

TAXONOMIST'S GLOSSARY

of

GENITALIA IN INSECTS

EDITED BY S. L. TUXEN, COPENHAGEN
Second revised and enlarged edition

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Fig. 214. *Saemundssonsonia* sp. (Mallophaga) ♂. Copulatory organ in ventral view. (Adapted from drawing by Terzi).

Fig. 215. *Trichodectidae* sp. (Mallophaga) ♀. Gonapophysis in ventral view, right half.

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27. HOMOPTERA¹⁾

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The male.

Auchenorrhyncha (figs. 216-220).

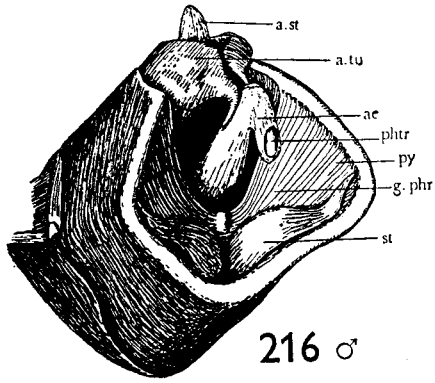
The 9th abdominal segment forms the *genital capsule* (figs. 216, 218). In most Fulgoromorpha the tergal, sternal and pleural parts are fused into a ring, the *pygofer*, dorsally with a more or less deep incision for the *anal tube* (a.tu). Ventrally, there is often also a more or less distinct incision. The lateral parts will then form backward projecting lobes, the *pygofer lobes*, py (fig. 216). In most Jassidomorpha, the sternum of the ninth segment is distinct, forming a semicircular or triangular plate, the *genital valve*, g.va (figs. 217-18). Behind the genital valve, the *genital plates*, g.pl (figs. 217-18)—two more or less horizontal plates of varying (triangular, trapezoidal or semicircular etc.) shape—form the bottom of the genital capsule, while the side walls of the latter consist of the *pygofer lobes*, py (fig. 217). In the Cicadidae, the boat-shaped 8th sternite or "*hypandrium*" protects the genitalia from below.

Dorsally, the genital cavity is covered by the tergal part of the pygofer and, behind the latter, by the *anal tube*, a.tu (figs. 216-17). This tube con-

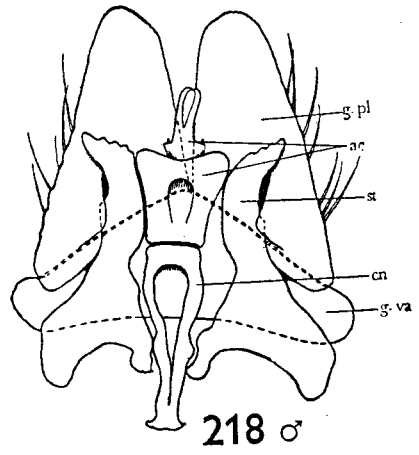
sists of the 10th abdominal segment and carries the terminal 11th abdominal segment, the *anal style*, a.st (figs. 216–17). Three or four parietal sclerites present in the integument of the latter are the *anal valves*, a.va (fig. 217). A transverse sclerotized intersegmental area present in certain groups between the 9th and 10th segments (i.e. basally of the anal tube) is termed the *anal collar*. The pygofer lobes as well as the anal tube and the anal collar may be armed with sclerotized appendages varying in shape. The genital plates and the pygofer lobes are generally setose. In certain groups, the arrangement of the setae is used as a basis for modern generic classification.

