

PARASITIDS ATTACKING THE EGYPTIAN SPECIES
OF ARMORED SCALE INSECTS
(HOMOPTERA:DIASPIDIDAE)

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Abstract

Eighteen parasitoids associated with the Egyptian armored scale insects (Homoptera: Diaspididae) are recorded. Key to the parasitoids attacking each species of armored scale insects in Egypt, based on the morphology of the adult female, are constructed. The general characters of the adult parasitoids are illustrated, together with more detailed figures of some key characters. Keys are designed for use with slide mounted specimens, and the techniques for their preparation are described.

Key-Words: Parasitoids, Diaspididae, Armored scale insect, Aphelinidae, Encyrtidae.

INTRODUCTION

About 64 species of armored scale insects (Homoptera: Diaspididae) are well known in Egypt (Ezzat and Nada, 1986). Armored scale insects are the most important pests on orchards trees in Egypt (Abd-Rabou, 1997).

Applied biological control by parasitoids has been an effective and highly desirable method of armored scale insects. Utilization of parasitoids provide an inexpensive, non-hazardous means of reducing pest populations and maintaining them often permanently below their economic thresholds (De Bach, 1974). A considerable amount of information on the parasitoids of armored scale insects has been accumulated in Egypt (Priesner & Hosny, 1940). However, no systematic, country wide survey of the parasitoids of those pests has ever been conducted, and very little has been added to their knowledge in recent years. The present work deals with the status of the parasitoids of armored scale insects in Egypt and keys of the female parasitoids associated with each Egyptian armored scale insects.

MATERIALS AND METHODS

General characteristics of the adult parasitoids: The taxonomy of the parasitoids is mainly based on the adult stage. The terminology used is mainly on the publication of Prinsloo (1980), Fig. 1.

Preparation of the parasitoids specimens: Identification of parasitoids was made by examining their adult mounted in Canada balsam according to Prinsloo (1980).

The specimens is placed in a small dish with a smooth wax floor with its ventral side facing upwards. The wings are then removed one by one by breaking them off at the base. This may be done by holding the specimen down with a soft nylon needle and bending the wing backward and forward with a fine, sharpened dissecting needle. The wings are then transferred to a small drop of Canada balsam on a clean glass slide by means of a nylon needle made tacky with balsam. They are now allowed to dry in a dustproof container. One reasonably dry, after two or three days, add a small amount of balsam and cover with a cover-slip of approximately 7 mm in diameter.

Directly after removal of the wings, the body is placed in 10% caustic soda (NaOH) at room temperature in a small syracuse watch-glass which can be numbered. The specimen is left for 24 to 48h, depending on the degree of sclerotization of the body. Clearing is completed when the soft parts of the body have almost or entirely disappeared, and only the sclerotized exoskeleton and genitalia remain.

After clearing, wash the specimen in 15% acetic acid for about 15 min, and then for the same period in distilled water. Omission of the acetic acid bath may be cause certain specimens to burst apart. After washing, dehydrate the specimen through a range of ethyl alcohols, 30%, 50%, 70% and 96% 10-15 min. in each. Immerse in terpeneol for about 20 min. to finally clear and dehydrate the specimen. Transfer the specimen to a droplet of Canada balsam on the slide that contains the wings.

Now, turn the specimen on its back and hold it down with the nylon needle. Using the steel dissecting needle in the free hand, separate the head from the body and transfer it to another droplet of balsam on the slide. The antennae may be removed from the head by carefully pressing against the antennal sockets with the steel needle. As with the other parts, the antennae are mounted together in their own drop of balsam.

In mounting the different parts separately on the slide, arrange them in an inverted position in order to compensate for the 180° inversion of the image which occurs under compound microscope. Hind wings are therefore placed anterior to fore wings and head and body with their posterior ends directed forwards. The head is mounted with the occiput on the surface of the slide, the mouth directed forwards. Place one antenna down on its outer surface, the other on the inner surface.

