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The taxonomic study of encyrtid parasitoids (Hymenoptera: Chalcidoidea) of diaspidids from India

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Abstract

The Diaspidids (Homoptera: Diaspididae) attack variety of plants and fruit trees like mango, apple, peach, citrus and plants like rose, tea etc. by a constant sucking of plant juices. Their mode of feeding not only damages the plant but also causes secondary infections. The biological control of these diaspidids can be done by many Indian encyrtid parasitoids, the successful biological control programmes largely depend upon the correct identification of these parasitoid species, as well as their correct status (primary or secondary parasitoids). The sound taxonomic and biological knowledge regarding these parasitoids is needed before their recommendation in any biological control programme. In the present paper, a basic taxonomic study has been conducted to provide valuable information on Indian encyrtid parasitoids through keys, description, their host and distribution.

Keywords: Taxonomy; Parasitoids; Diaspidids.

Introduction

Armoured scales/Diaspidids are the smallest of scale insects (Fig. 1), ranging in size from 1 – 3mm and member of the homopterous family Diaspididae (Superfamily Coccoidea). The scale insects characterized by the presence of a protective shell that provide protection during the life of the insects. The armoured scale contain species that attack a variety of plants and fruits tree like mango, apple, peach, citrus and other plants like rose, tea, etc. by permanent attachment on plant stem and leaves, constantly suck plant juices with the help of their sucking mouth parts which lead to damage of the plant and also causes secondary infections (DeBach, 1964). Majority of Homoptera in the families Coccoidea, Diaspididae and Pseudococcidae are parasitized by encyrtid species and their parasitoid are found in all habitats and are extremely important as biological control agents. Noyes (1990b) summarized the biology and taxonomy of encyrtid genera known to attack armoured scales.

The author has chosen the armoured scales due to the heavy loss and damage to fruit trees in our country caused by them with an emphasis on their biological control by many encyrtid parasitoids. It is true that success of any biological control programme depends largely on the correct identified both at generic and specific levels of the parasitoid species, its host and recognition whether a primary parasitoid or secondary parasitoid therefore taxonomic studies are needed before the recommendation

of parasitoid in biocontrol of pest species. So far, there is no comprehensive work dealing with the encyrtid parasitoids from India to control the population of pest species so that the food production of our country will enhance. The present study was conducted to facilitate available information on the encyrtid parasitoids by means of keys and a list (Table 1) including encyrtid parasitoids, number of species in world and in India, their diaspidid host (armoured scale insects) and their distribution (Table 2).

Family Encyrtidae Walker

The family Encyrtidae constitutes an important group of parasitic hymenopteran insects which are essential in maintaining the pest population under check and therefore extensively used in the Biological Control Programmes. The present work includes 14 encyrtid genera namely:

1. Genus *Adelencyrtus* Ashmead
2. Genus *Arrhenophagus* Aurivillius
3. Genus *Caenohomalopoda* Tachikawa
4. Genus *Cerapteroceroides* Ashmead
5. Genus *Coccidencyrtus* Ashmead
6. Genus *Comperiella* Howard
7. Genus *Epitetracnemus* Girault
8. Genus *Metaphycus* Mercet
9. Genus *Plagiomerus* Crawford
10. Genus *Teleterebratus* Compere & Zinna
11. Genus *Thomsonica* Ghesquiere
12. Genus *Trichomasthus* Thomson
13. Genus *Xenostryxis* Girault
14. Genus *Zaomma* Ashmead

Distinguishing Characters

Female: (Fig. 2) Size small to moderately large, 0.50 – 2.00 mm. Antenna 11-segmented (Fig. 3). Easily recognized by transverse and triangular axillae that meet medially and the position of cerci anterior to the tip of the abdomen; presence of very short marginal vein (Fig. 4), mesoscutum with complete or incomplete notaular lines, mesopleuron convexly enlarged.

Male: Sexual dimorphism in body color and antennal structure (Fig. 5) but other characters are similar to those in females except for the external genitalia.

1. Genus *Adelencyrtus* Ashmead [Key couplet: 6]

Adelencyrtus Ashmead, 1900b: 401. Type species. *Encyrtus chionaspidis* Howard, by original designation
Epiencyrtoides Girault, 1915a: 108. Type species *Epiencyrtoides quadridentatus* Girault, by original designation. As synonym of *Adelencyrtus* by Mercet, 1921: 698.

Diagnosis

Body excluding antennae, wings, legs, tegula completely dark; head dorsum nearly flat, in side view, head triangular and strongly inflexed at top of scrobes; mesoscutum with dark setae; mandibles 4-dentate; clava apically rounded or transversely truncate; fore wing infuscation relatively weak and at most with only two hyaline spots distad of venation; hypopygium not reaching more than two-third length along gaster.

Species and distribution

World, 25 species, cosmopolitan; 10 species from India.

2. Genus *Arrhenophagus* Aurivillius [Key couplet: 4]

Arrhenophagus Aurivillius, 1888: 144. Type species *Arrhenophagus chionaspidis* Aurivillius, by monotypy.
Mymariella Risbec, 1951: 402. Type species *Mymariella parlatoriae* Risbec, by monotypy. Synonymy by Anneck & Insely, 1971: 6.

Diagnosis

Mandibles with one pointed tooth; antenna with 2-4 anelliform segments, ad pressed with clava, clava large at least as long as remainder of antenna; fore wing broad, with distal veins not clearly defined; tarsi 4-segmented.

Species and distribution

Only 2 species; 1 species from India.

3. Genus *Caenohomalopoda* Tachikawa [Key couplet: 5]

Caenohomalopoda Tachikawa, 1979a: 169. Type species *Pseudhomalopoda shikokuensis* Tachikawa, by original designation.

