus aureus. Biosaintifika (*Journal of Biology & Biology Education*), 9(3), 460-465.