After mounting, the parts are left for 24 h or so to enable the balsam to set before they are each covered with a separate cover-slip. With the necessary experience, it is possible to fit the cover-slips immediately after mounting, without allowing the parts to shift when the cover-slip pressed down. In any event, the cover-slip is fitted by adding a small drop of balsam to each of the drops in which the parts are embedded, and then carefully lowering the cover-slip onto it. The cover-slip is now gently pressed down until it is just in contact with the specimen and the balsam has spread evenly. Excessive balsam may be cleaned from around the cover-slips with a fine brush dampened with xylene which acts as solvent.

During the course of the mounting and dissecting operations, dust and other impurities may accumulate on the slide, cover-slips and dissecting needles. These foreign particles may easily spoil a slide-mounted specimen which is otherwise of good quality. Slide preparations may be kept free from dust by periodically washing the dissecting needles in xylene throughout the course of the operation and by cleaning the slide and cover-slips with a clean cloth before use. Some makes of slides are not pre-cleaned when manufactured, and these should first be rinsed in alcohol to free the surface from any greasy substance.

RESULTS AND DISCUSSION

List of armored scale insects in Egypt and their parasitoids

1. *Abgrallaspis cyanophylli* (Signoret):

Four species of aphelinid parasitoids were recorded from samples of *A. cyanophylli*. These species are *Aphytis maculicornis* (Masi), *A. mytilaspidis* (Le Baron), *Encarsia citrina* (Craw), and *E. lounsburyi* (Berlese and Paoli).

Key to species of parasitoids of *A. cyanophylli*

1. Antennae 4-6 segmented, fore wing generally with lineae calva

- *Aphytis* (Figs. 5-7) 2
- Antennae 8-9 segmented, fore-wing without linea calve
 *Encarsia* (Figs. 12-13) 3
- 2.1. Head without distinct black bars and margins *A.mytilaspidis*
 Head with well-defined transverse black bar on occiput on each side of foramen
 *A.maculicornis*
- 3.1. Submarginal vein of fore wing with one seta; fore wing abruptly narrowed beyond venation and with apex narrowly rounded, with an inflexion at apex of retinaculum *E.lounsburyi*
- Submarginal vein with two setae, fore wing more or less parallelsided beyond venation and with apex broadly rounded, without an inflexion at apex of retinaculum *E.citrina*

2. *Aonidiella aurantii* (Maskell)

Seven species of aphelinid parasitoids were recorded from samples of *A.aurantii*.

These species are *Aphytis chrysomphali* (Mercet), *A.coheni* De Bach, *A.lingnanensis* Compere, *A.mytilaspidis* (Le Baron), *Encarsia citrina* (Craw), *E.lounsburyi* (Berlese and Paoli), and *Marietta leopardina* Motschulsky.

Key to species of parasitoids of *A.aurantii*

1. Antennae 4-6 segmented; fore wing generally with linea calva 2
- Antennae 8-9 segmented; fore wing without linea calve *Encarsia* 6
- 2.1. Eyes bare; pronotum composed of a single plate, not membranous in the middle; setae on thoracic dorsum short; metanotum at least as long as (Usually distinctly longer than propodeum); propodeum acrenulate; antennal scape with the band short, extending caudad from about middle of ventral margin *M.leopardina*
- Eyes hairy; pronotum membranous in the middle, thus apparently composed of two plates; setae on thoracic dorsum conspicuously longer; metanotum distinctly shorter than propodeum; propodeum with crenulae in the middle of posterior margin *Aphytis* 3
- 3.2. Propodeal crenulae small4
- Propodeal crenulae large 5
- 4.3. Antennel club short, not more than 3 times as long as wide, propodeum short, usually less than 4 times as long as the metanotum *A.mytilaspidis*

