PARASITOIDS ATTACK MEALYBUGS (HOMOPTERA: COCCOIDEA: PSEUDOCOCCIDAE) IN EGYPT

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(Manuscript received October 2000)

Abstract

Twenty six hymenopterous parasitoid species (Hymenoptera: Aphelinidae, Encyrtidae, Platygastridae, Signiphoridae) attack twenty mealybug species (Homoptera: Coccoidea: Pseudococcidae) are recorded in Egypt. The other twenty-five recorded mealybug species in Egypt have no records of parasitoids. Keys to these parasitoids were structured for each species of mealybugs. Identification was based on the taxonomic characters of the adult female. Detailed figures were constructed for some key characters. List of eighteen parasitoids and eight hyperparasitoids of Egyptian mealybugs are given.

INTRODUCTION

Mealybugs comprise some of the worst pests of fruit and shade trees in many parts of the world especially in tropical and subtropical countries.

Parasitoids play a good role in controlling mealybug species. This statement agree with findings of Noyes & Hayat (1994), Mo Fadyen (1979), Katsyvannos (1963) and Lohr et al. (1990). Priesner & Hosny (1940), Moursi (1948 a,b,c), Compere (1938), Atla (1997) and Abd-Rabou (2000 a, b), whom recorded nine parasitoids associated with mealybugs in Egypt.

This work stresses on hymenopterous parasitoids attacking mealybugs in Egypt. Identification of collected species during the last three years associated with mealybugs as well as keys of the parasitoids of each species of mealybugs are given.

LIST OF MEALYBUGS IN EGYPT AND THEIR PARASITOIDS

1. Amonotherium arabicum Ezat: One encyrtid parasitoid was collected from samples of A. arabicum. This species is Acerophagus sp.

2. Antonina graminis (Maskell): Six species of signiphorids and encyrtids were recorded and collected from concerned specimen under investigation. These are: Acerophagus sp., Anagyrus shahidi Hayat, A. pseudococcí (Girault), Chartocerus sub-
KEY TO SPECIES OF PARASITOIDS OF *A. GRAMINIS*

1. Funicle present .................................................. *Encyrtidae* ................................................................. 2

   - Funicle absent, but with 1-4 anelli; forewing 3 times as long as wide, longest marginal
     cilia 1/2-2/3 width of disc, submarginal vein with 2 setae .............................................
     *Chariocerus subaeneus* (Foerster) (Fig. 9)

2(1). Funicle 5-segmented ........................................... *Acerophagus* sp. (Fig. 1)

   - Funicle at least 6-segmented ........................................ 3

3(2). Forewing shortened, clearly not reaching apex of gaster ..............................................

   - Forewing normal, at least very nearly reaching apex of gaster .................................... 4

4(3). Forewing without hyaline fasciae distal of apex of venation ........................................

   - Forewing more or less generally suffused pale fuscous or with only longitudinal infuscate
     streaks adjacent to venation or with a pattern of dark and pale setae ............................... 5

5(4). Frontovertex less than one-third head width .................................................................

   - Frontovertex about half head width ..............................................................................

3. *Antonina natalensis* Brain: No parasitoids were collected from this species.

4. *Brevennia rehi* (Lindinger): Two species of encyrtids were collected and recorded
   from concerned specimens under investigation. These are: *Rhopus nigriclavus* (Girault)
   and *Cheiloneurus* sp.

KEY TO SPECIES OF PARASITOIDS OF *B. REHI*

1. Hypopygium reaching apex of gaster at least four-fifths along gaster, clava not longer
   than funicle ........................................................................... *Rhopus nigriclavus* (Girault) (Fig. 28)

   - Hypopygium reaching apex of gaster not more than two-thirds ....................... *Cheiloneurus* sp.

5. *Chorizococcus halli* Mckenzie & Williams: One encyrtid parasitoid was collected
   from samples of *C. halli*. This species is *Leptomastix* sp.

6. *Crisicoccus delotti* Ezzat: No parasitoids were collected from this species.
7. *Crisicoccus mangrovicus* Ben-Dov: No parasitoids were collected from this species.

8. *Dysmicoccus boninis* (Kuwana): Two species of encrytids were collected from concerned specimen under investigation. These are: *Rhopus nigriclavus* (Girault) and *Anagyrus* sp.

**KEY TO SPECIES OF PARASITOIDS OF *D. BONINIS***

1. Scape normally from 2:3 times as long as broad, linea calva interrupted ........................................................................................................ *Anagyrus* sp.
   - Scape normally 5 times as long as broad, linea calva not interrupted, clava not longer than funicle ........................................................................................................ *Rhopus nigriclavus* (Girault)

9. *Dysmicoccus brevipes* (Cockereil): Four species of signiphorids, and encrytids were collected and recorded from concerned specimen under investigations. These are: *Anagyrus pseudococcii* (Girault), *Leptomastidae abnormis* (Girault), *Leptomastix dactylopilii* Howard and *Chartocerus subaeneus* (Foerster).