On the inside of the genital capsule there are several structures of systematic value. The median partly sclerotized intromittent copulatory organ is the *phallus* or *penis*. It consists of the basal *phallobase* and the distal tubular *aedeagus*. The inner lining of the aedeagal duct is the *endophallus*. The latter is a continuation of the ductus ejaculatorius. The terminal opening of the ductus ejaculatorius is the *gonopore*, but this term is often (more or less erroneously) used as a synonym of the *phallotreme* (phtr) = the distal opening of the endophallus at or near the end of the aedeagus (figs. 216, 219). Certain parts of the phallobase are generally fused with the base of the aedeagus into one piece. Almost all systematists use the name “aedeagus” or “penis” as synonyms for this fused terminal organ (figs. 216, 218, ae, 219). Then, the tubular part is the “*shaft*”, sh.ae (fig. 219) of the aedeagus, while the basal part is termed “*socle*”, so. The cavity within the socle has been called the “*genital atrium*”, g.atr, the basal border of the latter the “*atrial rim*” atr.r. Sometimes there is a dorsal paired or single process or *apodeme*, ap.atr, arising from the atrial rim, and the latter may be ventrally protracted into a *preatrium*, pratr. In certain families, the aedeagus is enclosed in a more or less tubular *penis-sheath* (*theca*, *periandrium*) arising from the phallobase, or the aedeagus may be much reduced and functionally replaced by this penis-sheath. In the cicadas the theca encloses a complicated extensible membranous structure, the “*vesica*”, which may be armed with sclerotic spines and processes. Paired or unpaired processes or appendages may arise from any part of the aedeagal shaft as well as from the apodeme, the atrium, the preatrium or the penis-sheath.

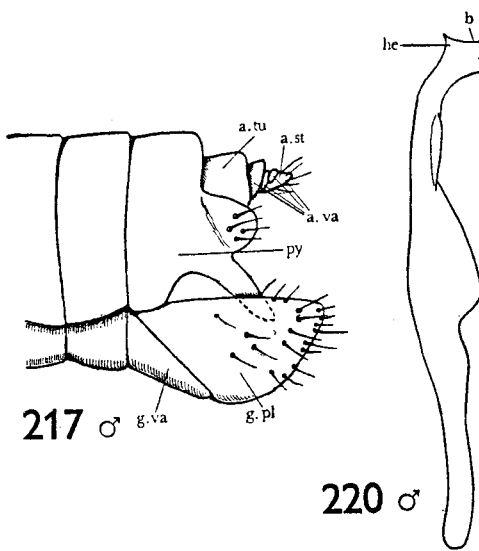
Basally the “aedeagus” (in the sense of systematists) articulates by the atrial rim or the preatrium with the apex of the *connective*, cn (fig. 218), a usually well sclerotized formation belonging to the phallobase and varying much in shape. Laterally, the connective articulates with the movable



216 ♂

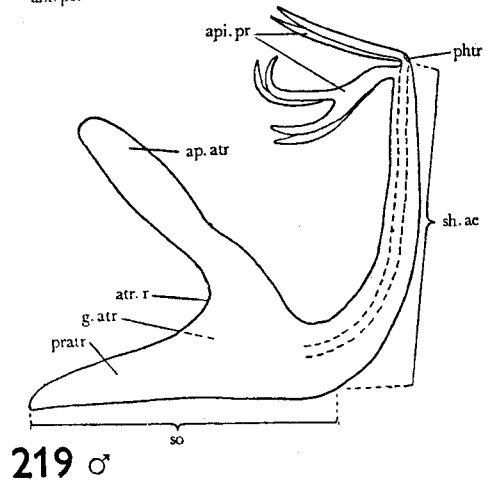


218 ♂

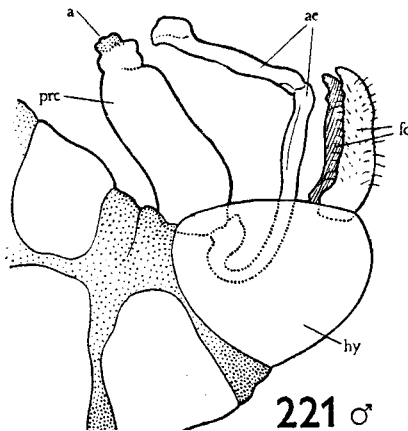


217 ♂

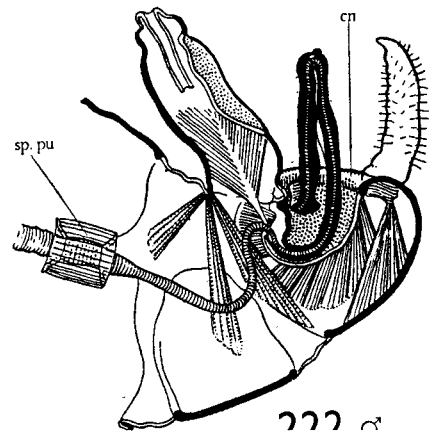
220 ♂



219 ♂



221 ♂



222 ♂

genital plates, with their apices directed backwards, and more or less concealed by the plates. In most Fulgoromorpha, where the genital plates are absent, the styles are visible from behind (fig. 216). In certain Typhlocybrids and Euscelids where the shape of the styles has a certain resemblance to that of a human leg, the apical part of the styles is termed the "foot", fo (fig. 220), the median corner of the latter the "heel", he. The anterior lateral angle of the foot is the *anterior point*, ant.poi, and the posterior lateral angle of the foot is termed the *posterior point*, po.poi, while the posterior outline of the foot, between the "heel" and the "posterior point", is called the "base", b, of the style.