Diagnosis

Funicle with 4-segmented, usually quadrate to broader than long; fore wing infuscate with well-defined rays or bands; hypopygium not reaching to the apex of gaster; tarsi 5-segmented.

Species and distribution

World, 7 species; 3 species from India.

4. Genus *Cerapteroceroides* Ashmead [Key couplet: 7]

Cerapteroceroides Ashmead, 1904b: 156. Type species *Cerapteroceroides japonicas* Ashmead, by monotypy.
Metacerapteroceroides Ishii, 1928: 151. Type species *Cerapteroceroides fortunatus* Ishii, by original designation. Synonyms by Tachikawa, 1963: 142.

Diagnosis

Flagellum broadened and flattened, scape triangular or trapezoid, pedicel large distinctly broader than F1; fore wing infuscate with deeper curve, broad with marginal vein subequal to stigmal vein.

Species and distribution

Old World, 8 species; 5 species from India.

5. Genus *Coccidencyrtus* Ashmead [Key couplet: 9]

Coccidencyrtus Ashmead, 1900b: 383. Type species *Encyrtus ensifer* Howard, by monotypy and original designation.
Encyrtomyia Girault, 1915a: 131. Type species *Encyrtomyia albiflegellum* Girault, by original designation. Synonymy by Noyes & Hayat, 1984: 253.

Diagnosis

Mandibles with one or two teeth and a truncation; first segment of funicle no longer than broad, fore wing hyaline, marginal vein more than twice as long as broad; mesopleuron enlarged posteriorly, hypopygium not reaching apex of the gaster.

Species and distribution

World, about 30 species, cosmopolitan; 3 species from India.

6. Genus *Comperiella* Howard [Key couplet: 7]

Comperiella Howard, 1906: 121. Type species *Comperiella bifasciata* Howard, by monotypy.

Pseudanusia Girault, 1915a: 155. Type species *Pseudanusia pia* Girault, by monotypy and original designation. Synonymy by Girault, 1917b: 37.

Diagnosis

Flagellum broadened and flattened, rarely F1 not transverse, antennal scape not more than 3x as long as broad, stigma vein with sensilla not arranged in a square, uncus present; fore wing with one or two longitudinal infusate rays; scutellum without a distinct bundle or tuft of setae or scale like setae.

Species and distribution

World, 9 species; 5 species from India.

7. Genus *Epitetracnemus* Girault [Key couplet: 6]

Epitetracnemus Girault, 1915a: 164. Type species *Epitetracnemus sexguttatipennis* Girault, by monotypy and original designation.

Anabrolepis Timberlake, 1920: 431. Type species *Anabrolepis extranea* Timberlake, by original designation. Synonymy by Noyes & Hayat, 1984: 273.

Diagnosis

Body completely dark; clava apically rounded or transversely truncate; fore wing strongly infusate from below parastigmal to apex and enclosing at least three hyaline spots distad of venation; hypopygium reaching apex of gaster.

Species and distribution

World, 6 species; 1 species from India, and Indet. species from India.

8. Genus *Metaphycus* Mercet [Key couplet: 13]

Metaphycus Mercet, 1917a: 138. Type species *Aphycus zebratus* Mercet, by monotypy. [As subgenus of *Aphycus*]. Given precedence over *Aenasioidea*: ICZN, opinion 1898, 1998: 129-130.

Aenigmaphycus Sharkov & Voynovich, 1988: 826. Type species *Aenigmaphycus paluster* Sharkov & Voynovich, by original

designation. Synonymy by Guerrieri & Noyes, 2000: 148.

Diagnosis

Antenna except sometime scape, cylindrical, neither flattened or broadened, funicle with at least 6 segments; thorax at least partly yellow or orange, mesoscutum with notaular lines present at least in anterior, scutellum without an apical flange.

Species and distribution

World, more than 400 species, cosmopolitan; 15 species from India.

9. Genus *Plagiomerus* Crawford [Key couplet: 2]

Plagiomerus Crawford, 1910: 89. Type species *Plagiomerus diaspidis* Crawford, by monotypy and original designation.

Parahomalopoda Girault, 1915c: 170. Type species *Parahomalopoda peruviansis* Girault, by monotypy and original designation. Synonymy by Noyes, 1980: 222.

Diagnosis

Mandibles with a truncate to serrate apex; funicle with 4 segments all at least slightly longer than broad; scutellum usually with two large scale like setae; hypopygium reaching to the apex of gaster; tarsi 5 segmented.

Species and distribution

World, 7 species; 2 species from India.

10. Genus *Teleterebratus* Compere & Zinna [Key couplet: 11]

Teleterebratus Compere & Zinna, 1955: 108. Type species *Teleterebratus perversus* Compere & Zinna, by monotypy and original designation.

Diagnosis

Clava with apex rounded and dorsal surface not curved, not all funicle segments longer than broad, at least one segment quadrate to broader than long; fore wing hyaline or infuscation faint and diffuse, or very pale brown; thoracic dorsum completely dark and metallic; hypopygium not extending to apex of gaster.

Species and distribution

World, 4 species, Australasian and Oriental; 1 species from India.

11. Genus *Thomsonisca* Ghesquiere [Key couplet: 13]

Thomsonisca Ghesquiere, 1946: 369. [Replacement name for *Thomsoniwella* Mercet]

Pakencyrtus Ahmad, 1970: 237. Type species *Pakencyrtus pakistanensis* Ahmad, by monotypy and original designation. Synonymy by Subba Rao, 1976: 689.

Diagnosis

Mandibles with one or two teeth and a truncation; clava with apex rounded; fore wing with postmarginal vein not longer than stigma vein; mesoscutum and scutellum completely dark; hypopygium not reaching more than from fifth length along gaster.

Species and distribution

World, 6 species; 4 species from India.

12. Genus *Trichomasthus* Thomson [Key couplet: 10]

Trichomasthus Thomson, 1876: 142. Type species *Encyrtus cyanae* Dalman, by subsequent designation of Gahan & Fagan, 1923: 148.