**KEY TO SPECIES OF PARASITOIDS OF *D. BREVIPES***

1. Funicle present ................................................. *Encyrtidae* .......................................................... 2
   - Funicle absent, but with 1-4 anelli; forewing 3 times as long as wide, longest marginal cell 1/2-2 3 width of disc, submarginal vein with 2 setae ........................................................................................................ *Chartocerus subaeneus* (Foerster)

2(1). Scape normally from 2:3 times as long as broad, linea calva interrupted, frontovertex less than one-third head width ........................................... *Anagyrus pseudococcii* (Girault)
   - Scape normally 5 times as long as broad, linea calva not interrupted .......... 3

3(2). First funicle segment not longer than pedicel, marginal vein is shorter than the siginal ........................................................................................................ *Leptomastidae abnormis* (Girault) (Figs, 18-19)
   - First funicle segment at least 1.5 times as long as pedicel, forewing not more than about 2.5 times as long as broad ........................................................................................................ *Leptomastix dactylopilii* Howard (Figs, 16-17)

10. *Dysmicoccus trispinosus* (Hall): No parasitoids were collected from this species.

11. *Erinococcus limoniastri* (Priesner & Hosny): No parasitoids were collected from this species.
12. *Euripersia artemisiae* (Hall): No parasitoids were collected from this species.

13. *Ferrisia virgata* (Cockerell): Nine species of encyrids were collected and recorded from concerned specimen under investigations. These are: *Acerophasus* sp., *Anagyrus kamali* Mounsi, *Blepyrus insularis* (Cameron), *Gyranusoides indica* Shafee, Alam and Agarwal, *Homalotylus vicinus* Silvestri, *Leptomastilae abnormis* (Girault), *Leptomastix dactylopilii* Howard, *Prochiloneurus aegypticus* (Mercet) and *Chartocerus subcaeneus* (Foerster).

**KEY TO SPECIES OF PARASITOIDS OF *F. VIRGATA***

| 1. Funicle present | ..........................Encyridae ..........................2 |
| .......................... | ..........................Acerophasus sp. .......................... |
| - Funicle absent, but with 1–4 anelli; forewing 3 times as long as wide, longest marginal cilia 1/2–2/3 width of disc, submarginal vein with 2 setae | ..........................Chartocerus subcaeneus (Foerster) .......................... |
| 2(1). Funicle 5-segment | .......................... |
| - Funicle at least 6-segmented | ..........................3 |
| 3(2). Forewing shortened, clearly not reaching apex of gaster | ..........................Challoneurus sp. .......................... |
| - Forewing normal, at least very nearly reaching apex of gaster | ..........................4 |
| 4(3). Scutellum without a distinct tuft or bundle of setae or scale like setae | ..........................Prochiloneurus aegypticus (Mercet) .......................... |
| - Scutellum with a group of coarse, long dark setae arranged in a more or less compact tuft or bundle or with two or more scale like setae, marginal vein at least nearly as long as stigmal vein | ..........................Blepyrus insularis (Cameron) (Fig. 8) .......................... |
| 5(4). First funicle segment not longer than broad | ..........................6 |
| - First funicle segment longer than broad | .......................... |
| 6(5). Notaular lines present. Funicle 7-segmented | ..........................Himalotylus vicinus Silvestri (Figs, 14-15) .......................... |
| - Notaular lines absent | ..........................7 |
| 7(6). Scape more than 3 times as long as broad, forewing not more than about 2.5 times as long as broad | ..........................Leptomastix dactylopilii (Howard) .......................... |
| - Scape not more than 3 times as long as broad | ..........................8 |
| 8(7). Forewing with one or two distinct fusca bands, marginal vein shorter than the stigmal | ..........................Leptomastilae abnormis (Girault) .......................... |
| - Forewing with infuscation limited to longitudinal streaks adjacent to venations | ..........................9 |
| 9(8). Forewing with postmarginal vein at least a little longer than stigmal vein | ..........................vein distinctly longer than stigmal vein .......................... |
14. **Greeneripersia kaiseri** Bodenheimer: No parasitoids were collected from this species.

15. **Heliococcus osborni** (Sanders): No parasitoids were collected from this species.

16. **Heterococcus cypri** (Hall): No parasitoids were collected from this species.

17. **Humococcus machenzi** Ezzat: No parasitoids were collected from this species.

18. **Krlischenkella sacchari** (Green): Two species of encyrtids were collected and recorded from concerned specimen under investigation. These are: *Rhopus nigriclavus* (Girault) and *Anagyrus saccharicola* Timberlake.

**KEY TO SPECIES OF PARASITOIDS OF K. SACCHARI**

2(1). Scape normally from 2-3 times as long as broad, lineae calva interrupted, stigma vein about as long as marginal vein .................................................. Anagyrus saccharicola Timberlake (Fig. 6)

- Scape normally 5 times as long as broad, lineae calva not interrupted, clava not longer than funicle .................................................. Rhopus nigriclavus (Girault)

19. **Macconellicoccus hirsutus** (Green): Twelve species of aphelinids, encyrtids, signiphorids and platygastrids were collected and recorded from concerned specimen under investigation. These are: *Allotropa* sp., *Anagyrus greeni* (Howard), *A. kamali* Mouri, *A. pseudococcis* (Girault), *Gyranusidae indica* Shafee, Alam and Agarwal, *Homaloctys vicinus* Silverst., *Leptomastix nigrocoaxalis* Compere, *Rhopus nigriclavus* (Girault), *Chartocerus subaeneus* (Foerster), *Mallotta leopoldina* Motschulsky, *Prochiloneurus annulatus* (Ferriere) and *Prochiloneurus avenicus* (Ferriere).

