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Aphelinid parasitoids (Hymenoptera: Chalcidoidea) of armoured scale insects (Homoptera: Diaspididae) from India

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Abstract

The members of the family Diaspididae are among the most important pests in agriculture and considered as a promising target for the biological control programmes. These insects may attack any part of plant by sucking sap, injecting toxic saliva, due to which the trees show heavy damage resulting in collapse. However, these insects are usually parasitized by the members of the families like Aphelinidae, Encyrtidae and Signiphoridae. Among these families of parasitic hymenoptera, the members of the family Aphelinidae appear to be a dominant factor in bringing about partial to complete control of these insects. The taxonomic study of these parasitoids is essential to provide correct identification without which successful control measures cannot be achieved. Present work is a preliminary step in providing knowledge of Indian Aphelinid genera which acts as an efficient biocontrol agent against above mentioned pest species and found to be helpful in biological control programmes.

Keywords: Aphelinidae; armoured scale insects; parasitoids; India.

Introduction

The members of the family Diaspididae are commonly called as "Armoured Scale Insects" (Fig. 3) belonging to the important family in the Coccoidea because of their number, abundance and economic significance. Many species of armoured scales are among the most important pest in agriculture and considered as a promising target for the biological control programmes. They are found on all parts of the plant but are most noticeable on the fruit. Heavy infestations may cause discoloration, shoot distortion and leaf drop. The tree's bark may split and the twigs and branches may die back and this sometimes shows heavy damage resulting in collapse. Chemical control is difficult because the insects are protected by their hard waxy coverings. They are also becoming resistant to many insecticides and pesticides. However, these armoured scales are usually parasitized by a number of chalcidoid parasitoids belonging to the families Aphelinidae, Encyrtidae and Signiphoridae. Among these families of parasitic Hymenoptera, the members of the family Aphelinidae appears to be a dominant factor in bringing about partial to complete control of armoured scale insects (Rosen and DeBach, 1979; Viggiani, 1990). In spite of the fact that large number of armoured scale Insects are responsible for damage of fruit trees resulting in loss of fruit production, so far there is no comprehensive work dealing with the armoured scale parasitoid of insects from India, however, several publications dealing with the taxonomy

of Indian Aphelinidae, parasitoids reared from armoured scale hosts were also described. The following publications are of use in identifying the parasitoids: Rosen and DeBach (1979); Agrawal (1984); Hayat (1974, 1983, 1985, 1986, 1998); Compere (1955).

In present work, a generic key for the identification of the Aphelinid parasitoids of the armoured scale insects is given along with the list of these parasitoids, their total number of species in world and India and species of armoured scale insects (hosts) with their distribution in India.

Family Aphelinidae

The Chalcidoid family Aphelinidae contains 32 genera in total among which 21 genera occur in India, of these the species of the genera known to be exclusively parasitic on armoured scale insects are *Aphytis* Howard, *Coccobius* Ratzeburg, *Coccophagoides* Girault, *Encarsia* Foerster, *Marlattella* Howard, *Pteroptrix* Westwood, and *Proaphelinoidea* Girault, and of these the genera *Bardylis* and *Prophycusare* not represented from India (Hayat, 1985, 1989).

The genus *Encarsia* Foerster with over 200 described species in the world contains about 20% species that are considered parasitoids of armoured scale insects.

Diagnosis of Aphelinids

Female: Small to medium sized chalcids not exceeding 1.5 mm in length, antennae 3-9 segmented, excluding the radicle and anelli

(Fig.1), mandible with 2 teeth and a truncation, mesoscutum with complete notaular line, forewing with marginal vein long, stigma vein usually short (Fig. 2); gaster usually with 7 terga, occasionally with 8 terga.

Male: Sexual dimorphism very little and largely confined to the antennal structure.

Brief notes on the Indian genera of Aphelinid parasitoids of armoured scale insects

1. Genus *Aphytis* Howard [Key couplet: 4] (Figs. 4-6)

Aphytis Howard, 1900: 168. Type species *Aphytis chilensis* Howard, by monotypy.

Prospaphelinus De Gregorio, 1914: 227. Type species *Aphelinus (Prospaphelinus) silvestrii* De Gregorio, by monotypy. As subgenus of *Aphelinus*. Synonymy by Mercet, 1930b: 48-49.