- Antennal club long, considerably more than 3 (often 4) times as long as wide, propodeum very long, at least as long as the scutellum *A.chrysomphali*
- 5.3. Body setae somewhat coarser and darker, those on sides of gaster usually distinct, usually 12-14 setae on mesoscutum, 50-70 setae in delta area of fore wings *A.coheni*
- Body setae relatively slender and pale, those on sides of gaster usually invisible or barely discernible, usually 10-12 setae on mesoscutum, 30-50 setae in delta area of fore wings *A.lingnanensis*
- 6.1. Submarginal vein of fore wing with one seta; fore wing abruptly narrowed beyond venation and with apex narrowly rounded, with an inflexion at apex of retinaculum *E.lounsburyi*
- Submarginal vein of fore wing with two setae, fore wing more or less parallelsided beyond venation and with apex broadly rounded, without an inflexion at apex of retinaculum *E.citrina*

3. *Aspidiotus hederae* (Vallot)

Four species of aphelinid parasitoids were recorded from sample of *A.hederae*. These species are *A.lingnanensis* Compere, *A.mytilaspidis* (Le Baron), *Encarsia citrina* (Craw), and *E.lounsburyi* (Berlese and Paoli).

Key to species of parasitoids of *A.hederae*

- 1. Antennae 4-6-segmented; fore wing generally with linea calva *Aphytis* 2
- Antennae 8-9 segmented; for wing without linea calva *Encarsia* 3
- 2.1. Propodeal crenulae large and elongate; thoracic sterna rather faintly dusky *A.lingnanensis*
- Propodeal crenulae small and rounded; thoracic sterna dusky *A.mytilaspidis*
- 3.1. Submarginal vein of fore wing with one seta; fore wing abruptly narrowed beyond venation and with apex narrowly rounded, with an inflexion at apex of retinaculum *E.lounsburyi*
- Submarginal vein with two setae, fore wing more or less parallelsided beyond venation and with apex broadly rounded, without an inflexion at apex of retinaculum *E.citrina*

4. *Chionaspis stanotophri* Cooley

One species of aphelinid parasitoid was recorded from samples of *C.stanotophri*. This species *Ablerus atomon* (Walker).

5. *Chrysomphalus dictyospermi* (Morgan)

Four species of aphelinid and encyrtid parasitoids were recorded from samples of *C.dictyospermi*. These species are *Aphytis* sp., *Encarsia citrina* (Craw), *Habrolepis aspidioti* Compere & Annecke, and *Marietta* sp.

Key to species of parasitoids of *C.dictyospermi*

1. Often less than 1 mm in length; antenna usually with three to eight segments, rarely with nine; mesoscutum with parapsidal sulci always developed; fore wing with marginal vein extremely long; ovipositor never protruding strongly *Aphelinidae* 2
- Often 0.5-6 mm in length; antenna with five to twelve segments; mesoscutum with parapsidal sulci seldom developed; fore wing with marginal vein relatively short; ovipositor rarely protruding strongly caudally; base of fore wing with fine setae extending based in an acuminate area almost to base of wing *H.aspidioti*
2. 1. Antennae 4-6 segmented; fore wing generally with linea calva3
- Antennae 8-9 segmented; fore wing without linea calva; submarginal vein with two setae *E.citrina*
- 3.2. Eyes bare; pronotum composed of a single plate, not membranous in the middle; setae on thoracic dorsum short; metanotum at least as long as (usually distinctly longer than propodeum); propodeum acrenulate .. *Marietta* sp., (Figs. 19-22).

6. *Chrysomphalus ficus* (Ashmead)

Four species of aphelinid and encyrtid parasitoids were recorded from samples of *C.ficus*. These species are *Aphytis chrysomphali* (Mercet), *Encarsia citrina* (Craw), *E.Iounsburyi* (Berlese and Paoli), and *Habrolepis* sp.