**KEY TO SPECIES OF PARASITOIDS OF M. HIRSUTUS**

1. Pronotum quadrate, not reaching tegulae; antennae usually enbowed, number of antennal segments, forewing with five or fewer cells ................ Chaetoididea .............. 2
- Pronotum triangular in a lateral view, reaching tegulae; antennae elbowed or filiform, number of antennal segments (7-15); forewings with few or fewed closed cells, submarginal vein without setae..........................................................Allo tropa sp. (Fig. 27)

2(1). Funicle present ...........................................................................................................3
- Funicle absent, but with 1-4 anelli; forewing 3 times as long as wide, longest marginal cilia 1/2-2/3 width of disc, submarginal vein with 2 setae .................................................................Chartocerus subaeus (Foerster)

3(2). Mesopleuron large and without a femoral groove.................................................4
- Mesopleuron impressed and with a femoral groove, antennal scape slender, or moderately flattened, not less than twice as long as wide .................................................................Marietta leopoldina Motschulsky (Fig. 23)

4(3). Forewing shortened, clearly not reaching apex of gaster .................................5
- Forewing normal, at least very nearly reaching apex of gaster; Hypopygium reaching or very nearly reaching apex of gaster; scape normally 5 times as long as broad; linea calva not interrupted and clava not longer than funicle .................................................................Phopous nigriclavus (Girault)

5(4). Scutellum without a distinct tuft or bundle of setae or scale like setae..........7
- Scutellum a group of coarse, long dark setae, arranged in a more or less compact tuft or bundle or with two or more scale like setae, marginal vein at least nearly as long as stigmal vein .........................................................................................................................6

7(5). Notaular lines present. Funicle 7-segmented..........................Homalotylus vicinus Silvestri
- Notaular lines absent ...........................................................................................................8

8(7). Scape more than 3 times as long as broad, forewing with linea calva interrupted by at least five setae ............Leptomastix nigrocoxalis Compere (Figs, 20-21)
- Scape not more than 3 times as long as broad .....................................................................................9

9(8). Forewing with one or two distinct fuscus bands, marginal vein shorter than the stigmal .................................................................Leptomastidae abnormis (Girault)
- Forewing with infuscation limited to longitudinal streaks adjacent to venations ...

.................................................................10

10(9). Forewing with postmarginal vein at least a little longer than stigmal vein, marginal vein distinctly longer than stigmal vein...........................................................................................................Gyranoidea indica Shafee, Alam and Agarwal
- Forewing with postmarginal vein not longer than stigmal vein..............................................11

11(10) First funicle segment dark brown, remainder of flagellum brown.................................Anagyrus kamali Mouri
- First funicle segment brown or dark brown, remainder of flagellum white........12

12(11) Gaster longer than thorax..................................................Anagyrus greeni (Howard) (Fig. 3)
20. Miroccoccus inermis (Hall): No parasitoids were collected from this species.

21. Misericoccus imperatae (Hall): No parasitoids were collected from this species.

22. Naiacoccus minor Green: No parasitoids were collected from this species.

23. Nipaeccoccus nipae (Maskell): No parasitoids were collected from this species.

24. Nipaeccoccus viridis (Newstaed): Eight species of aphelinids, encyrtids and signiphorids were collected and recorded from concerned specimen under investigation. These are: Acerophagus sp., Anagyrus aegyptiacus Moursi, Anagyrus pseudococci (Girault), Leptomastix flava Mercet, L. nigrocoxalis Compere, Chartocerus subaeneus (Foerster), Marietta leopoldina Motschulsky and Prochiloneurus sp.

KEY TO SPECIES OF PARASITOIDS OF N. VIRIDIS

1. Funicle present........................................................................................................2

   - Funicle absent, but with 1-4 anelli; forewing 3 times as long as wide, longest marginal
cilia 1/2-2/3 width of disc, submarginal vein with 2 setae ..............................................

      ......................................................Chartocerus subaeneus (Foerster)

2(1). Mesopleuron large and without a femoral groove..............................................3

   - Mesopleuron impressed and with a femoral groove, antennal scape slender, or
moderately flattened, not less than twice as long as wide ...........................................

      ..............................................................................................Marietta leopoldina Motschulsky

3(2). Funicle 5-segmented....................................................................................Acerophagus sp.

   - Funicle at least 6-segmented.................................................................................4

4(3). Scutellum without a distinct tuft or bundle of setae or scale like setae..............5

   - Scutellum with a group of coarse, long dark setae arranged in a more or less comp-
pack tuft or bundle or with two or more scale like setae, marginal vein at least
nearly as long as stigmal vein ......................................................................................Prochiloneurus sp.

