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A review of the European genera of Trichogrammatidae (Hymenoptera: Chalcidoidea)

Abstract: After the presentation of the general characters of the family and the nomenclature used in its taxonomy, the author reviewed the 31 genera of Trichogrammatidae recorded in Europe and provided a key for their identification. For each genus, a short diagnosis is given with illustrations and notes on distribution, diversity, and hosts. The classification of the family is discussed.

Riassunto: Una revisione dei generi europei di Trichogrammatidae (Hymenoptera: Chalcidoidea).

Dopo la presentazione dei caratteri generali della famiglia e della nomenclatura utilizzata per la sua tassonomia, l'autore rivede i 31 generi di Trichogrammatidae segnalati in Europa e propone una chiave per la loro identificazione. Per ogni genere è data una breve diagnosi, con illustrazioni e note sulla distribuzione, diversità e ospiti. È discussa la classificazione della famiglia.

Key words: general morphology, nomenclature, taxonomy, classification, insect-egg parasitoid.

INTRODUCTION

The Family Trichogrammatidae (Hymenoptera: Chalcidoidea) includes internal egg parasitoids of several orders of insects, mostly Hemiptera, Coleoptera, Lepidoptera, and Diptera. Although widely distributed, their small size (from about 0.2 mm to 1.5 mm) and fragility make their collecting and study difficult. At present, about 100 genera are recognized, including more than 1000 valid species (Viggiani, 2019). Morphologically, the members of this group are distinguished by having 3-segmented tarsi in both sexes and antennae with a maximum of a 2-segmented funicle. Molecular evidence places Trichogrammatidae as a monophyletic group of the Chalcidoidea (Owen *et al.*, 2007). Pioneers of the study of Trichogrammatidae in Europe were Westwood (1833), Haliday (1833), and Förster (1856). The first monograph of this group was published by Kryger (1918), who recorded 11 genera and 30 species. Subsequently, important contributions were made by Nowicki (1935, 1936, 1940) as reported by Viggiani (2011). Trichogrammatidae, with a few exceptions (Viggiani, 2002), are endophagous egg parasitoids of insects of several orders, mostly Hemiptera Auchenorrhyncha, Lepidoptera and Coleoptera. Host records are known mainly for *Trichogramma*, a genus including species used in biological control projects. Most species are solitary parasitoids, monovoltine or polyvoltine, but some are gregarious (as a few *Tri-*

chogramma species, *Lathromeris cecidomyiiae*, *Pseudoligosita servadeii*).

The knowledge of the Trichogrammatidae increased worldwide since last century. The aim of the present paper is to revise the genera recorded in European countries, providing a key for their identification and, in addition, a short diagnosis of each genus, with notes on distribution, diversity, and associated hosts.

MATERIALS AND METHODS

Specimens of Trichogrammatidae, collected using several methods (mostly by yellow pan traps and Malaise traps), were received in the past decades, since 1960, for identification from several regions of the world. The collections of the family preserved in several museums, mostly at the Natural History Museum (London), the Canadian National Collection of Insects (Ottawa), the Muséum d'Histoire naturelle (Genève), the Queensland Museum (Brisbane), the National Museum of Natural History (Washington), and the Zoological Museum (Copenhagen), were studied. The collection of Trichogrammatidae preserved at present at the Dipartimento di Agraria, Università di Napoli Federico II (previously *Dipartimento di Entomologia e Zoologia Agraria*, Portici, Napoli), including many specimens accumulated by the present author since 1960, some reared from known hosts, has been of pri-

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mary importance for the preparation of this review. All material has been studied on specimens mounted on permanent slides, using Canadian balsam as the final medium. Most of the illustrations included in the paper, line drawings, have been taken from papers previously published by the present author.

GENERAL MORPHOLOGY OF TRICHOGRAMMATIDAE AND NOMENCLATURE

The body of the Trichogrammatidae is divided into head, mesosoma, and metasoma (Fig. 1). The head capsule, because of its minimal size, is analyzed only for a few characters, namely the presence of malar sulci (Fig. 2, msl), the position of the antennal toruli (Fig. 2, tor) in reference to the ventral margin of the eyes (Fig. 2, ey), and a distinct clypeus (Fig. 2, cly). The mouth parts, mostly mandibles (Figs. 2, m and 3) and maxillary palpi (Fig. 4, mp) (lacking in the genus *Sinepalpigramma*), show variations in taxonomic value; in particular, the number of one or 2-segmented maxillary palpi is important for the classification of the genera. The labial palpi are all 1-segmented, small or vestigial in the members of the family. Primary importance in the characterization of genera and species have the antennae (Fig. 5). They show a first segment, the scape (Fig. 5, s), varying in shape in some species, followed by the pedicel (Fig. 5, p) with limited variations concerning the sculpture, the anelli (1-3) (Fig. 5, a), ring-like segments, the postannellar segments, partitioned into 1- or 2-segmented funicle (Fig. 5, f) or arranged in 1-4-segmented club (Figs. 5, c; 120), or without funicle (Fig. 15). On the funicle and club segments, different types of sensilla can be found (Pinto, 2006). The most important for taxonomic use are mainly the placoid sensilla (pls), the basiconic peg sensilla (bps) and the flagelliform setae (Fig. 18).

In the mesosoma (Fig. 1), the main characters of taxonomic interest concern the mid lobe of the mesoscutum (Fig. 6, mlm) (shape, sculpture, number of setae), the scutellum (Fig. 6, sct), the metanotum (Fig. 1) (shape and relative length) (Fig. 6, mt) and the propodeum (Fig. 6, p).

The fore wing (Fig. 7) shows important variations of primary value for the identification of genera and species. They concern the blade shape, the venations, and the discal setation. The blade may have a wide disk, around $\frac{1}{2}$ of the wing length, or narrower, $\frac{1}{5}$ or more. The venation may reach half of the wing

length or may be longer. Variations may be found in the ratio and shape between the premarginal vein (Fig. 7, pm), the marginal vein (Fig. 7, mv), and the stigmal vein (Fig. 7, sv). The premarginal is straight, confluent with the marginal vein or not; in the last case, the costal cell (Fig. 7, cc) is markedly wider at the level of the conjunction between the premarginal vein and the subcostal vein (Fig. 7, sc). A radial process (Fig. 7, rp) is or is not developed at the base of the premarginal vein. The density and arrangement of the setae on the disk are variable and offer important characters for the characterization of genera and species. Several setal tracks may be distinct on disk, and, of them, the RS_1 (Fig. 7), a setal track starting from the end of the stigmal vein and running posteriorly below the marginal vein; its presence or absence is considered of primary value in the taxonomy of genera. The length of the setae running along the distal margin of the disk, the fringe (Fig. 7, f), shows variations to be considered in the characterization of species. The hind wing (Figs. 8 and 9) has limited characters of taxonomic value; these are mainly the disk shape, the arrangement of setae in a few tracks or not, and the length of the fringe.

The characters of the legs concern the presence or absence of thorn-like spines on the dorsal surface of the fore tibia (Fig. 10, tls), the ratio of the length of the basitarsus (Fig. 10, bt)/length of the spur (Fig. 10, bt) of the middle leg, and the length of the hind tibia (Fig. 10, t)/length of the ovipositor (Fig. 13, o).

Several metasomal characters need to be examined and described: the ratio of length mesosoma/length metasoma (Fig. 1), shape, sculpture, and setae of metasomal tergal and sternal segments, extension of the last sternal segment, the hypogynium (Fig. 13, h), the extension of the entire ovipositor (Fig. 13, o), and, if extruded, the length of this part.

The male taxonomic characters not genitalic follow those of the female and show important variations concerning mainly the antenna and some metasomal features, but the fundamental importance in the identification and classification of the Trichogrammatidae have male genitalia. The basic structure of the male genitalia of Trichogrammatidae (Fig. 14), as found in several families of Chalcidoidea (here named chalcidoid type) is represented by a protective structure of the aedeagus (Fig. 14, aed), frequently with bacilliform apodemes (Fig. 14, aap), the phallobase (Fig. 14, ph) distally with some lateral (parameres) (Fig. 14, par) and ventral appendices (volsellae) (Fig. 14, vs). The phal-

lobase may be completely opened dorsally (Fig. 14, da) or partially, only at the base (Fig. 110, ada). In some types of male genitalia, an intervalsellar process is developed (Figs. 28; 110, ivp), and other structures are present as a dorsal lamina in the species of the genus *Trichogramma* (Fig. 110, adl). However, in several groups of genera, remarkable and gradual variations are observed in the basic male genitalia structure, toward a simple, tubular complex, in which the aforementioned structures of the basic genitalia type are not identifiable. The taxonomic importance of these variations, previously overlooked in Chalcidoidea, was pointed out by the present author (Viggiani, 1971a) in a presentation to the XIII International Congress of Entomology, Moscow, 2-9 August 1968.

KEY TO THE IDENTIFICATION OF THE GENERA OF TRICHOGRAMMATIDAE RECORDED IN EUROPEAN COUNTRIES

- | | | | |
|-------|---|--|--------------------------|
| 1(2) | - Antenna of female (Figs. 5, 22) with funicle 1-2-segmented2 | | |
| | - Antenna of female without funicle (Fig. 52) .. | | |
| |27 | | |
| 2(1) | - Antenna with 2-segmented funicle3 | | |
| | - Antenna with 1-segmented funicle14 | | |
| 3(2) | - Antennal club 2-3-segmented (Figs. 5, 69) .. | | |
| |4 | | |
| | - Antennal club 1-segmented (Fig. 34)15 | | |
| 4(3) | - Marginal vein of the fore wing not reaching the anterior margin of the blade or male antenna with a short terminal c ₄ (Fig. 82) ..5 | | |
| | - Marginal vein of the fore wing reaching the anterior margin of the blade6 | | |
| 5(4) | - Fore wing broad (Fig. 82), with a strongly sigmoid venation, disk sparsely to moderately setose, with RS ₁ present and linear setal tracks distinct. Ovipositor long and exerted. Male as the female, but the funicle and club not markedly distinct, without flagellar long setae, but also with other variations in some species. Male genitalia (Fig. 84) of chalcidoidea type | | |
| | <i>Poropoea</i> | | |
| | - Fore wing (Fig. 19) not wider distally, with long venation, disk densely setose, RS ₁ absent, a few linear setal tracks. Gaster ovate or oblong-ovate, with ovipositor exerted or not. Male as female, but antenna with funicle | | |
| | 2-segmented and distinct club 3-segmented, each segment with long setae. Male genitalia (Fig. 21) of chalcidoid type | | <i>Asynacta</i> |
| 6(4) | - Maxillary palps 2-segmented (Fig. 102).....7 | | |
| | - Maxillary palps 1-segmented11 | | |
| 7(5) | - Female antenna with 3 anelli8 | | |
| | - Female antenna with 2 anelli9 | | |
| 8(7) | - Female and male antenna similar (Figs. 25 and 27) with 3 anelli, fore wing (Fig. 26) venation reaching the half of the blade. Male genitalia (Fig. 28) of chalcidoid type, with a well-developed intervalsellar process..... | | |
| | <i>Ceratogramma</i> | | |
| | - Female and male antenna different.....9 | | |
| 9(6) | - Female antenna with at most 2 anelli, 2-segmented funicle and 3-segmented club, but male antenna with a short terminal c ₄ segment and with flagellar segments with long setae; front tibia (Fig. 10) with some denticles. Male genitalia of chalcidoid type (Fig. 66)..... | | <i>Mirufens</i> |
| | - Female and male antenna similar.....10 | | |
| 10(7) | - Fore wing broad (Fig. 104), disk 0.6× the wing length, very short marginal vein with very angular junction to premarginal vein as the latter to subcostal vein; disk densely setose without setal tracks, except r and RS ₁ with a few setae. Male similar to female. Male genitalia (Fig. 106) with rather broad phallobase entirely opened dorsally, parameres, volsellae; aedeagus with long apodemes..... | | <i>Szelenyia</i> |
| | - Fore wing (Fig. 94) with disk 0.5× as the wing vein, short marginal vein, shorter than premarginal vein, without very angular junction to premarginal vein as the latter to subcostal vein, disk densely setose without setal tracks. Male similar the female, but premarginal and marginal veins fused (Fig. 96) and widely inflated, forming an oval complex extending in almost entire basal wing. Male genitalia (Fig. 97) of chalcidoid type | | <i>Pterandrophysalis</i> |
| 11(6) | - Female and male antenna different.....12 | | |
| | - Female and male antenna similar.....13 | | |
| 12(6) | - Female antenna with 2-segmented funicle and 3-segmented club, but male antenna (Fig. 65) with a short terminal c ₄ segment and flagellar with long setae arranged in whorls. | | |

- Male genitalia (Fig. 121) of chalcidoid type *Ufens*
- As *Ufens* but male genitalia (Figs. 122 and 123) not of chalcidoid type *Ufensia*
- 13(11) - Funicle ovate-shaped, segments (Fig. 67) transverse; male antennal club 2-3- segments segmented; fore wing densely setose, without vein tracks, except RS₂. Male genitalia (Fig. 70) of chalcidoid type *Monorthochaeta*
- Funicle not ovate-shaped (Fig. 30), with the last segment subcylindrical and other characters different 14
- 14 - Fore tibia with a spine on the dorsal surface; female antenna (Fig. 30) with the first funicular segment shorter than the second one; fore wing moderately setose, with several setal tracks, RS₁ present. Male genitalia (Fig. 32) tubular, simple, without parameres and volsellae *Chaetostricha*
- Fore tibia without spine on the dorsal surface or other different characters 15
- 15(10) - Female antenna (Fig. 49) with the first funicular segments longer than wide. Male genitalia (Fig. 51) with trunk-conic phallobase, widest at base, distally with parameres and volsella *Ittys*
- Female antenna (Fig. 78) with the first funicular segments not longer than wide. Male genitalia (Fig. 80) without parameres and volsellae *Paracentrobia*
- 16(3) - Female antenna (Fig. 128) with 2 funicular segments and club conic-ovate, 1-segmented. Male antenna as the female. Fore wing (Fig. 130) with short venation, not reaching the half of the length, disk densely setose without or with a few setal tracks. Ovipositor (Fig. 129) very long, with sabre-like valvulae, extruded from the end of metasoma *Xiphogramma*
- Female antenna (Fig. 107) with 2 funicular segments and 1-segmented club, but rather flat, apico-ventrally trunked 16
- 17(13) - Fore wing (Fig. 108) with marginal and stigmal veins forming an arch. Male antenna (Fig. 109) with one postanellar segment with several long setae. Male genitalia (Fig. 110). Variations are present in the subgenera *Trichogrammanza* Carver (male antenna with 2 funicular segment, 1 club segment), and *Vanlisus* Pinto (male with 2 funicular segment and club 3-segmented). Venation of fore wing with marginal vein and stigmal vein forming an arch; RS₁ present. Genitalia with phallobase showing a dorsal lamina, laterally parameres, ventrally volsella with digiti and an intervallosellar process *Trichogramma*
- As in *Trichogramma* but fore wing (Fig. 112) without RS₁ *Trichogrammatoidea*
- 18(2) - Fore wing (Figs. 61 and 86) very narrow, at least 5× as long as wide 18
- Fore wing wider 19
- 19(3) - Female antenna (Fig. 85) with funicular segment appressed to the 3-segmented club. Fore wing disk moderately setose, not arranged in linear tracks *Prestwichia*
- Female antenna with funicle present or not, and not appressed to the 2-3-segmented club, Fore wing (Fig. 61) disk glabrous with a 1-2 rows of a few seta and long fringe *Megaphragma*
- 20(2) - Female antenna (Fig. 90) with 1-segmented funicle and 3-segmented club 23
- Female antenna (Fig. 40) with 1-segmented funicle and 1-2-segmented club 20
- 21(16) - Fore wing (Fig. 42) disk almond-shaped, widest near level of stigmal vein, with 1-2 setae. Female antenna with funicular segment present or not, club commonly 1-2-segmented *Epoligosita*
- Fore wing disk not almond-shaped and moderate or dense setation 21
- 22(17) - Mid lobe of mesoscutum and scutellum with 2 pairs of setae 22
- Mid lobe of mesoscutum and scutellum with 1 pair of setae 23
- 23(17) - Fore wing (Fig. 23) with RS₁ present; petiolar segment without a transverse row of denticles. Male genitalia (Fig. 24) with phallobase wider basally, having basal margin ventrally concave, without parameres and volsellar digiti, aedeagus fused with distal phallobase and without apodemes *Bloodiella*
- Fore wing without RS₁ present; petiolar segment with a transverse row of denticles. Male genitalia with broad phallobase; parameres and volsella present *Soikiella*

- 24(18) - Female antennal c3 (Fig. 71) usually with a distal stick-like process or clavate apical placoid sensillum. Fore wing (Fig. 72) with a few setae or moderately setose. Metasomal terga uniformly sclerotized. Male as the female, but antennal club without a terminal stick-like process. Male genitalia (Fig. 73) tubular, simple *Oligosita*
- Female antennal c3 (Fig. 90 without clavate apical process. At least some metasomal terga with the posterior part longitudinally striate. Female and male antenna similar.....24
- 25(23) - Male antenna with funicle and club segments with several linear placoid sensilla (Fig. 47. Male genitalia (Fig. 48) complex and with long aedeagus *Hayatia*
- Male genitalia (Fig. 92) simple tubular, curved ventrally..... *Pseudoligosita*
- 26(19) - Female antenna (Fig. 34) with funicular segment longer than wide. Fore wing (Fig. 35) disk densely setose. Body (Fig. 33) with rather long setae..... *Chaetostrichella*
- Female antenna (Fig. 37) with funicular segment transverse or cup-shaped. Fore wing (Fig. 38) with disk moderately setose: Body with setae relatively short..... *Doirania*
- 27(1) - Maxillary palpus 2-segmented.....28
- Maxillary palpus 1-segmented.....29
- 28(1) - Female antennal c5 (Fig.52) ending in a stick-like process; fore wing (Fig. 53) with RS₁ absent in several species. Male genitalia (Fig. 55) with parameres present or not, volsellae absent and aedegal apodemes present..... *Lathromeris*
- Female antenna with 2 anelli, without and 5-segmented club. Fore wing (Fig. 76) with short marginal vein and broad stigma vein, disk wide, moderately setose with RS₁ and several vein tracks. Ovipositor long and exerted. Male as the female. Male genitalia (Fig. 77) with long phallobase, parameres, volsellar digiti, aedeagus with apodemes *Ophioneurus*
- 29(27) - Antennal club 4-5-segmented30
- Antennal club 2-3-segmented31
- 30(28) - Female antennal (Fig. 56) 5-segmented. Fore wing (Fig. 57) moderately to densely setose, with setal tracks converging to the straight RS₁. Male genitalia (Fig. 58) simple, tubular *Latromeroidea*
- Female antenna with 4-segmented club. Fore venation short not reaching half fore wing length, disk moderately or densely setose with a few linear setal tracks. Ovipositor rarely long and extruded. Male genitalia (Fig. 127) simplified, tubular..... *Uscana*
- 31(29) - Fore wing (Fig. 15) with disk densely setose without or with a few linear setal tracks, RS₁ absent. Gaster of different shape, mostly oblong-ovate, with ovipositor extruded or not. Male genitalia (Fig. 17) not of chalcidoid type, but with trunk-conic phallobase, basally wider, distally not distinct from the aedeagus, without or reduced parameres and volsellar digiti, aedeagus with or without short bacilliform apodemes *Aphelinoidea*
- Female antenna (Fig. 115) with suboval club 2-3-segmented, with a terminal stick-like sensillum. Male genitalia (Fig. 117) of different types, but in *T. bimaculata* of chalcidoid type, with phallobase without distinct short parameres and volsellae, aedeagus with long, bacilliform apodemes... *Tumidiclava*

REVIEW OF THE GENERA

***Aphelinoidea* Girault**

Aphelinoidea Girault, 1911. Trans. Am. Ent. Soc. 37: 2.
Type species: *Aphelinoidea semifuscipennis* Girault
(Trichogrammatidae: Trichogrammatinae, Paracentrobiini)

Diagnosis. Female (Fig. 133). Maxillary palpus 1-segmented. Antenna (Fig. 15) with 2 anelli, without funicle and elongate club 2-3-segmented, frequently incompletely divided. Fore wing (Figs. 16 and 134) with short venation, stigmal vein without or very short neck, disk densely setose without or with a few linear setal tracks, RS₁ absent. Gaster of different shape, mostly oblong-ovipositor extruded or not. Male. Antenna as the female. Genitalia (Fig. 17) with trunk-conic phallobase, basally wider, distally not distinct from the aedeagus, without or with reduced parameres and volsellae, with ventral 2 setae at level of volsellar area, aedeagus with or without short bacilliform apodemes.