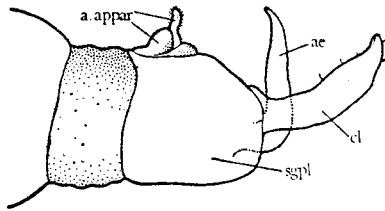
In the Delphacidae, a transverse wall or *genital phragm*, g.phr (*diaphragm*, *aedeagal brace*, fig. 216) divides the space within the genital capsule into two chambers, an anterior one enclosing the aedeagus at rest, and a very shallow posterior one opening posteriorly, in which the styles are placed. The basal part of the styles is connected with the connective through a ventral opening in the genital phragm, while the aedeagus may be extended through a dorsal opening in the latter, under the anal tube. In the Cicadidae, genital plates and genital valve as well as styles and connective are absent, the pygofer being concentrated into a complete ring.

Psyllina (figs. 221–222).

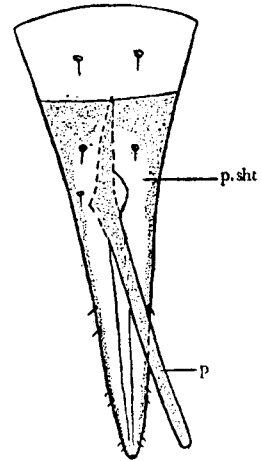
The 9th abdominal sternum is shaped more or less like a helmet or a baby's hood, the convexity directed ventrocaudad. It is called the *hypan-drium* or *subgenital plate*, hy. It has also been termed the "genital plate", but as this word has also been used for the proctiger, it should be avoided for both organs. From the upper opening of the hypandrium the *proctiger*, prc, arises, and behind the latter, the *aedeagus*, ae, and the *forceps*, fc. The proctiger (anal valve) is a tube varying in shape, sclerotized dorsally and laterally but membranous ventrally, and with its lateral portions sometimes prolonged caudad into lobes of varying shape and size. The *anus*, a, is situated at the apex of the proctiger.

The *aedeagus* is a simple, elongate tube consisting of two segments articulating with each other. The proximal segment is subcylindrical, and is enlarged and branched at its inner end. The distal segment usually is shorter than the proximal one, and may exhibit variation between species. It varies in shape, and may be thickened and lobed apically. At some distance from its apex, the ductus ejaculatorius terminates in a tube whose shape and position may vary in different species. The aedeagus has been little used in taxonomy until recently, but it is now usually treated as a distinguishing structure. The female genitalia of the Psyllina are shown in figures 221 and 222.

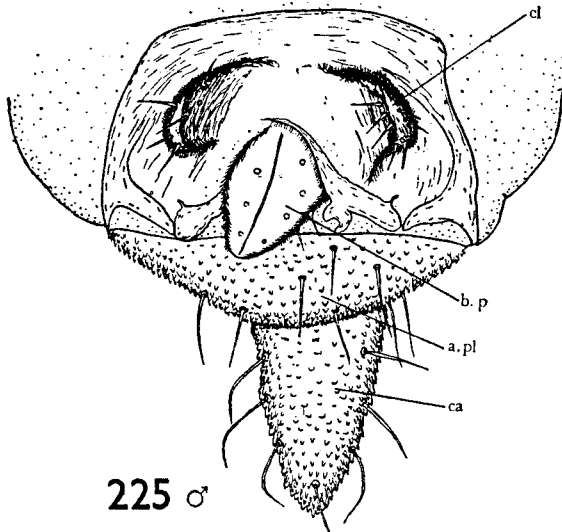
The organs belonging to the phallobase—*basal plates* or *connective*, *cn*—are rarely mentioned in systematic literature. The basal part of the aedeagus is more or less transverse, the lateral ends of this part articulating firstly with the basal corners of the hypandrium, secondly with the apices of the



