



# ENCYRTID PARASITOID (HYMENOPTERA: CHALCIDOIDEA) OF PSEUDOCOCCIDAE (HEMIPTERA: COCCOIDEA) COLLECTED BY HOST REARING

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## Abstract

Encyrtids plays an important role in the management of soft scale insects in the field condition. These soft scale insects acts as a major pest to the crops and causes severe damage. The infected plant parts were collected and reared under laboratory condition. Through this host rearing, following eight genus were recorded. The most commonly emerged encyrtid genus is the *Aenasius*, *Blepyrus* and *Anagyrus* following that hyperparasitoid also emerged which are negative for biocontrol program. Thus the cotton mealy bugs have more number of encyrtid emergence in this host rearing during 2018-2019.

**Key words:** Encyrtids, Soft scale insects, Host rearing, Tritrophic relationship.

## Introduction

Members of the superfamily Coccoidea (Hemiptera) are serious pest of different host plants, especially in agricultural and horticultural ecosystems. This superfamily includes several Diaspididae (armored scales) Psudococcidae, Coccidae are the most economically important. Besides direct damage is caused by sucking the sap of plants, they also promote development of sooty mold on honeydew excretions (Ben-Dov *et al.*, 2010). Many chalcidoids (Insecta: Hymenoptera) are parasitoids of coccids and this group is considered to be among the most important in biological control (Noyes, 2010). The superfamily Chalcidoidea currently includes approximately 22,000 species with members widely distributed throughout the world. Encyrtidae is one of the important families of Chalcidoidea. Noyes and Hayat, (1994) discussed host-parasitoid associations of encyrtid parasitoids and mealybugs and recorded 49 species of encyrtids as parasitoids of mealybugs from India. Hayat, (2006) recovered 62 species of encyrtids from mealybugs in India.

## Materials and Methods

Mealybugs and scale insects were collected along with infested plant parts from different localities of Tamil Nadu, Tiruchendur, Coimbatore and rural areas in

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Cuddalore like Kadukamaram, Sivapuri, Annamalai nagar and Madhanam. The coccids collected were kept in ventilated plastic bags and monitored for emergence of parasitoids. After the emergence of parasitoid, they are killed in an atmosphere of ethyl acetate. The parasitoids that emerged were preserved in 70% ethanol and later processed and curated as per standard protocol (Noyes, 1982). The collected parasitoids were then dry mounted and labeled in a rectangular card or card points. Coccids were identified using keys provided by Williams, (2004) for mealybugs, Hodgson and Henderson, (2000) for soft scales. The specimens collected were kept in deposited with Parasitoid Taxonomy and Biocontrol Laboratory, Department of Entomology, Faculty of Agriculture, Annamalai University, Annamalainagar.

## Results and Discussion

The survey conducted resulted in the records of the following coccids and encyrtid parasitoids. Not all encyrtids recorded are primary parasitoids of mealybugs, species of *Cheiloneurus* and *Procheiloneurus* are secondary parasitoids/hyperparasitoids parasitizing primary parasitoids and *Homalotylus* are parasitoids of coccinellid larvae and pre pupal stage since it is the predator of mealybugs. All the parasitoids identified using the keys provided by Noyes and Hayat, (1994) and Hayat, (2006 and 2009).