Distribution and diversity. Worldwide, including 39

species with several diversities. 6 species are recorded from Europe. At present, the genus is partitioned into the following subgenera: *Aphelinoidea* Girault, *Lathromeroides* Girault, *Encyrtogramma* De Santis. In the subgenus *Aphelinoidea* the *A. semifuscipennis* (fore wing disk conspicuously setose, without hyaline path beyond venation) and *A. plutella* (fore wing disk with hyaline path) species groups are recognized (Triapitsyn, 2018).

Hosts. Hemiptera Cicadellidae.

***Asynacta* Foerster**

Asynacta Foerster 1856. Hymenopterologische Studien 2: 87, 89.

Type species: *Eulophus exiguus* Nees, 1834.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 18) with 1 anellus, funicle 2-segmented and 3-segmented club; segments of funicle and club with rather long setae. Fore wing (Figs. 19 and 20) with long venation, marginal vein not reaching the margin of the blade, disk densely setose, RS₁ absent, a few linear setal tracks. Gaster ovate or oblong-ovate, with ovipositor exerted or not. Male. Antenna with funicle 2-segmented and club 3-segmented, each segment with long setae. Genitalia (Fig. 21) of chalcidoid type with elongate, boat-shaped phallobase with complete dorsal aperture, distally long parameres and volsellae, and intervolsellar process, aedeagus long, narrow and with bacilliform apodemes.

Distribution and diversity. Europe and China. The genus includes 3 species, 1 European.

Hosts. Coleoptera Chrysomelidae (Naiquan, 1994).

***Bloodiella* Nowicki**

Bloodiella Nowicki, 1935. Zeit. angew. Ent. Berlin 21: 579.

Type species: *Bloodiella andalusica* Nowicki.

(Trichogrammatidae: Trichogrammatinae: Chaetostrichini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 22) rather short, with 1 anellus, 1-segmented funicle and club 3-segmented. Fore wing (Fig. 23) rather large, with marginal and premarginal veins subequal, RS₁ present, and stigmal vein with a short neck, disk densely setose with several linear setal tracks. Gaster ovate, with ovipositor not extruded. Male. Antenna as in the female. Genitalia (Fig. 24) not of chalcidoid type, with phallobase distinct and wider basally, with basal margin ventrally concave, without parameres and volsellae, aedeagus fused with distal phallobase and without apodemes.

Distribution and diversity. Europe, South Africa, ? South America. The only European species *B. andalusica* has been recorded in Spain, Turkey, Poland, Corsica, France, Yugoslavia, Italy.

Hosts. Coleoptera Chrysomelidae. Biological notes on *B. andalusica* are given by Viggiani *et al.* (2021).

***Ceratogramma* De Santis**

Ceratogramma De Santis, 1957. Notas Mus. La Plata 19: 130.

Type species: *Ceratogramma schachovskoyi* De Santis.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 2-segmented. Antenna (Fig. 25) with 3 anelli, 2 funicular and 3 club segments. Fore wing (Fig. 26) rather wide, marginal vein as long or longer than stigmal vein, with a large costal cell, disk moderately setose, without or a few setal tracks, RS₁ absent. Male as the female, but antennal club (Fig. 27) 3-4-segmented. Genitalia (Fig. 28) of chalcidoid type, with elongate, boat-shaped phallobase, with parameres, volsellae, developed intervolsellar process, and eedeagus with long bacilliform apodemes.

Distribution and diversity. About 10 species are recorded, mostly in the New World. In Europe, *C. tatianae* Fursov (as *Szelenyia*) (Fursov, 1995) has been recorded. This species, known only from the female holotype, shows the antenna as in other species of the genus, but the marginal vein of the fore wing is shorter of the stigmal vein. The present inclusion of *C. tatianae* in the genus *Ceratogramma* will be better evaluated when the male is discovered.

Hosts. *C. etiennei* Delvare is known as egg parasitoid of *Diaprepes abbreviatus* (L.) (Coleoptera Curculionidae) (Delvare, 1988). No other host records are known for the genus.

***Chaetostricha* Walker**

Chaetostricha Walker, 1851. Ann. Mag. Nat. Hist. 7: 210.

Type species: *Chaetostricha dimidiata* Walker.

(Trichogrammatidae: Trichogrammatinae: Chaetostrichini)

Diagnosis. Female (Fig. 29). Maxillary palpus 1-seg-

mented. Antenna (Fig. 30) with 2 anelli, 2 funicular segments and cub 3-segmented. Fore wing (Figs. 30, 31 and 135) with marginal vein rather long, RS_1 present, discal moderately setose, with distinct setal tracks. Front tibia normally with one or more spines at middle of dorsal surface. Ovipositor extruded or not beyond metasoma. Male. Antenna similar to female. Genitalia (Fig. 32) long, tubular, without parameres and volsellae, with antero-dorsal aperture short, subovate.

Distribution and diversity. Widespread, except in Central and South America. The genus includes 24 species, 10 recorded in Europe. In Italy, *C. similis* (Silvestri) and *C. walkeri* (Foerster) have been recorded (Silvestri, 1918).

Hosts. Hemiptera (Membracidae and Miridae).

***Chaetostrichella* Girault**

Chaetostrichella Girault, 1914. Mitt. Zool. Mus. Berl. 7: 147.

Type species: *Chaetostrichella platoni* Girault. (Trichogrammatidae: Oligositinae: Oligositini)

Diagnosis. Female (Fig. 33). Similar to *Pseudoligosita*, but with antennal club 1-segmented (Fig. 34), fore wing (Fig. 35) with disk densely setose, without vein tracks, ovipositor long. Male. Antenna as the female. Genitalia (Fig. 36) tubular, without distinct phallobase, parameres and volsellae.

Distribution and diversity. Europe, India. Four species are known, 3 are Palearctic. The genus is recorded from Italy (Pinto and Viggiani, 2004).

Hosts. Unknown.

***Doirania* Waterston**

Doirania Waterston, 1928. Ann. Mag. Nat. Hist. 2 (ser.10): 386.

Type species: *Doirania leefmansi* Waterston. (Trichogrammatidae: Oligositinae: Oligositini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 37) with 1 transverse or cup-shaped funicular segment, club 1-segmented. Fore wing (Fig. 38) with disk moderately setose. Male. As the females, but metasoma with a medio-ventral projection on the antepenultimate sternite. Genitalia tubular, simple (Fig. 39).

Distribution and diversity. Japan, New Guinea, Indonesia, North America. The genus includes 3 species and 2 of them *D. leefmansi* Waterston and *D. longiclavata* Yashiro, recorded also in Europe.

Hosts. Orthoptera Tettigoniidae.

***Epoligosita* Girault**

Epoligosita Girault, 1916. Mem Queensland Mus. 5: 206.

Type species: *Paroligosita biclavata* Girault and Dodd. (Trichogrammatidae: Oligositinae: Oligositini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 40) with funicular segment present or absent, club 1-3-segmented. Fore wing almond-shaped (Figs. 42 and 138) large, widest at level of the stigmal vein, disk glabrous, at most with 1-2 setae. Propodeal disk (Fig. 41 6B) with a subtriangular lobe. Male. Antenna as in female. Genitalia (Fig. 43) tubular, without distinct phallobase and distal appendices.

Distribution and diversity. Widespread. The genus includes 25 species and 2 of them, *E. nudipennis* (Kryger) and *E. vera* Viggiani, are European.

Hosts. Cicadellidae. *E. vera* has been recorded in southern Italy as egg parasitoid of the Cicadellidae *Lindbergina aurovittata* (Douglas) on *Quercus* spp. (Viggiani, 1969; 1985).

***Hayatia* Viggiani**

Hayatia Viggiani, 1982. Boll. Lab. Ent. Agr. "Filippo Silvestri" 39: 27.

Type species: *Hayatia indica* Viggiani, 1982. Boll. Lab. Ent. Agr. "Filippo Silvestri" 39: 28.

(Trichogrammatidae: Oligositinae: Oligositini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 44) with 1 anellus, 1 funicular segment, usually longer than wide, club 3-segmented; fore wing (Fig. 45) with normal disk rather densely or sparsely setose, RS_1 absent as some other setal tracks. Gaster conic-ovate with ovipositor (46) not extruded, with third valvula very narrow, lancet-shaped. Male. As the female, but antenna (Fig. 47) with funicular segment annuliform or cup-shaped and club segments with several linear sensilla; genitalia (Fig. 48) with complex and tubular body.

Distribution and diversity. India, Africa, Europe, Cape Verde Island. 10 species are included in the genus.

Hosts. Unknown.

***Ittys* Girault**

Ittys Girault, 1911. Trans. Amer. Ent. Soc. 37: 25.

Type species: *Trichogramma cerasarum* Ashmead. (Trichogrammatidae: Trichogrammatinae: Paracentrobiini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 49) with 2 anelli, 2 funicular segments, the

first usually longer than wide, club 3-segmented; fore wing (Fig. 50) with normal disk rather densely setose, RS_1 and some other setal tracks are present. Gaster-conic-ovate with robust ovipositor, but not much extruded. Male. As the female; genitalia (fig. 51) with trunk-conic phallobase, widest at base, distally with parameres, volsellae, intervolsellar process, aedeagus with apodemes.

Distribution and diversity. Widespread, 9 species recorded, including only 1 European species, *I. annae* (Karpinski), firstly recorded in Poland, but here from Belgium and Italy. New records: 2 females, Belgium, Treignes, 12.vi.1992, from eggs of *Cicadetta montana*, 8 females, Italy, Piedimonte d'Alife, 22-28.vi.1920, ex eggs of *Cicada orni*, leg. F. Silvestri. 5 females, same data, 30.vi.1921.

Hosts. Hemiptera (Membracidae, Cicadidae). *I. annae* is recorded as egg parasitoid of *Cicadetta montana* Scop., developing one generation in a year's course, synchronized with the emerging and egg-laying season of the host (June, beginning of July) (Karpinski, 1954).

Comments. The *Ittys* species of North America were revised by George (2007). The author confirms also in the new 4 described species the same type of the male genitalia illustrated by Viggiani (1971b, 1984) for the genotype, *I. ceresarum* (Ashmead) and *I. annae* (Karpinski). George (2007) proposed a key to the identification of the USA species based on male. In the family classification of Trichogrammatidae based on molecular results (Owen *et al.*, 2007) the genus *Ittys* is included in the tribe Paracentrobiini (subfamily Oligositinae).

***Lathromeris* Foerster**

Lathromeris Foerster, 1856. Hymenopterologische Studien 2: 87.

Type species: *Lathromeris scutellaris* Foerster.

(Trichogrammatidae: Trichogrammatinae: Paracentrobiini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 52) with 2 anelli, club 5-segmented and c5 ending in a stick-like process; fore wing (Fig. 53) with elongate marginal vein, RS_1 absent in several species; hypopygium often prolonged beneath ovipositor. Male. Antenna (Fig. 54) without the prolonged process on c5. Genitalia (Fig. 55) not of chalcidoid type, with phallobase rather subcylindrical or ovate, distally pointed, with parameres present or not, volsellae absent and aedeagus with long, bacilliform apodemes present.

Distribution and diversity. Wide distribution in the world. Includes 27 species, but several species seem misplaced in this genus. In Europe, 7 species are recorded, 2 of which are in Italy (*L. scutellaris* Förster and *L. cecidomyiiae* Viggiani & Laudonia).

Hosts. Several species attack eggs of Lepidoptera (Noctuidae, Pyralidae). An exception, not only for the genus *Lathromeris*, but in the Trichogrammatidae, is *L. cecidomyiiae*, gregarious larval parasitoid of *Lasiopoda* sp. (Diptera, Cecidomyiidae) (Viggiani & Laudonia, 1994; Jesu & Laudonia, 1994).

***Lathromeroidea* Girault**

Lathromeroidea Girault 1912. Mem. Queensland Mus. 1: 94.

Type species: *Lathromeroidea nigra* Girault.

(Trichogrammatidae: Oligositinae: Chaetostichinae)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 56) with 2 anelli and 5-segmented club, c5 without stick-like process. Fore wing (Fig. 57) moderately to densely setose, with veins tracks converging to the straight RS_1 . Genitalia (Fig. 58) rather tubular, and wider basally, body with 2 ventral setae, without parameres, volsellae and aedeagal apodemes. According to Pinto (2006), *Lathromeroidea* is a very complex genus with high diversity. He divided the genus into three informal species groups, A, B, and C, based only on the forewing structure. All species described before Pinto (2006) are included in the species group A.

Distribution and diversity. Wide distribution. The genus includes 16 species, only *L. silvarum* occurring in Europe.

Hosts. For most species unknown. *L. gerriphaga* Pinto is recorded as egg parasitoid of Hemiptera Gerridae (Pinto, 2006).

***Megaphragma* Timberlake**

Megaphragma Timberlake, 1923. Proc. Hawaiian Ent. Soc. 5: 412.

Type species: *Megaphragma mymaripenne* Timberlake. (Trichogrammatidae: Oligositinae: Oligositini)

Diagnosis. Female (Figs. 59, 144 and 146). Maxillary palpus 1-segmented. Antenna (Fig. 60) with 1 anellus, 1 funicular segment (not present in some species) and club 1-2- or 3-segmented. Fore wing (Fig. 61) very narrow, 5.3-10x, with long marginal vein, disc with one seta or with a few setae in one or two rows or glabrous. Gaster with tergite 7 without spiracles and tergite 8 without cerci. Male as female, but antenna (Fig. 62)

often postanellar segments of different shape. Genitalia simple, tubular, very small.

Distribution and diversity. Cosmopolitan. The genus, revised by Polaszek *et al.* (2022), includes 32 valid species, assigned to the following species group: *M. mymaripenne*-group, *M. longiciliatum*-group, *M. polychaetum*-group, *M. ghesquierei*-group, *M. stenopterum*-group, *M. antecessor*-group, *macrostigmum*-group. The recorded European species are *M. longiciliatum* Subba Rao, *M. noyesi* Polaszek & Fusu, *M. polilovi* Polaszek, Fusu & Viggiani (as *M. mymaripenne* in Viggiani & Bernardo, 1997), and *M. rivelloi* Viggiani. *M. polilovi*, a common parasitoid of *Heliothrips haemorrhoidalis* in Italy, reproduces normally by thelitoxy, males are very rare. The same host is parasitized by *M. longiciliatum* (as *M. amalphantum* Viggiani in Viggiani & Bernardo, 1997). Biological data on the latter two species are given by Bernardo & Viggiani (2003).

Hosts. Thysanoptera (Figs. 145 and 146).

***Mirufens* Girault**

Mirufens Girault, 1915. Mem. Queensland Mus. 3: 147. Type species: *Mirufens dentipes* Girault.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 2-segmented. Antenna (Fig. 63) with 2 anelli, 2 funicular and 3 club segments; pedicel transversely ridged. Fore wing (Fig. 64) rather broad, venation with stigmal vein elongate, subequal to marginal vein; disk with RS₁ curved and rows of setal tracks. Fore tibia with a row of thorn-like spines (Fig. 10, tls). Ovipositor usually long. Male as the female, but antenna (Fig. 65) with 4-segmented club and c4 very short; funicular and club segments with long flagelliform setae. Genitalia (Fig. 66) of chalcidoid type, with phallobase dorsally opened, parameres, volsellae and aedeagal bacilliform apodemes present.

Distribution and diversity. Widespread. The genus, revised by Neto & Pintureau (1997), includes 16 species. In Europe 2 species are recorded, *M. gundlachi* (Nowicki) and *M. longicauda* (Blood).

Hosts. Hemiptera (Membracidae, Cicadellidae).

***Monorthochaeta* Blood**

Monorthochaeta Blood, 1923. Ann. Rept. Proc. Bristol Nat. Soc. 5: 254.

Type species: *Monorthochaeta nigra* Blood.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 67) with 2 anelli, funicle with 2 transverse segments and 3-segmented club. Fore wing (Fig. 68) with long radial process, densely setose, RS₁ absent and only linear setal track, RS₂ present. Male as the female, but club 2-3-segmented (Fig. 69). Genitalia (Fig. 70), with boat-shaped phallobase, distally with two asymmetrical and sclerotized volsellar sclerites; parameres not present; aedeagus with long bacilliform apodemes.

Distribution and diversity. The genus includes 3 described species, all from the Palearctic Region. The type of the genus, *M. nigra*, was recorded from Italy (Viggiani, 1971). Additional material was reared from *Cassida* sp. in Campania (Capua) and in Sicily (Palermo).

Hosts. Coleoptera Chrysomelidae (*Cassida* spp.).

***Oligosita* Walker**

Oligosita Walker, 1851. Ann. Mag. Nat. Hist. 7: 212.

Type species: *Oligosita collina* Walker.

(Trichogrammatidae: Oligositinae: Oligositini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 71) with 1 anellus, 1 funicular segment, 3-segmented club, c3 distally with a distal stick-like process or clavate apical placoid sensillum. Fore wing (Fig. 72) with a few setae or moderately setose. Metasomal terga uniformly sclerotized. Male as the female, but antennal club without a terminal stick-like process. Genitalia (Fig. 73) tubular, simple, without appendices, with specific variations in shape, basally without bacilliform aedeagal apodemes.

Distribution and diversity. Worldwide. The genus includes about 100 species, of which about 10 are recorded from Europe.

Hosts. Hemiptera, mostly Cicadellidae (Viggiani, 1982).

***Ophioneurus* Ratzeburg**

Ophioneurus Ratzeburg, 1852. Ichneumon der Forstinsekten 3: 196.

Type species: *Ophioneurus signatus* Ratzeburg.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female (Fig. 74). Maxillary palpus 2-segmented. Antenna (Fig. 75) with 2 anelli, without funicle and 5-segmented club. Fore wing (Fig. 76) with short marginal vein and broad stigmal vein, disk wide, moderately setose with RS₁ and several vein tracks. Ovipos-

itor long and exerted. Male as the female. Genitalia (Fig. 77) of chalcidoid type, with long, boat-shaped phallobase, parameres, volsellae, and aedeagus with long bacilliform apodemes.

Distribution and diversity. The genus includes 10 species, some not well-defined, distributed in the Palearctic Region and Australia. In Europe, 4 species are recorded.