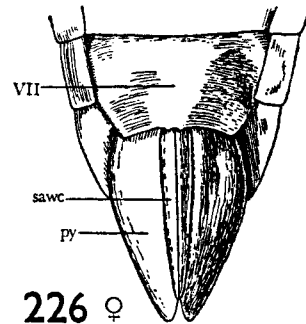
223 ♂



224 ♂



225 ♂



226 ♀

anterior paired arms of the wishbone-shaped connective, while the unpaired posterior end of the latter is connected to the bases of the forceps.—In the cavity of the aedeagus opens the ductus ejaculatorius, which in its inner part is transformed into a bobbin-shaped *sperm pump*, *sp.pu*. This pump is visible in transparent preparations.

Aleyrodina (fig. 223).

The male copulatory apparatus is very simple in this group. It consists of the forceps-shaped *claspers* or *parameres*, cl, and the simple tubular *aedeagus* or *penis*, ae, both organs arising from the 9th abdominal segment or *subgenital plate*, sgpl. The latter is dorsally incised for the *anal apparatus*, a.appar, which has, in this group, no relation to copulatory functions. The anal orifice is dorsally covered by a more or less semicircular, triangular or quadrangular lid-like valve, the *operculum*, while a finger-like or knobbed, backward directed process with numerous minute spines, the *lingula*, arises from the ventral border of the anus. Laterally and posteriorly the operculum and at least the base of the lingula are encircled by a semicircular or angular sclerotic edge. The space within this edge anteriorly limited by the fore border of the operculum is the so-called *vasiform orifice*.

Coccina (fig. 224).

In recent years the male genitalia of certain species of five families (Margarodidae, Phenacoleachiidae, Pseudococcidae, Coccidae, and Diaspididae) of the Coccoidea have been studied carefully. Knowledge of the genitalia of this sex now aids materially in the understanding of relationships of members of the group.

The genitalia consist of the *penial* or *penis sheath*, p.sht, and the *aedeagus* or *penis*, p. The penial sheath is usually sheathlike and at least partially sclerotized, with a longitudinal, elongate slit on its ventral surface through which the penis protrudes. The sheath may be somewhat conical throughout, or produced distally into a short apical extension (Beardsley 1960: 206, Pseudococcidae) or into an elongate style (Ghauri 1962: 35, Diaspididae). The sheath has a basal ridge, and may or may not have two "median lobes" (Beardsley 1960: 206, Pseudococcidae) or two "sclerotic plates" (Ghauri 1962: 35, Diaspididae). The anus is located dorsally on the base of the sheath.

Aphidina (fig. 225).

The male genitalia, though sometimes mentioned in descriptions, have furnished no specific characters of crucial importance in this group. On the 9th abdominal sternum, there is a tubular *penis* or *aedeagus* varying in length, and, laterally of the penis, a pair of short finger- or cone-shaped or valvular *claspers*, *parameres*, or *opercula*, cl. The penis is extensible, the apical part being soft and at rest retracted within the sclerotized basal part, which is alone visible in ordinary mounts. The latter is more or less conical

The female.

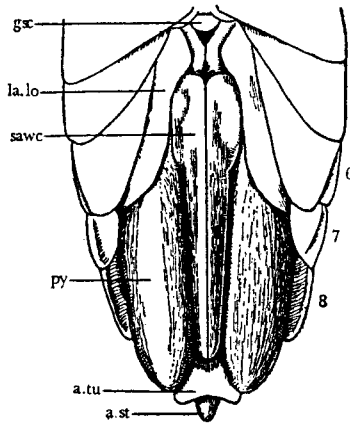
Auchenorrhyncha (figs. 226–228).

The hind margin of the 7th (“last”) abdominal sternum (fig. 226) is often incised or notched in a characteristic way. The various parts of the genital apparatus have been comparatively little used in taxonomy so far. The tergum of the 9th abdominal segment forms the *pygofer*, *py* (figs. 226–28), the lateral parts of which are the “*valvulae laterales*” of older authors. (Do not confuse these “*valvulae laterales*” with the lateral valves or third valvulae of the ovipositor). Dorsocaudad of the pygofer we find the *anal tube*, *a.tu*, with the *anal style*, *a.st* (figs. 227–28, see male).