Genera of Encyrtidae Collected from Host Rearing			
S.No	Host Plant	Host Insect	Genera of Encyrtid
1.	Black gram( <i>Phaseolus mungo</i> )	Mealy bugs	<i>Leptomastix</i> <i>Blepyrus</i>
2.	Neerium( <i>Neerium oleander</i> )	<i>Ferrisia virgata</i>	<i>Aenasius arizonensis</i> <i>Blepyrus</i>
3.	Indian mallow( <i>Abutilon indicum</i> )	<i>Phenacoccus solenopsis</i>	<i>Aenasius arizonensis</i>
4.	Citrus( <i>Citrus aurantiifolia</i> )	<i>Planococcus citri</i>	<i>Proleurocerus</i>
5.	Pungam( <i>Pongamia glabra</i> )	<i>Phenacoccus solenopsis</i>	<i>Blepyrus</i>
6.	Arjun tree( <i>Terminalia arjuna</i> )	<i>Psyllid sp</i>	<i>Psyllaephagus</i>
7.	Mango tree( <i>Mangifera indica</i> )	<i>Drosicha mangiferae</i>	<i>Anagyrus</i>
8.	Brinjal( <i>Solanum melongena</i> )	<i>Coccidohystrich insolita</i>	<i>Cheiloneurus</i>
9.	Cotton( <i>Gossypium sp</i> )	<i>Phenacoccus solenopsis</i>	<i>Aenasius arizonensis</i> <i>Homalotylus</i> <i>Cheiloneurus</i> <i>Anagyrus</i> <i>Aenasius</i>
10.	Casuarina( <i>Casuarina equisetifolia</i> )	<i>Pseudoripersia turgipes</i>	<i>Cheiloneurus</i>

### *Aenasius advena* Compere

• Specimens examined: India: Tamil Nadu, Thoothukudi, Tiruchendur. (8°49'46" N 78°12'19" E, 3m), 5 females, i.2019, ex. *Ferrisia virgata* (Cockerell) on *Leucaena leucocephala*, coll. R.Minu; Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 10 females, v. 2019, ex. *Ferrisia virgata* on *Nerium indicum*, coll. R.Minu; Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 4 females, vi.2019, ex. *Ferrisia virgata* on *Pongamia pinnata*, coll. R. Kanagarajan; Namakkal (11°28' N 78°11' E), 2 females, xii.2018, ex. *Phenacoccus solenopsis* Tinsley on *Hibiscus rosasinensis* and *Abutilon indicum*, coll. J. Mary lisha.

• Distribution: India: Andaman and Nicobar islands, Delhi, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Uttaranchal, Uttar Pradesh. (Bangladesh; Pakistan; Hawaii Is.; Malaysia; Philippines; Solomon Is.; New Caledonia; Samoa; Fiji; Loyalty Is.; widely distributed, nearly cosmopolitan in the old world tropics, and also from the Neotropical region) (Hayat, 2006).

• Hosts: Recorded here from *Ferrisia virgata* on *Leucaena leucocephala*, *Nerium indicum* and *Pongamia pinnata* (present record for India) and from *Phenacoccus solenopsis* on *Hibiscus rosa-sinensis* and *Abutilon indicum*.

### *Aenasius bambawalei* Hayat

• Specimens examined: India: Tamil Nadu, Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 17 females, xi.2018, ex. *Phenacoccus solenopsis* on *Cyamopsis tetragonolobus*, *Lycopersicon esculentum*,

*Abelmoschus esculentus*, *Hibiscus rosa-sinensis*, *Hibiscus cannabinus*, *Legenaria siceraria*, *Solanum melongena*, *Amaranthus tricolor*, *Datura stramonium*, *Helianthus annuus* and *Gossypium hirsutum*, coll. R. Minu; Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 3 females, v.2019, ex. *Pseudococcus longispinus* (Targioni- Tozzetti) on *Cyanodon dactylon*, coll. R.kanagarajan; Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 23 females, iii.2019, ex. *Phenacoccus solenopsis* on *Cyamopsis tetragonolobus*, *Lycopersicon esculentum*, *Abelmoschus esculentus*, *Hibiscus rosasinensis*, *Hibiscus cannabinus*, *Legenaria siceraria*, *Solanum melongena*, *Amaranthus tricolor*, *Datura stramonium*, *Helianthus annuus* and *Gossypium hirsutum*, coll. L.N Nisha; Virudhunagar, Aruppukottai (9°52' N 78°10' E, 95.4m), 2 females and 1 male, vi.2019, ex. *Phenacoccus solenopsis* on *Lycopersicon esculentum*, coll. R.Minu; Coimbatore, Mettupalayam (11°30' N 79°95' E, 310 m), 4 females and 2 males xi.2019.