Hosts. Coleoptera Attelabidae. *O. longiclavatus* Viggiani is recorded as egg parasitoid of *Rhynchites auratus* (Scop.) in Italy (Viggiani, 1974).

Paracentrobia Howard

Paracentrobia Howard, 1897. Jour. Linn. Soc. London Zool. 26: 178.

Type species: *Paracentrobia punctata* Howard.

(Trichogrammatidae: Trichogrammatinae: Paracentrobiini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 78) with 2 anelli, 2 funicular and 3 club segments. Fore wing (Fig. 79) usually rather narrow, with long marginal vein, disk with some or without vein tracks, frequently with a black spot on the stigmal vein. Ovipositor not extruded. Male as the female. Genitalia (Fig. 80) not of chalcidoid type, but a trunk-conic phallobase, wider at base, with transverse and short anterodorsal aperture, without parameres and volsellae, aedeagus with long bacilliform apodemes.

Distribution and diversity. Worldwide. 46 species are assigned to the genus *Paracentrobia*. In Europe the following 6 species are recorded: *P. fimbriata* Fursov, *P. masovica* (Nowicki), *P. monotricha* (Nowicki), *P. pulchella* (Claridge), *P. tenuinervis* (Nowicki) and *P. zabinskii* (Nowicki) (UCD, 2023).

Hosts. Hemiptera (Heteroptera, mostly Auchenorrhyncha). *P. pulchella* has been reared from eggs of *Capsus ater* (L) (Miridae) in England (Claridge, 1959).

Poropoea Förster

Poropoea Förster, 1851. Verh. Naturh. Ver. preuss. Rheinl. 1: 28.

Type species: *Poropoea stollwerkii* Förster.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female (Fig. 141). Maxillary palpus 2-segmented. Antenna (Fig. 81) with 2 anelli, 2 funicular segments, each longer than wide, and 3-segmented club. Fore wing (Fig. 82) broad, with a strongly sigmoid venation not reaching the anterior margin of the wing, disk

sparsely to moderately setose, with RS₁ present and linear setal tracks distinct. Ovipositor long and exerted. Male as the female, but funicle and club not distinct (Fig. 83), without flagellar long setae, and other variations in some species. Genitalia (Fig. 84) of chalcidoid type, phallobase completely opened dorsally with parameres, volsellae, intervolsellar process, and aedeagus with long bacilliform apodemes.

Distribution and diversity. Widespread. The genus includes 21 species, of which 4 are recorded from Europe. *P. stollwerkii* Förster and *P. defilippii* Silvestri, respectively as egg parasitoids of *Attelabus nitens* (Scopoli) and *Byctiscus betulae* L. (Coleoptera Attelabidae), were studied in Italy by Silvestri (1916), who gave the adult redescription, morphological details of egg and young stages, with biological notes of both species.

Hosts. Coleoptera Attelabidae.

Prestwichia Lubbock

Prestwichia Lubbock, 1894. Trans. Linn. Soc. London 24: 140.

Type species: *Prestwichia aquatica* Lubbock.

(Trichogrammatidae: Oligositinae: Oligositini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 85) with 1 anellus, 1 funicular segment rather appressed to the 3-segmented club. Fore wing (Fig. 86) very narrow, at least 5× as long as wide in normal specimens, with long marginal vein, disk moderately setose, with setae not arranged in regular linear tracks. Legs with spiny middle and hind tibiae. Body with long setae on head and mesosoma. Male usually wingless. Genitalia (Fig. 87) simple, long, tubular, without appendices and a basal sclerification.

Distribution and diversity. Genus widely distributed with 6 described species. The species *P. aquatica* Lubbock and *P. solitaria* Ruscka are recorded from Europe.

Hosts. Aquatic insects (Coleoptera, Hemiptera, Odonata).

Pseudoligosita Girault

Pseudoligosita Girault, 1913. Mem. Queensland Mus. 2: 104.

Type species: *Pseudoligosita arnoldi* Girault.

(Trichogrammatidae: Oligositinae: Oligositini)

Diagnosis. Female (Fig. 88). Maxillary palpus 1-segmented. Antenna (Figs. 90 and 139) with 1 anellus, 1 funicular segment and 3-segmented club, c3 without clavate apical process. Fore wing (Figs. 91 and 140) premarginal and marginal veins in straight connection,

costal cell narrow, disk moderately to densely setose. At least some metasomal terga with the posterior part longitudinally striate (Fig. 88). Male as the female. Genitalia (Figs. 89 and 92) simple, tubular, without appendices, but with specific variations in shape and basal traits.

Distribution and diversity. Worldwide. The genus includes about 50 species. In Europe, 9 species are recorded.

Hosts. Hemiptera, Orthoptera and Coleoptera (Viggiani, 1982). Hosts and biological traits are known only for a few species. *P. phaneropterae* Viggiani has been recorded from Italy as a gregarious egg parasitoids of *Phaneroptera nana* Fieber (Viggiani, 2021).

***Pterandrophysalis* Nowicki**

Pterandrophysalis Nowicki, 1935. Zeit. angew. Ent. Berlin 21: 575.

Type species: *Pterandrophysalis levantina* Nowicki. (Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 2-segmented. Antenna (Fig. 93) with 2 anelli, 2 funicular, and 3 club segments. Fore wing (Fig. 94) around 2× as long as wide, with short marginal vein, shorter than premarginal vein, disk densely setose without setal tracks, RS₁ absent. Male. Antenna as in female (Fig. 95) but premarginal and marginal veins fused and widely inflated (Fig. 96), forming an oval complex extending in almost the entire basal wing. Genitalia (Fig. 97) of chalcidoid type, phallobase with parameres and well-developed volsellae; aedeagus with long bacilliform apodemes.

Distribution and diversity. Europe and North America. Two species are described *P. levantina* Nowicki and *P. plamana* Burks, Pinto and Heraty (fossil) (Burks *et al.*, 2015).

Hosts. *P. levantina* has been collected from eggs of *Bangasternus orientalis* (Capiomont) (Coleoptera Curculionidae) in Greece (Pinto, 2006).

***Soikiella* Novicki**

Soikiella Nowicki, 1934. Polsk. Pismo Ent. 12: 1.

Type species: *Soikiella mongibelli* Nowicki. (Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 98) with 1 anellus, 1 funicular and 3 club segments, c3 with a terminal process. Fore wing

(Fig. 99) with short venation, disk moderately setose with linear setal tracks, but without RS₁. Male antenna with 2 funicular and 3 club segments, c3 without a terminal process. Genitalia (Fig. 100) of chalcidoid type, with broad phallobase dorsally opened, parameres well developed and reduced volsellae; aedeagus basally with short and transverse apodemes (Fig. 101). *Distribution and diversity.* North America, Asia, Europe. The genus includes 4 species, 2 of them recorded from Europe (Italy): *S. mongibelli* Nowicki and *S. italica* Viggiani. A key to their identification is provided by Bernardo *et al.* (2017).

Hosts. Eggs of Diptera (Asilidae).

***Szelenyia* Nowicki**

Szelenyia Nowicki, 1940. Zeit. angew. Ent. Berlin 26: 633.

Type species: *Szelenyia tamaricis* Nowicki.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 2-segmented (Fig. 102). Antenna (Fig. 103) with 2-segmented funicle and 3-segmented club. Fore wing (Fig. 104) broad, disk width 0.6× the wing length, marginal vein very short, with marked angular junction to premarginal vein as the latter to subcostal vein; disk densely setose without setal tracks, except r and RS₁ with a few setae. Male antenna (Fig. 105) as female. Genitalia (Fig. 106) of chalcidoid type, with wide boat-shaped phallobase, opened with long parameres and volsellae, aedeagus with long, bacilliform apodemes.

Distribution and diversity. Europe (France, Corsica). Known only as *S. tamaricis*, a type of genus.

Hosts. Not known, probably Coleoptera.

***Trichogramma* Westwood**

Trichogramma Westwood, 1833. Phil. Mag. 2: 444.

Type species: *Trichogramma evanescens* Westwood.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female (Fig. 142). Maxillary palpus 1-segmented. Antenna (Fig. 107) with 2 anelli, 2 funicular segments, and 1-segmented club, rather flat, apico-ventrally trunked. Venation of fore wing (Fig. 108) with marginal vein and stigmal vein forming an arch; disk moderately setose with several setal tracks, RS₁ present. Male antenna (Fig. 109) with one postanellar segment covered with several long setae. Genitalia (Fig. 110) with phallobase showing an ovate antero-

dorsal aperture (ada), a dorsal lamina (dla), parameres (par), volsellae (vs), and an intervalsellar process (ivp); aedeagus with long bacilliform apodemes. Variations are present in the subgenera *Trichogrammanza* Carver (male antenna with 2 funicular segment, 1 club segment), and *Vanlisus* Pinto (male with 2 funicular segment and club 3-segmented).

Distribution and diversity. Worldwide. *Trichogramma* is the largest genus of Trichogrammatidae with 241 species listed (UCD, 2023). The recorded European species are about 40, but several of them need to be revised. Several species of *Trichogramma* have been used in a biological control program.

Hosts. Lepidoptera, Diptera, Hymenoptera and Neuroptera.

***Trichogrammatoidea* Girault**

Trichogrammatoidea Girault, 1911. Trans. Amer. Ent. Soc. 37: 13.

Type species: *Chaetostricha nana* Zehntner.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 111) with 2 anelli, 2 funicular segments, and 1-segmented club. Fore wing (Fig. 112) without RS₁. Male antenna (Fig. 113) with 2 funicular segments and club 3-segmented. Genitalia (Fig. 114) as in *Trichogramma*, but without dorsal lamina.

Distribution and diversity. Most species of the 31 listed species are recorded from Asia. Only one species, *T. stammeri* Nowicki, is recorded from Europe.

Hosts. Lepidoptera.

***Tumidiclava* Girault**

Tumidiclava Girault, 1911. Trans. Amer. Ent. Soc. 17: 6.

Type species: *Tumidiclava pulchrinotum* Girault.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Figs. 115 and 143) with 2 anelli and suboval club 2-3-segmented with a terminal long stick-like sensillum. Fore wing (Fig. 116) moderately wide, around twice as long as wide, with short venation not reaching half of the blade, disk moderately or densely setose, RS₁ absent and a few linear setal tracks. Ovipositor not extruded. Male as the female, but antenna without terminal stick-like sensillum. Metasomal tergite VII with a pair of lateral lobes. Genitalia (Fig. 117) with elongate

phallobase, wider in the middle, without or reduced parameres, volsellae; aedeagus with long, bacilliform apodemes.

Distribution and diversity. Worldwide. The genus includes 20 species. In Europe, the species *T. bimaculata* (Blood), *T. minuscola* Nowicki, and *T. subcaudata* Nowicki are recorded (Aishan *et al.*, 2015).

Hosts. Coleoptera and Lepidoptera (Pinto, 2006).

***Ufens* Girault**

Ufens Girault, 1911. Trans. Amer. Ent. Soc. 37: 32.

Type species: *Trichogramma nigrum* Ashmead.

(Trichogrammatidae: Trichogrammatinae: Trichogrammatini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 118) with 2 anelli, 2 funicular segments, and 3-segmented club. Fore wing (Fig. 119) broad, often rather trunked distally, with marginal vein and stigma vein more or less subequal, disk with regular setal tracks. Male antennal club (Fig. 120) with a small 4th segment; flagellar segments with long setae arranged in whorls. Genitalia (Fig. 121) with a distinct phallobase at least basally not fused with the aedeagus, with wide antero-dorsal aperture oblong or ovate and distal appendices of different shape.

Notes. The genus was revised by Owen (2011). The author listed 53 species (31 new species, 9 species described by previous authors, and 13 species not associated with males and considered *nomina dubia*). He provided a key to the identification of the world species based on the genitalia characters of the males. According to a morphological and molecular analysis, the genus was included in the subfamily Oligositinae. In all species studied by Owen, with the exception of 6 species, the genitalia have a distinct phallobase oblong or transverse ovate with distal appendices. In the present author classification of the family Trichogrammatidae (Viggiani, 1971b) the genus, including only the species with distinct phallobase, are assigned to the subfamily Trichogrammatinae. The species with genitalia without a distinct phallobase, tubular-like, are included in the genus *Ufensia* Girault (Viggiani, 1971, 1989b) assigned to the subfamily Oligositinae.

Distribution and diversity. Worldwide. Rather wide genus including 48 species (Owen, 2011). Only two species, *U. dilativena* Nowicki and *U. similis* (Kryger), are recorded in Europe.

Hosts. Hemiptera (Cicadellidae) and Orthoptera.

***Ufensia* Girault**

Ufensia Girault, 1913. Mem. Queensland Mus. 2: 101.
Type species: *Ufensia pretiosa* Girault.

(Trichogrammatidae: Oligositinae: Chaetostichini)

Diagnosis. Female as *Ufens*, but male genitalia (Figs. 122 and 123) simplified, without phallobase distinct from the aedeagus and genitalic body with some appendice.

Distribution and diversity. Europe, South America, Indo-Malaysia, Australia. At present, the following 5 species are assigned to this genus: *U. dolichopenis* Owen, *U. foersteri* (Kryger), *U. rimatus* Lin, *U. simplipenus*, *U. spicifer* Owen. The only European species is *U. foersteri*.

Hosts. Hemiptera (Miridae) One of the few species with documented records is *Ufens minuta* Viggiani (= *foersteri* Kryger), egg parasitoids of *Reuteria marqueti* Puton (Miridae) in Italy (Viggiani, 1989b).

***Uscana* Girault**

Uscana Girault, 1911. Trans. Amer. Ent. Soc. 37: 22.
Type species: *Uscana semifumipennis* Girault.

(Trichogrammatidae: Trichogrammatinae: Chaetostichini)

Diagnosis. Female (Fig. 124). Maxillary palpus 1-segmented. Antenna (Fig. 125) with 2 anelli and club 4-segmented. Mid lobe of mesoscutum and scutellum both with 2 pairs of setae. Fore wing (Fig. 126) around twice longer than wide, disk densely or moderately setose with linear setal tracks not always distinguished. Legs with hind femur broader. Ovipositor rarely extruded. Male similar the female. Genitalia (Fig. 127) short, rather tubular, without distinct phallobase and aedeagus, having a short, round or oval antero-dorsal aperture.

Distribution and diversity. Worldwide. The genus includes 33 species, some of which probably need another generic placement. In Europe, 7 species are recorded.

Hosts. Coleoptera Bruchidae. Other recorded host (Tingidae) (Livingstone & Yacoub, 1988) should be confirmed. For a few species, the specific host is known. *U. spermophagi* Viggiani is recorded as parasitoid of the *Spermophagus sericeus* Geoffr. (Col. Bruchidae) (Viggiani, 1979).

***Xiphogramma* Nowicki**

Xiphogramma Nowicki, 1940. Zeit. angew. Ent. Berlin 26: 640.

Type species: *Xiphogramma holorhoptra* Nowicki.

(Trichogrammatidae: Oligositinae: Chaetostichini)

Diagnosis. Female. Maxillary palpus 1-segmented. Antenna (Fig. 128) with 2 anelli, 2 funicular, and 1 club segment. Fore wing (Fig. 130) with short venation, not reaching half of the fore wing length, stigmal vein very short, sessile, disk densely setose without or a few setal tracks, with reduced or lacking RS₁. Ovipositor (Fig. 129) sword-like, very long, extruded from the end of the metasoma. Male as the female. Genitalia (Figs. 131 and 132) simple, tubular, with short antero-dorsal aperture, basally very narrow, without distal appendices.

Distribution and diversity. Europe, Asia, Saudi Arabia, Africa, North America. 6 species are known. *P. levantina* Nowicki is the only European species.

Hosts. Unknown.

BIO-ECOLOGICAL TRAITS

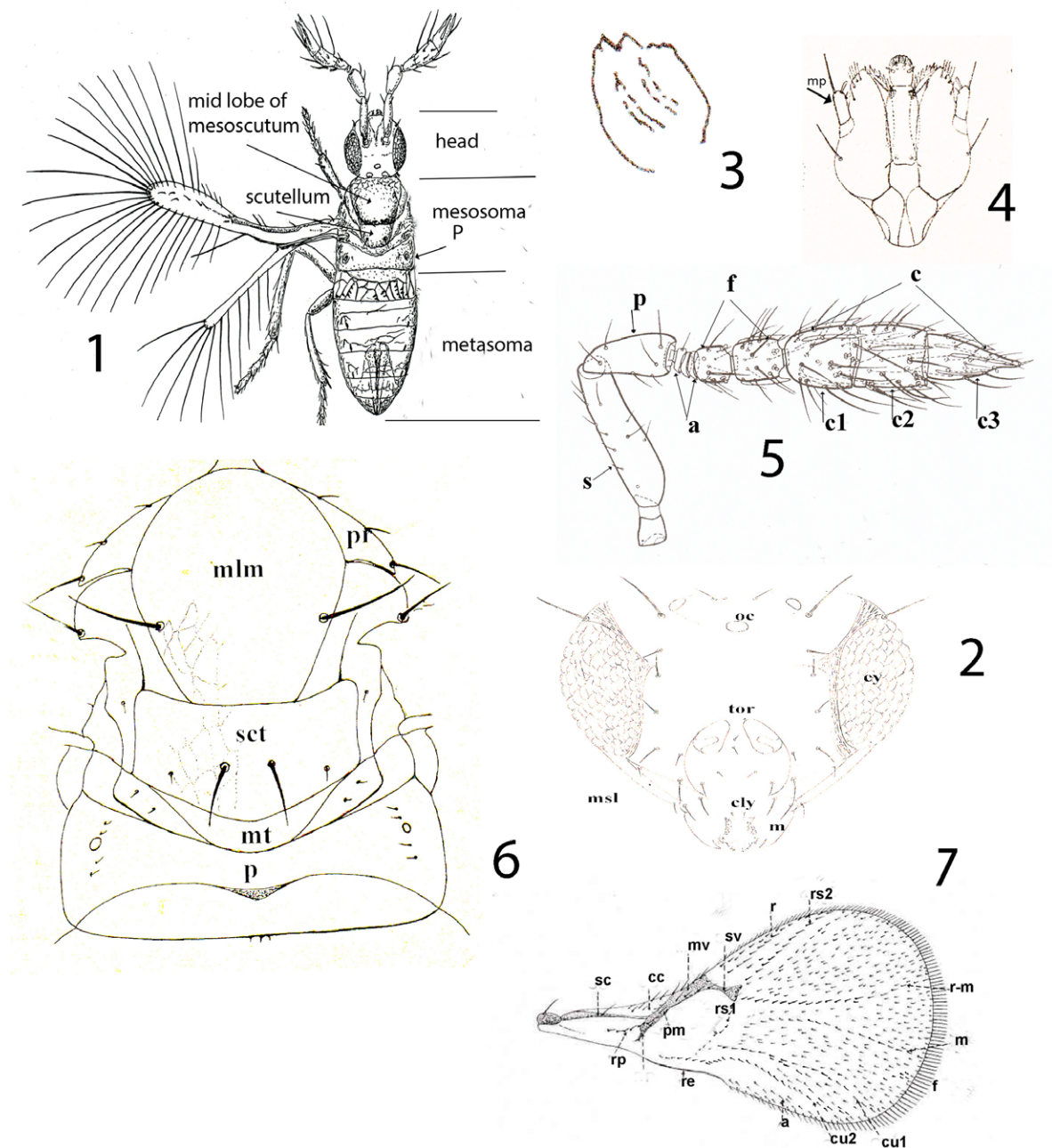
The knowledge of the bio-ecological traits of the Trichogrammatidae is very poor. For most of the species, any host is known, except for *Trichogramma*, in some countries, even mass-reared and used in biological control against insect pests. Normally, the species of Trichogrammatidae are solitary endo-egg parasitoids of insects (mostly Coleoptera, Lepidoptera, Hemiptera Auchenorrhyncha, Diptera, Odonata, some associated with aquatic plants). Documented exception is represented by *Lathromeris cecidomyiiae* Viggiani & Laudonia (Viggiani & Laudonia, 1994; Jesu & Laudonia, 1994), a larval parasitoid of *Lasioptera* sp. (Diptera Cecidomyiidae) on *Arundo donax* L. According to Owen *et al.* (2007), the molecular data suggest that Trichogrammatidae primitively parasitized Coleoptera. The following genera include species recorded as egg parasitoids of Coleoptera (*Asynacta*, *Bloodiella*, *Ceratogramma*, *Monorthochaeta*, *Ophioneurus*, *Poropoea*, *Prestwichia*, *Pterandrophysalis*, *Tumidiclava*, *Uscana*). Polivoltine species are normally associated with the same type of host. On the contrary, some species are monovoltine, and their life cycle is synchronized with that of the host. *Pseudoligosita phaneropterae* Viggiani is a gregarious egg parasitoid of *Phaneroptera nana* Fieber (Orthoptera Tettigoniidae); the adults emerge in autumn when the host oviposits new, fresh eggs. The parasitoid starts a new generation, which ends in the autumn of the next year; the synchronization of the host-parasitoid life cycle is regulated by a process of diapause involving the parasitoid larvae and pupae

(Viggiani, 2021). The same synchronization of the host-parasitoid life cycle has been reported for *Ittys annae* Karpinski (1954). Some genera of Trichogrammatidae have species associated prevalently with Lepidoptera (*Trichogramma* spp.), Hemiptera Auchmorrhyncha (*Oligosita* spp., *Pseudoligosita* spp.), or only with Thysanoptera (Polaszek *et al.*, 2022). Gregarious species, associated with relatively large insect eggs, are recorded in the genus *Trichogramma* and *Pseudoligosita*.

