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List of Abbreviations (Morphology)

1	M	Male
2	F	Female
3	Co	Compound eyes
4	Om	Ommatidia
5	Ta	Tarsus
6	Hw	Hind wing
6	An	Antenna
7	Ped	Pedicel
8	S1	First Subsegment of antenna
9	S2	Second Subsegment of antenna
10	S3	Third Subsegment of antenna
11	S4	Fourth Subsegment of antenna
12	S5	Fifth Subsegment of antenna
14	TH	Terminal hair
15	LT_{IV}	Long trichoid sensilla
16	T_{II}	Trichoid sensilla type II
17	T_{III}	Trichoid sensilla type III
18	T_I	Trichoid sensilla type I
19	B_I	Basiconic sensilla type I
20	B_{II}	Basiconic sensilla type II
21	B_{III}	Basiconic sensilla type III
22	ST	Styloconic sensilla
23	Cam	Campinoform sensilla
24	H.B	Humped base
25	T_b	Bulbous tips

List of Abbreviations

26	T_c	Cuticular process
27	Li	Lingula
28	Ov	Ovipositor
29	Go	gonapophysis
30	Cl	claspers
31	L.E.S	lateral ecdysial suture
32	W.p	wax particles

Summary

The present studies were carried out in the Experimental Farm of Faculty of Agriculture, Al-Azhar University during 2014-2015 seasons of cantaloupe. The main objectives of the present work were to study Ecological, Physiological and Ultra-Structure Studies on the Whitefly, *Bemisia tabaci* (Gen.) Infesting Cantaloupe and Their Natural Enemies at Assiut.

The obtained results could be summarized as follows:

1- Ecological studies

1.1-Survey of pests and their associated predators recorded on cantaloupe plants at Assiut

Results indicated that the presence of 22 species of arthropods belonged to 17 families and 11 orders. From the species collected, 4 species are considered main pest causing great damage, 6 slightly harmful, and 8 beneficial arthropods as well as unidentified species of true spiders.

1.1.1- Pests

The collected species inhabiting cantaloupe plants can be classified as sucking pests, leaf feeders, and leaf miners. In general of 8 orders (Orthoptera, Thysanoptera, Hemiptera-Heteroptera, Hemiptera- Homoptera, Coleoptera, Lepidoptera, Diptera and Acarina) and 11 families (Gryllotalpidae, Agromyzidae, Cocciniellidae, Pentatomidae, Aleyrodidae, Aphididae, Cicadellidae, Acridiidae, Noctuidae, Thripidae and Tetranychidae).

1. 1.2- Predators

Eight species were identified as entomophagous. They are belonging to 5 orders (Dermaptera, Hemiptera-Heteroptera, Neuroptera, Coleoptera, and Diptera as well as some of the unidentified species of true spiders) and 6 families (Labiduridae, Anthocoridae, Chrysopidae, Coccinellidae, Lygaeidae and Syrphidae). The green lacewing, *Chrysoperla carnea* (Steph.), *scymnus sp.* and the lady beetles, *Coccinella undecimpunctata* L., were the most abundant predators which recorded and identified.

1.2- Dominance and abundance degrees of sucking pests and the associated predators on cantaloupe plants

In general, from the above mentioned results it could be concluded that *B. tabaci* and *T. urticae* seem to be the most important economic pests infesting cantaloupe as indicated by the highest value of dominance and abundance degrees.

However, the high abundance degrees of *M. persicae* and *A. gossypii* which had low dominance degrees indicate that these species could be of economic importance if the environmental conditions changed in their favour. Meanwhile, the species of *Empoasca* and *T. tabaci* which had low values of abundance and dominance are expected to be of little economic importance as they may cause a minor role as pests in cantaloupe plantations in Assiut.

Although the predators, *scymnus sp* and *C. undecimpunctata* seem to be the most numerous predators recovered inhabiting cantaloupe plants.

1.3- Seasonal abundance of the whitefly, *B. tabaci* in cantaloupe:

From the present results it could be observed that, the cantaloupe plants suffered from the attack with nymphs and adults of the *B. tabaci* in the period from vegetative stage to the ripening stages. The population densities of the pest increased progressively from end of May to the third week of June) when the plants were in the end of flowering stage to mid-July when the plants were in the fruit set stage.