Coccidoxenus Crawford, 1913: 248. Type species *Coccidoxenus portoricensis* Crawford, by monotypy and original designation. Synonymy by Trjapitzin, 1968a: 213.

Diagnosis

Head and thorax with conspicuous pale setae, mandibles with one or two teeth and a truncation; all funicle segments longer than broad; fore wing hyaline; mesopleuron enlarged posteriorly, touching base of gaster.

Species and distribution

World, 31 species, cosmopolitan; 3 species from India.

13. Genus *Xenostryxis* Girault [Key couplet: 12]

Xenostryxis Girault, 1920a: 41. Type species *Xenostryxis margiscutellum* Girault, by monotypy.

Paraschedius Mercet, 1925c: 328. Type species *Paraschedius ductor* Mercet, by original designation. Synonymy by Hayat, 2003a: 203.

Diagnosis

Mandibles tridentate; all funicle segments longer than broad, flagellum neither broadened nor flattened, more or less cylindrical; fore wing hyaline, marginal vein clearly longer than broad; dorsum of thorax yellow or orange.

Species and distribution

Old World, 8 species; 2 species from India.

14. Genus *Zaomma* Ashmead [Key couplet: 9]

Zaomma Ashmead, 1900b: 401. Type species *Encyrtus argentipes* Howard, by monotypy and Original designation.

Metapterancyrtus Tachikawa, 1963: 213. Type species *Metapterancyrtus eriococci* Tachikawa, by monotypy and original designation. Synonymy by Trjapitzin & Gordh, 1978b: 636.

Diagnosis

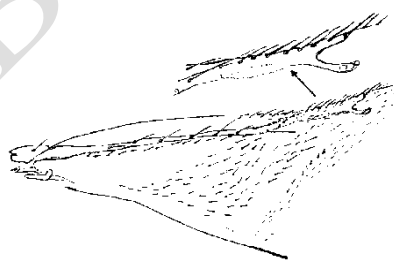
Funicle with at least 6 segments; fore wing hyaline, marginal vein longer than stigmal vein; scutellum with a group of coarse, long, dark setae arranged in a more or less compact bundles or tuft.

Species and distribution

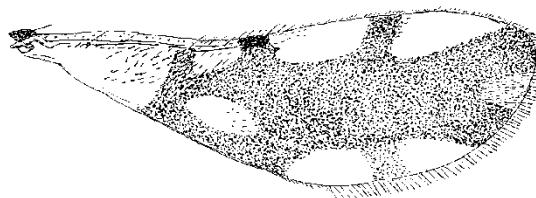
Only 1 species from India.

Illustrated key to encyrtid genera, parasitoids of armoured scale insects/Diaspidids