Paraphytis Compere, 1925: 129. Type species *Paraphytis vittatus* Compere, by original designation. Synonymy by DeBach & Rosen, 1976: 541.

Syediella Shafee, 1970: 144. Type species *Syediella maculate* Shafee, by original designation. Synonymy by Hayat, 1982: 169.

Diagnosis

Female

Colour of body, antennae, wings and legs variable. Antenna with 6 segments, some with 5 or 4 segments. Pronotum medially membranous, thus made up of two plates, the seta at each postero lateral corner longer than other setae along collar; mid lobe with reduced number of setae, mainly 10-12, each axilla with 1 and scutellum with 4 setae; axillae very slightly projecting forwards; mesothoracic dorsum with a median pale line or shallow groove; metanotum with a antero-median tubercle; propodeum always longer than metanotum, with a fine open 'S'-shaped ridge mesad of each spiracle and medially always variously reticulate; mesopostphragma long and broad. Fore wing variable, but with venation long, reaching clearly beyond half-length of wing; Legs normal, not robust; tarsai 5-segmented. Petiole transverse, usually reticulate. Gaster with 7 terga.

Species and Distribution

World species, 130; India, 17 species.

2. Genus *Coccobius* Ratzeburg [Key couplet: 5] (Figs. 7-9)

Coccobius Ratzeburg, 1852: 195. Type species *Coccobius annulicornis* Ratzeburg, designated by

Gahan & Fagan, 1923: 37. Placed on Official List of Generic Names in Zoology, ICZN, 1991, Opinion 1646, Bull. Zool. Nomen., 48: 183-184.

Physcus Howard, 1895b: 43. Type species *Coccophagus varicornis* Howard, by monotypy. Synonymy by Hayat, 1983: 78.

Encyrtophyscus Blanchard, in De Santis, 1948: 192. Type species *Physcus flavoflagellatus* De Santis, by original designation. Synonymy by Hayat, 1983: 78.

Physculus Yasnosh, 1977: 1115. Type species *Physculus danzigae* Yasnosh, by original designation. Synonymy by Hayat, 1983: 78.

Diagnosis

Female

Antenna with 7 segments, with an anellus. Pronotum entire, narrow in dorsal view of thorax; mid lobe of mesoscutum large, with numerous setae of which the posterior pair long; side lobes small, shaped like a trapezium, each with 2 setae; axillae small, scutellum large, posterior margin broadly rounded, usually with 4-6 setae, rarely more than 6; metanotum with a median longitudinal groove; propodeum not or not much longer than metanotum, Fore wing without a lineal calva and with a characteristically shaped stigmal vein, Tarsai 5-segmented; mid tibial spur large; mid basitarsus with peg-like setae. Gaster at least as long as thorax, rarely shorter; hopypygium not extending to apex of gaster; ovipositor variable.

Species and Distribution

World species 74; India, 7 species.

3. Genus *Coccophagoides* Girault [Key couplet: 6] (Figs. 10 & 11)

Coccophagoides Girault, 1915: 58. Type species *Coccophagus abnormicornis* Girault, by original designation.

Diaspiniphagus Silvestri, 1927: 35. Type species *Prospalta similis* Masi, by original designation. Synonymy by Mercet, 1928b: 511.

Primaprospaltella DeBach & La Salle, 1981: 644. Type species *Prospalta murtfeldtae* Howard, by original designation. Synonymy by Hayat, 1983: 81.

Diagnosis

Female

Antenna with 8 segments, and usually with an anellus. Thorax depressed; pronotum medially membranous; axillae strongly produced forwards; scutellum distinctly shorter than mid lobe, each axilla and scutellum with 12-22, 2-3, 1-2, and 4-6 setae; propodeum with posterior margin medially triangularly produced. Fore wing

with marginal vein distinctly shorter than costal cell. Tarsai 5-segmented; tarsal segments generally shorter. Gaster about as long as head plus thorax; TVII band-like, latero-ventrally continuous with or connected to, outer plates of ovipositor, thus gaster with 8 terga; ovipositor at most slightly exerted; hypopygium either prominent reaching to apex or beyond of gaster, or only to about the level of cereal plates.