5(4). Scape more than 3 times as long as broad.......................................................6

   - Scape not more than 3 times as long as broad.....................................................7

6(5). Second funicle segment with sensila ..................................................Leptomastix flava Mercet (Fig. 22)

   - Second funicle segment without sensila .............................................................Leptomastix nigrocoxalis Compere

7(5). Second funicle segment dark brown ..............................................................Anagyrus aegyptiacus Moursi

   - Second funicle segment white .................................................................Anagyrus pseudococci (Girault)
25. *Octococcus salsolicola* (Priesner & Hosny): Two species of encyrtids were collected and recorded from concerned specimen under investigation. These are: Gyranoidea sp. and Prochiloneurus sp.

**KEY TO SPECIES OF PARASITOIDS OF O. SALSOLICOLA**

1. Scutellum without a distinct tuft or bundle of setae or scale like setae, marginal vein distinctly longer than stigmal vein ..............................................Gyranoidea sp.

   - Scutellum with a group of coarse, long dark setae arranged in a more or less compact tuft or bundle or with two or more scale like setae, marginal vein at least nearly as long as stigmal vein ..................................................Prochiloneurus sp.

26. *Pelilococcus priesneri* (Laing): No parasitoids were collected from this species.

27. *Pelilococcus zillae* (Hall): No parasitoids were collected from this species.

28. *Phenacoccus gypsophilae* Hall: No parasitoids were collected from this species.

29. *Phenacoccus pyramidensis* Ezzat: No parasitoids were collected from this species.

30. *Planococcoides lindingeri* (Bodenheimer): One encyrtid parasitoid was collected from sample of *P. lindingeri*; this species is Leptomastidae bifasciata (Mayr).

31. *Planococcus citri* (Risso): Eleven species of aphelinids and encyrtids were collected and recorded from concerned specimen under investigation. These are: Angyurus greeri (Howard), *A. pseudococci* (Girault), *Blepyrus insularis* (Cameron), Encyrtus sp., Gyranoidea sp., Leptomastidae abnormis (Girault), Leptomastix dactylopii Howard, *L. flava* Mercet, Chalcineurus sp., Marietta pica (Andre) and Prochiloneurus aegypticus (Mercet).

**KEY TO SPECIES OF PARASITOIDS OF P. CITRI**

1. Mesopleuron large and without a femoral groove .................................................................2

   - Mesopleuron impressed and with a femoral groove, antennal scape flattened and expanded beneath, not more than twice as long as wide .................................................................Marietta pica (Andre) (Fig. 24)

2(1). Forewing shortened, clearly not reaching apex of gaster ..............................................3

   - Forewing normal, at least very nearly reaching apex of gaster; mesoscutum without a transverse posterior depression, neither mesoscutum with a median bundle
of setae nor posterior margin of pronotum with a line of stiff black bristles
.......................................................................................... Cheiloneurus sp.
3(2). Scutellum without a distinct tuft or bundle of setae or scale like setae.........4
   - Scutellum with a group of coarse, long dark setae arranged in a more or less
     compact tuft or bundle or with two or more scale like setae..........................5
4(3). Marginal vein at least nearly as long as stigmal vein........................................
.......................................................................................................................... Prochiloneurus aegyptiacus (Mercet)
   - Marginal shorter than stigmal vein........................................ Encyrtus sp. (Fig. 11)
5(3). First funicle segment not longer than broad ..............................................
.......................................................................................................................... Blepyrus insularis (Cameron)
   - First funicle segment longer than broad.......................................................6
6(5). Scapae more than 3 times as long as broad....................................................7
   - Scapae not more than 3 times as long as broad.............................................8
7(6). Forewing more than 2.5 times as long as broad........................................ Leptomastix flava Mercet
   - Forewing not more than 2.5 times as long as broad......................................
.......................................................................................................................... Leptomastix daedalopol Howard
6(6). Forewing with one or two distinct fuscous bands, marginal vein shorter than the
   stigmal .............................................................................................................. Leptomastidae abnormis (Girault)
   - Forewing with infuscation limited to longitudinal streak adjacent to venations ....
..........................................................................................................................9
9(8). Forewing with postmarginal vein at least a little longer than stigmal .............
.......................................................................................................................... Gyranusidea sp.
   - Forewing with postmarginal vein not longer than stigmal.............................10
10(9). Gaster longer than thorax .................................................Anagyrus greeni (Howard)
   - Gaster about as long as thorax, second funicle segment white
     ..................................................................................................................... Anagyrus pseudococi (Girault)

32. Planococcus ficus (Signoret): Seven species of aphelinids and encyrtids were
    collected and recorded from concerned specimen under investigation. These are:
    Anagyrus pseudococi (Girault), Leptomastidae abnormis (Girault), Leptomastix
dactylopi Howard, L. flava Mercet, Chalcocerus subaeus (Foerster), Marietta picta
    (Andre) and Prochiloneurus aegyptiacus (Mercet).