- 1. Fore wing hyaline (Fig. A) 2
- Fore wing infuscate (Fig. a) 3

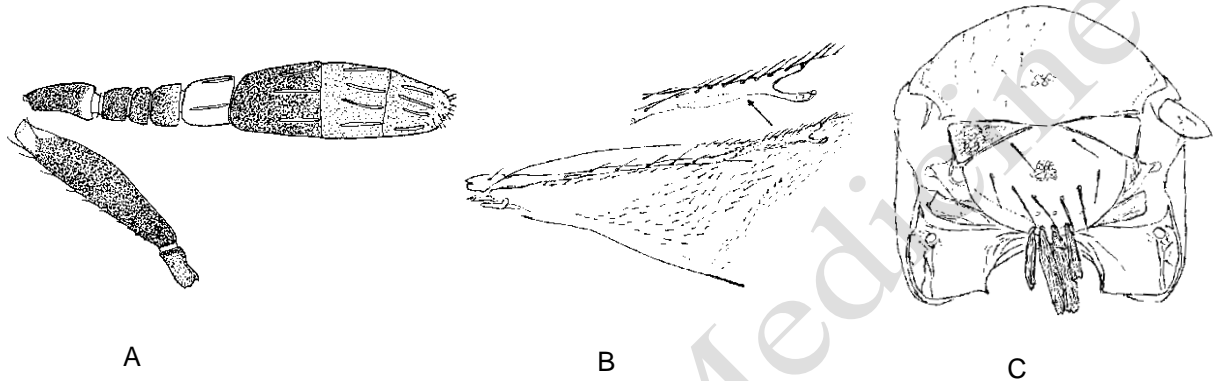


A

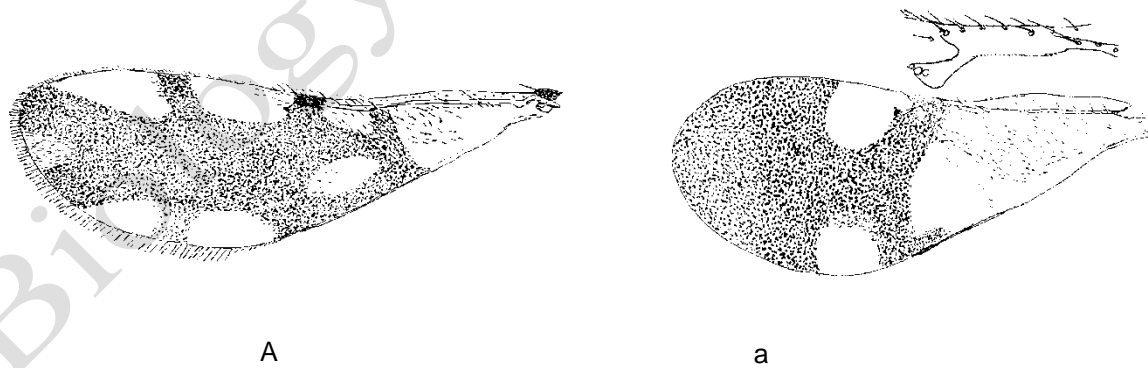


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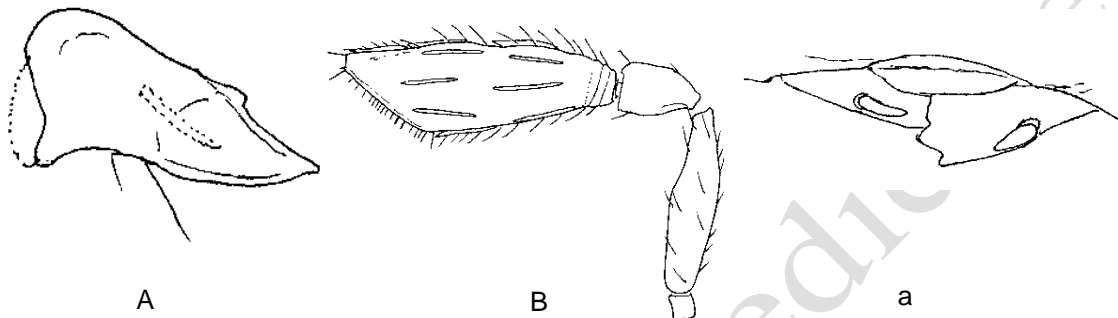
2. Tarsi 4 segmented 4
 - Tarsi 5 segmented, funicle segment except F1, quadrate to broader than long (Fig. A), marginal vein at least as long as stigma vein (Fig. B), scutellum usually with large scale like setae (Fig. C) *Plagiomerus* Crawford



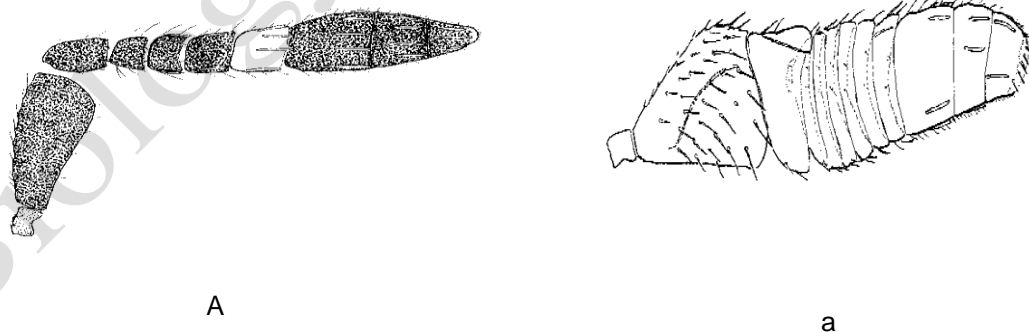
3. Fore wing with well-defined infuscate rays or bands (Fig. A) 5
 - Fore wing with well-defined hyaline spots (Fig. a) 6



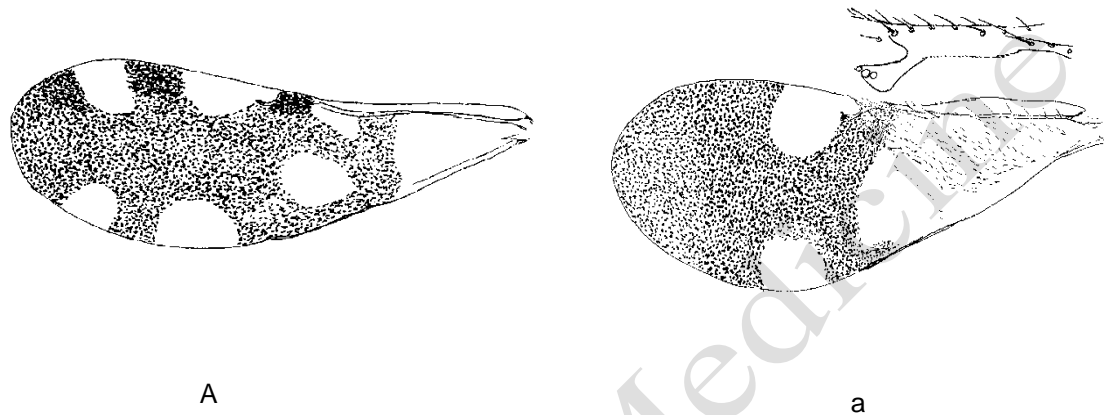
4. Mandible with one pointed tooth (Fig. A), antenna with 2-4 anelliform segments (Fig. B), clava large, fore wing broad*Arrhenophagus Aurivillius*
 - Mandible with one or two teeth and a truncation or with 3 teeth (Fig. a) 8



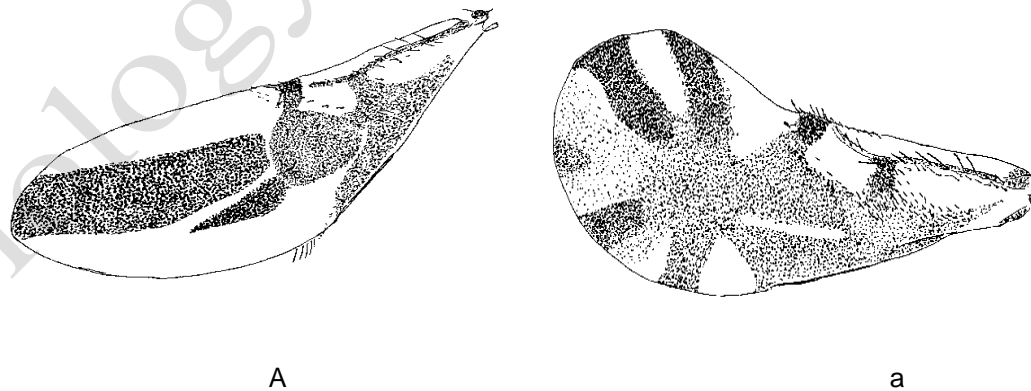
5. Four funicle segments (Fig. A), hypopygium not reaching apex of gaster.....*Caenohomalopoda Tachikawa*
 - Six funicle segments (Fig. a)..... 7