Key to species of parasitoids of *C.ficus*

1. Often less than 1 mm. in length; antenna usually with three to eight segments, rarely with nine; mesoscutum with parapsidal sulci always developed; fore wing with marginal vein extremely long; ovipositor never protruding strongly

- *Aphelinidae* 2
- Often 0.5-6 mm. in length; antenna with five to twelve segments; mesoscutum with parapsidal sulci seldom developed; fore wing with marginal vein relatively short; ovipositor rarely protruding strongly caudally *Habrolepis* sp. (Figs. 16-18)
 - 2.1. Antennae 4-6 segmented, fore wing generally with lineae calva, propodeum very long at least as long as the scutellum *A.chrysomphali*
 - Antennae 8-9 segmented, fore wing without lineae calva *Encarsia* 3
 - 3.2. Submarginal vein of fore wing with one seta; fore wing abruptly narrowed beyond venation and with apex narrowly rounded, with an inflexion at apex of retinaculum *E.lounsburyi*
 - Submarginal vein with two setae; fore wing more or less parallelsided beyond venation and with apex broadly rounded, without an inflexion at apex of retinaculum *E.citrina*

7. *Diaspis echnocacti* (Bouche)

One species of aphelinid parasitoid was recorded from samples of *D.echnocacti*. This species is *Aphytis mytilaspidis* (La Baron).

8. *Hemiberlesia latania* (Signoret)

Two species of aphelinid and encyrtid parasitoids were recorded from samples of *H.latania*. These species are *Aphytis mytilaspidis* (Le Baron) and *Habrolepis aspidioti* Compere & Annecke.

Key to species of parasitoids of *H.latania*

1. Mesoscutum with parapsidal sulci always developed; propodeum short, usually less than 4 times as long as the metanotum *A.mytilaspidis*
- Mesoscutum with parapsidal sulci seldom developed, base of fore wing with fine setae extending based in an acuminate area almost to base of wing *H.aspidioti*

9. *Insulaspis pallidula* (Green)

Two species of aphelinid parasitoids were recorded from samples of *I.pallidula*. These species are *Aphytis* sp. and *Encarsia lounsburyi* (Berlese and Paoli).

Key to species of parasitoids of *I.pallidula*

1. Antennae 4-6 segmented; fore wing generally with linea calva *Aphytis* sp.
- Antennae 8-9 segmented; fore wing without linea calva; submarginal vein of fore wing with one setae *E.lounsburyi*

10. *Lepidosaphes beckii* (Newman)

Three species of aphelinid parasitoids were recorded from samples of *L.beckii*. These species are *Aphytis lepidosaphes* Compere, *A.mytilaspidis* (Le Baron) and *Encarsia citrina* (Craw).

Key to species of parasitoids of *L.beckii*

1. Antennae 4-6 segmented; fore wing generally with linea calva..... *Aphytis* sp.
- Antennae 8-9 segmented; fore wing without linea calva; submarginal vein of fore wing with two setae *E.citrina*

11. *Lepidosaphes ulmi* (Linnaeus)

Two species of aphelinid parasitoids were recorded from samples of *L.ulmi*. These species are *Aphytis mytilaspidis* (Le Baron) and *Encarsia citrina* (Craw).

Key to species of parasitoids of *L.ulmi*

1. Antennae 8-9 segmented; fore wing without lineaa calva; submarginal vein of fore wing with two setae; fore wing more or less parallelsided beyond venation *E.citrina*
- Antennae 4-6 segmented; for wing generally with linea calva; propodeum short, usually less than 4 times as long as the meatnotum *A.mytilaspidis*

12. *Leucaspis riccae* Targioni-Tozzetti

One species of aphelinid parasitoid was recorded from samples of *L.ricca*. This pecies is *Aphytis* sp.

13. *Lindingaspis floridana* Ferris

Two species of aphelinid parasitoids were recorded from samples of *L.floridana*. These species are *Aphytis lingnanensis* Compere, and *Encarsia citrina* (Craw).