KEY TO SPECIES OF PARASITOIDS OF P. FICUS

1. Funicle present .........................................................................................2
   - Funicle absent, but with 1-4 setae; forewing 3 times as long as wide, longest marginal
     clava 1/2-2/3 width of disc, submarginal vein with 2 setae
2(1). Mesopleuron large and without a femoral groove .......................... 3
- Mesopleuron impressed and with a femoral groove, antennal scape flattened and expanded beneath, not more than twice as long as wide .......................................................... 3
- Sessita picta (Andre) ........................................................................ 4
3(2). Scutellum without a distinct tuft or bundle of setae or scale like setae ........ 4
- Scutellum with a group of coarse, long dark setae arranged in a more or less compact tuft or bundle or with two or more scale like setae, marginal vein at least nearly as long as stigmal vein .................. Prochiloneurus aegypticus (Mercet) 4(3). Scape more than 3 times as long as broad ........................................ 5
- Scape not more than 3 times as long as broad ........................................ 6
5(4). Forewing more than 2.5 times as long as broad.................. Leptomastix flava Mercet
- Forewing not more than 2.5 times as long as broad ................................ 6
- Leptomastix dactylopii Howard ...................................................... 7
- Leptomastix dactylopii Howard ...................................................... 7
6(4). Forewing with one or two distinct fuscus bands, marginal vein shorter than the stigmatic ........................................ Leptomastixidae abnormis (Girault)
- Forewing with infuscation limited to longitudinal streaks, adjacent to venations, postmarginal vein not longer than stigmal, gaster about as long as thorax, second funicle segment white ...................... Anagyrus pseudococcii (Girault)
33. Pseudococcus comstocki (Kuwana): Six species of encyrtids were recorded and collected from concerned specimen under investigation. These are: Anagyrus sp. Anagyrus pseudococcii (Girault), Leptomastixidae abnormis Girault, Leptomastix dactylopii Howard, L. flava Mercet and Prochiloneurus aegypticus (Mercet).

KEY TO SPECIES OF PARASITOIDS OF P. COMSTOCKI
1. Funicle 5-segmented .................................................. Acerophagus sp.
- Funicle at least 6-segmented .................................................. 2
2(1). Scutellum without a distinct tuft or bundle of setae or scale like setae .......... 3
- Scutellum with a group of coarse, long dark setae arranged in a more or less compact tuft or bundle or with two or more scale like setae, marginal vein at least nearly as long as stigmal vein .................. Prochiloneurus aegypticus (Mercet) 3(2). Scape more than 3 times as long as broad ........................................ 4
- Scape not more than 3 times as long as broad ........................................ 5
4(3). Forewing more than 2.5 times as long as broad.................. Leptomastix flava Mercet
- Forewing not more than 2.5 times as long as broad ................................ 6
- Leptomastix dactylopii Howard ...................................................... 7
- Leptomastix dactylopii Howard ...................................................... 7
Figs. 1-9. Fig 1. Antennae of Aoerophagus sp., Fig. 2. Antennae of Anagyrus aegyptiacus, Fig. 3. Antennae of A. greeni, Fig. 4. Antennae of A. kamali, Fig. 5. Antennae of A. pseudococci, Fig. 6. Antennae of A. saccharicola, Fig. 7. Antennae of A. shahidi, Fig. 8. Antennae of Belpyrus insularis, Fig. 9. Forewing of Chartocerus subaeneus (Forester).
Figs. 10-19. Fig 10. Challoneurus sp., Fig. 11. Encyrtus sp., Figs. 12-13. Gyranusoides indica, Fig. 12. Forewing, Fig. 13. Antenna, Figs. 14-15. Homalotylus vicinus, Fig. 14. Forewing, Fig. 15. Antennae, Figs. 16-17. Leptomastix dactylotli, Fig. 16. Antennae, Fig. 17. Forewing, Figs. 18-19. Leptomastidae abnormis, Fig. 18. Forewing, Fig. 19. Antennae.
Figs. 20-27. Figs. 20-21. *Leptomastix nigrocoxalis*, Fig. 20. Antennae, Fig. 21 Forewing, Fig. 22. Antennae of *Leptomastix flavus*, Fig. 23. *Mariotta Leopoldina*, Fig. 24. *Mariotta picta*, Fig. 25. *Prochiloneurus sp.*, Fig. 26. Antennae of *Rhopus nigriclavus*, Fig. 27. Forewing of *Allotropa sp.*
5(4). Forewing with one or two distinct fuscous bands, marginal vein shorter than the stigmal ......................................................Leptomastidae abnormis (Girault)

- Forewing with infuscation limited to longitudinal streaks, adjacent to venation, postmarginal vein not longer than stigmal, gaster about as long as thorax, second funicle segment white................................Anagyrus pseudococci (Girault)

34. Pseudococcus longispinus (Targioni-Tazzetti): Six species of aphelinids, encyrtids, signiphorids and platygastrids were collected and recorded from concerned specimen under investigation. These are: Aliotropa sp., Anagyrus pseudococci (Girault), Gyranusoida indica Shafee, Alam and Agarwal, Leptomastidae abnormis (Girault), Leptomastix dactylopi Howard and Chartocerus subaeneus (Foerster).

KEY TO SPECIES OF PARASITOIDS OF P. LONGISPINUS

1. Pronotum quadrate, not reaching tegulae; antennae usually elbowed, number of antennal segments, forewing with five or fewer cells ............. Chalcidoidea ................2

- Pronotum triangular in a lateral view, reaching tegulae; antennae elbowed or filiform, number of antennal segments (7-15), forewing with five or fewer cells closed, submarginal vein without setae..........................................................Aliotropa sp.