6. Fore wing with at least 3 hyaline spots distad of venation (Fig. A), head with strong transverse line of dense silvery white setae below and across face*Epitetracnemus* Girault
 -. Fore wing with only two hyaline spots distad of venation (Fig. a) transverse line of setae across face absent or very sparse..... *Adelencyrtus* Ashmead



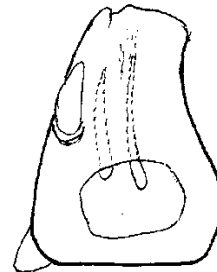
7. Fore wing with one or two longitudinal infuscate rays (Fig. A) *Comperiella* Howard
 -. Fore wing with many infuscate rays radiating from a longitudinal line in centre of wing, scape triangular, pedicel broader than F1 (Fig. a) *Cerapteroceroides* Ashmead



8. Mandible tridentate (Fig. A)10
 -. Mandible with one or two teeth and a truncation (Fig. a)9

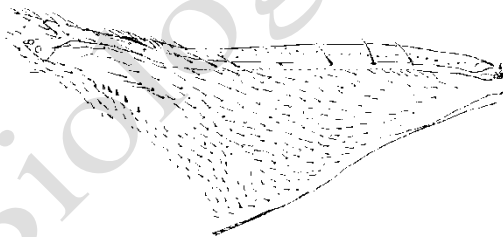


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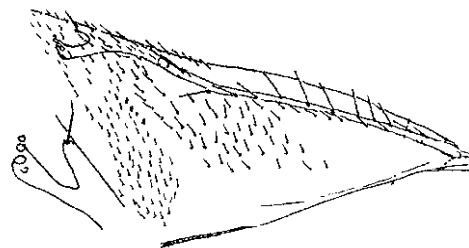


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9. Marginal vein more than twice as long as broad (Fig. A), occipital margin more or less rounded *Coccidencyrthus* Ashmead
 -. Marginal vein at most 2x as long as broad, stigma vein and parastigma not down curved (Fig. a), funicle segment short to transverse *Zaomma* Ashmead

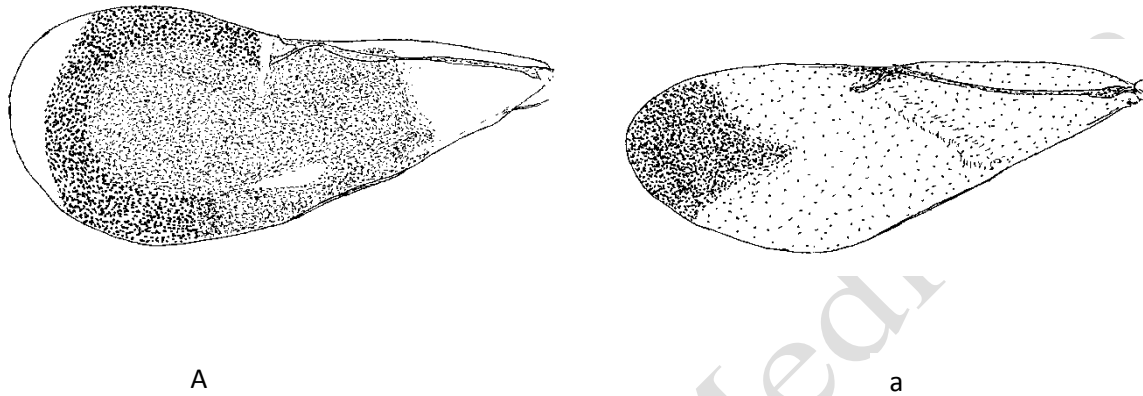


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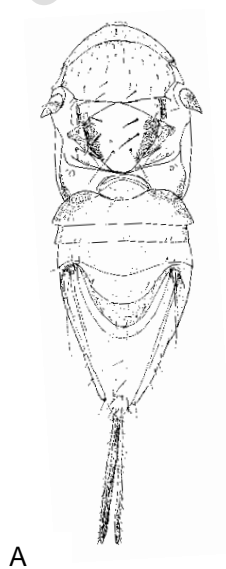


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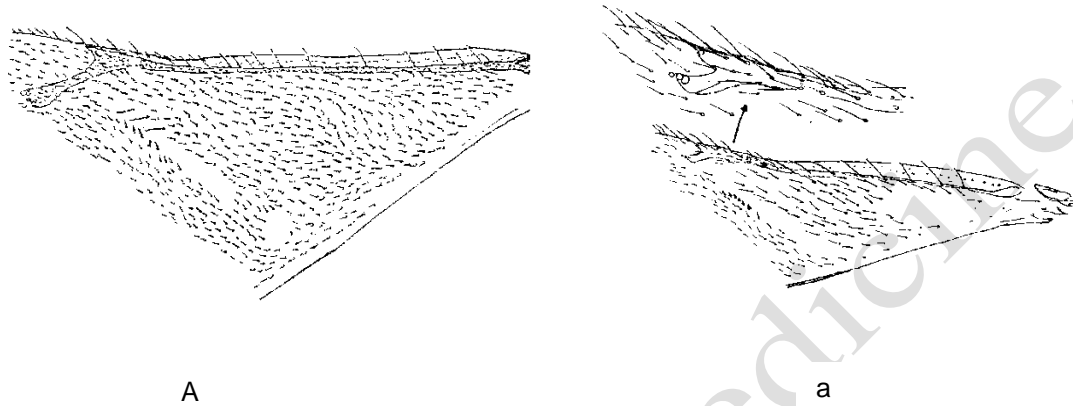
- 10. Fore wing infusate (Fig. A), occipital margin rounded or sharp, head and thorax with conspicuous pale setae *Trichomasthus* Thomson
- Fore wing hyaline or very pale brown (Fig. a).....11