Species and Distribution

World species, 16; India, 2 species.

4. Genus *Encarsia* Foerster [Key couplet: 6] (Figs. 12-14)

Encarsia Foerster, 1878 65 Type species *Encarsia tricolor* Foerster, by monotypy *Aspidiotiphagus* Howard, 1894a 229 Type species *Coccophagus citrinus* Craw, by original designation Synonymy by Viggiani & Mazzone, 1979 44

Prospalta Howard, 1894b 6 Type species *Coccophagus aurantus* Howard, designated by the ICZN, Opinion 845 Preoccupied by *Prospalta* Walker, 1857, in Lepidoptera *Prospaltella* Ashmead, 1904b 126 Replacement name for *Prospalta* Howard, not Walker Synonymy by Viggiani & Mazzone, 1979 44

Mimatomus Cockerell, 1911 464 Type species *Mimatomu speltatus* Cockerell, by monotypy As synonym of *Prospaltella* by Girault, 1917a 114

Doloresia Mercet, 1912b 294 Type species *Prospaltella filicormis* Mercet, by original designation Synonymy by Mercet, 1930a 191

Prospaltoides Brethes, 1914 12 Type species *Prospaltoides howardi* Brethes, by original designation Synonymy with *Aspidiotiphagus* through synonymy of the type species, by Brethes, 1916 429

Paraspidwtiphagus Alam, 1956 359 Type species *Aspidiotiphagus flavus* Compere, by original designation As subgenus of *Aspidiotiphagus*

Aleurodiphilus DeBach & Rose, 1981 659 Type species *Aleurodiphilus amencanus* DeBach & Rose, by original designation Synonymy by Hayat, 1983- 85

Diagnosis

Female

Antenna with 8 segments, scape cylindrical or slightly flattened, but never expanded beneath; relative dimensions variable. Mandibles bidentate, teeth either sharp or blunt, or weakly developed. Thoracic dorsum only a little convex, but usually on the flatter side; pronotum medially membranous, with usually 6-12 setae along collar, a seta at each postero-lateral angle conspicuously longer; mid lobe with 2-18 setae; scutellum distinctly broader than long, more or less biconvex lens shaped, with 4 setae, and a

pair of pits; propodeum narrow in middle, not much longer than metanotum. Forewing shape and length of marginal fringe variable; costal cell at most as long as marginal vein, and usually with a line of minute setae on ventral surface; submarginal vein with 2 setae, rarely 1 or more than 2; there is always present a strong seta at junction of submarginal vein and parastigma or on parastigma; the number of setae on (anterior margin of) marginal vein vary; postmarginal vein absent, rarely indicated and then very short and like a spur; discal setae variable, disc very sparsely to very densely setose; Hind wings narrow, with sparsely setose disc and with a row of setae extending from apex of veins to apex of wing. Legs normal; tarsai 5-segmented or sometimes midtarsai 4-segmented. Petiole transverse. Gaster with 7 terga; hypopygium never extending to apex of gaster.

Species and Distribution

World species, 222; India, 52 species.

5. Genus *Marlattella* Howard [Key couplet: 2] (Figs. 15 & 16)

Marlattella Howard, 1907: 73. Type species *Marlattella prima* Howard, by original designation.

Diagnosis

Female

Antenna 4-segmented; funicle segment small, quadrate or broader than long; clava long, slightly curved. Eyes small, occupying much less than half of head; malar space longer; frontovertex narrower than eye. Pronotum medially membranous; mid lobe, each side lobe and scutellum with 6, 2 and 4 setae; axilla without setae; mid lobe and scutellum with a mid-longitudinal fine line; propodeum slightly longer than metanotum, with a triangular projection in middle of posterior margin. Fore wing as in *Aphytis*; costal cell distinctly shorter than marginal vein and with 2 setae; linea calva distinct, proximally bordered by several lines of setae; submarginal vein with one seta; stigma vein short, but with a distinct neck, stigma with 4 sensilla. Tarsai 5-segmented. Gaster as in *Aphytis*; hypopygium not extending to apex of gaster.

Species and Distribution

World species, 2; India, 1 species.