Key to species of parasitoids of *L.floridana*

1. Antennae 8-9 segmented; fore wing without linea calva; submarginal vein of fore wing with two setae; fore wing more or less parallelsided beyond venation *E.citrina*

- Antennae 4-6 segmented; fore wing generally with linea calva; propodeal crenulae large and elongate; thoracic sterna rather faintly dusky *A.lingnanensis*

14. *Mycetaspis personata* (Comstock)

One species of aphelinid parasitoid was recorded from samples of *M.personata*. This species is *Aphytis mytilaspidis* (Le Baron).

15. *Parlatoria blanchardii* (Targioni-Tozzetti)

One species of aphelinid parasitoid was recorded from samples of *P.blanchardii*. This species is *Aphytis phoenicis* De Bach & Rosen.

16. *Parlatoria oleae* (Colveè)

Six species of aphelinid parasitoids were recorded from samples of *P.oleae*. These species are *Aphytis chrysomphali* (Mercet), *A.diaspidis* (Howard), *A.maculicornis* (Masi), *Encarsia aurantii* (Howard), *Coccophagoides* sp., and *Marietta leopardina* Motschulsky.

Key to species of parasitoids of *P.oleae*

1. Antennae 4-6 segmented 2

- Antennae 8-9 segmented 5

2.1. Eyes bare; pronotum composed of a single plate, not membranous in the middle setae on thoracis dorsum short; metanotum at least as long as (Usually distinctly longer than) propodeum; propodeum acrenulate *M.leopardina*

- Eyes hairy; pronotum membranous in the middle, thus apparently composed of two plates; setae on thoracic dorsum conspicuously longer; metanotum distinctly shorter than propodeum; propodeum with crenulae in the middle of posterior margin *Aphytis* 3
- 3.2. Head without distinct black bars and margins; propodeum 6-8 times as long as the metanotum; the crenulae usually non overlapping; ovipositor not more than 1 2/3 times length of middle tibia *A.chrysomphali*
- A narrow, well-defined transverse black bar on occiput on each side of foramen 4
- 4.3 Propodeal crenulae rounded; ovipositor 1 1/3 to 1 3/4 times length of middle tibia *A.diaspidis*
- Propodeal crenulae elongate; ovipositor 1 2/3 times to nearly twice length of middle tibia *A.maculicornis*
- 5.1. Submarginal vein with 2 setae; ovipositor short, not more than three quarters the length of middle tibia and originating from segment VI..... *E.aurantii*
- Submarginal vein with 3 or more setae *Coccophagoides* sp... (Figs. 8-11)

17. *Parlatoria ziziphi* (Lucas)

Four species of aphelinid and encyrtid parasitoids were recorded from samples of *P.ziziphi*. These species are *Aphytis chrysomphali* (Mercet), *Encarsia citrina* (Craw), *Marietta leopardina* Motschulsky, and *Habrolepis aspidioti* Compere & Annecke.

Key to species of parasitoids of *P.ziziphi*

- 1. Often less than 1 mm. in length; antennae usually with three to eight segments, rarely with nine; mesoscutum with parapsidal sulci always developed; fore wing with marginal vein extremely long; ovipositor never protruding strongly *Aphelinidae* 2
- Often 0.5-6 mm. in length; antenna with five to twelve segments; mesoscutum with parapsidal sulci seldom developed; fore wing with marginal vein relatively short; ovipositor rarely protruding strongly caudally, male funicle two segmented *H.aspidioti*

- 2.1. Antennae 4-6 segmented; fore wing generally with linea calva3
- Antennae 8-9 segmented; fore wing without linea calva; submarginal vein with two setae; fore wing more or less parallel-sided beyond venation and with apex broadly rounded, without an inflexion at apex of retinaculum *E.citrina*
- 3.2. Eyes bare; pronotum composed of a single plate, not membranous in the middle setae on thoracic dorsum short; metanotum at least as long as (usually distinctly longer than) propodeum; propodeum acrenulate *M.leopardina*
- Eyes hairy; pronotum membranous in the middle, thus apparently composed of two plates; setae on thoracic dorsum conspicuously longer; metanotum distinctly shorter than propodeum; propodeum with crenulae in the middle of posterior margin, ovipositor not more than $1 \frac{2}{3}$ times length of middle tibia *A.chrysomphali*