- 11. Thoracic dorsum largely yellow or orange (Fig. A)12
- Thoracic dorsum completely dark and metallic, hypopygium not reaching past apex of gaster, clava with apex rounded *Teleterebratus* Compere & Zinna



12. Marginal vein very short or punctiform (Fig. A) 13
 -. Marginal vein at least twice as long as broad, hypopygium not extending more than three quarters along gaster, at least one funicle segment quadrate to broad (Fig. a)
 *Xenostyxis* Girault



13. Toruli situated relatively lower, their lower margin below lower eye margin (Fig. A), foe wing with linea calva interrupted or closed or dorsal surface of wing by at least one line of setae
 *Metaphycus* Mercet
 -. Toruli situated relatively higher on head, with their lower margins level with or above lower eye margins (Fig. a).....
 *Thomsonisca* Ghesquiere

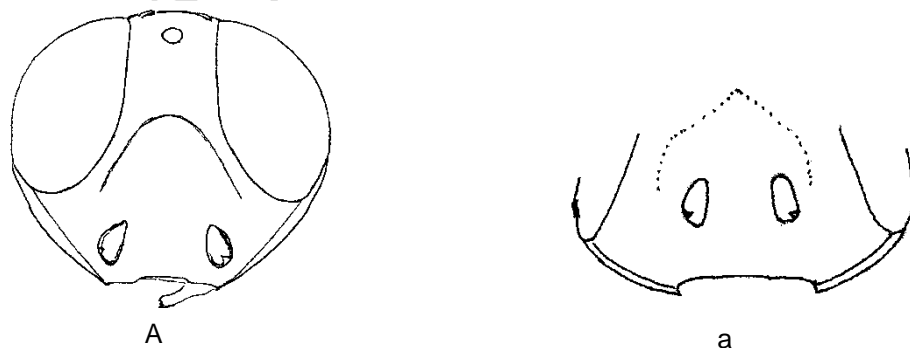


Table 1. List of Encyrtid parasitoid genera including total number of species (World and Indian), diaspidid host and distribution.

Parasitoid Genera	Total No. of Species		Diaspidid Host(s)	Distribution
	World	India (excluding those species with unknown hosts)		
<i>Adelencyrtus</i>	25	10		
Ashmead	-	<i>Adelencyrtus moderatus</i> (Howard)	<i>Duplacionaspis</i> sp.; <i>lepidosaphes</i> sp. on citrus (Compere & Annecke)	Andaman & Nicobar Island, Assam, Delhi, Karnataka, Orissa, Pondicherry, Uttaranchal, Uttar Pradesh, West Bengal.
		<i>Adelencyrtus coxalis</i> Hayat, Alam & Agarwal	<i>Pinnaspis strachani</i> on <i>Murraja koengii</i> (Hayat <i>et al.</i>)	Andhra Pradesh
		<i>Adelencyrtus axillaris</i> (Girault)	<i>Aspidiotus destructor</i> (Hayat) on black pepper.	Kerala
		<i>Adelencyrtus mayurai</i> (Subba Rao)	<i>Melanaspis glomerata</i> (Subba Rao & Hayat) on sugarcane	Delhi, Gujarat, Karnataka, Tamil Nadu, Uttar Pradesh.
		<i>Adelencyrtus bimaculatus</i> Alam	<i>Aonidiella orientalis</i> (Hayat <i>et al.</i>) on <i>Citrus</i> sp. and on <i>Dalbergia sissoo</i>	Andaman & Nicobar Islands, Jharkhand, Karnataka, Rajasthan, Uttar Pradesh.
		<i>Adelencyrtus bifasciatus</i> (Ishii)	<i>Aonidiella aurantii</i> (Subba Rao & Hayat) on rose; <i>Melanaspis</i> sp. (Compere & Annecke) on sugarcane; <i>M. glomerata</i> (Agarwal) on sugarcane.	Bihar, Delhi, Karnataka, Maharashtra
<i>Arrhenophagus Aurivillius</i>	2	1		
		<i>Arrhenophagus chionaspidis</i>	<i>Pinnaspis strachani</i> (Hayat); <i>Diaspis</i> sp.	Andhra Pradesh, Karnataka, Uttar

		Aurivillius	on <i>Citrus medica</i> (Agarwal)	Pradesh
Caenohomalopoda Tachikawa	7	3		
		<i>Caenohomalopoda longistylata</i> (Singh)	On Indet. diaspidid	Mizoram
		<i>Caenohomalopoda longiclava</i> (Basha & Hayat)	On Indet. Diaspidid	Bihar
		<i>Caenohomalopoda koreana</i> (Paik & Paik)	On Indet. diaspidid	Tamil Nadu
Cerapteroceroides Ashmead	8	5		
		<i>Cerapteroceroides ghorpadei</i> (Hayat)	Hyperparasitoids of diaspididae via other Encyrtidae and Aphelinidae	Karnataka, Kerala
		<i>Cerapteroceroides similis</i> (Ishii)		Himachal Pradesh,
		<i>Cerapteroceroides japonicus</i> (Ashmead)		Uttaranchal
		<i>Cerapteroceroides angustifrons</i> (Singh & Agarwal)		Assam
		<i>Cerapteroceroides latifrons</i> (Singh & Agarwal)		Assam
Coccidencyrtus Ashmead	3	30		
		<i>Coccidencyrtus mandibularis</i> (Hayat, Alam & Agarwal)	<i>Pinnaspis strachani</i> (Hayat); <i>Phenocaspis</i> sp. on <i>Mangifera indica</i> (Hayat et al.)	Karnataka, Uttar Pradesh
		<i>Coccidencyrtus shafeei</i> (Hayat, Alam & Agarwal)	<i>Aonidiella</i> sp. (Hayat et al.) on <i>Mangifera indica</i>	Kerala, Rajasthan, Uttar Pradesh
		<i>Coccidencyrtus clavatus</i> (Hayat, Alam & Agarwal)	<i>Lepidosaphes</i> sps. (Hayat et al.) on <i>Tamarindus indica</i>	Andaman & Nicobar Islands, Andhra Pradesh
Comperiella Howard	9	5		
		<i>Comperiella indica</i> Ayyar	<i>Aspidiotus tamarindi</i> (Ayyar) on tamarind	Tamil Nadu, Uttar Pradesh