6. Genus *Pteroptrix* Westwood [Key couplet: 1] (Figs. 17 & 18)

Pteroptrix Westwood, 1833b: 344. Type species *Pteroptrix dimidiatus* Westwood, by monotypy. [*Pterothrix* Nees, 1834: 409. Invalid emendation] [*Gyrolasia* Foerster, 1856: 145. Replacement name for *Pterothrix* Nees, considered preoccupied by *Pterothrix* de Candolle, in plants]

Archenomus Howard, 1898: 136. Type species *Archenomus bicolor* Howard, by monotypy. Synonymy by Nowicki, in Mercet, 1928b: 507

Casca Howard, 1907: 83. Type species *Casca chinensis* Howard, by original designation. Synonymy by Novitzky, 1962: 193.

Artas Howard, 1907: 85. Type species *Artas koebele* Howard, by original designation. Synonymy by Hayat, 1983: 94.

Wspaniella Mercet, 1911: 511. Type species *Archenomus lauri* Mercet, by original designation. Implied synonym of *Pteroptrix* by Viggiani, in Viggiani&Garonna, 1993: 58.

Pteroptrichoides Fullaway, 1913: 27. Type species *Pteroptrichoides perkinsi* Fullaway, by original designation. Synonymy by Mercet, 1928b: 507.

Apteroptrix Girault, 1915: 65. Type species *Apteroptrix albifemur* Girault, by original designation. Implied synonym of *Pteroptrix* by Viggiani, in Viggiani&Garonna, 1993: 58.

Pseudopteroptrix Fullaway, 1918: 464. Type species *Pseudopteroptrix imitatrix* Fullaway, by monotypy. Synonymy by Mercet, 1928b: 507.

Oa Girault, 1929b: [4], Type species *Archenomus biguttatus* Girault, by original designation. Implied synonym of *Pteroptrix* by Viggiani, in Viggiani&Garonna, 1993:58.

Aphelosoma Nikol'skaya, 1963: 186. Type species *Aphelosoma plana* Nikol'skaya, by original designation. Synonymy by Viggiani, in Viggiani&Garonna, 1993: 58.

Archenomiscus Nikol'skaya, in Nikol'skaya&Yasnosh, 1966: 249. Type species *Pteroptrix maritimus* Nikol'skaya, by designation of Hayat, 1983: 77. Implied synonym of *Pteroptrix* by Viggiani, in Viggiani&Garonna, 1993: 58. [Described as a subgenus of *Archenomus*]

Diagnosis

Female

Extremely close to *Encarsia* Foerster, and especially, but differing from that genus in

having all tarsi 4-segmented, antenna 7 or 8 segmented and the flagellum usually elongate, spindle-shaped.

Species and Distribution

World species, 62; Oriental, 30; India, 5 species.

7. Genus *Proaphelinoides* Girault

[Key couplet: 4] (Figs. 19 &20)

Proaphelinoides Girault, 1917c: [4]. Type species *Proaphelinoides elongatiformis* Girault, by original designation.

Bestiola Nikol'skaya, 1963: 187. Type species *Bestiola mira* Nikol'skaya, by original designation. Synonymy by Rosen, 1980 [Dec.]: 299; also Hayat, 1981 [Jan.]: 469.

Diagnosis

Female

Antenna 6 segmented, Mandible bidentate, Pronotum long, medially divided by a suture; mid lobe and scutellum with a fine mid-longitudinal line/groove; scutellum with a notch in posterior margin; setae on thoracic dorsum long and brown to dark brown; mid lobe, each side lobe, each axilla and scutellum with 12-16, 2, 1 and 4 setae; propodeum medially as long as metanotum and with a fine; posterior margin of propodeum with very fine crenulae. Fore wing broad, with or without a bunch of dark setae behind proximal half of marginal vein; linea calva distinct or not clearly defined, proximally bordered by 1-4 lines of setae; submarginal vein with 2 setae, the distal seta very long; marginal vein distinctly longer than costal cell and with long setae; stigma with 4 sensilla. Hind wing broad, with sparsely to moderately densely setose disc. Legs long and slender; tarsi 5-segmented. Gaster at least as long as head plus thorax; ovipositor long, slightly exerted at apex.

Species and Distribution

World species, 4; India, 2 species.