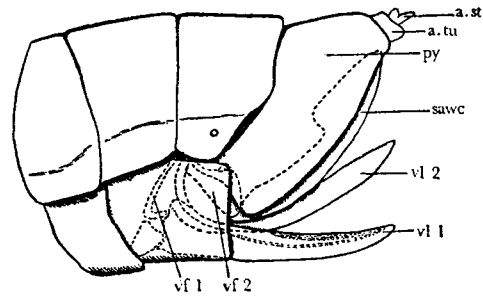
In a ventral groove in the pygofer lies the *ovipositor*. The latter consists of three pairs of oblong valves, viz. one pair emerging from the 8th and two pairs from the 9th abdominal segment. They are basally attached to the so-called *valvifers*, *vf 1* and *vf 2* (fig. 228), paired rests of the 8th and 9th abdominal sterna. In the Delphacidae, the valvifers of the 8th abdominal sternum are visible from below as two lobes flanking the basal part of the ovipositor—the *lateral lobes*, *la.lo* (fig. 227). A small unpaired sclerite belonging to the 7th sternite sometimes visible between their bases is the “*genital scale*”, *gsc* (*écaille génitale* of Ribaut) (fig. 227). The posterior pair of valves (*lateral valves*, *third valvulae*) of the 9th sternum encloses laterally the remaining two pairs of valves (the “*saw*”) and is often termed the “*saw-case*”, *sawc* (figs. 226–28). The “*saw*” (this term is rarely used in English literature on the present insects but is current in German and French: “*Säge*”, “*tarière*”) consists of two pairs of generally more or less sabre-like sclerites: one outer pair belonging to the 8th sternum (*anterior valves*, *first valvulae*, *vl 1*, fig. 228), and one inner pair (*median* or *inner valves*, *second valvulae*, *vl 2*) arising from the anterior part of the valvifers of the 9th abdominal segment (second valvifers). The median valves are generally at least basally fused one to the other. The term “*saw*” (“*Säge*”) is sometimes reserved for the median valves only. They are often toothed at their tips. In the Tettigometridae, an ovipositor is absent. In certain other Fulgoroid families, the valves are short and broad, not sword-shaped.

Psyllina (fig. 229).

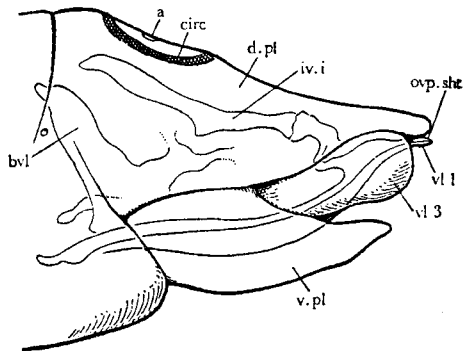
The ovipositor is enclosed between two plates, one dorsal and one ventral, in shape recalling a bird’s beak. These are the so-called *genital plates* (or *valves*; this term should be avoided, since the parts in question do not belong to the ovipositor), one dorsal (upper), and one ventral (lower), *v.pl*. The *dorsal (upper) plate*, *d.pl*, bears dorsally the anus, *a*, which is sur-