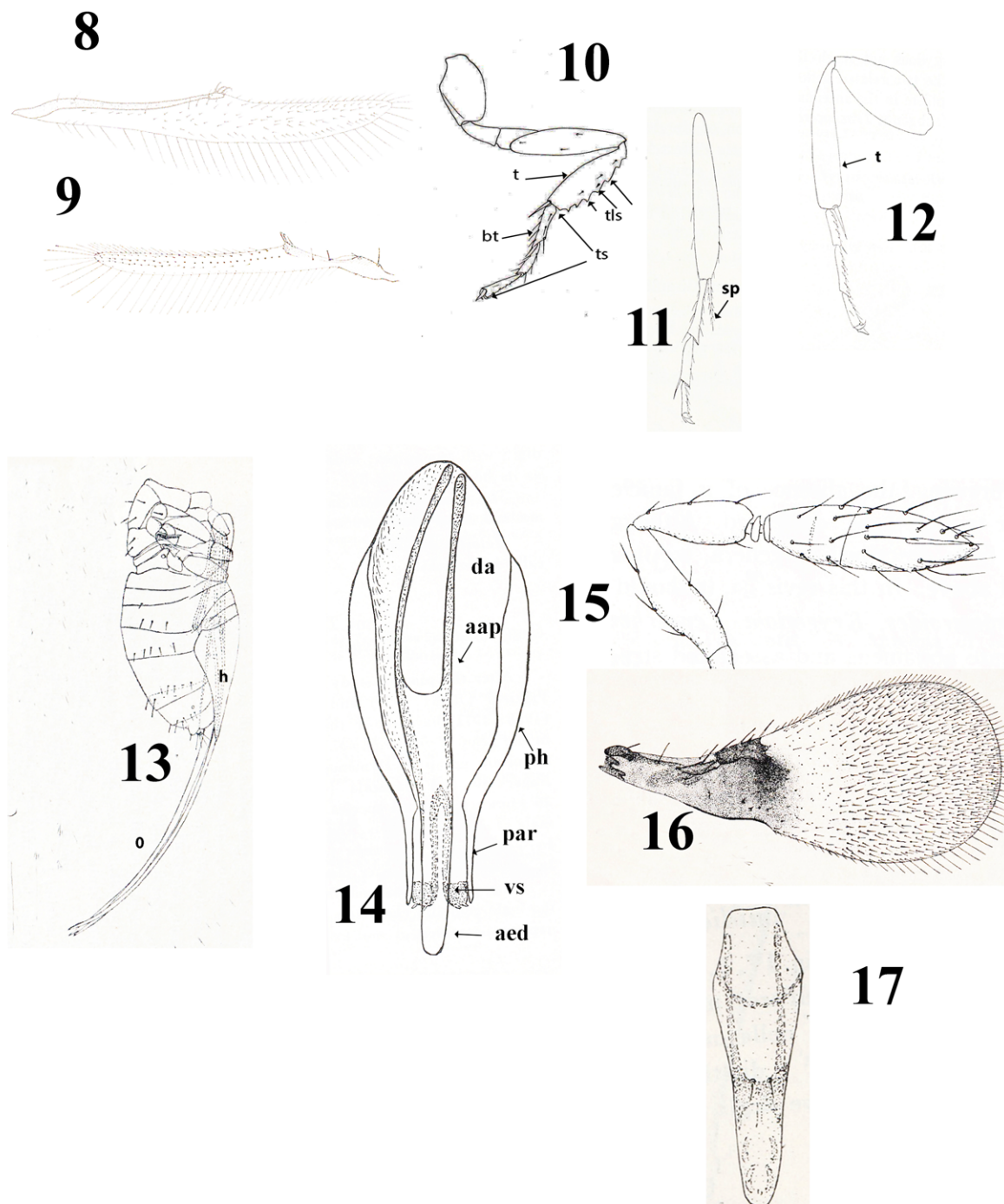
CLASSIFICATION

The history of the classification of Trichogrammatidae until the end of the 20th century was presented in a previous paper (Viggiani, 2002). The first modern revision of the family was presented by Doutt & Viggiani (1968). After the remarkable variations shown by Viggiani (1971b, 1984) in the shape and structure of the male genitalia in Trichogrammatidae, as in any other family of Chalcidoidea, except Mymaridae (Viggiani, 1989, 2004), the same author proposed a classification of the family. In the family Trichogrammatidae, the subfamilies Trichogrammatinae [including genera with species having male genitalia provided with a protective structure of the aedeagus, the phallobase, distally with some lateral (parameres) and ventral appendices (volsellae)] and the Oligositinae with male genitalia simplified without a distinct phallobase, were recognized. In the subfamily Trichogrammatinae, the tribes Trichogrammatini (species with phallobase boat-shaped or, rather, tubu-

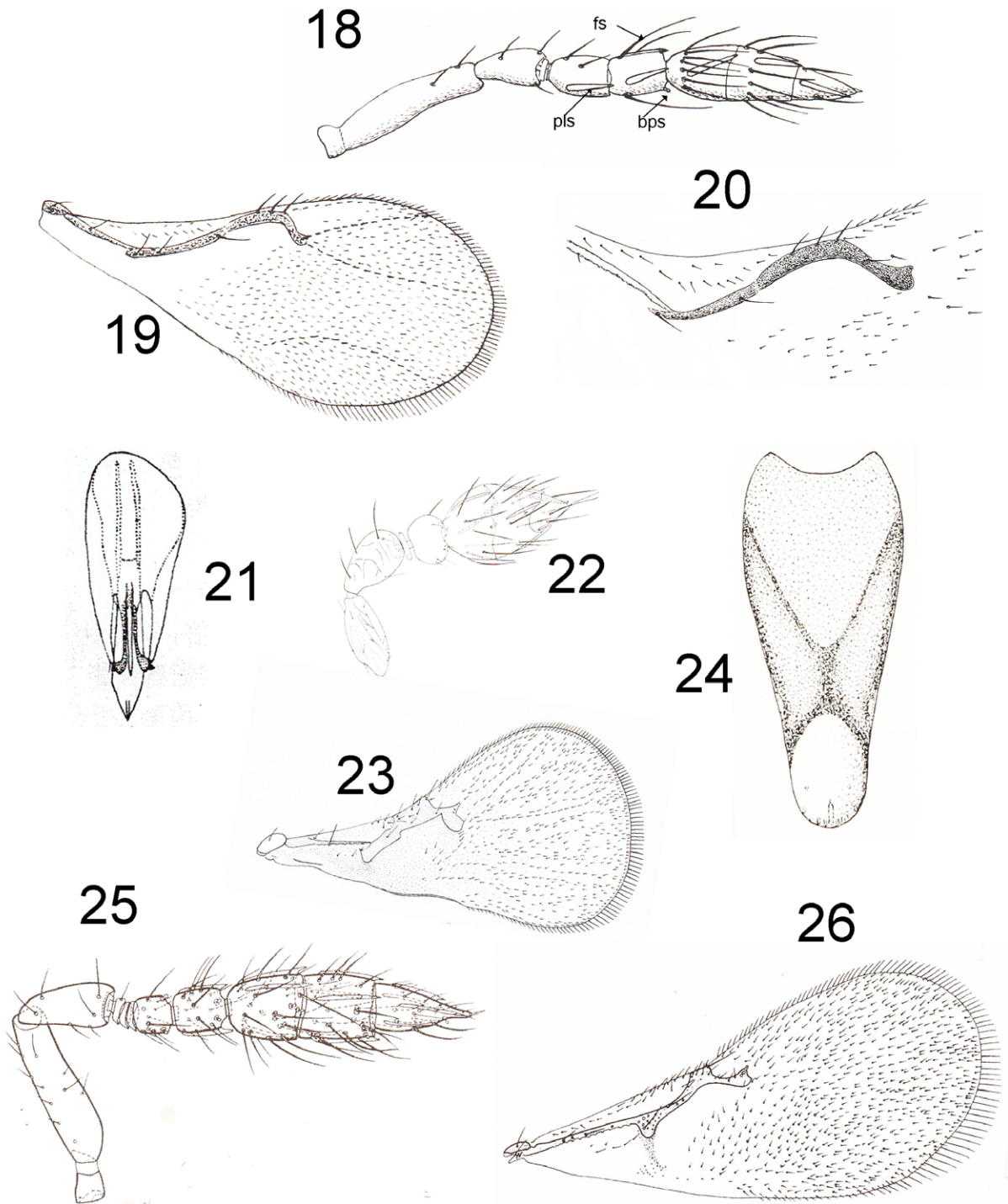
lar with antero-dorsal aperture of different shape and extension) and Paracentrobiini (phallobase subtrunc-conic, basally wider, and with antero-dorsal aperture transverse or subovate). In the subfamily Oligositinae, the tribes Chaetostrichini (male genitalia with a distinct antero-dorsal aperture, in some cases delimited by an annular sclerite) and Oligositini (male genitalia with antero-dorsal aperture not clearly distinct). After 35 years (Owen *et al.*, 2007), an evaluation of the utility of the male genitalia for higher-level classification of the Trichogrammatidae, using molecular methods, was carried out. Utilizing 121 taxa, included in 52 genera of the 84 genera that were recognized at that time, the authors proposed a new classification of the Trichogrammatidae. In the subfamily Trichogrammatinae, only the tribe Trichogrammatini was included, and in the Oligositinae, the tribe Paracentrobiini was transferred from Trichogrammatinae and added to the tribes Chaetostrichini and Oligositini recognized by Viggiani (1971). Nevertheless, Owen *et al.* (2007) included in the tribe Trichogrammatini only the genera *Thanatogramma* Pinto, *Trichogramma* Westwood, *Trichogrammatoidea* Girault, and *Xenufens* Girault; the other 33 genera were considered *incertae sedis* within Trichogrammatinae. In the subfamily Oligositinae, the same authors included 11 genera in the tribe Chaetostrichini, 12 in Oligositini, 4 in the Paracentrobiini, and 24 genera in *incertae sedis* within Oligositinae. Substantially, the molecular classification proposed by Owen *et al.* (2007) confirms the bulk of that of Viggiani, based on the features of the male genitalia. Further studies will clarify controversial points.



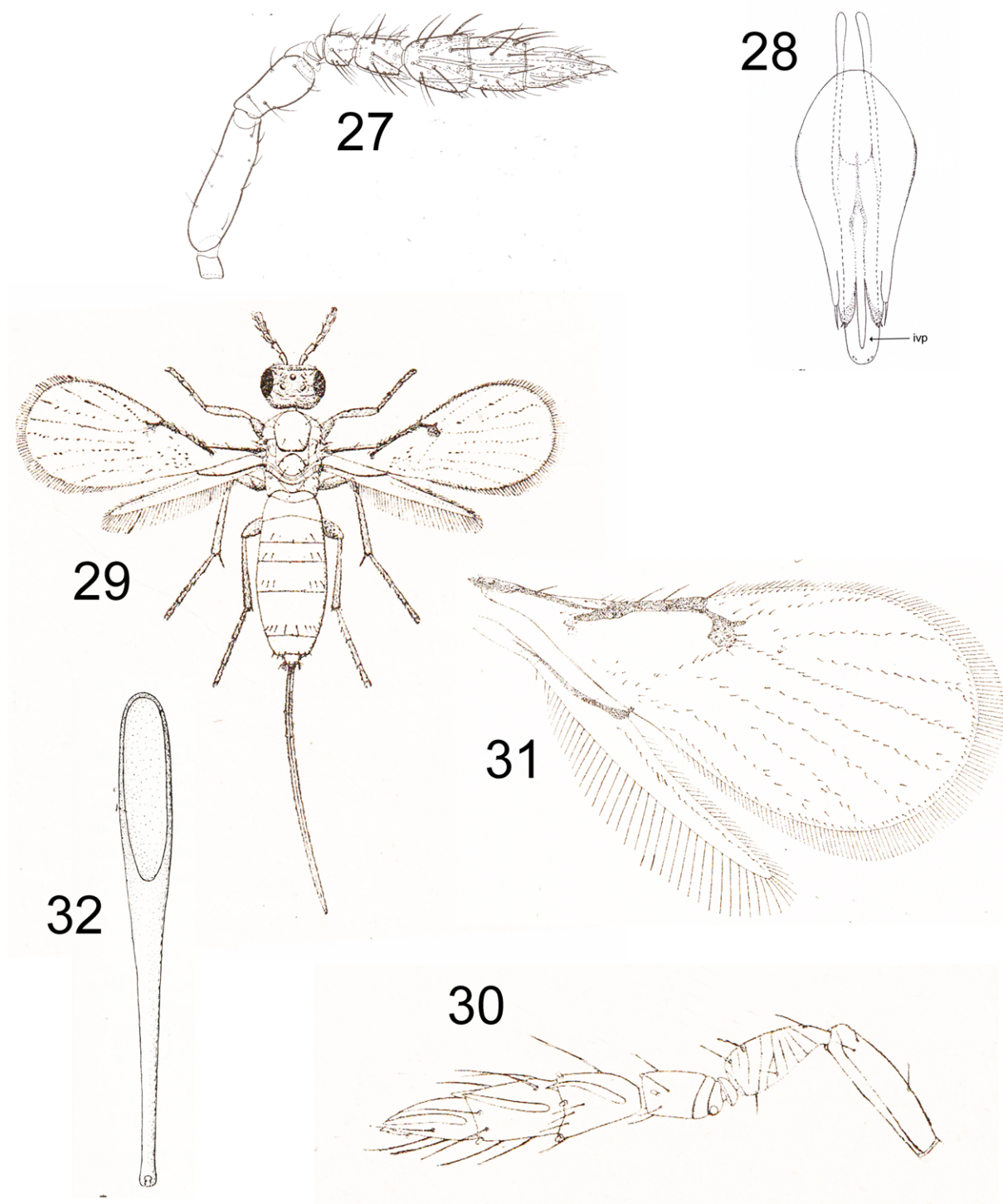
Figs. 1-7. 1.) *Megaphragma mymaripenne*, female, habitus, p = propodeum. 2) *Pintoa nearctica*, head front view, cly = clypeus, ey = eye, m = mandible, msl = malar sulcus line, oc = ocellus, tor = torulus. 3) *Megaphragma* sp., mandible. 4) *Chaetistricha walkeri*, maxillae and labium, mp = maxillary palpus. 5) *Ceratogramma tatianae*, female antenna, a = anelli, c = club, c1 = first club segment, c2 = second club segment, c3 = third club segment, f = funicle, p = pedicel, s = scape. 6) *Pintoa* sp., mesoscutum and propodeum, mlm = mid lobe of mesoscutum, mt = metanotum, pr = pronotum. 7) *Ufens niger*, fore wing, a = anal vein track, b = basal vein track, cc = costal cell, cu₁ = first branch of cubital vein track, cu₂ = second branch of cubital vein track, m = median vein track, mv = marginal vein, pm = premarginal vein, r = radius, re = retinaculum, r-m = r-m cross vein track, rp = radial process, RS₁ = radial sector (vein track 1_{st} Abscissa), RS₂ = radial sector (vein track 2_{nd} Abscissa), sc = subcostal vein.



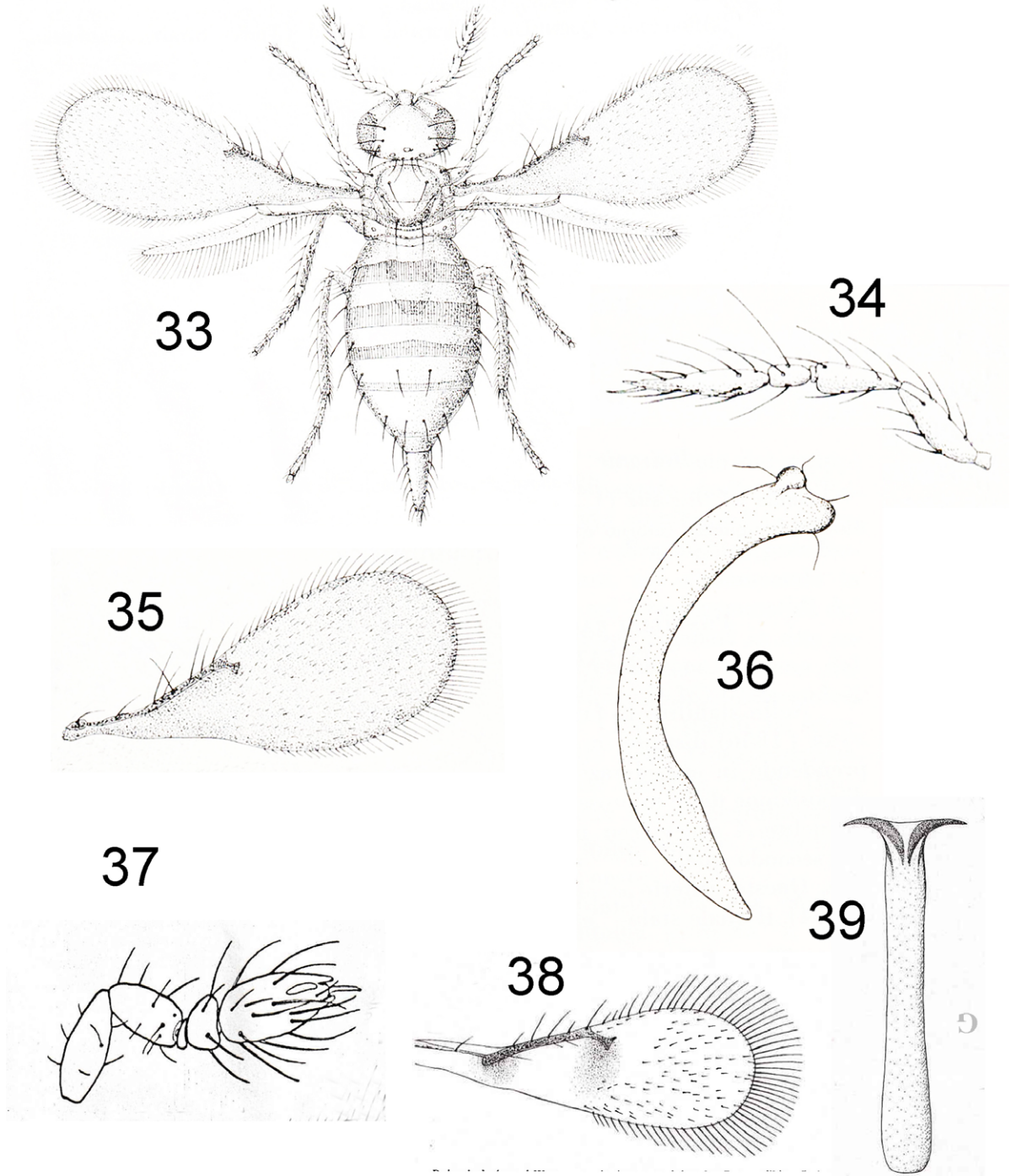
Figs. 8-17. 8) *Ceratogramma tatianae*, hind wing. 9) *Paracentrobia zabinski*, hind wing. 10) *Mirufens dentipes*, fore leg, bt = basitarsus, tls = thorn-like spine, ts = tarsus, t = tibia. 11) *Mirufens dentipes*, mid leg, s = spur. 12) *Mirufens dentipes*, hind leg, t = tibia. 13) *Chaetostricha walkeri*, mesosoma and metasoma, side view, h = hypopygium, o = ovipositor. 14) *Szelenya tamaricis*, male genitalia, aap = aedeagal apodem, da = dorsal aperture, aed = aedeagus, par = paramere, ph = phallobase, vs = volsella. 15) *Aphelinoidea xiphias*, female antenna. 16) *Aphelinoidea deserticola*, fore wing. 17) *Aphelinoidea* sp., male genitalia.