		<i>Comperiella lemniscata</i> Compere & Annecke	<i>Aonidiella orientalis</i> (Hayat) on <i>Zizyphus jujube</i> (Glover) same host on <i>Eugenia jambolana</i> (Agarwal) same on <i>Psidium guajava</i> (Hayat) same on <i>Ficus sp.</i> (Hayat) on <i>Carissa grandiflora</i> (Compere & Annecke)	Jharkhand, Maharashtra, Rajasthan, Uttar Pradesh
		<i>Comperiella bifasciata</i> Howard	<i>Aonidiella aurantii</i> (Subba Rao) on rose; <i>Aonidiella citrina</i> (Flanders); <i>Aspidiotus destructor</i> on mango (Tandon & Shrivastava)	Delhi, Karnataka, Tamil Nadu, Uttar Pradesh
		<i>Comperiella aspidiotiphagha</i> Subba Rao	<i>Aonidiella orientalis</i> on <i>Eugenia</i> (Hayat et al.); <i>jambolana</i> (Agarwal) same host on <i>Dalbergia sissoo</i> (Subba Rao); <i>Psidium guajava</i> and <i>Ficus sp.</i> (Hayat et al.) <i>Aspidiotus</i> sps. on <i>Dalbergia sissoo</i>	Delhi, Rajasthan, Uttar Pradesh
<i>Epitetracnemus</i> Girault	6	1		
		<i>Epitetracnemus intersectus</i>	On Indet. diaspidid scales	Andaman & Nicobar Islands
<i>Metaphycus</i> Mercet	More than 400 sp.	15		
		<i>Metaphycus zebratus</i> (Mercet)	<i>Aonidiella orientalis</i> <i>Dalbergia sissoo</i> (Shafee et al.)	Himachal Pradesh, Punjab, Uttar Pradesh
		<i>Metaphycus mashoodi</i> Noyes & Woolley	<i>Aonidiella orientalis</i> on <i>Eugenia jambolana</i> (Alam)	Uttar Pradesh
<i>Plagiomerus</i> Crawford	7	2		
		<i>Plagiomerus bangaloriensis</i> Shafee, Alam & Agarwal	<i>Aonidiella orientalis</i> On <i>Polygonum glabrum</i> (Hayat)	Karnataka, Kerala
<i>Teleterebratus</i> Compere & Zinna	4	1		

		<i>Teleterebratus indicus</i> (Narayanan)	<i>Quadriaspidotus perniciosus</i> (Narayanan)	Jammu & Kashmir
Thomsonisca Ghesquiere	6	4		
		<i>Thomsonisca pakistanensis</i> (Ahmad)	<i>Aspidiotus destructor</i> (Subba Rao) on <i>Mangifera indica</i> ; <i>Aulacaspis</i> sp. (Subba Rao) on mango; <i>Phenocaspis</i> sp. (Subba Rao) on <i>Mangifera indica</i> <i>Aspidiotus</i> sp. (Hayat et al.) on sandalwood	Karnataka, Rajasthan, Uttar Pradesh
		<i>Thomsonisca sankarani</i> Subba Rao	<i>Aulacaspis</i> sp. (Subba Rao); <i>Pseudaulacaspis barberi</i> (Subba Rao) on <i>Mangifera indica</i> , <i>Pseudaulacaspis cockerelli</i> (Hayat)	Karnataka
		<i>Thomsonisca indica</i> Hayat	<i>Aonidiella orientalis</i> on <i>Ficus</i> sp.(Hayat)	Uttar Pradesh
Trichomasthus Thomson	31	3		
		<i>Trichomasthus rufus</i> (Singh, Agarwal & Basha)	On indet. diaspididae scales Unknown	Assam
		<i>Trichomasthus assamensis</i> (Hayat & Basha)	Unknown	Assam
Xenostryxis Girault	8	2		
		<i>Xenostryxis tenuicauda</i> (Hayat)	Indet. diaspidid	Kerala
		<i>Xenostryxis brevicauda</i> (Hayat)	Indet. diaspidid	Andhra Pradesh, Kerala
Zaomma Ashmead	13	1		
		<i>Zaomma lambinus</i> (Walker)	Indet. Diaspidini (Hayat et al.)	Andaman & Nichobar Island, Kerala, Uttar Pradesh

Table 2. Distribution of Encyrtid parasitoids in States of India.