• Distribution: India: Delhi, Haryana, Maharashtra (Hayat, 2006), Tamil Nadu (present record).

• Hosts: Recorded here from *Phenacoccus solenopsis* on *Cyamopsis tetragonolobus*, *Lycopersicon esculentum*, *Abelmoschus esculentus*, *Hibiscus rosasinensis*, *Hibiscus cannabinus*, *Legenaria siceraria*, *Solanum melongena*, *Amaranthus tricolor*, *Datura stramonium* and *Helianthus annuus* (present record for India) and from *Pseudococcus longispinus* on *Cyanodon dactylon*; Recorded here from *Phenacoccus solenopsis* on *Gossypium hirsutum* and *Abutilon indicum* (present record for Tamil Nadu).

**Anagyrus (Howard)**

• Specimens examined: India: Tamil Nadu, Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 8 females and 32 males, 15.vii.2019, ex. *Maconellicoccus hirsutus* on *Gossypium hirsutum* and *Abelmoschus esculentus*, coll. R.Minu; Coimbatore, Mettupalayam (11°30' N 76°95' E, 310m), 3 females, 2.xi.2019, ex. *Phenacoccus solenopsis* on *Hibiscus rosasinensis* and *Vitis vinifera*, coll. R. Kanagarajan; Trichy, padallur (11°30' N 78°50' E, 78 m), 4 females, 21.v.2019, ex. *Phenacoccus solenopsis* on *Gossypium hirsutum*, coll. D.Devaki.

• Distribution: India: Andaman and Nicobar islands andhra Pradesh, Bihar, Delhi, Goa, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Orissa, Punjab, Tamil Nadu, Uttaranchal, Uttar Pradesh. (Oman; Iran; Iraq; Hong Kong; Thailand; China; Indonesia: Java; Hawaii) (Hayat, 2006).

• Hosts: Recorded here from *Maconellicoccus hirsutus* on *Gossypium hirsutum* and *Abelmoschus esculentus* (present record for India) and from *Phenacoccus solenopsis* on *Hibiscus rosa-sinensis*, *Vitis vinifera* and *Gossypium hirsutum*.

**Blepyrus insularis (Cameron)**

• Specimens examined: India: Tamil Nadu, Dharmapuri, Hogenakkal (11°19' N 77°40' E, 1523 m), 10 females, 10.i.2018, ex. *Ferrisia virgata* on *Leucaena leucocephala*, coll. G.Naveena; Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 5 females, 5.ii.2010, ex. *Ferrisia virgata* on *Abelmoschus moschatus*, coll. S. Sudhandira; Pudukkottai, Pullanviduthi (10°38' N 78°82' E, 98.4 m), 7 females, 25.vi.08, ex. *Coccidohistrix insolita* (Green) on *Solanum torvum*, coll. V. Priyadarshini; Coimbatore, Mettupalayam (11°30' N 76°95' E, 310m), 1 female, 2.xii.2018, ex. *Phenacoccus solenopsis* on *Datura stramonium*, coll. S. Nandhini; Tiruchendur, Thoothukudi (8°49'46' N 78°12'19' E, 3m), 1 female, 14.xii.2018, ex. *Phenacoccus solenopsis* on *Abutilon indicum*, coll. R.Minu; Trichy, Perumalpalayam (11°30' N 77°45' E, 79.5 m), 3 females, 2.ix.2019, ex. *Phenacoccus solenopsis* on *Abutilon indicum*, coll. J. Mary lisha.

• Distribution: India: Delhi, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttaranchal, Uttar Pradesh, West Bengal. (Sri Lanka; Malaysia; Sarawak; Papua New Guinea; Mariana Is.; Hawaii Is.; Nigeria) (Hayat, 2006).