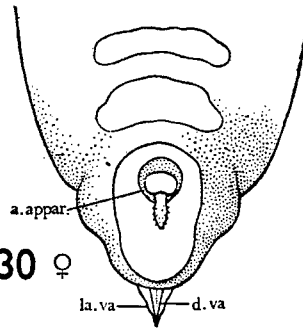
227 ♀



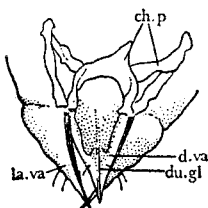
228 ♀



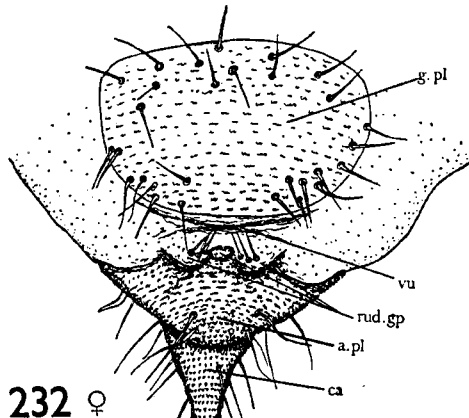
229 ♀



230 ♀



231 ♀



232 ♀

consists of the usual three pairs of *valvulae* (valves): one “ventral”, one “dorsal” and one “inner” pair. The ventral valvulae belong to the 8th abdominal sternum, the others to the 9th sternum. In a lateral view of the unprepared insect, one sees the apical part of the dorsal valvula of the corresponding side, between the diverging dorsal and ventral plates, as a broad, membranous plate that is usually rounded apically (fig. 229, vl 3). The ventral and inner valvulae are generally entirely or almost entirely concealed between the dorsal ones. In many species, however, their extreme tips project behind the dorsal valvulae and are thus visible as two blade-like points, the inner pair, *ovp.sht*, more dorsal than the ventral one, vl 1 (fig. 229). The two inner valvulae are dorsally fused at their apex into the so-called *ovipositor-sheath*, which is ventrally interlocked with the margin of the ventral valvulae by a longitudinal ridge fitting into a groove on each of the latter. The ventral valvulae may be smooth or serrate and may differ in shape distally. The inner valvulae may be sinuate or straight and may differ in shape. Though mentioned infrequently in the past, the valvulae are now being studied and are proving to be of assistance in female classification. The ventral and inner valvulae are deeply inserted in the genital chamber, and are connected with a complex endoskeletal bar-system, *basivalvulae*, *bvl*, and *inferior intervalvulae*, *iv.i*, on which the ovipositor muscles arise.

Aleyrodina (figs. 230–231).

The ovipositor consists of three plates or *gonapophyses*, viz. one ventrolateral or *ventral* pair, and one unpaired dorsal gonapophysis. The *dorsal gonapophysis* (*d.va*) is more or less triangular and elongate with sclerotized margins. A fine medial longitudinal canal ending on the apex of this gonapophysis, visible in microscopical mounts, is the efferent duct of the unpaired cement gland, *du.gl*. It has been mistaken for the inner margins of one or even two supposed *pairs* of valves (“inner and upper valves” or “superior processes” of Quaintance & Baker, “dorsal valves” and “inner valves” of Deshpande). The ventral or anterior gonapophyses (“*lateral valves*”), *la.va*, are sclerotized along their dorsal margins and at their acute apices, but their ventral part is membranous. Their apices are sometimes serrate. Quaintance & Baker described this ventral pair as consisting of two fused pairs of valves. The three gonapophyses are basally supported by a system of sclerotized bars (“*inner chitinous press*”, *ch.p*). The *anal apparatus* with the “vasiform orifice”, *a.appar*, is visible dorsally in front of the ovipositor. The vasiform orifice of the female is shaped as in

The genital parts are rarely described in this group, as specific taxonomy is based almost entirely on the last larval instar ("pupa" or "pupa case").

Coccina.

The *vulva* or genital (vaginal) opening is a simple transverse slit on the ventral surface of the abdomen. No appendages of any kind are present, but the surrounding derm is often conspicuously wrinkled. The position of the vulva varies and is used as a character of some systematic value.

Aphidina (fig. 232).

(♀ and ♀.) The genital opening or *vulva*, *vu*, is an inconspicuous transverse slit at the hind margin of the so-called *genital* or *subgenital plate*, *gpl*, which is the practically unspecialized 8th abdominal sternum. The 10th abdominal sternum is the more or less convex "*anal plate*", *a.pl*, while the tergum of the same segment is the so-called "*cauda*", *ca*. The anal opening is present between the base of the cauda and the posterior margin of the anal plate. The 9th abdominal sternum is much reduced and is represented by the so-called "*rudimentary gonapophyses*", *rud.gp*, a few small, generally pilose protuberances at the fore margin of the anal plate. Their number, which varies from 0 to 4, is sometimes mentioned in descriptions. The number and arrangement of the hairs on the gonapophyses, the "*gonochaetae*", may also be of some diagnostic value.