2(1). Funicle present ....................................................................................................................3

- Funicle absent, but with 1-4 anelli; forewing 3 times as long as wide, longest marginal cella 1/2-2/3 width of disc, submarginal vein with 2 setae...........
..................................................................................................................Chartocerus subaeneus (Foerster)

3(2). Scapae more than 3 times as long as broad, forewing not more than about 2.5 times as long as broad..............................................Leptomastix dactylopi Howard

- Scapae not more than 3 times as long as broad.................................................................4

4(3). Forewing with one or two distinct fuscous bands, marginal vein shorter than the stigmal.................................................................Leptomastidae abnormis (Girault)

- Forewing with infuscation limited to longitudinal streaks, adjacent to venations.......

...........................................................................................................................................5

5(4). Forewing with postmarginal vein at least a little longer than stigmal vein, marginal vein distinctly longer than stigmal vein........................................................................Gyranusoida indica Shafee, Alam and Agarwal

- Forewing with postmarginal vein not longer than stigmal vein, first funicle segment brown or dark brown, remainder of flagellum white, gaster about as long as thorax, second funicle segment white.............Anagyrus pseudococci (Girault)
35. **Saccharicoccus sacchari** (Cockerell): Eight species of encyrtids and signiphorids were collected and recorded from concerned specimen under investigation. These are: *Anagyrus greeni* (Howard), *A. pseudococci* (Girault), *A. saccharicola* Timberlake, *Leptomastidae abnormis* (Girault), *Microterys* sp., *Rhopus nigrilavus* (Girault), *Chartocerus subaeneus* (Foerster) and *Paraphaenaodiscus* sp.

**KEY TO SPECIES OF PARASITOIDS OF S. SACCHARI**

1. Funicle present .........................................................Encyrtidae..............................................................2
   - Funicle absent, but with 1-4 anelli; forewing 3 times as long as wide, longest marginal cilia 1/2-2/3 width of disc, submarginal vein with 2 setae.................................................................Charcoterus subaeneus (Foerster)
2(1). Forewing shortened, clearly not reaching apex of gaster .........................................5
   - Forewing normal, at least very nearly reaching apex of gaster ........................................3
3(2). Hypopygium reaching or very nearly reaching apex of gaster...........................................
   - Hypopygium not reaching more than two-thirds along gaster...........................................4
4(3). Scutellum without a distinct apical flange ............................................................Microterys sp.
   - Scutellum with a thin apical flange ...............................................................Paraphaenaodiscus sp.
5(2). Forewing with one or two distinct tuscus bands, marginal vein shorter than the stigmal ....................................................Leptomastidae abnormis (Girault)
   - Forewing with infuscation limited to longitudinal streaks, adjacent to venations, forewing with postmarginal vein not longer than stigmal vein.................................................6
6(5). Stigmal vein about as long as marginal vein................................................Anagyrus saccharicola Timberlake
   - Stigmal vein longer than marginal vein........................................................................7
7(6). Gaster longer than thorax ..................................................................................Anagyrus greeni (Howard)
   - Gaster about as long as thorax, second funicle segment white...........................................
      .................................................................Anagyrus pseudococci (Girault)

36. **Spillococcus alhagii** (Halis): Two species of encyrtids were recorded and collected from concerned specimen under investigation. These are: *Acerophagus* sp. and *Leptomastidae* sp.

**KEY TO SPECIES OF PARASITOIDS OF S. ALHAGII**

1. Funicle 5-segmented ............................................................................................................Acerophagus sp.
   - Funicle 11-segmented .................................................................................................Leptomastidae sp.
37. *Spinococcus convolvuli* Ezzat: Three species of encyrtids were collected and recorded from concerned specimen under investigation. These are: *Gyranusoides* sp., *Leptomastix* sp. and *Prochiloneurus* sp.

**KEY TO SPECIES OF PARASITOIDS OF *S. CONVOLVULI***

1. Scutellum without a distinct tuft or bundle of setae..............................................3
   - Scutellum with a group of coarse, long dark setae arranged in a more or less compact tuft or bundle or with two or more scale-like setae, marginal vein at least nearly as long as stigma vein ......................................................................................*Prochiloneurus* sp.
2(1). scape more than three times as long as broad..................................*Leptomastix* sp.
   - Scape more than three times as long as broad, forewing with postmarginal vein at least or little longer than stigma .............................................*Gyranusoides* sp.

38. *Trabutina manipara* (Hemprich & Ehrenberg): No parasitoids were collected from this species.

39. *Trionymus angustifrons* Hall: Two species of encyrtids were collected and recorded from concerned specimen under investigation here found in Egypt. These are: *Rhopus* sp. and *Cheiloneurus* sp.