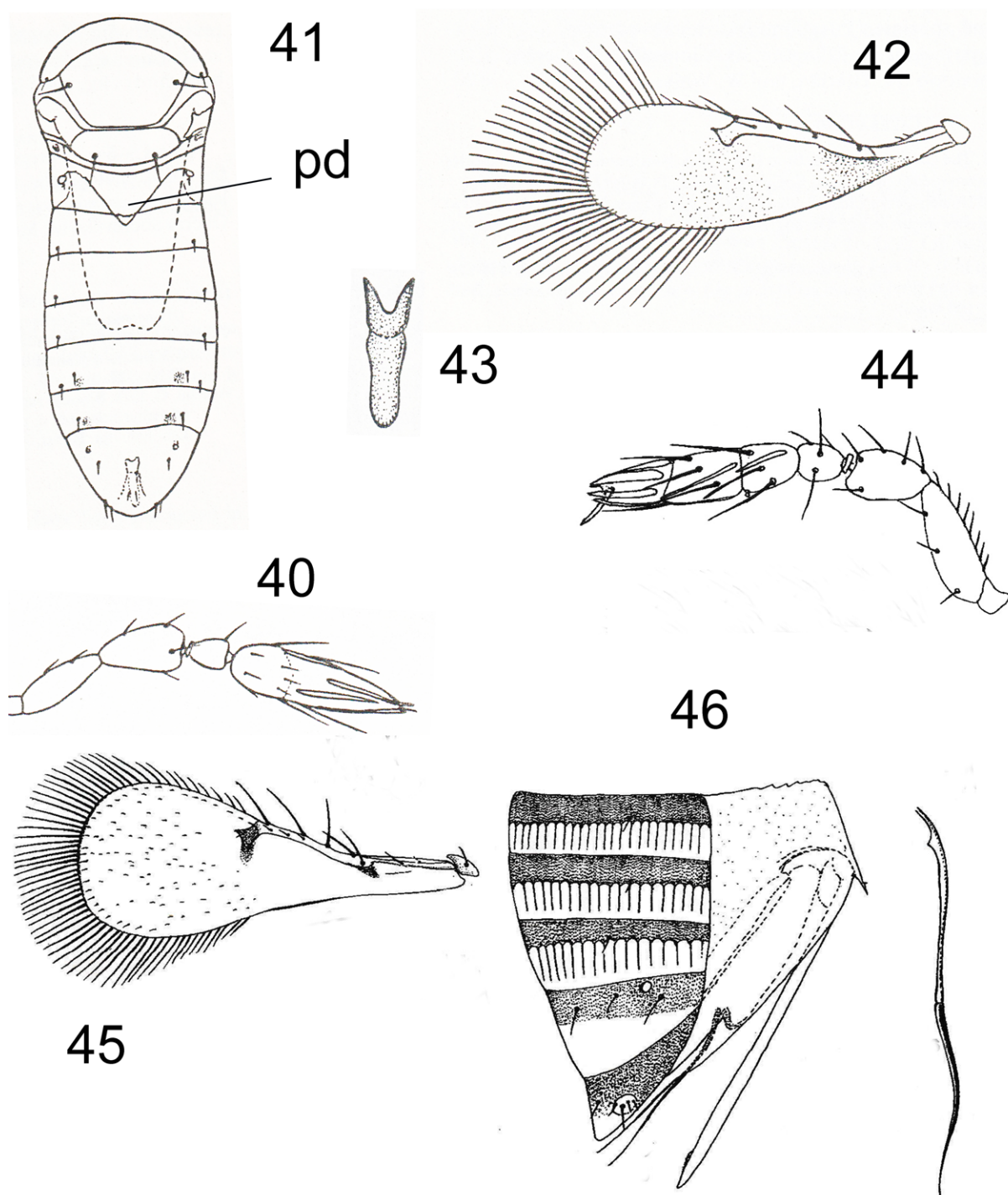
Figs. 18-26. 18) *Asynacta exigua*, female antenna, bps = basiconic peg sensillum, fs = flagellar setae, pls = placoid sensillum. 19) *Asynacta exigua*, fore wing. 20) *Asynacta exigua*, particular of the venation. 21) *Asynacta ambrostomae*, male genitalia. 22) *Bloodiella andalusica*, female antenna. 23) *Bloodiella andalusica*, fore wing. 24) *Bloodiella gynandrophthalmae*, male genitalia. 25) *Ceratogramma tatianae*, female antenna. 26) *Ceratogramma tatianae*, fore wing.



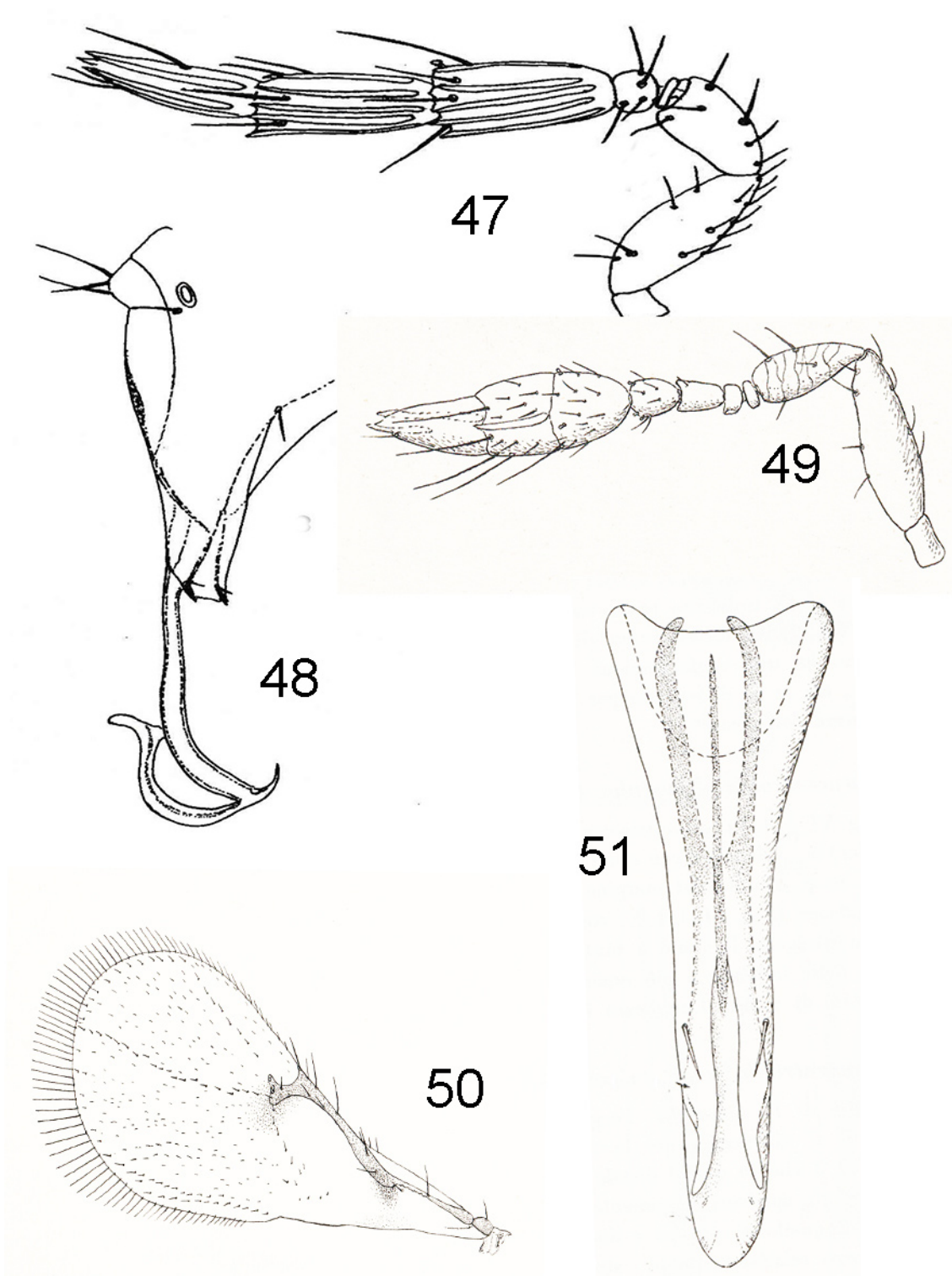
Figs. 27-32. 27) *Ceratogramma tatianae*, male antenna. 28) *Ceratogramma brasiliense*, male genitalia. 29) *Chaetostricha walkeri*, habitus female. 30) *Chaetostricha walkeri*, female antenna. 31) *Chaetostricha walkeri*, fore and hind wings. 32) *Chaetostricha silvestrii*, male genitalia.



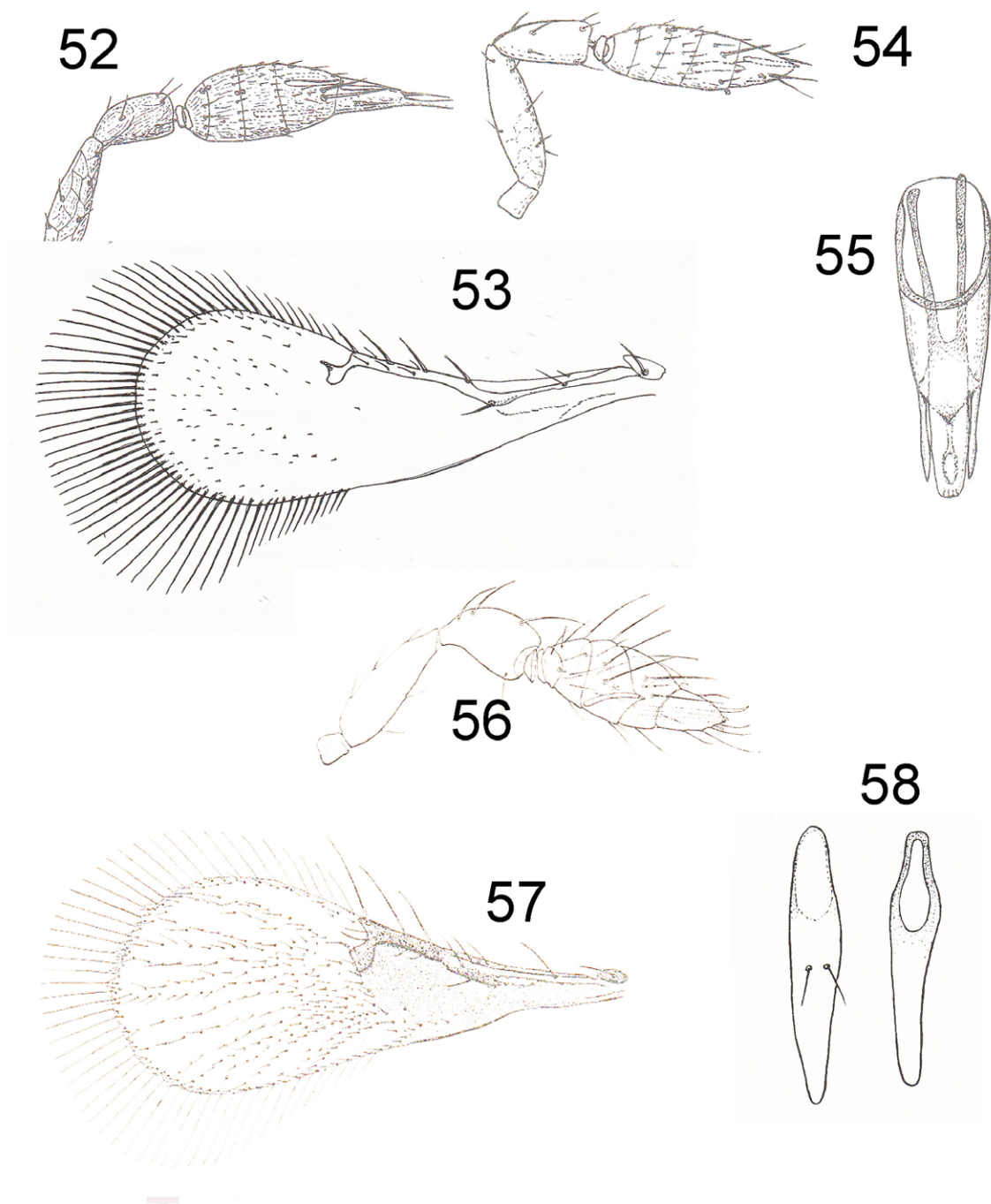
Figs. 33-39. 33) *Chaetostrichella pungens*, female, habitus. 34) *Chaetostrichella pungens*, female antenna. 35) *Chaetostrichella pungens*, fore wing. 36) *Chaetostrichella pungens*, male genitalia. 37) *Doirania leefmansi*, female antenna. 38) *Doirania leefmansi*, fore wing. 39) *Doirania leefmansi*, male genitalia.



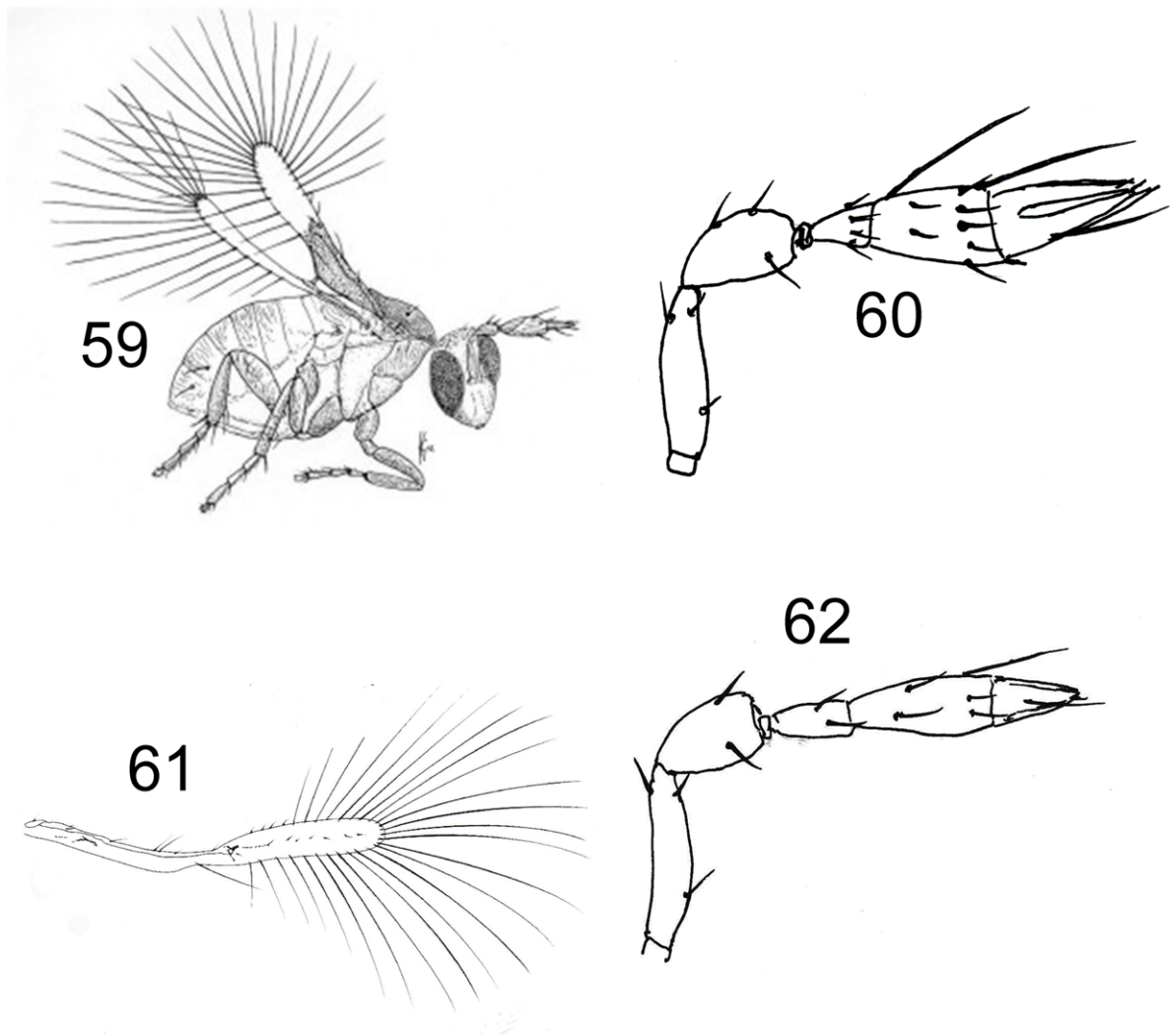
Figs. 40-46. 40) *Epoligosita mexicana*, female antenna. 41) *Epoligosita mexicana*, mesosoma and metasoma, pd = propodeal disk. 42) *Epoligosita mexicana*, fore wing. 43) *Epoligosita mexicana*, male genitalia. 44) *Hayatia procypriota*, female antenna. 45) *Hayatia procypriota*, fore wing. 46) *Hayatia procypriota*, part of the distal abdomen with ovipositor and particular of the lacet-shaped third valvula.



