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ON THE WING-VENATION, MALE GENITALIA AND SPERMATHECA
OF *PODOPS INUNCTA* (F.), WITH A NOTE ON THE DIAGNOSIS
OF THE SUBFAMILY PODOPINAE DALLAS (HEM., PENTATOMIDAE)

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ACKNOWLEDGEMENTS. During the course of taxonomic work on some Ethiopian Pentatomoidea, the genitalia of *Crollius* Distant was examined. An unusual structure was found and, upon sending details of this to Dr. Reece I. Sailer (U.S. National Museum), he advised examination of an apparently similar structure in the British bug, *Podops inuncta* (F.). I am grateful to Dr. Sailer for his suggestion; the present paper is the outcome. My thanks are also tendered to Mr. G. E. Woodroffe (Pest Infestation Lab., Slough) for supplying a considerable batch of live insects, and to Dr. A. D. Baker (Science Service, Ottawa) for supplying me with a copy of his twenty-year-old paper on genitalia. Mr. J. G. Pendergrast has kindly given me his valuable advice on many points and permitted use of his unpublished observations.

WING VENATION. The wing of *P. inuncta* (fig. 1) presents no features differentiating it from Pentatomoidea. The Antevannal, absent in Coreoidea, and two Intervannals are present. R+M is superficially one vein but the trachea M departs from it some distance before the caesura and joins the vein Cu for a short distance. M and Cu diverge once more half way across the membrane. The caesura and coupling stigma are well marked. The terminology used is explained elsewhere (Leston, 1953 c.).

The parallel courses of R+M and Cu clearly separate *Podops* from the Scutellerinae. This dichotomy was introduced by Stål (1872: 31) but has been overlooked by Poisson in the new *Traité* (1951: 1793) where the *Podops* group (as Graphosominae Puton) is lumped with Scutellerinae Laporte. The remoteness of R+M from Cu and the presence of a hamus in Scutellerinae (not itself a homogeneous group, *teste* Leston, 1952) are primitive characters (found, e.g., in many Tessaratominae) whilst *Podops* is, in the absence of these two characters, more evolved.

MALE GENITALIA. (1) THE 8TH SEGMENT. The 8th segment of *Podops* is identical with that found in Pentatominae. No distinct tergum remains whilst the spiracles are present but greatly reduced and lack functional tracheation and a closing apparatus. These features are present in the primitive Phloeidae and many Tessaratominae.

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(2) THE 9TH SEGMENT. The pygophore, or 9th segment, is remarkable in *Podops* by virtue of the presence of a pair of hinged flaps which completely close the opening to the genital atrium. Fig. 2 is an apical view of the insect showing the flaps covering much of the pygophore from this aspect. The pygophore is shown ventrally in fig. 3 with flaps half open and, diagrammatically, dorsally in fig. 4 with the flaps at maximum opening position. Fig. 5 shows the dorsum of the left flap. Boiling in KOH (10%) by no means destroyed the connection between the flap and the inner border of the pygophore; thus it is assumed to be merely desclerotized cuticle and not muscle. The position of attachment is well away from the basement of the hypandrium (9th-10th intersegmental membrane). The term parandria is probably apposite for the flaps providing no homology is implied.

Schouteden (1905: 31) mentioned "deux processus semilunaires contigus sur la ligne médiane du segment" in *Podops* but did not investigate their nature; they are figured on Plate 3, fig. 18, of his monograph.