Key to Indian Aphelinid Genera, Parasitoid of Armoured Scale Insects

- 1. Tarsi 4 segmented, antenna 7 segmented (Fig. 17).....*Pteroptrix* Westwood
- Tarsi 5 segmented (Fig. 16).....2
- 2. Antenna 4 segmented (Fig. 15)*Marlattella* Howard
- Antenna with more than 4 segments.....3
- 3. Antenna 6 segmented (Fig. 19), propodeum longer than metanotum.....4
- Antenna at least 7 segmented, propodeum no longer than metanotum.....5

- 4. Body elongated and flattened; fore wing with a branch of dark setae below marginal vein (Fig. 20)....
.....*Proaphelinoides* Girault
- Body neither elongated nor flattened, forewing normal*Aphytis* Howard
- 5. Antenna 7 segmented (Fig. 7); axillae short, not protruding.....
.....*Coccobius* Ratzeberg
- Antennae 8 segmented; axillae protruding6
- 6. Antennae spindle shaped; forewing with marginal vein shorter than sub-marginal vein, the latter with 3 setae (Fig. 10 & 11).....
..... *Coccophagoides* Girault
- Antenna usually not spindle shaped, fore wing with marginal vein longer than submarginal, the latter with 2 setae (Fig. 12 & 13).....
.....*Encarsia* Foerster

List of Aphelinid parasitoids, including total number of species (world and Indian), armoured scale insects/Diaspidids host(s) and distribution.

Parasitoid Genera	Total Number of Species		Diaspidid Host(s)	Distribution
	World	India (excluding those species with unknown hosts)		
<i>Aphytis</i> Howard	130	17		
		<i>Aphytis bangalorensis</i> Rosen & DeBach	<i>Pseudaulacaspis barberi</i> (Green) on Mango	Karnataka
		<i>Aphytis fiorinae</i> (Rosen & Rose)	<i>Fiorinia theae</i> (Green) on tea	Assam
		<i>Aphytis lephidosaphes</i> (Compere)	<i>Cornuaspis beckii</i> (Newman)	India without specific region
		<i>Aphytis lingnanensis</i> Compere	<i>Aonidiella aurantii</i> (Maskell)	Near New Delhi, Assam, Uttar Pradesh
		<i>Aphytis melinus</i> DeBach	<i>Aonidiella aurantii</i> (Maskell) on rose indet.diaspidid on Citrus species	Haryana, New Delhi
		<i>Aphytis vandenboschi</i> DeBach & Rosen	<i>Quadriaspidotus perniciosus</i>	Himachal Pradesh
		<i>Aphytis coheni</i> DeBach	<i>Aonidiella orientalis</i>	Khunti near Bihar
		<i>Aphytis manii</i> Hayat	<i>Hemiberlesa lataniae</i>	Karnataka
		<i>Aphytis</i>	<i>Paralatoria oleae</i>	India

		<i>paramaculicornis</i> (DeBach& Rosen)	(Lucas)	
		<i>Aphytis peculiaris</i> (Girault)	<i>Aonidiella orientalis</i> (Newstead) on rose	Khunti near Bihar
		<i>Aphytis proclia</i> (Walker)	<i>Parlatoria ziziphus</i> (Lucas)	India
		<i>Aphytis philippinensis</i> DeBach& Rosen	<i>Aonidiella aurantii</i> (Maskell)	Assam, Karnataka
		<i>Aphytis sankarani</i> Rosen &DeBach	<i>Pseudaulacaspis cockerelli</i> (Cooley) on betel nut, banana and coconut	Karnataka
		<i>Aphytis theae</i> (Cameron)	<i>Fiorinia theae</i> (Green) on tea <i>Pseudaonidia duplex</i> (Cockerell) on tea	Assam, Himachal Pradesh
Coccobius Ratzberg	26	7		
		<i>Coccobius aligarhensis</i> (Hayat)	<i>Aonidiella orientalis</i> (Newstead) on <i>Ficus</i> sp.	Uttar Pradesh
		<i>Coccobius eticulates</i> (Compere &Annecke)	<i>Aonidiella orientalis</i> (Newstead) on <i>Dalbergia sisso</i>	Andhara Pradesh, Uttar Pradesh, Karnataka, Maharashtra, Bihar (Khunti), Kerala
		<i>Coccobius comperei</i> (Hayat)	on Indet. Diaspidids	Karnataka , Kerala
		<i>Coccobius fulvus</i> (Compere &Annecke)	<i>Pinaspis strachani</i> (Cooley) on <i>Citrus</i> sp.; <i>Aonidiella orientalis</i> (Newstead) on <i>Dalbergia sisso</i>	Karnataka, Uttar Pradesh
Coccophagoides Girault	16	2		
		<i>Coccophagoides utilis</i> Doult	<i>Parlatoria oleae</i> (Lucas) on peach	Bihar
		<i>Coccophagoides orientalis</i> Agarwal	<i>Aonidiella orientalis</i> (Newstead) on neem, ziziphus, jamun etc.	Bihar, Rajasthan, Uttar Pradesh