**KEY TO SPECIES OF PARASITOIDS OF *T. ANGUSTIFRONS***

1. Hypopygium reaching or very nearly reaching apex of gaster..............*Rhopus* sp.
   - Hypopygium not reaching more than two-thirds a long gaster........*Cheiloneurus* sp.
40. *Trionymus cressae* (Hall): No parasitoids were collected from this species.
41. *Trionymus internodii* (Hall): No parasitoids were collected from this species.
42. *Trionymus masrensis* Hall: No parasitoids were collected from this species.
43. *Trionymus phragmitis* (Hall): No parasitoids were collected from this species.
44. *Trionymus williamsi* Ezzat: One encyrtid parasitoid was collected from samples of *T. williamsi*. This species is *Rhopus* sp.
45. *Vryburgia amaryllidis* (Bouche'): Two species of encyrtids were recorded and collected from concerned specimen under investigation. These are: *Anagyrus* sp. and *Rhopus* sp.
KEY TO SPECIES OF PARASITOIDS OF V. AMARYLLIDIS

7(6). Gaster about as long as thorax .................................................. Anagyrus sp.
- Gaster about as long as head and thorax together ...................................... Rhopus sp.

The previous Egyptian parasitoids fauna of mealybugs were studied by Priesner & Hosny (1940), Moursi (1948 a,b,c), Rashad (1975), Noyes and Hayat (1994), Atia (1997) and Abd-Rabou (2000 a,b).

It is clear from Table 1 that M. hirsutus aquire the largest number of parasitoids and only 6 species recorded without aquiring any hyperparasitoids. The role of hyperparasitism in suppressing parasitoids of mealybugs is given. A. graminis, M. hirsutus, N. viridis, P. citri, P. ficus and S. sacchari aquire the largest number of hyperparasitoids, being 4,3,3,3 and 3, respectively.

A. pseudococcii and L. nigrocoxalis were recorded associated with the largest number of mealybug species. Prochiloneurus sp. as a hyperparasitoid has shown a wide range of association with parasitoids of mealybug species.
Table 1. List of Egyptian mealybugs parasitoids and hyperparasitoids.

<table>
<thead>
<tr>
<th>Family and Species</th>
<th>Code</th>
<th>Type of parasitism</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Family : Aphelinidae</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Marietta leopardini</em> Motschulsky</td>
<td>1</td>
<td>Hyperparasitoid</td>
</tr>
<tr>
<td><em>Marietta picta</em> (André)</td>
<td>2</td>
<td>Hyperparasitoid</td>
</tr>
<tr>
<td><strong>Family : Encyrtidae</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acerophagus</em> sp.</td>
<td>3</td>
<td>Primary parasitoid</td>
</tr>
<tr>
<td><em>Anagyrus aegyptiacus</em> Moursi</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><em>A. greeni</em> (Howard)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><em>A. kamali</em> Moursi</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><em>A. pseudococci</em> (Girault)</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><em>A. saccharicola</em> Timberlake</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td><em>A. shahidi</em> Hayat</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td><em>Anagyrus</em> sp.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><em>Biophanus insularis</em> (Cameron)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td><em>Cheiloncurus</em> sp.</td>
<td>12</td>
<td>Hyperparasitoid</td>
</tr>
<tr>
<td><em>Encyrtus</em> sp.</td>
<td>13</td>
<td>Primary parasitoid</td>
</tr>
<tr>
<td><em>Gyranusoida indica</em> Shaffee, Alam</td>
<td>14</td>
<td>*</td>
</tr>
<tr>
<td>&amp; Agarwal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Gyranusoida</em> sp.</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td><em>Homalotylus vicinus</em> Silvestri</td>
<td>16</td>
<td>Hyperparasitoid</td>
</tr>
<tr>
<td><em>Leptomastidae abnormis</em> (Girault)</td>
<td>17</td>
<td>Primary parasitoid</td>
</tr>
<tr>
<td><em>Leptomastroidea bifasciata</em> (Mayr)</td>
<td>18</td>
<td>*</td>
</tr>
<tr>
<td><em>Leptomastroidea</em> sp.</td>
<td>19</td>
<td>*</td>
</tr>
<tr>
<td><em>Leptomastix dactylopii</em> Howard</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><em>L. flava</em> Mercet</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td><em>L. nigrocoxalis</em> Compere</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td><em>Leptomastrix</em> sp.</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td><em>Microterys</em> sp.</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td><em>Paraphana timidalis</em> sp.</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td><em>Prochiloneurus aegyptiacus</em> (Mercot)</td>
<td>26</td>
<td>Hyperparasitoids</td>
</tr>
<tr>
<td><em>P. annulatus</em> (Ferriere)</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td><em>P. avanicus</em> (Ferriere)</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td><em>Prochiloneurus</em> sp.</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td><em>Rhopus nigriclava</em> (Girault)</td>
<td>30</td>
<td>Primary parasitoid</td>
</tr>
<tr>
<td><em>Rhopus</em> sp.</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td><strong>Family : Platyastridae</strong></td>
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<td></td>
</tr>
<tr>
<td><em>Alliotropha</em> sp.</td>
<td>32</td>
<td>Primary parasitoid</td>
</tr>
<tr>
<td><strong>Family : Signiphoridae</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Chartocerus subaeneus</em> (Foerster)</td>
<td>33</td>
<td>Hyperparasitoid</td>
</tr>
</tbody>
</table>
Table 2. Egyptian mealybugs and their parasitoids.