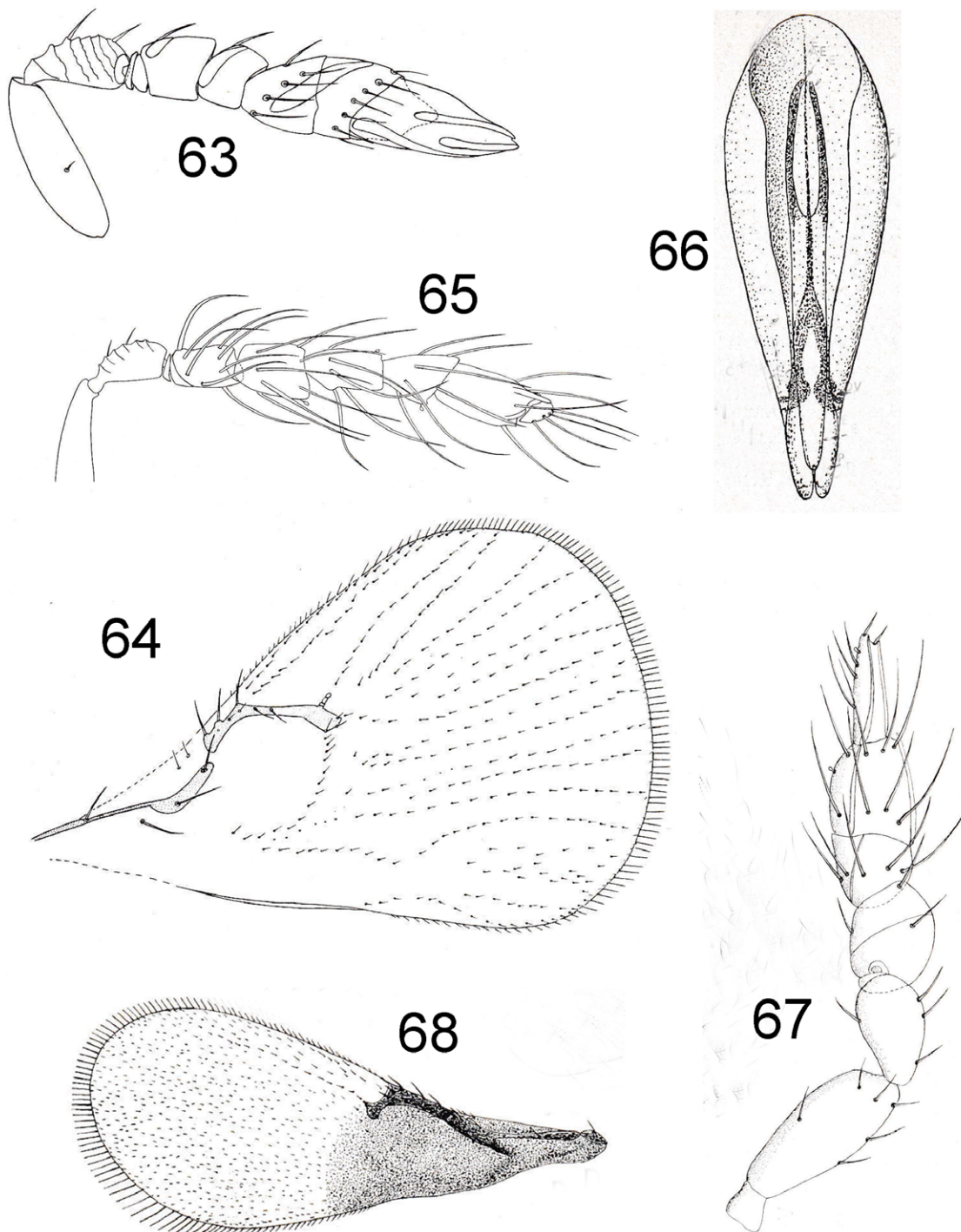
Figs. 47-51. 47) *Hayatia procyptota*, male antenna. 48) *Hayatia procyptota*, male genitalia. 49) *Ittys annae*, female antenna. 50) *Ittys annae*, fore wing. 51) *Ittys annae*, male genitalia.



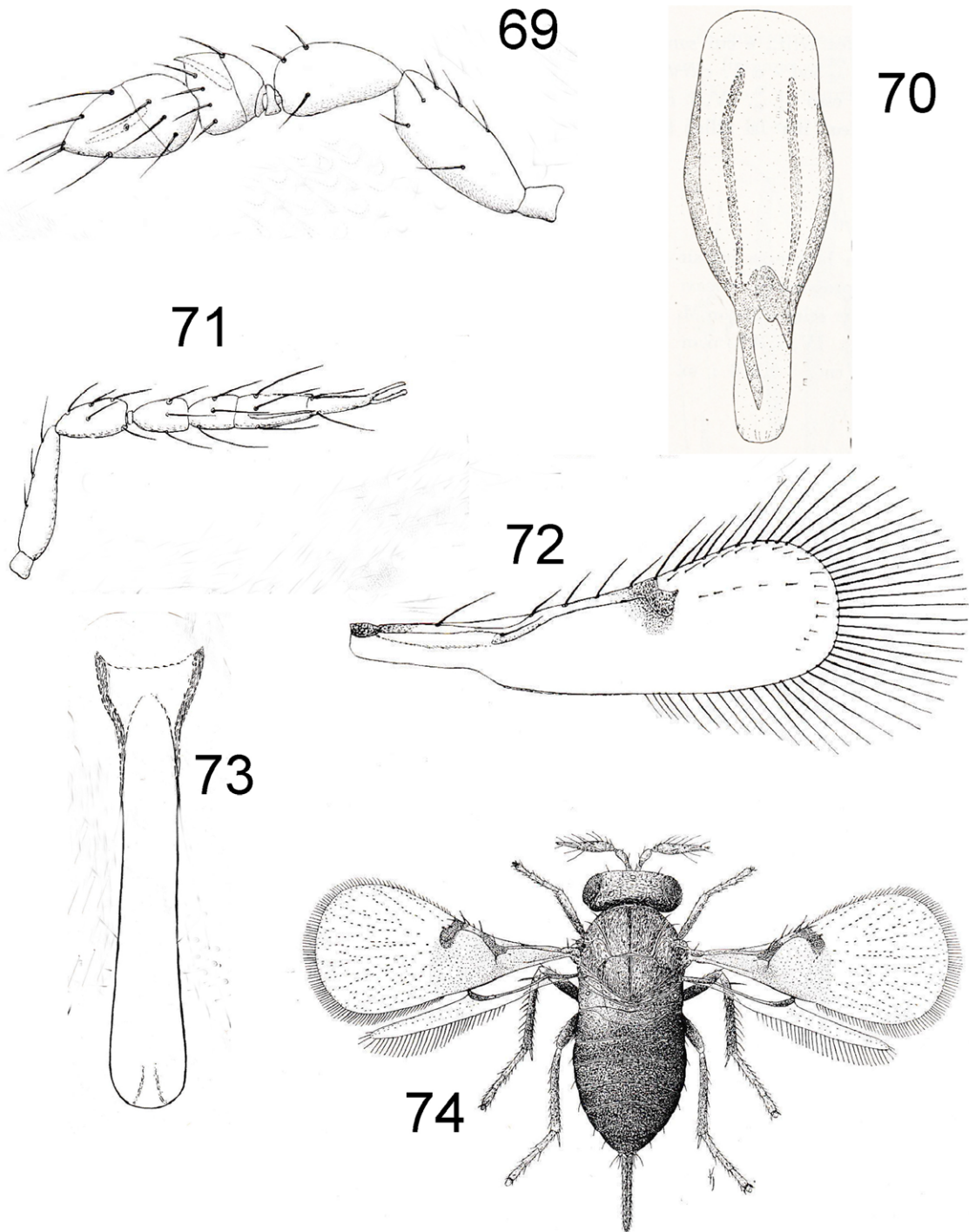
Figs. 52-58. 52) *Lathromeris cecidomyiiae*, female antenna. 53) *Lathromeris cecidomyiiae*, fore wing. 54) *Lathromeris cecidomyiiae*, male antenna. 55) *Lathromeris cecidomyiiae*, male genitalia. 56) *Lathromeroidea silvarum*, female antenna. 57) *Lathromeroidea silvarum*, fore wing. 58) *Lathromeroidea* sp., male genitalia, ventral and dorsal view.



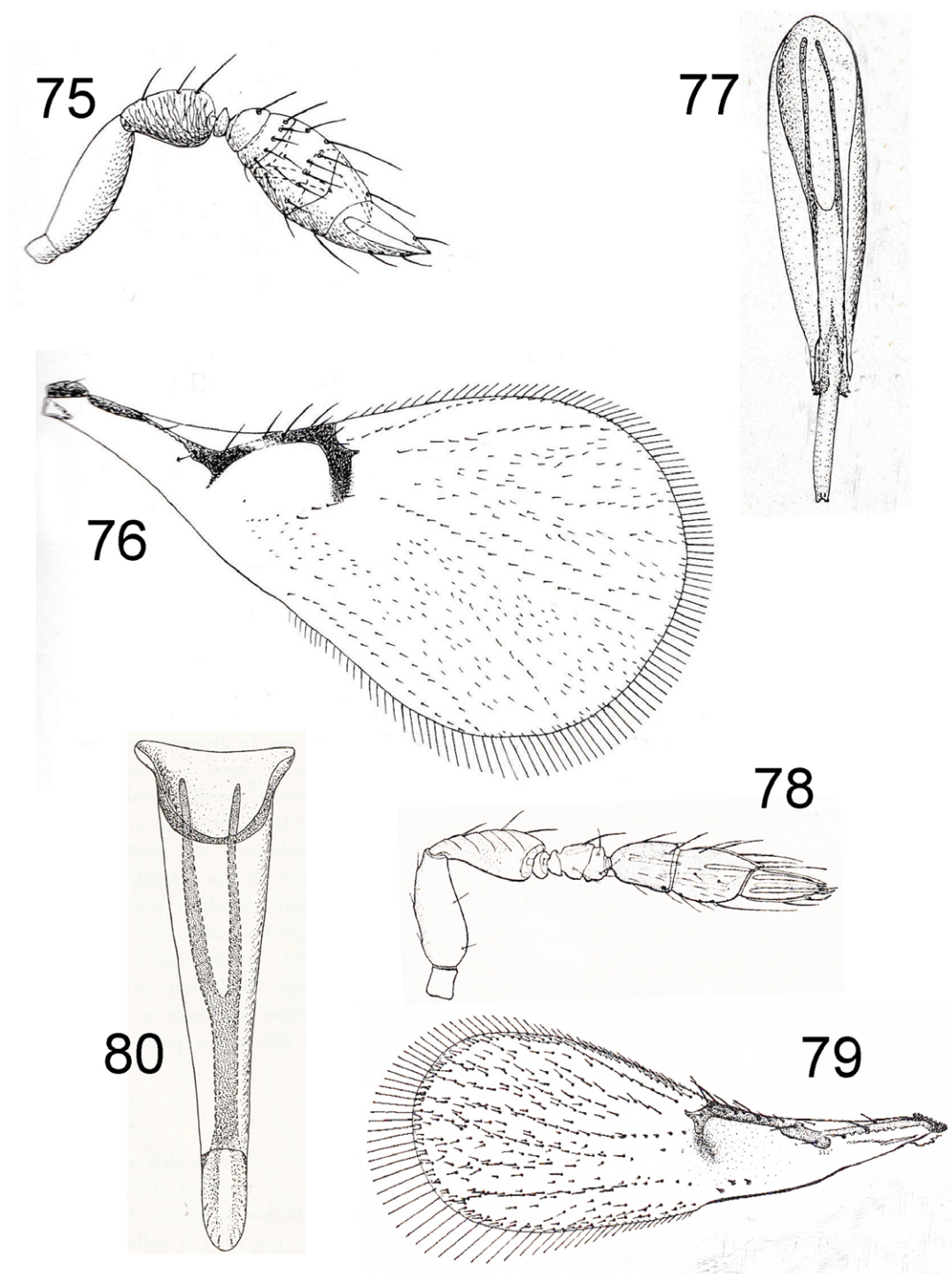
Figs. 59-62. 59) *Megaphragma rivelloi*, female, habitus. 60) *Megaphragma mymaripenne*, female antenna. 61) *Megaphragma mymaripenne*, fore wing. 62) *Megaphragma mymaripenne*, male antenna.



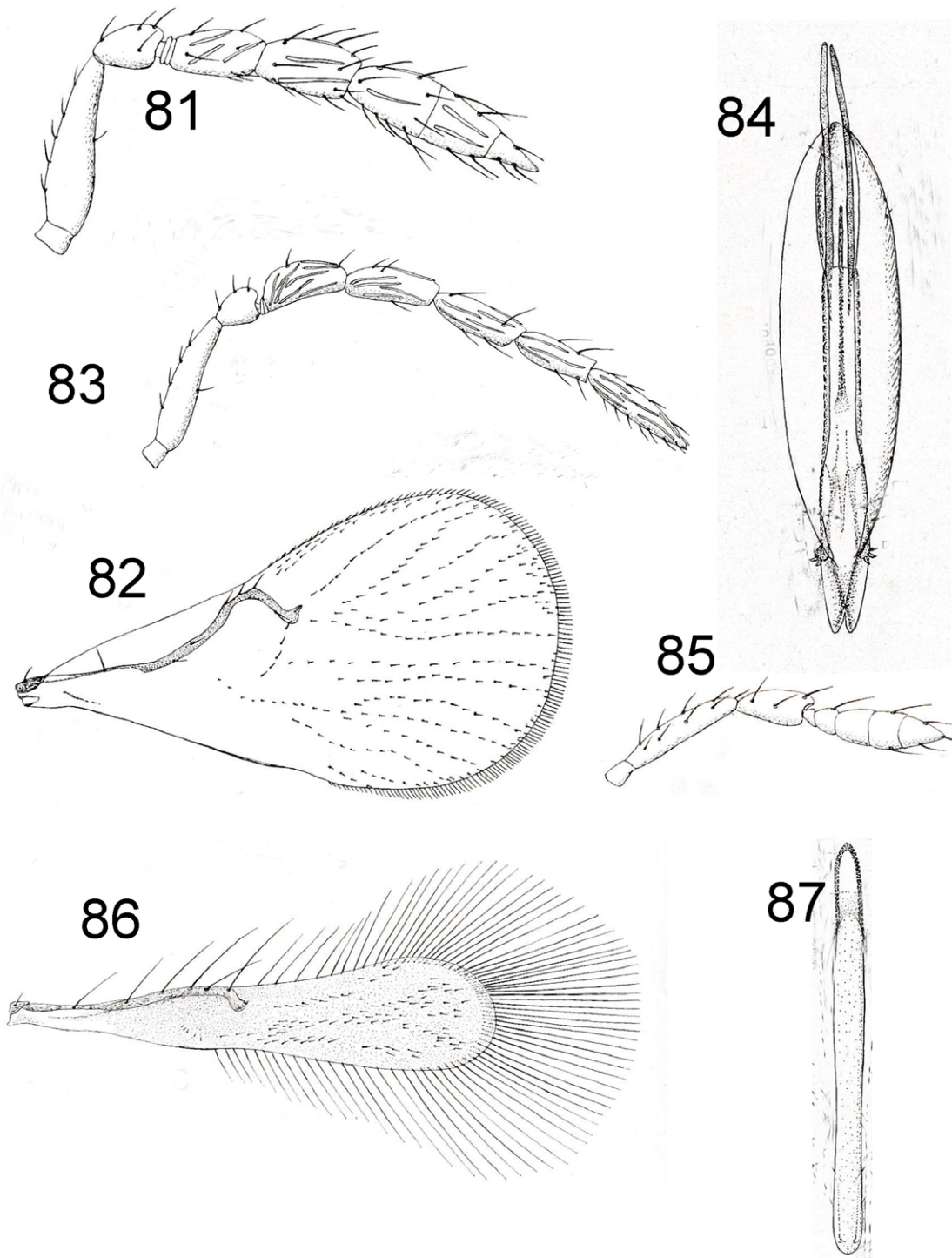
Figs. 63-68. 63) *Mirufens dentipes*, female antenna. 64) *Mirufens dentipes*, fore wing. 65) *Mirufens dentipes*, male antenna. 66) *Mirufens* sp., male genitalia. 67) *Monortochoeta nigra*, female antenna. 68) *Monortochoeta nigra*, fore wing.



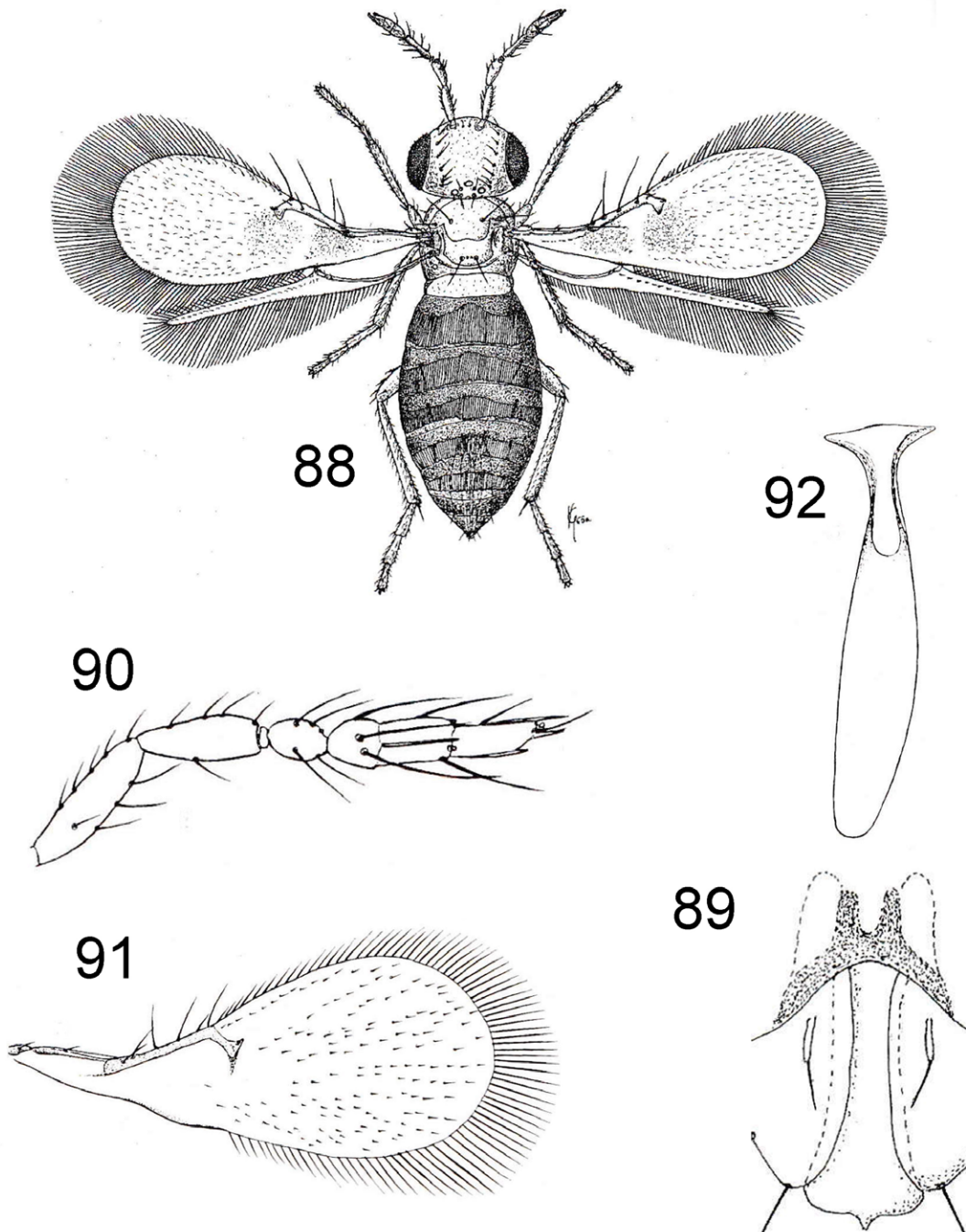
Figs. 69-74. 69) *Monortochaeta nigra*, male antenna. 70) *Monortochaeta nigra*, male genitalia. 71) *Oligosita sanguinea*, female antenna. 72) *Oligosita sanguinea*, fore wing. 73) *Oligosita anomala*, male genitalia. 74) *Ophioneurus longiclavatus*, female, habitus.