<i>Encarsia</i> Foerster	222	52		
		<i>Encarsia citrina</i> (Craw)	<i>Aonidiella orientalis</i> (Newstead) on coconut; <i>Quadraspidiotus</i> <i>perniciosus</i> (Comstock)	Karnataka, Himachal Pradesh, Jammu & Kashmir
		<i>Encarsia perniciosi</i> (Tower)	<i>Quadraspidiotus</i> <i>perniciosus</i> (Comstock) on apple	Punjab, Uttar Pradesh, Jammu & Kashmir, Himachal Pradesh
		<i>Encarsia elongate</i> (Dozier)	<i>Fiorinia theae</i> (Green) on tea	Assam
		<i>Encarsia sankarani</i> Hayat	<i>Fiorinia theae</i> (Green) on tea	Assam
		<i>Encarsia aurantii</i> (Howard)	<i>Aonidiella orientalis</i>	Karnataka, Andhara Pradesh
		<i>Encarsia</i> <i>bifasciata</i> Hayat	<i>Aonidiella orientalis</i> (Newstead) on <i>Ficus</i> sp.	Bihar, Delhi, Uttar Pradesh
<i>Marlattella</i> Haward	2	1		
		<i>Marlattella maculata</i> (Hayat)	<i>Aonidiella orientalis</i> (Newstead) on <i>Ficus</i> sp.	Uttar Pradesh
<i>Proaphelinoidis</i> Girault	4	2		
			(Armoured scale of the tribe odonaspidini)	Assam, Karnataka
<i>Pteroptrix</i> Westwood	62	5		
		<i>Pteroptrix chinensis</i> (Westwood)	<i>Quadraspidiotus</i> <i>perniciosus</i> (Comstock)	Jammu & Kashmir
		<i>Pteroptrix koebelei</i> (Haward)	<i>Anlacaspis tubercularis</i>	Karnataka
		<i>Pteroptrix</i> <i>machiaveli</i> (Girault)	<i>Chionaspis ramakrishnai</i>	Karnataka
		<i>Pteroptrix</i> <i>longiclavata</i> (Shafee et al)	<i>Aonidiella orientalis</i> (Newstead)	Uttar Pradesh

Discussion

The Aphelinid parasitoids had been chosen by the author as they are important in controlling the pest of agriculture especially the armoured scale insects and act as ecofriendly biocontrol agents to the environment. The taxonomic

studies of these parasitoids both at generic and specific levels is important before their recommendation in any biological control program, without which an effective control measures cannot be achieved as

misidentification leads to the failure of any biocontrol strategy.

The present work providing brief study of these parasitoids which can be identified using key to genera as well as distribution of these parasitoids and their specific hosts (armoured scale insects). The present work is helpful in providing knowledge of Indian Aphelinid genera mainly associated with armoured scale species. This work also provides important information about the distribution of aphelinid parasitoids, which is helpful in any conservation programmes of these parasitoids.