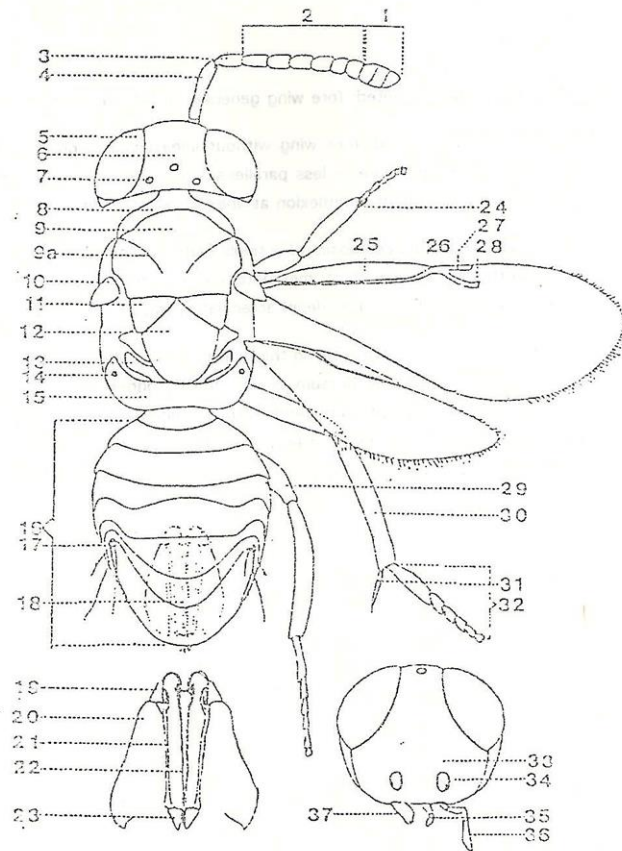


Fig. 1. Female chalcidoid, schematic, with parts named. 1. Antennal club, 2. Antenna funicle, 3. Pedicel, 4. Seape, 5. Compound eye, 6. Frontovortex, 7. Ocellus, 8. Pronotum, 9. Mesoscutum, 9a. Parapsidal spiracle or sulcus, 10 Tegula, 11. Axilla, 12. Scutellum, 13. Metanotum, 14. Propodeal spiracle, 15. Propodeum, 16. Gaster, 17. Cercal plate, 18. Ovipositor, 19. First valvifer, 20. Outer plate (second valvula), 21. Inner plate (second valvifer), 22. Shaft of ovipositor, 23. Gonostylus (third valvula), 24. Strigil, 25. Submarginal vein, 26. Marginal vein, 27. Postmarginal vein, 28. Stigmal vein (radial vein), 29. Hind femur, 30. Mid tibia, 31. Tibial spur, 32. Tarsus, 33. Serobe, 34. Torulus (antennal socket), 35. Labial palpus, 36. Maxillary palpus, 37. Mandible.