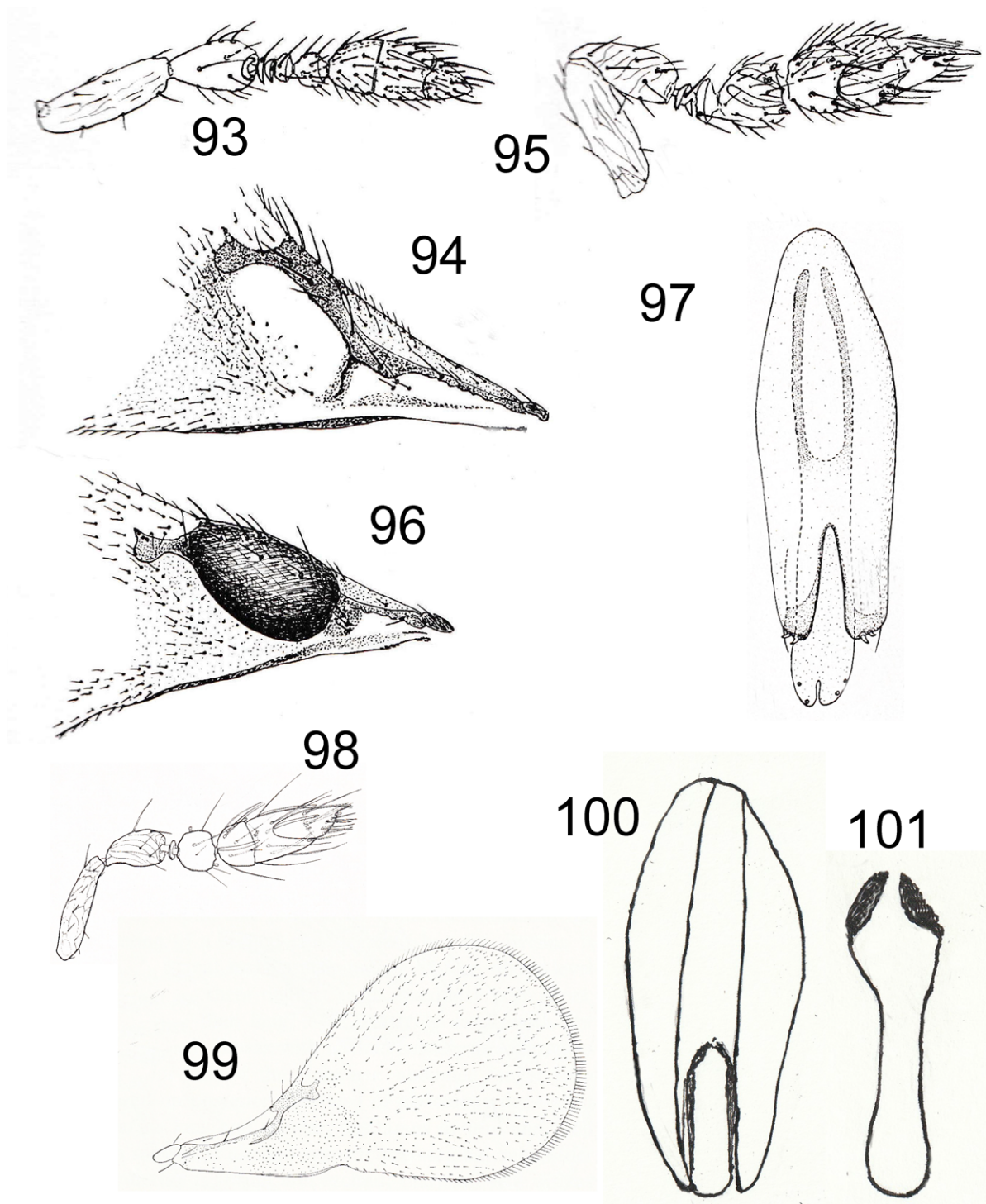
Figs. 75-80. 75) *Ophioneurus signatus*, female antenna. 76) *Ophioneurus signatus*, fore wing. 77) *Ophioneurus signatus*, male genitalia. 78) *Paracentrobia zabinskii*, female antenna. 79) *Paracentrobia zabinskii*, fore wing. 80) *Paracentrobia dimorpha*, male genitalia.



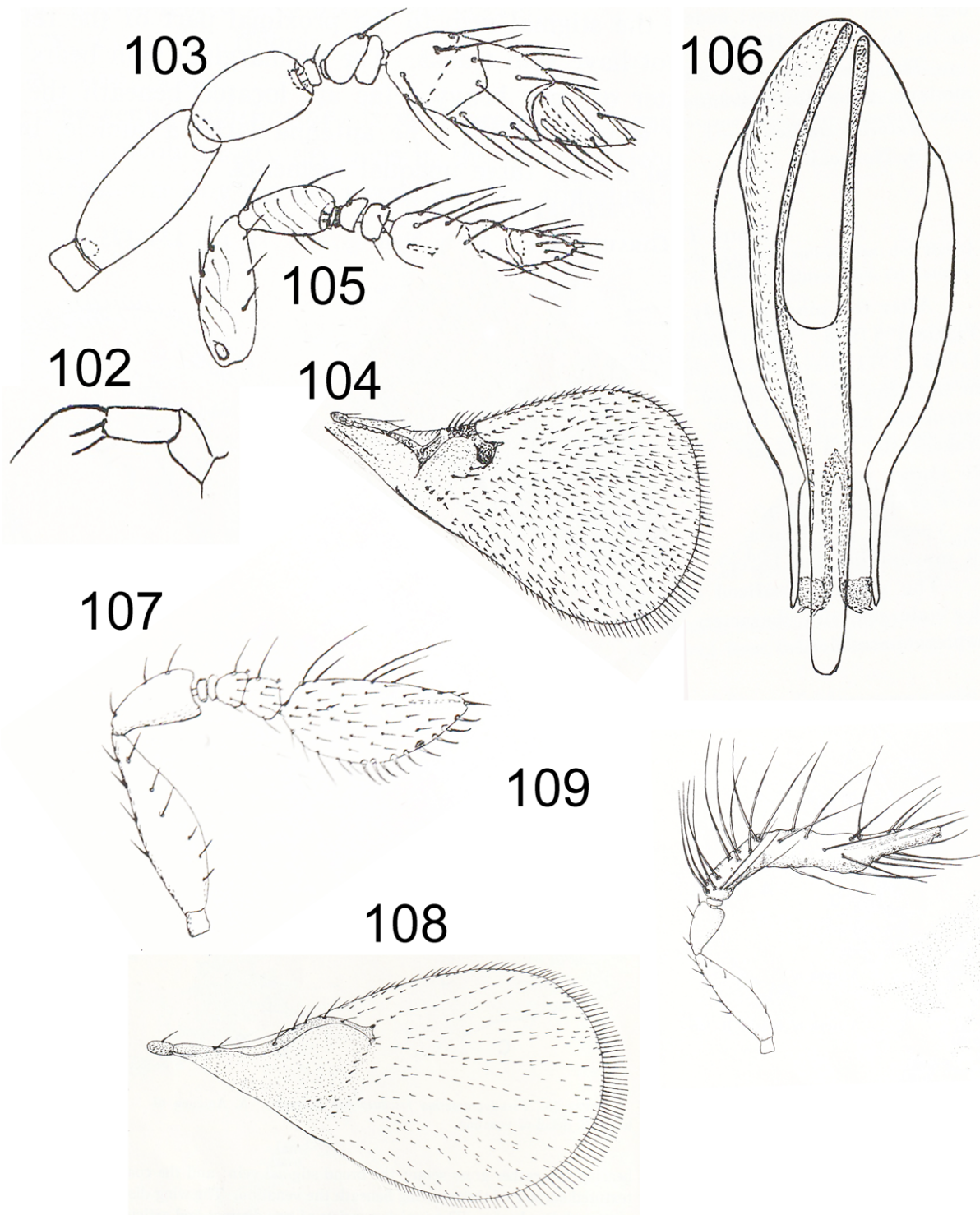
Figs. 81-87. 81) *Poropoea stollwercki*, female antenna. 82) *Poropoea stollwercki*, fore wing. 83) *Poropoea stollwercki*, male antenna. 84) *Poropoea stollwercki*, male genitalia. 85) *Prestwichia aquatica*, female antenna. 86) *Prestwichia aquatica*, fore wing. 87) *Prestwichia aquatica*, male genitalia.



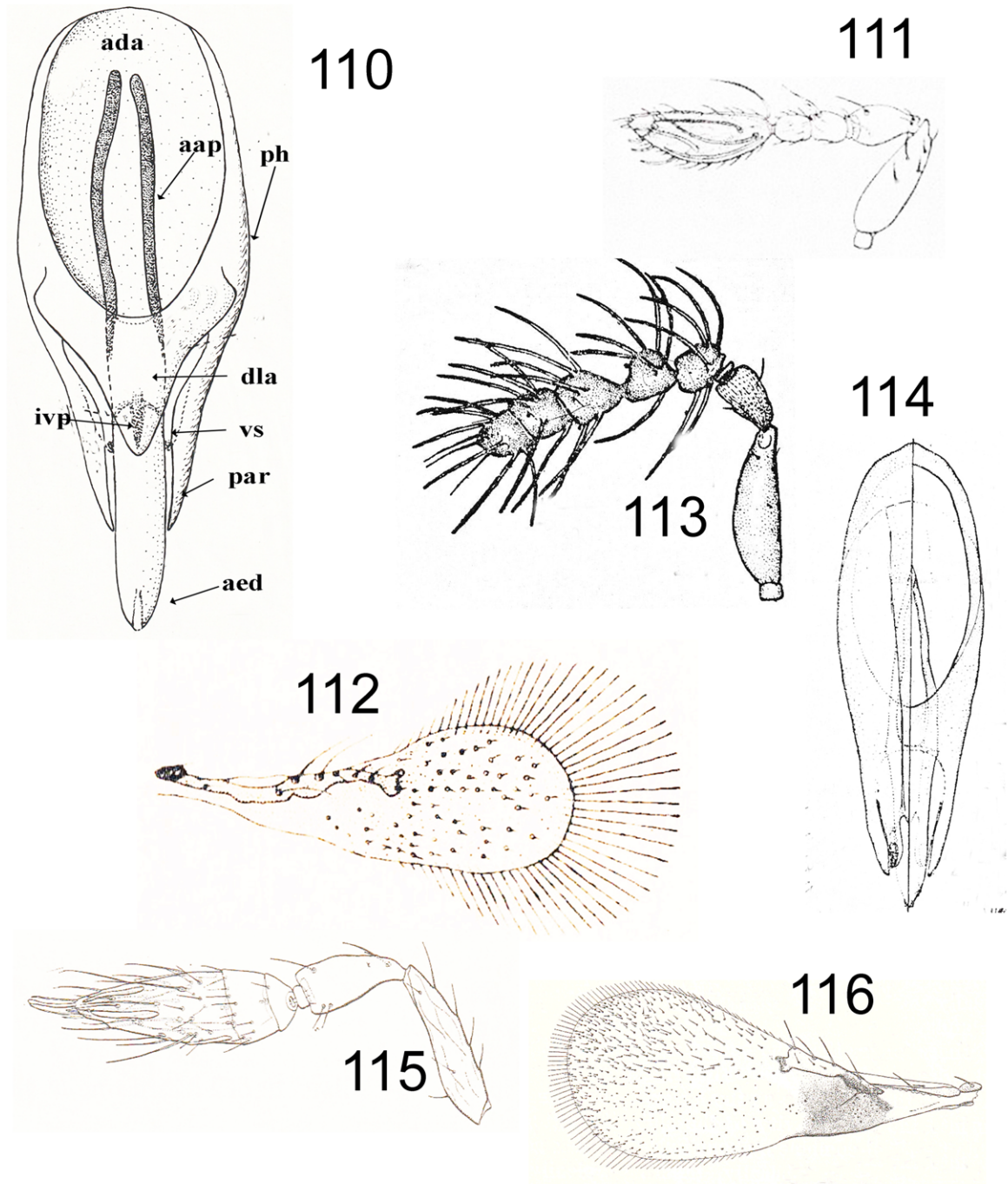
Figs. 88-92. 88) *Pseudoligosita masneri*, female, habitus. 89) *Pseudoligosita masneri*, male genitalia. 90) *Pseudoligosita phaneropterae*, female antenna. 91) *Pseudoligosita phaneropterae*, fore wing. 92) *Pseudoligosita phaneropterae*, male genitalia.



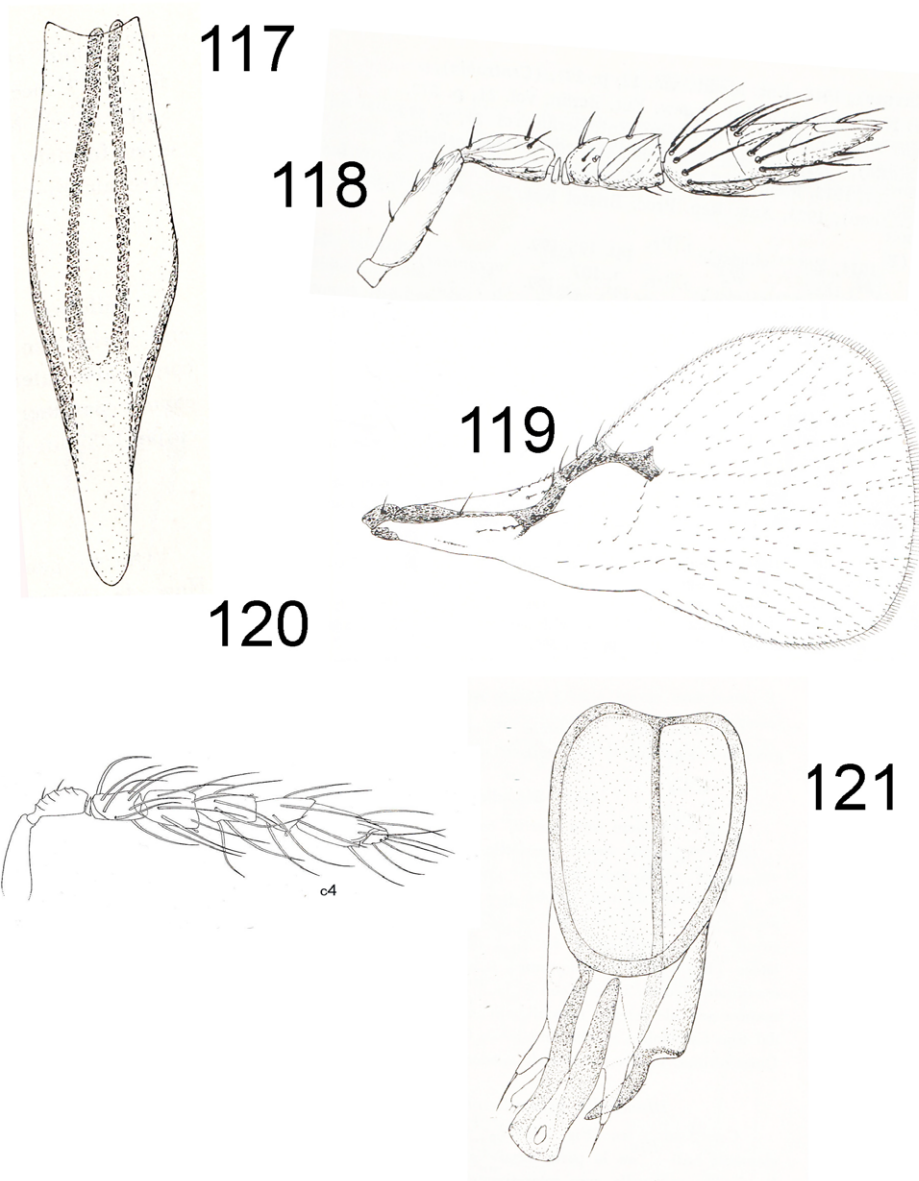
Figs. 93-101. 93) *Pterandrophysalis levantina*, female antenna. 94) *Pterandrophysalis levantina*, female fore wing venation. 95) *Pterandrophysalis levantina*, male antenna. 96) *Pterandrophysalis levantina*, male fore wing. 97) *Pterandrophysalis levantina*, male genitalia. 98) *Soikiella mongibelli*, female antenna. 99) *Soikiella mongibelli*, fore wing. 100) *Soikiella italica*, male genitalia. 101) *Soikiella italica*, aedeagus.



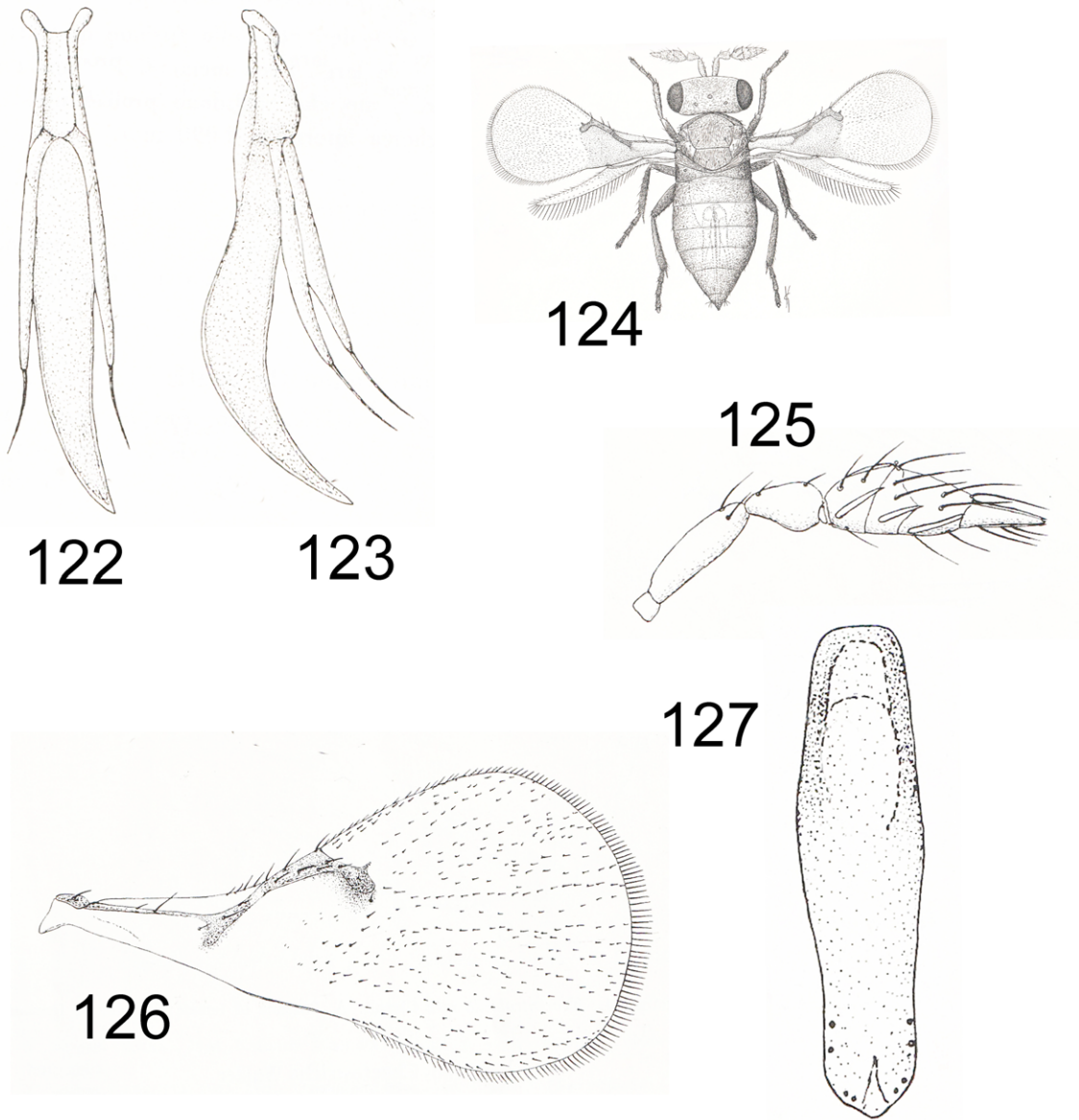
Figs. 102-109. 102) *Szelelya tamaricis*, maxillary palpus. 103) *Szelelya tamaricis*, female antenna. 104) *Szelelya tamaricis*, fore wing. 105) *Szelelya tamaricis*, male antenna. 106) *Szelelya tamaricis*, male genitalia. 107) *Trichogramma evanescens*, female antenna. 108) *Trichogramma evanescens*, fore wing. 109) *Trichogramma evanescens*, male antenna.