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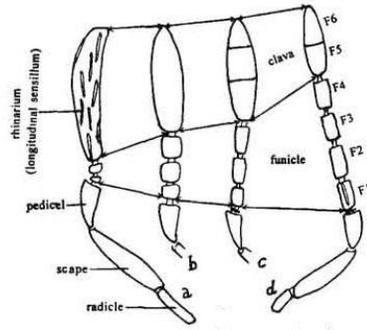
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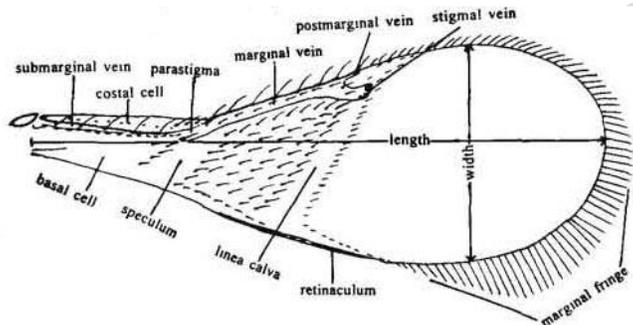
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Figures



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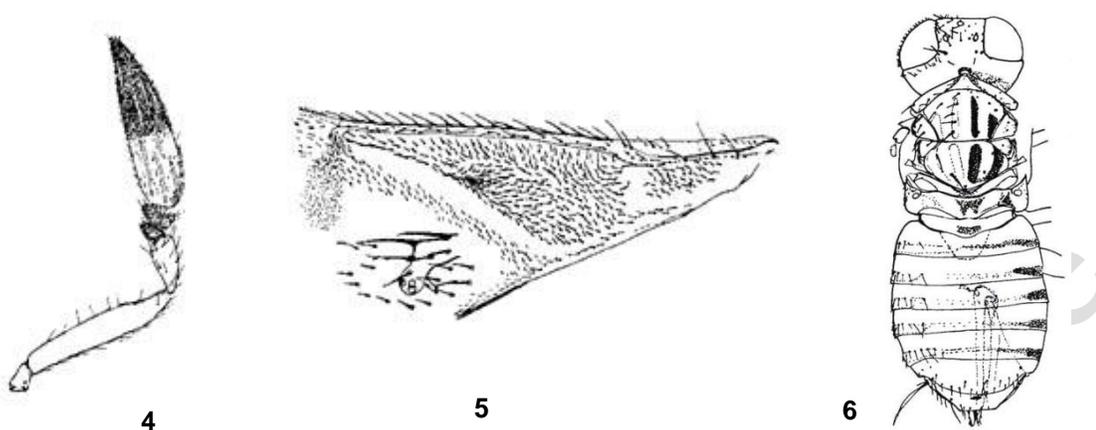
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Figs. 1 & 2. Explanation of terms (Aphelinidae): 1, Antenna; 2, Forewing.