ENCYRTIDAE		STATE CODES (ABBREVIATIONS)†																																				
GENUS	SPECIES	AN	AP	AR	AS	BR	CH	CT	DN	DD	DL	GA	GJ	HR	HP	JK	JH	KA	KL	LD	MP	MH	MN	ML	MZ	NL	OR	PY	PB	RJ	SK	TN	TR	UA	UP	WB		
<i>Adlencyrtus</i>	<i>moderatus</i>	●	-	-	●	-	-	-	-	-	●	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	●	●	-	-	-	-	-	-	●	●	●
<i>Adlencyrtus</i>	<i>coxalis</i>	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Adlencyrtus</i>	<i>axillaris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Adlencyrtus</i>	<i>mayurai</i>	-	-	-	-	-	-	-	-	●	-	●	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	●	-	-	
<i>Adlencyrtus</i>	<i>bimaculatus</i>	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	●	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	●	-	
<i>Adlencyrtus</i>	<i>bifasciatus</i>	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Arrhenophagus</i>	<i>chionaspidis</i>	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	
<i>Caenohomalopoda</i>	<i>longistylata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Caenohomalopoda</i>	<i>longiclava</i>	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Caenohomalopoda</i>	<i>koreana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	
<i>Cerapteroceroides</i>	<i>ghorpadei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Cerapteroceroides</i>	<i>similis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Cerapteroceroides</i>	<i>japonicus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	
<i>Cerapteroceroides</i>	<i>angustifrons</i>	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Cerapteroceroides</i>	<i>latifrons</i>	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Coccidencyrtus</i>	<i>mandibularis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-
<i>Coccidencyrtus</i>	<i>shafeei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	●	-
<i>Coccidencyrtus</i>	<i>clavatus</i>	●	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Comperiella</i>	<i>indica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	●	-	
<i>Comperiella</i>	<i>lemniscata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	●	-	-	-	-	-	●	-	-	-	-	-	-	●	-
<i>Comperiella</i>	<i>bifasciata</i>	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-
<i>Comperiella</i>	<i>aspidiotiphaga</i>	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	●	-
<i>Epitetraneurus</i>	<i>intersectus</i>	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Metaphycus</i>	<i>zebratus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	●	-
<i>Metaphycus</i>	<i>mashhoodi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-
<i>Plagiomerus</i>	<i>bangaloriensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Plagiomerus</i>	<i>monticulus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	
<i>Teletebratus</i>	<i>indicus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	
<i>Thomsonisca</i>	<i>pakistanensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	●	-
<i>Thomsonisca</i>	<i>sankarani</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Thomsonisca</i>	<i>indica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-
<i>Trichomasthus</i>	<i>rufus</i>	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Trichomasthus</i>	<i>assamensis</i>	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Xenostyxis</i>	<i>tenuicauda</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Xenostyxis</i>	<i>brevicauda</i>	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Zaomma</i>	<i>lambinus</i>	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-

† Abbreviations Used

AN Andaman & Nicobar Islands
 AP Andhra Pradesh
 AR Arunachal Pradesh
 AS Assam
 BR Bihar
 CH Chandigarh
 CT Chhattisgarh
 DN Dadar and Nagar Haveli
 DD Daman and Diu
 DL Delhi
 GA Goa
 GJ Gujarat

HR Haryana
 HP Himachal Pradesh
 JK Jammu and Kashmir
 JH Jharkhand
 KA Karnataka
 KL Kerala
 LD Lakshadweep
 MP Madhya Pradesh
 MH Maharashtra
 ML Meghalaya
 MZ Mizoram
 NL Nagaland

OR Orissa
 PY Pondicherry
 PB Punjab
 RJ Rajasthan
 SK Sikkim
 TN Tamil Nadu
 TR Tripura
 UA Uttarakhand
 UP Uttar Pradesh
 WB West Bengal

Discussion

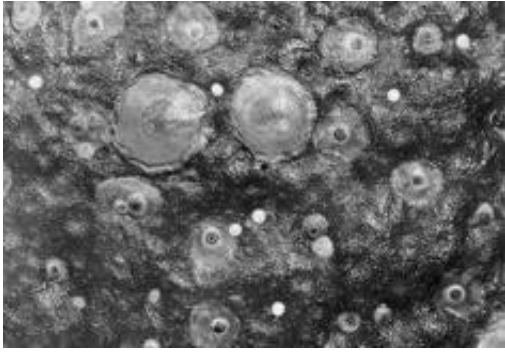
The present study revealed the importance of Encyrtid Parasitoids in controlling Armoured scale insects (extremely harmful and injurious to many important fruit trees and ornamental plants). The Identification of these Parasitoids is essential by giving identifying keys, and a list providing many species of Parasitoids, host of Parasitoids and their distribution in India. The studied 14 Encyrtid Parasitoids otherwise act as efficient biocontrol agents against Armoured scale insects. It is well known that any success or failure in any biocontrol programme depends on the correct identification of the host and its Parasitoid, incorrect identification leads to waste of years of manpower and loss of money. So, correct identification is very important for any success.

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**Fig. 1: Armoured scale insects
(Family Diaspididae)**



**Fig. 2: *Comperiella bifasciata*
(Family Encyrtidae)**

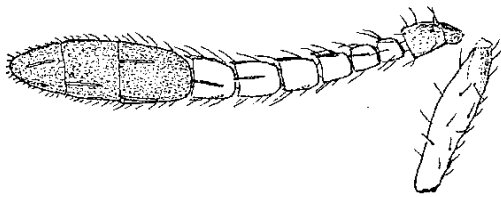


Fig. 2: ♀ Antenna

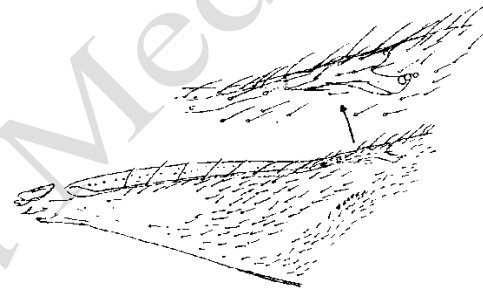


Fig. 3: Forewing (marginal vein)

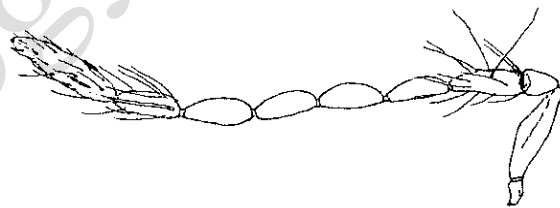


Fig. 4: ♂ Antenna