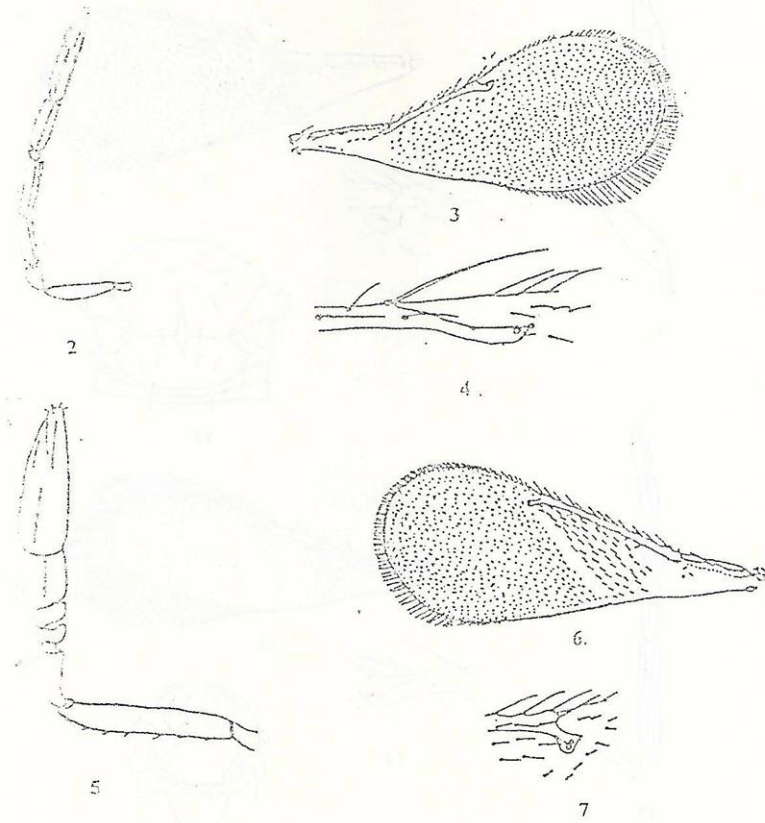


Fig. 2-7. 2-4, *Alerus* sp.: 2. Female antenna, 3. Fore wing, 4. Distal veins of fore wing, 5-7. *Aphytis* sp.: 5. Female antenna, 6. Fore wing, 7. Distal veins of fore wing.

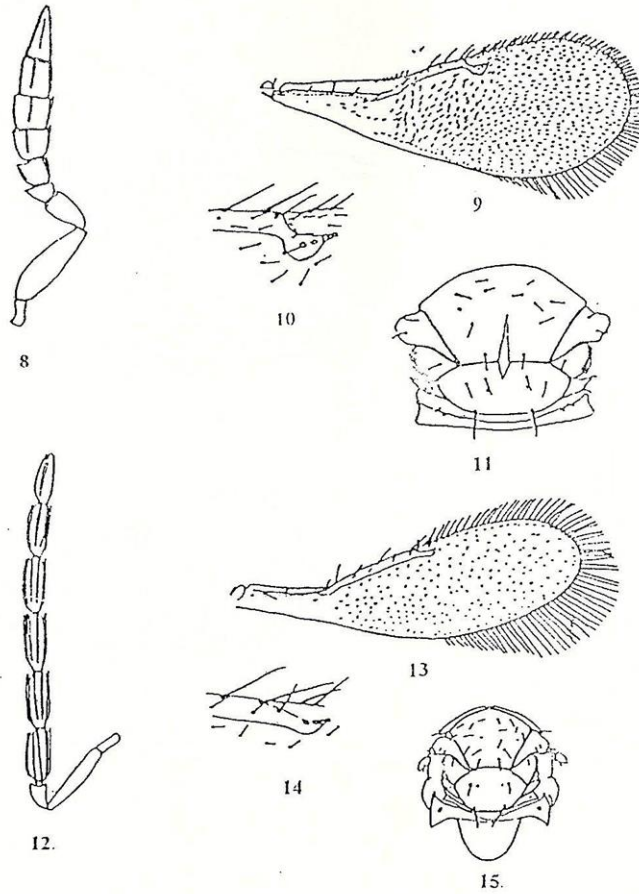


Fig. 8-15. 8-11, *Coccophagoides* sp.: 8. Female antenna, 9. Fore wing, 10. Distal veins of fore wing, 11. Thoracic dorsum. 12-15, *Encarsia* sp. : 12. Female antenna, 13. Fore wing, 14. Distal veins of fore wing, 15. Thoracic dorsum.