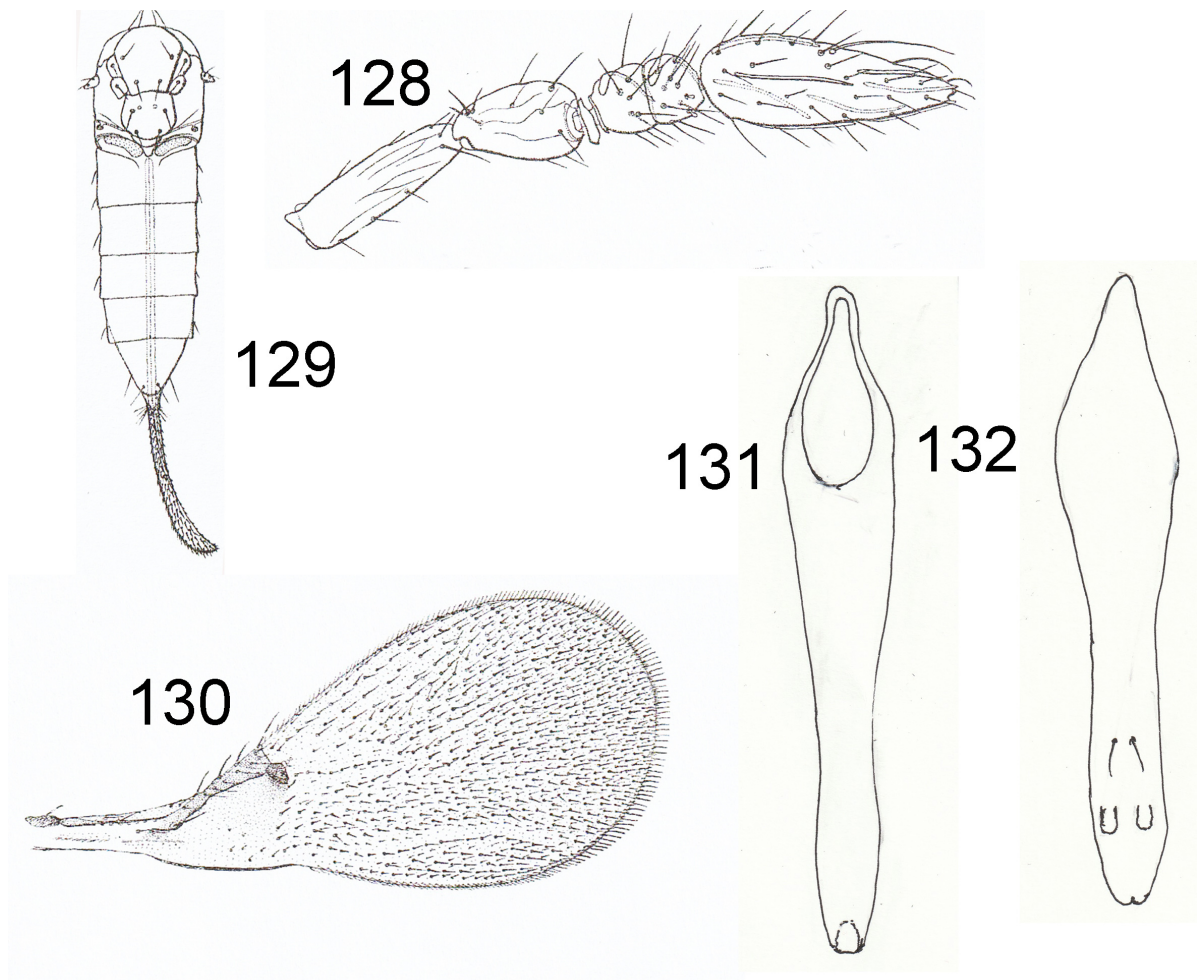
Figs. 110-116. 110) *Trichogramma evanescens*, male genitalia, aap = aedeagus apodeme, ada = antero-dorsal aperture, aed = aedeagus, dla = dorsal lamina, ivp = intervolsellar process, par = paramere, ph = phallobase, vs = volsella. 111) *Trichogrammatoidea stammeri*, female antenna. 112) *Trichogrammatoidea stammeri*, fore wing. 113) *Trichogramma prabhakeri*, antenna. 114) *Trichogrammatoidea lutea*, male genitalia. 115) *Tumidiclava subcaudata*, female antenna. 116) *Tumidiclava subcaudata*, fore wing.



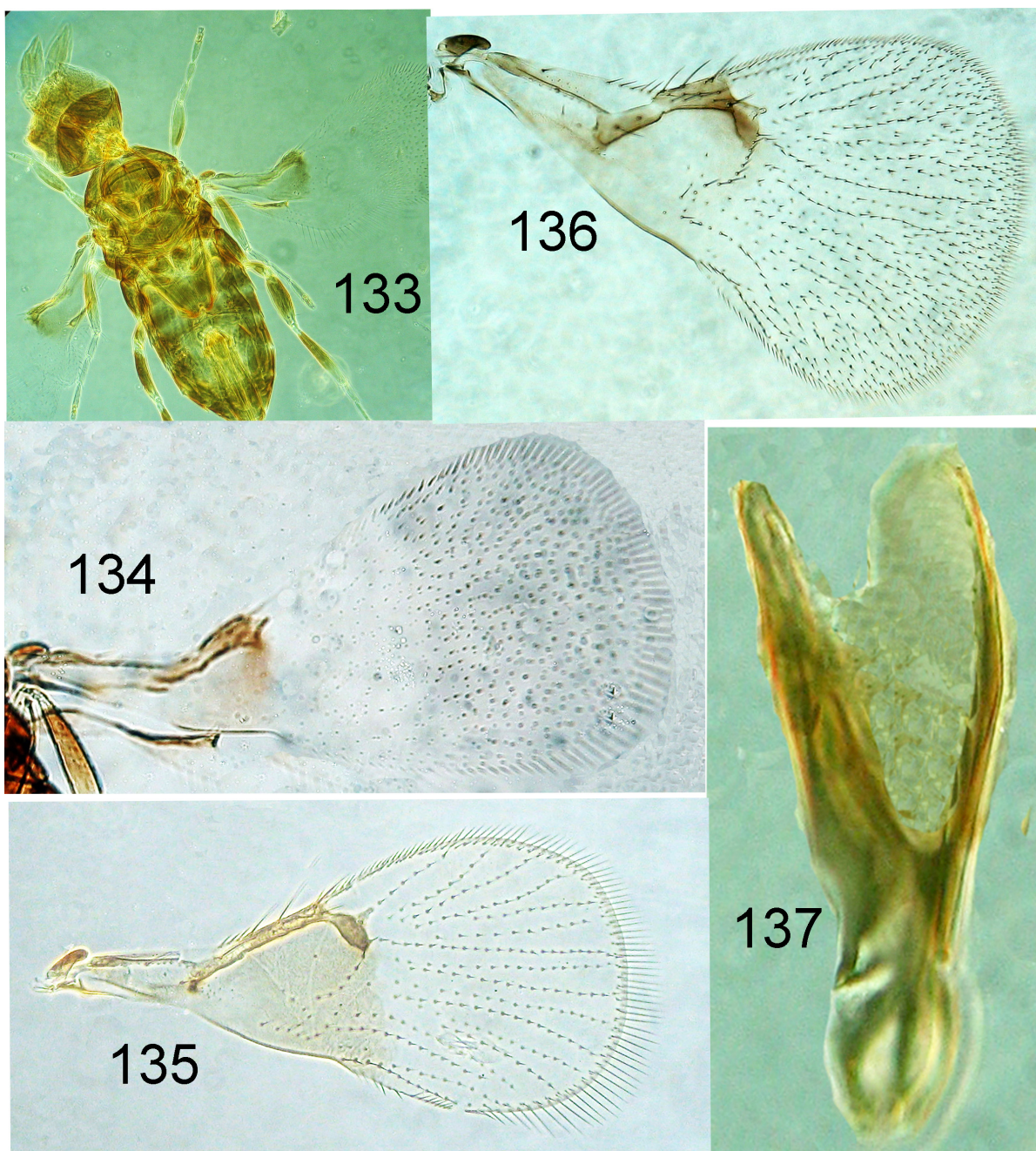
Figs. 117-121. 117) *Tumidiclava bimaculata*, male genitalia. 118) *Ufens* sp., female antenna. 119) *Ufens* sp., fore wing. 120) *Ufens* sp., male antenna. 121) *Ufens similis*, male genitalia.



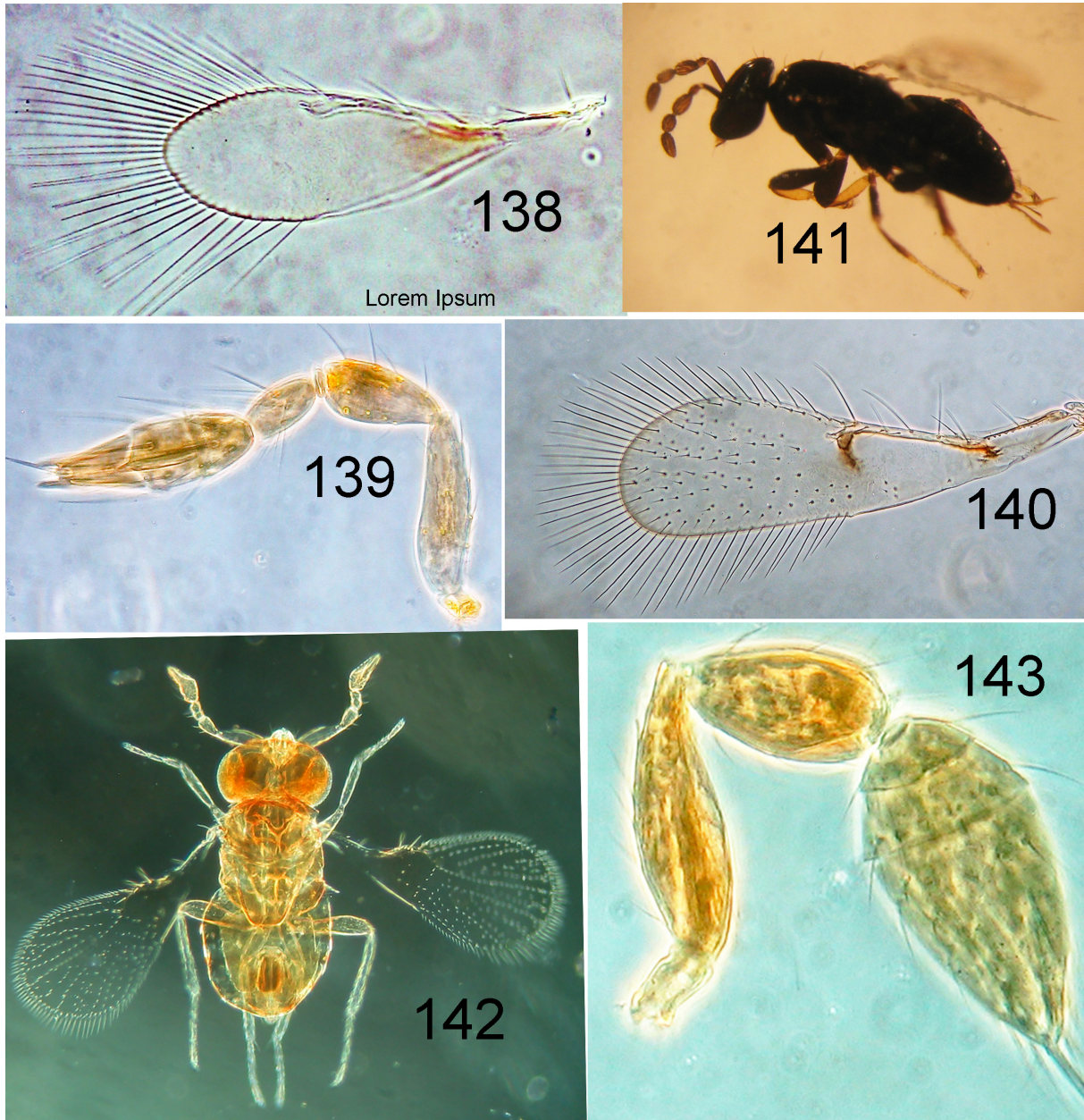
Figs. 122-127. 122) *Ufensia* sp., male genitalia, dorsal view. 123) *Ufensia* sp., male genitalia, lateral view. 124) *Uscana spermophagi*, female, lhabitus. 125) *Uscana semifumipennis*, female antenna. 126) *Uscana semifumipennis*, fore wing. 127) *Uscana senex*, male genitalia.



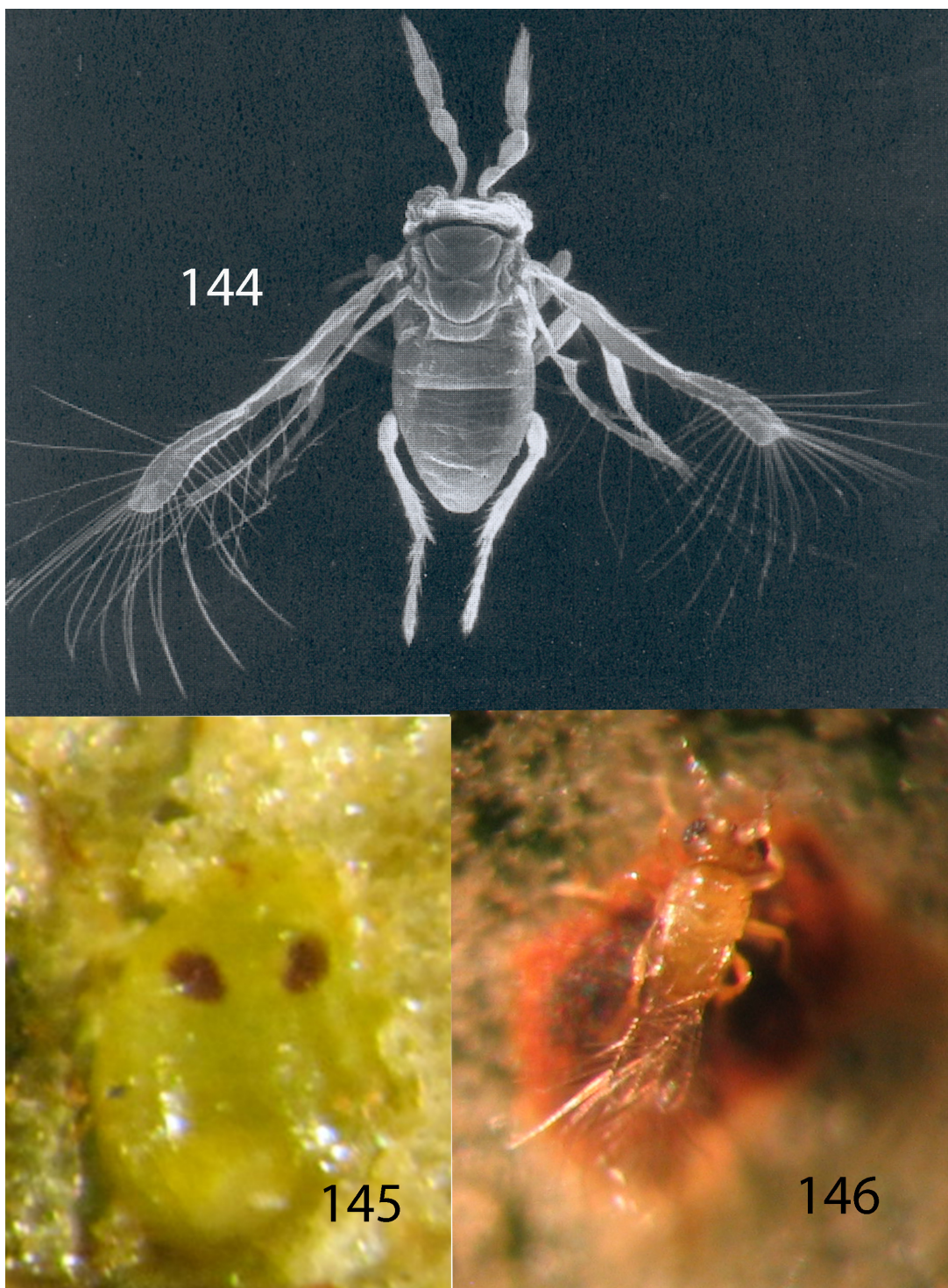
Figs. 128-132. 128) *Xiphogramma holorhoptra*, female antenna. 129) *Xiphogramma holorhoptra*, mesosoma and metasoma. 130) *Xiphogramma holorhoptra*, fore wing. 131) *Xiphogramma fuscum*, male genitalia, dorsal. 132) *Xiphogramma fuscum*, male genitalia, ventral.



Figs. 133-137. 133) *Aphelinoidea* sp., female, habitus. 134) *Aphelinoidea* sp., fore wing. 135) *Chaetostricha* sp., fore wing. 136) *Bloodiella andalusica*, fore wing. 137) *Bloodiella andalusica*, male genitalia.



Figs. 138-143. 138) *Epoligosita arabica*, fore wing. 139) *Pseudoligosita* sp., female antenna. 140) *Pseudoligosita* sp., fore wing. 141) *Poropoea africana*, female, habitus. 142) *Trichogramma* sp., adult female. 143) *Tumidiclava* sp., female antenna.



Figs. 144-146. 144) *Megaphragma mymaripenne*, female, habitus (SEM). 145) Pupa of *Megaphragma* sp. in egg of *Heliothrips haemorrhoidalis*. 146) *Megaphragma* sp., ovipositing in the egg of *Heliothrips haemorrhoidalis*.

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