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SUMMARY

Whitefly, ***Bemisia tabaci*** (Genn) is a major pest infesting vegetable crops in Egypt. The pest ***B. tabaci*** attacks these crops during its different developmental stages causing several damages. Therefore, it is important to protect these crops against its insect pest.

The aim of the present work is to throw more light to integrated control program such as, using some hybrid strains of vegetable plants. Also, using some natural compounds, mass rearing and releasing of parasites on the field. In the present work, the obtained results can be summarized as follows:

1- Population density of whitefly ***B. tabaci*** and its parasites at Sabahia region in Alexandria. in different vegetables during nili plantation in two seasons 1999, 2000.

1-1. Hybrid strains of okra plants:

In comparing population density of whitefly ***Bemisia tabaci*** and its parasites on six hybrid strains of okra, the results provided highly significant differences between two seasons 1999, 2000 during nili plantation (4 months). The highest peak of abounding in (Aug., 23, 1999) and (Aug., 19, 2000) there were positive correlation between average temperature, relative humidity and both of whitefly immatures stages and its parasites during two seasons.

The data revealed also that the infestation by whitefly on hybrid strains of okra during seasons 1999, 2000 gradually decreased as follow: (R. X Si.), (R. X F.), (A. X Si. X Si.), (Es. X A. X A.), (R. X Es.) and (A. X F.), respectively. i.e. the R. X Si.

Strain was more susceptible to whitefly than other strains, while (A. X F). strain was the less susceptible strain. Parasites were preferred R. X Si. strain more than other strains while, A. X F. was the less preferable strain during two seasons.

Prevalence of parasites was ***Eretmocerus sp.*** only in June. while two parasites ***Eretmocerus sp.*** and ***Encarsia sp.*** appeared together during July, August. But during September ***Encarsia sp*** appeared only on all strains. The highest whitefly infestations were in July, August, June and September during two seasons. The most abundance of parasites was in July, Aug., Sept. and June during two seasons

1-2 Hybrid strains of tomato

Comparing population of the whitefly and its parasites on three hybrid strains of tomato, the results proved that there were highly significant difference between two seasons 1999, 2000 during nili plantation (4 months). The highest peak of abundance was on (July, 20, 1999) and (August, 1, 2000). There were positive correlations between average temperature, relative humidity and both of whitefly immatures stages and its parasites during two seasons. Data revealed also that infestation on hybrid strains of tomato during two seasons that whitefly decreased gradually as follows: M_{100}, Peto-68 and Mcs. i.e. the M100 strain was more susceptible to whitefly than other strains, while MCs was the lowest susceptible strain.

The finding of parasites was ***Eretmocerus sp.*** in (June, July and August) while ***Encarsia sp*** appeared only in September in

season 1999, whereas in season 2000 ***Eretmocerus sp*** was found in (June, July and August) while ***Encarsia sp*** was during (August and Sept.) The highest whitefly infestation was in July, Aug., June and Sept., respectively, in 1999 season whereas, the highest infestations were in Aug., July, June and Sept. respectively during 2000 season. The highest abundance of parasites was in July, Aug., June and September, respectively during 1999 season, while in Aug., July, June and September during season 2000 respectively.

1-3. Eggplant species

The population densities of whitefly and its parasites were evaluated on three eggplant strains during two seasons 1999, 2000. The results show that, significant difference between whitefly population during two seasons there were highly abundance in season 1999 than in season 2000. The highest peak of abundance was on (September, 1999) and (August, 2000).

There were positive correlations between average temperature, relative humidity and all whitefly immature stages, parasites in the two seasons. Data revealed that there were no significant difference among three strains of eggplant. The Black long strain was infested by whitefly and parasites higher than Black round and white long strain respectively. There were significant differences among average parasites on all strains of eggplant, and the Black long strains was more preferred to parasites than White long and Black round strains, respectively. ***Eretmocerus sp*** was found during July, while ***Eretmocerus sp*** and ***Encarsia sp*** were founded during August and ***Encarsia sp*** only was found only during September and October.

The highest whitefly infestation was found during August, September, July, October and November respectively. August, September, October, July and November were the more suitable months for parasites respectively, during season 1999.In season 2000 the temperature degree and relative humidity were lower than in season 1999. Whitefly infestation on eggplant strains ranged as follows, Black long, Black round and White long, respectively.

The highest preference strains of eggplant to parasites were Black long, White long and Black round strains, respectively. ***Eretmocerus sp*** was found during July, ***Eretmocerus sp*** and ***Encarsia sp*** were during August while ***Encarsia sp*** alone was found during September and October. The highest whitefly infestations were during August, September, October and July. The highest abundance of parasites were in September, August, October and July respectively.