<table>
<thead>
<tr>
<th>Mealybug species</th>
<th>parasitoids Codes</th>
<th>Hyperparasitoids Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amonasterium arabicum Ezzat</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Antonina graminis (Maskell)</td>
<td>3, 7, 9</td>
<td>12, 29, 23</td>
</tr>
<tr>
<td>Antonina natalensis Brain</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Brevennia rehi (Lindigo)</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>Chorizococcus halli McKenzie &amp; Williams</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td>Cricicococcus delotti Ezzat</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cricicococcus mangrovicus Ben-Dov</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dymicococcus boninis</td>
<td>10, 30</td>
<td>-</td>
</tr>
<tr>
<td>D. brevipes (Cockerell)</td>
<td>7, 17, 20</td>
<td>33</td>
</tr>
<tr>
<td>D. trispinosus (Hall)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Erimoccoccus limoniastri (Priesner &amp; Hosny)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Eupersia argemisae</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Eumodia viagata (Cockerell)</td>
<td>3, 6, 11, 14, 17, 20</td>
<td>16, 26, 23</td>
</tr>
<tr>
<td>Graenoropersia kaisari Bodenheimer</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Helococcus osborni (Sanders)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Heterococcus cyperi (Hall)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hulicococcus machnheili Ezzat</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kritshkella sacchari (Green.)</td>
<td>8, 30</td>
<td>-</td>
</tr>
<tr>
<td>Maconellicoccus hirsutus (Green)</td>
<td>5, 6, 7, 14, 22, 30, 32</td>
<td>1, 16, 27, 28</td>
</tr>
<tr>
<td>Microcococcus imersia (Hall)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Microcococcus imperatiae (Hall)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Neococcus minor Green</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Niccaepoccus nipae (Maskell)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nipaeococcus viridis (Newstead)</td>
<td>3, 4, 7, 21, 22</td>
<td>1, 29, 33</td>
</tr>
<tr>
<td>Octococcus salsolica (Priesner &amp; Hosny)</td>
<td>15</td>
<td>29</td>
</tr>
<tr>
<td>Peltococcus priesneri (Laing)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Table 2. Continued.

<table>
<thead>
<tr>
<th>Mealybug species</th>
<th>Parasitoids Codes</th>
<th>Hyperparasitoids Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Peliococcus zillae</em> (Hall)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Pherococcus gypsophilae</em> Hall</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Pherococcus pyramidens</em> Ezzat</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Planococoides lindingeri</em> (Bodenheimer)</td>
<td>18</td>
<td>-</td>
</tr>
<tr>
<td><em>Planococcus citri</em> (Risso)</td>
<td>5, 7, 11, 13, 15</td>
<td>2, 12, 26</td>
</tr>
<tr>
<td></td>
<td>17, 20, 21</td>
<td></td>
</tr>
<tr>
<td><em>Planococcus licus</em> (Singoreti)</td>
<td>7, 17, 20, 21</td>
<td>2, 26, 33</td>
</tr>
<tr>
<td><em>Pseudococcus comstocki</em> (Kuwana)</td>
<td>7, 10, 17, 20, 21</td>
<td>26</td>
</tr>
<tr>
<td><em>P. longispinus</em> (Targioni-Tozzetti)</td>
<td>7, 14, 17, 20, 32</td>
<td>33</td>
</tr>
<tr>
<td><em>Saccharicoccus sacchari</em> (Cockerell)</td>
<td>5, 7, 8, 17, 24, 29</td>
<td>25, 33</td>
</tr>
<tr>
<td><em>Spilococcus alhagii</em> (Hall)</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td><em>Spinoecoccus convolvuli</em> (Ezzat)</td>
<td>15, 23</td>
<td>29</td>
</tr>
<tr>
<td><em>Trabutina manipara</em> (Hemprich &amp; Ehrenberg)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Trionymus angustifrons</em> (Hall)</td>
<td>31</td>
<td>29</td>
</tr>
<tr>
<td><em>Trionymus cressae</em> (Hall)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>T. internodi</em> (Hall)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>T. masreusii</em> (Hall)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>T. phragmitis</em> (Hall)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>T. williamsi</em> Ezzat</td>
<td>31</td>
<td>-</td>
</tr>
<tr>
<td><em>Vrybugia amaryllidis</em> (Bouche)</td>
<td>10, 31</td>
<td>-</td>
</tr>
</tbody>
</table>
REFERENCES


الطفيليات التي تتلفف علي البق الدقيق في مصر

شعيبان عبد ربه

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

تم تسجيل 21 نوعاً تتلفف علي أنواع البق الدقيق في مصر. تم تصميم مفاهيم تصنيف طيفيليات كل نوع علي حدة من أنواع البق الدقيق المختلفة. تم مرشح الرسوم التوضيحية لبعض الصفات التي تختلف البق الدقيق فيه. تم أيضاً دفع عدد 18 طفل أولي و8 طفليات ثانية التي تزداد الأدوات المتلازمة من البق الدقيق في مصر. والتي يبلغ عددها 15 نوعاً لم يسجل عليه تمام طفليات.