- Fig. 216. *Javesella pellucida* (F.) (Delphacidae) ♂. Genital capsule with anal tube, as seen obliquely from behind and the left.
- Fig. 217. *Graphocraerus ventralis* (Fall.) (Euscelidae) ♂. Apex of abdomen from the left.
- Fig. 218. *Jassargus flori* (Fieb.) (Euscelidae) ♂. Sternal parts of genital capsule, as seen from above, tergal parts removed.
- Fig. 219. *Typhlocyba lanternae* W. Wagn. (Typhlocybidae) ♂. Aedeagus from the left.
- Fig. 220. *Erythroneura parvula* (Boh.) (Typhlocybidae) ♂. Left genital style from above.
- Fig. 221. *Psylla mali* (Schmidb.) ♂. Apex of abdomen from the left, membranous parts dotted. Aedeagus in copulatory position. (After Weber, modified).
- Fig. 222. Same in sagittal section, showing muscles for aedeagus, proctiger and forceps. Aedeagus in rest. (After Weber, modified).
- Fig. 223. *Aleyrodes* sp. ♂. Apex of abdomen. (After Weber, modified).
- Fig. 224. *Asterolecanium ungulatum* Russell (Coccina) ♂. Ventral view of penis sheath.
- Fig. 225. *Aulacorthum* sp. (Aphidina) ♂. Apex of abdomen from below.
- Fig. 226. *Athysanus argentarius* Metc. (Euscelidae) ♀. Apex of abdomen from below.
- Fig. 227. *Delphax crassicornis* (Panz.) (Delphacidae) ♀. Apex of abdomen as seen from below.
- Fig. 228. *Athysanus argentarius* Metc. (Euscelidae) ♀. Apex of abdomen as seen from the left, parts of ovipositor artificially spread out.
- Fig. 229. *Psylla mali* (Schmidb.) ♀. Apex of abdomen from the left, inner skeletal parts

- Fig. 230. *Aleyrodes* sp. ♀. Apex of abdomen from above. (After Weber, modified).
 Fig. 231. *Aleyrodes* sp. ♀. Apex of abdomen in an oblique ventral view. (After Weber, modified).
 Fig. 232. *Metopeurum fuscoviride* Stroyan (Aphidina) ♀. Apex of abdomen from below.

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28. HETEROPTERA¹⁾

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Since the first edition of this chapter (Dupuis & Carvalho 1956), numerous important investigations, still actively being pursued, have been devoted to the genitalia of the Heteroptera. There have been significant new achievements, but so many points remain unanswered that a revised treatment can hardly be more than a compromise between the previous contribution and some future exhaustive and critical work.

The present review is restricted to an outline of the main morphological features, with reference to the cases best studied, the most significant works and proper terms.

Several naturally occurring, but exceptional features will not be discussed, as, for example, unusual degrees of reduction (e.g. Hencocephalidae, Jeannel 1942), extreme asymmetry (see Larsén 1938 p. 226–227), monstrosities (inversions, duplications, intersexes, etc. Balazuc 1952).

Despite their probable, but not yet investigated, significance as regards the ontogeny of the genitalia, the experimental adultoids obtained by surgical (Wigglesworth 1934, etc.) or chemical (Slama 1962, Slama & Williams 1965, Williams & Slama 1966) interference will be disregarded.

Also beyond the scope of the Glossary are some features of functional but not morphological genitalic significance as, for example 1) the female spermaleges (Ribaga's or Berlese's organs, "paragenital" system), superseding the customary duct in the process of insemination among Cimicidae, Anthocoridae, Polycetenidae, Plokiophilidae (see Carayon 1952, Carayon in Usinger 1966), 2) the conceptaculum seminis (Carayon 1954) in the Cimicidae, 3) the paragenital (ectodermal) glands (Bonhag & Wick 1953 = uradénies Thouvenin 1965) of sporadic occurrence among male and female Pentatomomorpha and 4) the appendage-like and perhaps copulatory "parasternites" of the 8th and even of the 7th urite among the male Cryptostemmatidae (Wygodzinsky 1947).

For more detailed accounts of the question and extensive—but not complete—bibliographies, consult the two papers by Dupuis (1955, 1963) and the major publications listed at the end.

With respect to the copulatory and egg laying apparatus, the present contribution does not consider names prior to those by Sharp (1890) and Verhoeff (1893) whose invaluable works constitute the proper starting point of knowledge of the morphology of these structures. As far as the ectodermal part of the female genital tract is concerned, more space has been devoted to this than in the 1st edition, and the starting point is the work by von Siebold (1837).