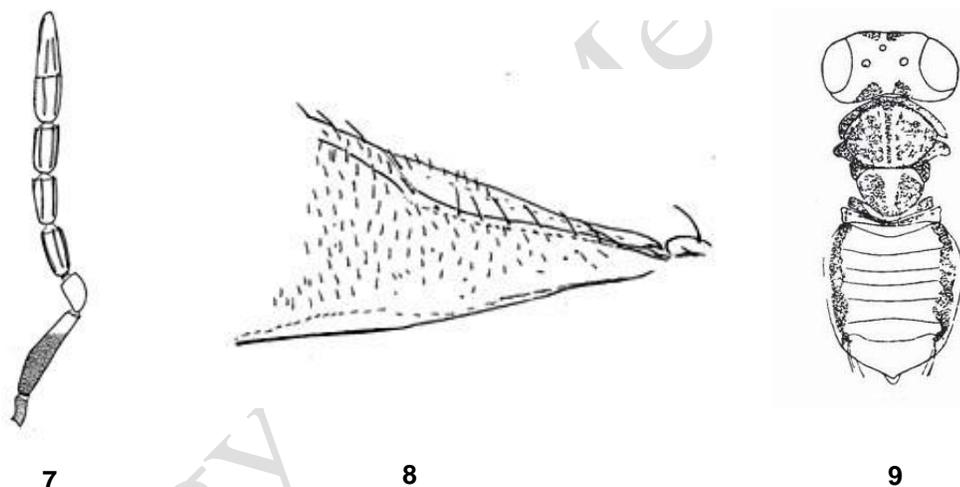


3

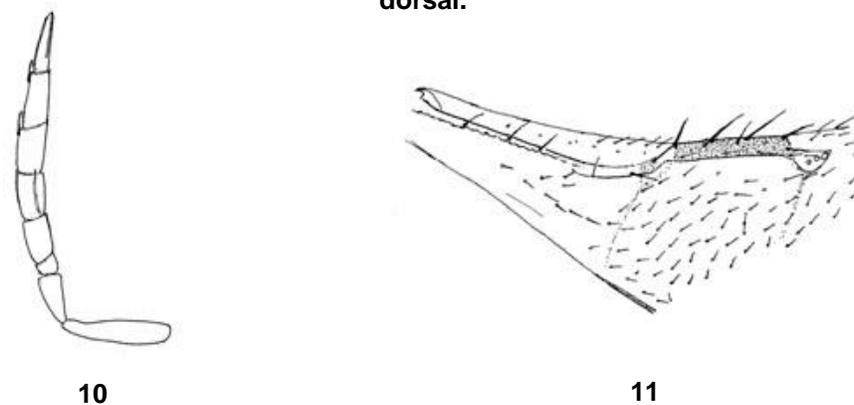
Fig. 3. Armoured Scale Insect (*Aonidiella orientalis*).



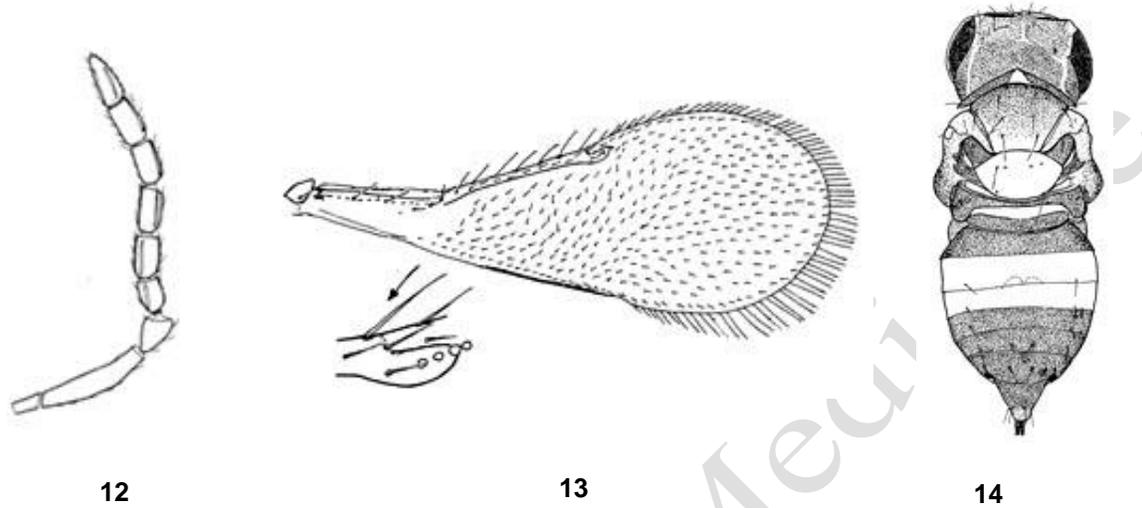
Figs. 4-6. *Aphytis* Howard: 4, Antenna; 5, Forewing, basal part; 6, Body, dorsal.



Figs. 7-9. *Coccobius* Ratzeburg: 7, Antenna; 8, Forewing, basal part; 9, Body, dorsal.



Figs. 10 & 11. *Coccophagoides* Girault: 10, Antenna; 11, Forewing, basal part.



Figs. 12-14. *Encarsia* Foerster: 12, Antenna; 13, Forewing, basal part; 14, Body, dorsal.



Figs. 15 & 16. *Marlattiella* Howard: 15, Antenna; 16, Tarsal segments.



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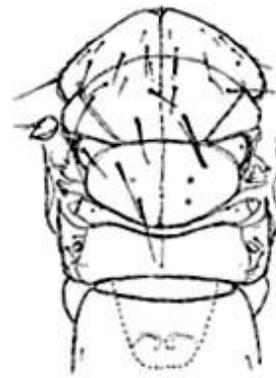


18

Figs. 17 & 18. *Pteroptrix* Westwood: 17, Antenna; 18, Thorax, dorsal.



19



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Figs. 19 & 20. *Proaphelinoides* Girault: 19, Antenna; 20, Thorax, dorsal.