1-4 Hybrid strain of pepper

The population densities of whitefly and its parasites were evaluated on six hybrid pepper strains during two season 1999 and 2000. the results show that, the hybrid pepper were not infested during two season. Thus the comparing between it and Non-hybrids strains and weed ***Poinsitta euphorbia*** which infested by little numbers of whitefly was studied Parasite ***Encarsia sp*** was found on the weed ***Poinsitta sp.*** only during two seasons. There were significant difference between infestation of both whitefly immature stages and its parasites during seasons 1999 and 2000. Infestation in 1999 was higher than that in 2000 season. During season 1999 data indicated that there were significant differents

among whitefly infestation on the three tested species, There were no significant difference between averages parasites on hybrid and no hybrid pepper, but There were significant difference between both of them and the weed ***Poinsitta sp***. .

The highest whitefly immature infestations occurred in August, September, October and July respectively. The highest accounts of parasites were in September, August, October and July. During season 2000, There were also significant difference among whitefly infestation on the three tested species. There are no significant difference between averages parasites on hybrid and non hybrid pepper, but significant different between them and the weed ***Poinsitta sp***. The highest infestation by whitefly immature stages were occurred in August, September, July and October respectively. The highest accounts of parasites were found in August, September, October and July respectively.

1-5 Comparing among four studied vegetable crops

When comparing among the four studied crops (okra, tomato, eggplant and pepper) infested by whitefly and its parasites during two seasons 1999, 2000. Data proved that, the highest infested crop was tomato followed by eggplant, okra and hybrid pepper respectively. Figures proved also, that the highest numbers of parasites were found on okra followed by tomato, eggplant and pepper respectively. In general, tomato was the most susceptible crop among the tested crops and the pepper was the highest resistant crop to whitefly infestation.

2-Effect of Biofly and Jojoba oil on whitefly stages under laboratory conditions.

Seven tested concentration: 0.00625, 0.01250, 0.02500, 0.05000, 0.10000, 0.20000 and 0.40000 cm^3 / 10 L.W from both of Biofly and Jojoba were tested against adults and other stages of whitefly:

2.1. Effect of Biofly on whitefly adults

Statistical analysis ofdata showed that, mortality percentages of adults whitefly were highly increased with the development time and concentration increasing. Data revealed also that, Biofly gave less effect on laid egg during all concentrations except (0.2 and 0.4 cm^3 / 10 L.W.) concentrations, but it was revealed highly effect on hatching of eggs on all concentrations except (0.00625 and 0.01250 cm^3 / 10 L.W.) concentration.

2.2 Effect of Jojoba oil on whitefly adults

Statistical analysis showed that, the highest mortality percentage of adult stages was (100%) observed with the highest concentration (0.2 and 0.4 cm^3 / 10 L.W.) in the fourth, fifth, sixth and seventh days. Data showed also that, the highest percentage of laid-eggs and their hatching (98.20, 67.08% respectively) occurred on the lowest concentration (0.00625 cm^3 / 10 L.W.) followed by reduction percentage of laid eggs gradually until reaching (0.0%) by the concentrations of (0.2 and 0.4 cm^3 / 10 L.W.).

2.3 Ovicidal activity of Biofly against whitefly

Statistical analysis proved that the highest mortality (100%) on pupal for the emergence of 3rd to 4th and adults for emergence of (pupae to adult) stages by concentrations (0.02500, 0.05000, 0.10000, 0.20000 and 0.40000 cm^3 / 10 L.W.) (i.e. all tested concentrations except for 0.00625, 0.01250 cm^3 / 10 L.W.). Data proved also, that the tested concentrations effect on egg hatching increased gradually from the lowest concentration to the highest concentration. Data indicated that, Biofly had higher effects on pupae and adults than on other immature stages.

2.4 Ovicidal activity of Jojoba oil against whitefly.

Statistical analysis revealed that, all concentrations gave 100% mortality for emergence of 1st to 2nd instars except for the two lowest concentrations (0.00625, 0.01250 cm^3 / 10 L.W.). All concentrations gave 100% mortality against pupae and adults except for (0.00625 cm^3 / 10 L.W.) concentration that gave 25.0% mortality. The highest concentrations (0.05000, 0.10000, 0.20000 and 0.40000 cm^3 / 10 L.W.) were gave 100% mortality for egg hatching. This indicates that, Jojoba oil was most effective on first instar larvae than last instars.

3- Effect of Biofly and Jojoba oil on all stages of whitefly and its associated parasites under field conditions.

3.1. On tomato plant

Three hybrid strains of tomato, treated by both of Jojoba oil and Biofly during two seasons 1999 and 2000, proved the following results:

Jojoba oil gave high effect after 24 hrs. on eggs, larvae and pupae. Highest effects of Jojoba were revealed during 1-5 days, and its effect was more rabid, and high on whitefly eggs than on other stages; it gave high effect against reduced parasites.