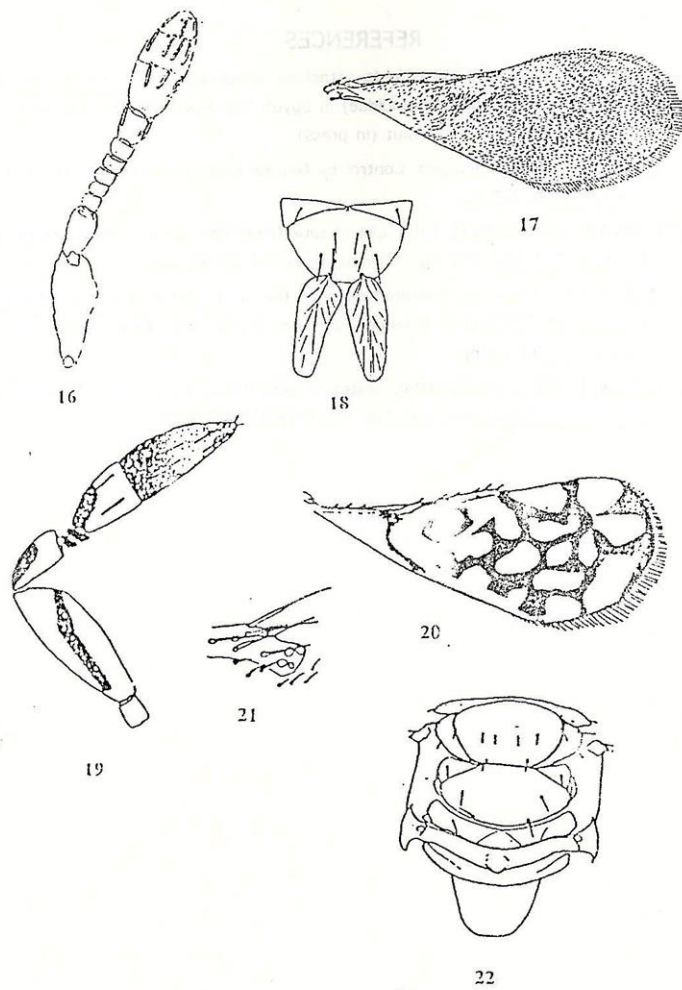


Fig. 16-22. 16-18, *Habrolepis* sp.: 16. Female antenna, 17. Fore wing, 18. Dorsal aspect of scutellum, 19-22, *Marietta* sp. : 19. Female antenna, 20. Fore wing, 21. Distal veins of fore wing, 22. Thoracic dorsum.

REFERENCES

- 1 . Abd-Rabou, S. 1997. Parasitoids attacking some species of scale insects (Homoptera: Coccoidea: Diaspididae) in Egypt. The First Scientific conference of Agricultural Sciences, Assiut (In press).
- 2 . De Bach, P., 1974. Biological Control by Natural Enemies. Cambridge University Press, London, 323 pp.
- 3 . Ezzat, Y.M. and S.A. Nada, 1986. List of superfamily Coccoidea as known to exist in Egypt. Bull. Lab. Ent. Agr. "Fillippo Silvestri", 43: 85-90.
- 4 . Prinsloo, G.L., 1980. An illustrated guide to the families of African Chalcidoidea (Insecta: Hymenoptera). Science Bull. Dep. Agric. Fish. Republic of South Africa, No. 395: 66 pp.
- 5 . Priesner, H. and M. Hosny. 1940. Notes on parasites and predators of Coccidae and Aleyrodidae in Egypt. Bull. Soc. Ent. Egypte, 24: 58-70.

الطفيليات التي تتطفل علي الحشرات القشرية في مصر

شعبان عبد ربه

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - جيزه.

تم في هذا العمل تسجيل عدد ١٨ طفيل مصاحبة للحشرات القشرية في مصر ، إلي جانب مفاتيح تصنيفيه للطفيليات المصاحبه لكل نوع من الحشرات القشرية التي تم تجميعها أعتمادا علي التشريح المورفولوجي لاناث الحشرة الكاملة. الصفات العامه للحشرات الكامله قد تم أيضا وصفها إلي جانب طريقه تحضير الطفيليات المتخصصة علي الحشرات القشرية.