1.4- Effect of cantaloupe varieties

The results revealed that varieties of Ideal and Primo of cantaloupe was more susceptible to the whitefly infestation harbouring the highest population of the pest followed by Sundown during the two seasons.

1.5- Effect of Nitrogen fertilization rate

Generally, during, the highest numbers of *B. tabaci* was recorded on the plants received double of the recommended dose of Nitrogen fertilizer. Whereas, the lowest infestation were recorded on the plants in the check plots or received the half and recommended dose of Nitrogen fertilizer, respectively.

2- Physiological studies

The physiological results showed a variation in (total carbohydrate, total protein and total lipids) and digestive enzymes during study period within the fourth instars of *B. tabaci* according to different cantaloupe cultivars (Ideal, Sundown and Primo).

Total carbohydrate levels in immature stages of *B.tabaci* collected from cantaloupe cultivars primo was higher than those in Ideal and sundown. In contrast, total carbohydrate levels in immature stages of *B.tabaci* collected from cantaloupe cultivars Ideal was lower than both.Total protein levels in immature stages collected from cultivar Ideal was significantly lower than Sundown and primo. Although, there were no significant difference between Sundown and Primo cultivars. otherwise, the

content of total lipids showed a significant difference between the two cultivars Ideal and Sun down and between Ideal and Primo but no significant difference between Sundown and Primo. Demonstration of α - amylase activity and lipase in *B. tabaci* nymphal stages showed a significant different in α - amylase and lipase activity, the activity of α - amylase and lipase were highest in immature stages of *B.tabaci* collected from cantaloupe Primo and slightly declined in Sundown, Ideal cultivar was the lowest in two enzymes.

3- Morphological studies

This morphological study showed that there are differences in types, numbers and lengths of sensilla which scattered over the body of whitefly male and female. Morphometric differences were found all over the body.

The antennae of adult of *B.tabaci* are 7-segments on both sexes. Antenna of *B. tabaci* composed of, scape was the first basal segment and above this segment directly the bulbous pedicel, then long flagellum which composed of 5 sub segments. These antennal segments finished by long hair which defined as terminal hair . This hair has looked with long curved trichoid on the tip of the female, while has been a long annular styloconic sensilla on the tip of the male. Antenna of *B. tabaci* possessed several different kinds of sensillae; they were trichoid sensilla (T_I), trichoid sensilla type II, III (T_{II} , T_{III}), long trichoid sensilla (LT_{IV}) which on the females 5 long trichoid sensilla were presented and 7 on the males, Basiconic sensilla type I, II, III (B_I , B_{II} , B_{III}), Styloconic sensilla (ST) that was mentioned firstly in this study in *B.tabaci*, and campainoform sensilla (Cam). There were large differences between lengths of these sensilla on male and female and sometimes differences in lengths and shapes. The diameter of the ommatidia of compound eye on female of *B.tabaci* was greater than the male. In this study, there were no sensilla observed on male and female eyes.

Legs of adult *B. tabaci* consisted of: coxae, trochanters, femora, tibiae, short tarsi and pretarsi. The pretarsus bears a pair of claws. The tarsus of female of *B. tabaci* was longer than the tarsus of male. *B.tabaci* tarsus had different types of sensilla, basiconic sensilla (B_{II}), very long trichoid sensillae (LT_{IV}), trichoid sensilla (T_I , T_{II} , T_{III}). Also, there were large morphometric differences in these sensilla between two sexes.

Summary

The ovipositor of female was composed of two pairs of gonapophyses and the male genitalia consisted of a pair of parameres (claspers), from the tip of the male abdomen. Both male and female genitalia were covered with different sensilla as trichodea sensilla (T_{II}, T_{III}), long trichoid sensilla (LT_{IV}) and basiconic sensilla (B_{II}). Moreover, The female genitalia had basiconic sensilla (B_{II}) which not observed on male genitalia. In contrast, the male genitalia had trichoid sensilla (T_I) but this type of sensilla not observed on the female.

Wings were usually white, the front wings were larger than the hind wings on male and female. Fore and hind wings on both sexes had a different type of sensilla; trichodea sensilla (T_I, T_{II}, T_{III}) and basiconic sensilla (B_I, B_{II}, B_{III})

The final whitefly larval stage was usually termed a puparium, Fourth instars were oval in shape and flattened dorso-ventrally with one segmented antennae and had few sensory organs. In the fourth instar of *B. tabaci*, the ecdysal suture was appeared dorsal and laterally