• Hosts: Recorded here from *Ferrisia virgata* on *Leucaena leucocephala* and *Abelmoschus moschatus* (present record for India) and from *Coccidohistrix* [= *Centroccoccus*] *insolita* on *Solanum*

*torvum* and from *Phenacoccus solenopsis* on *Datura stramonium* and *Abutilon indicum*.

**Cheiloneurus Hayat, Alam and Agarwal**

• Specimens examined: India: Tamil Nadu, Cuddalore, Chidambaram (11°40' N 79°70' E, 2.7 m), 2 females, 1.ii.2019, ex. *Rastrococcus iceryoides* (Green) on *Pongamia pinnata* via *Neoplatycerus tachikawai*, coll. S. Manicavasagam.

• Distribution: India: Goa, Karnataka, Kerala (Hayat, 2006), Tamil Nadu (present record).

• Hosts: Recorded here from *Rastrococcus iceryoides* on *Pongamia pinnata* via *Neoplatycerus tachikawai* (present record for India).

**Homalotylus (Agarwal)**

• Specimens examined: India: Tamil Nadu, Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 6 females, 15.v.2019, ex. [indet. Coccinellid predaceous on]: *Phenacoccus solenopsis* on *Gossypium hirsutum*, coll. R.Poovizhi.

• Distribution: India: Himachal Pradesh, Jharkhand, Karnataka, Kerala, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal (Hayat, 2006).

• Hosts: Recorded here from [indet. Coccinellid predaceous on]: *Phenacoccus solenopsis* on *Gossypium hirsutum* and *Cyamopsis tetragonolobus*.

**Leptomastix nigrocincta Risbec**

• Specimens examined: India: Tamil Nadu, Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 9 females, 26.vi.2019, ex. (with) *Phenacoccus solenopsis* on *Gossypium sp* and *Hibiscus rosa-sinensis*, coll. R.Minu.

• Distribution: India: Andaman and Nicobar islands andhra Pradesh, Delhi, Karnataka, Kerala, Madhya Pradesh, Tamil Nadu, Uttar Pradesh. (China; Madagascar) (Hayat, 2006).

• Hosts: Recorded here from *Phenacoccus solenopsis* on *Gossypium* and *Hibiscus rosa-sinensis*.

**Prochiloneurus Silvestri**

• Specimens examined: India: Tamil Nadu, Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 1 female, 3.vii.2019, ex. (with) *Phenacoccus solenopsis* on *Gossypium sp*, coll. A. Athithya; Cuddalore, Annamalainagar (11°24' N 79°44' E, +5.79 m), 2 females and 3 males, 19.vii.2019, ex. (with) *Coccidohistrix* [= *Centroccoccus*] *insolita* on *Solanum torvum*, coll. M. Vishnu.

• Distribution: India: Andhra Pradesh, Bihar, Goa, Haryana, Karnataka, Kerala, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh. (Eritrea; South Africa) (Hayat, 2006).

• Hosts: Recorded here (with) *Phenacoccus solenopsis* on *Anona squamosa*, *Hibiscus mutabilis*, *Hibiscus rosasinensis* and *Solanum melongena* (present record for India) and (with) *Coccidohistrix* [= *Centrocooccus*] *insolita* on *Solanum torvum*.

### Psyllaephages Ashmead

• Specimens examined: India: Tamil Nadu, Cuddalore, Annamalai nagar (11°24' N 79°44' E, +5.79 m), 7 females and 3 males, ex. (with) *Psyllids* on in *Terminalia sp.*, 4.vi. 2019, col. R.Minu

• Distribution: India: Andhra Pradesh, Karnataka, Kerela and Tamil Nadu

• Hosts: Recordrd here with *Psyllids* on *Terminalia spp.*

Thus through this host rearing, it is evident that the cotton mealy bugs have more number of parasitization by encyrtid parasitoid. The primary parasitoid *Aenasius bambawalei* Hayat emerged the most. This helps to understand the tritrophic relationship among the host plant, host insect and the parasitoid in cotton as well as in other host plants.

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