Biofly effect on whitefly stages during 1-9 days, was more highly effective on larvae and pupae than on eggs. MCs strain was more affected by Biofly than M100 and Peto - 68 strains. Reduction of parasites may be due to the reduction of whitefly larvae and pupae. Both Jojoba and Biofly gave 100% reduction in all tomato strains after 16 days. Generally, Biofly proved to be better control agent for whitefly than Jojoba and gave safe effects on parasites.

3.2 On eggplant plant:

Three eggplant strains were treated with Jojoba oil and Biofly during two seasons 1999 and 2000, Data proved the following results:

Jojoba oil gave high control on whitefly eggs (100% reduction) after 5 days and gave satisfactory effects against parasites. While Biofly gave high control on whitefly larvae and pupae after 9 days. Biofly gave safe effect on parasites in the first period of treatment.

Reduction percentages of whitefly on eggplant reached 100% after 9 days after one spray with Jojoba and Biofly.

3.3 On okra plant:

Six hybrid strains of Okra (R. X Si.), (R. X Es.), (A. X F.), (R. X F.), (A. X Si. X Si.), (Es. X A. X A.) were treated by both of Jojoba oil and Biofly during two seasons 1999, 2000, Data proved the following results:

Okra plant were treated has two sprays during 18 days with Jojoba and Biofly. Jojoba oil proved to be better control agent to whitefly eggs than to other stages during 5 days after first spray while Biofly gave satisfactory control to whitefly larvae and pupae during 9 days after first spray.

Jojoba seems good and rapid control agent for whitefly, While Biofly gave slight control agents for whitefly and safely for parasites, because of the reduction of parasites was associated with whitefly pupae.

4- Preference of whitefly adults and its parasitoid *Encarsia formosa* on three host plants:

On three host plants (tobacco, okra and tomato) whitefly, ***B. tabaci*** and its parasite ***Encarsia formosa*** were reared to study their plant preference.

According to the obtain results, tomato plants were highly preferable to ***E. formosa*** parasite than okra plants. No difference was found between adult parasites -emergence on tomato and okra plants. Results indicated that, whitefly prefer tomato plants, more

than okra and tobacco plant respectively, while parasites could not live on tobacco plant, may be due to the toxic alkaloids in its leaves. The result gave also, parasites reaching (58.5%) on okra plants while reaching 82.3% on tomato plants under the same laboratory conditions. There were no significant differences between parasites emergence on both of tomato and okra (98 %).

5. Biology of *Bemisia tabaci* Genn. on six hybrid pepper under laboratory conditions:

Data revealed that, Diwali and sky line 2 strains were not suitable to infestation with all immature stages. Data showed also that, Possia, Hot chili, Delhi hot and Sanskript were more suitable hybrid strains to whitefly infestation and egg laying but the eggs were not able to continue.

6. Chemical analysis examination of the tested plants.

Alkaloids, unsaturated sterols (triterpenes) and flavonoids were compared on hybrid strains of pepper, non-hybrid pepper and hybrid strains of okra. In the laboratory data indicated that, alkaloid groups in existed all hybrid strains of pepper and in non-hybrid pepper whereas, they did not exist in hybrid strains of okra. Unsaturated sterol groups were existence in all hybrid strains pepper by changeable quantities. Also they did not exist in hybrid strain of okra by changeable quantities whereas they did not exist in non-hybrid pepper.

Flavonoids did not exist finally in all hybrid strains of pepper and they existed with few amounts in non-hybrid pepper, whereas they exist highly in all hybrid strains of okra. The results indicated that, there were negative correlation between existence of alkaloid and stirols together and adult presence and eggs laying ability, while there were positive correlations between flavonoids existence and adult presence and ability of egg - laying.

7. The experiments of release

7.1 Trial of release of the parasite *Encarsia formosa* under semi-field conditions:

Two release levels of the parasitoid ***E. formosa*** to control ***B. tabaci*** were studied under the semi-field conditions. The results indicated that the average of egg to whitefly adult survival for ***B. tabaci*** in absence of ***E. formosa*** was 71.3%, while it was 25.2% in low release (1 female / plant), and 0.9% in high release (three female / plant) while average percentages of parasitism were 42.6%, %, 87.6% in low and high release, respectively. Data indicate that, low release was better than the high release, because the second generations was continuous on low releases. But in high releases, the second generation was weak and the mortality reached to 100% and couldn't produce new host (whitefly pupae) for parasites in some replicates.

7.2 Mass-rearing of ***E. formosa*** and release on Sweet-Potato plants under field conditions:

Under field conditions, mass-rearing of ***E. formosa*** was made on cauliflower plants. The cauliflower leaves containing pupal parasites were cut and release on Sweet Potato plants in the field. Three levels of releases were tested (1 parasite / plant, 3 parasite / plant and 5 parasite / plant). The results showed that , the whitefly control was on low release (1 parasite / plant), but other two release levels were not allowed to continuous parasitism.