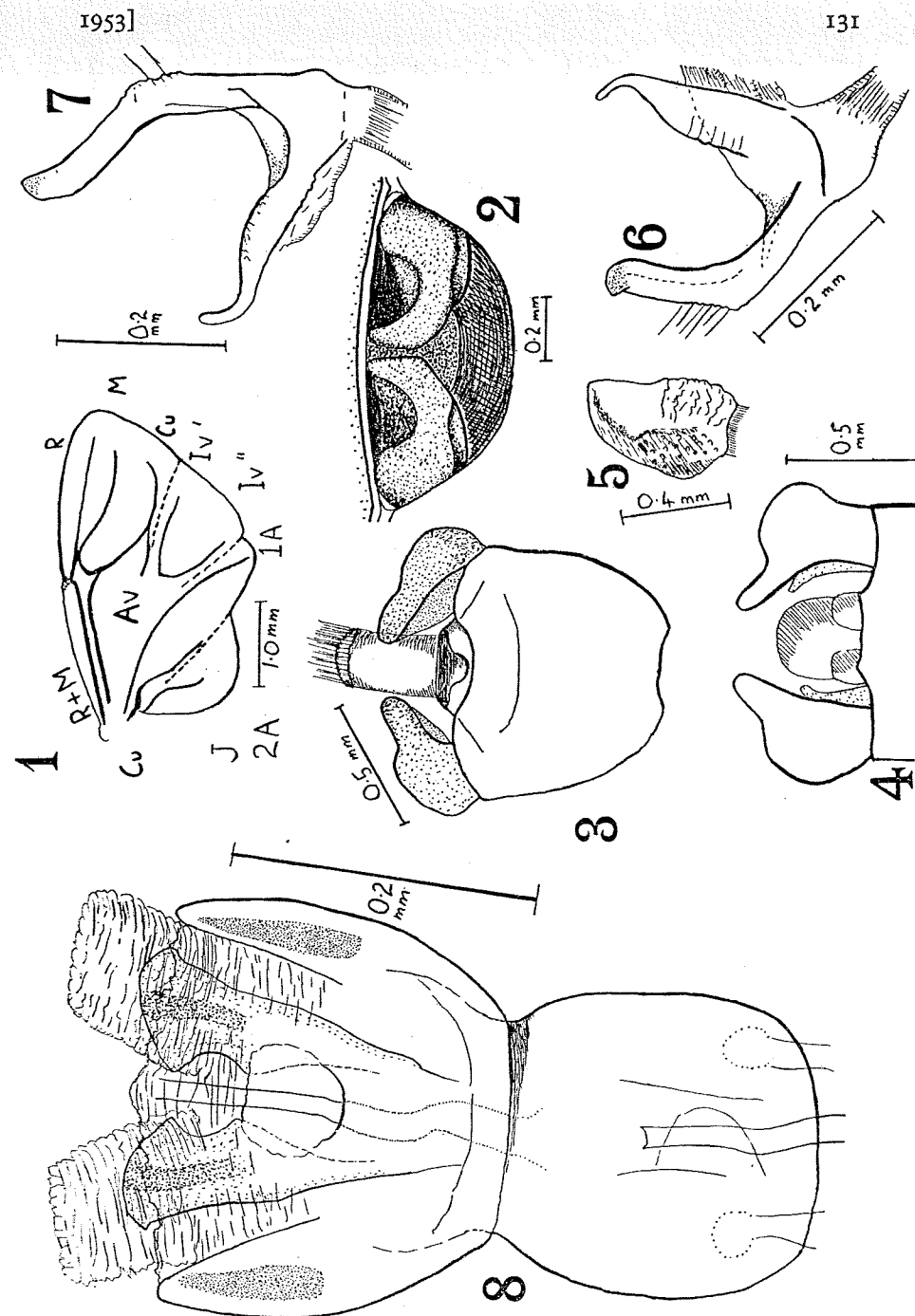
(3) THE PARAMERES. Singh-Pruthi's (1925) fig. 15 purports to show the parameres of *Podops* and, page 145, he writes "parameres slender." His figure shows a uniramous, somewhat sickle-shaped, rod; in fact, the parameres of this species are clearly biramous and shaped quite unlike any other parameres so far known in Pentatomoidea. Figs. 6 and 7 show two aspects of the left paramere.

(4) THE AEDEAGUS. Fig. 8 shows the aedeagus of *Podops* in repose whilst fig. 9 is the same organ erected (this figure also shows the basal plates). At once the great danger of figuring or describing collapsed aedeagi becomes apparent, yet Singh-Pruthi figured almost all his species in a collapsed state and proceeded to draw taxonomic conclusions therefrom. Piotrowski (1950) has also fallen into the same trap but Baker (1931) clearly pointed out the mechanics of this structure (his paper has consistently been overlooked by all authors save Sailer). Bonnemaïson (1952) has figured the great difference in appearance in the aedeagus of *Eurydema* in its two states and has claimed, erroneously, to be the first to note this.

The theca of *Podops* differs from that of most other Pentatomoidea in being vasiform; this I believe to be a group characteristic. The vesica is sclerotic and apically curved through 90°; on each side is a flattened strip-like conjunctival process to which the apical vesica is firmly affixed: these parts erect together. The conjunctiva produces a small pair of lateral appendages; a median, apically bifurcate appendage and a short, somewhat triangular, anti-vesica appendage: these are all typically membranous conjunctival appendages.

No attempt has been made to show the internal sac and seminal ducts within the vesica: Singh-Pruthi's and Piotrowski's attempts are usually bad guesses and Baker pointed out the extreme difficulty of visualizing this area. The basal plate (fig. 9) is of the usual Pentatomoid form, complete with dorsal and ventral connectives, etc. Only Baker has given a satisfactory account of this structure and thus his terminology has been followed.

Podops inuncta (F.). 1, Right hind wing. 2, Apical view of pygophore showing the paired flaps (parandria). 3, Ventrum of pygophore with parandria half-open. 4, Dorsum of pygophore, apex only, somewhat schematic. 5, Right parandrium. 6, Left paramere. 7, The same, another view. 8, Aedeagus, retracted.



THE SPERMATHECA. This is shown in fig. 10. Mr. Pendergrast informs me (personal communication) that it is similar to the spermatheca in Pentatominae and *Graphosoma* Lap. but quite unlike those of Scutellerinae and Tessaratominae. It differs somewhat from the spermatheca of *Eurydema*, as figured by Bonnemaïson (1952: 172), but there are reasons, not connected with this structure, for placing *Stracharia* Stål somewhat apart from most Pentatominae.

THE HISTORY OF PODOPINAE DALLAS 1851. I have pointed out elsewhere (1953a) the validity and priority of Podopinae Dallas as a name for the group which includes *Podops*. Stål (1872:33-34) keyed the European Pentatominae (as a subfamily) and his first four groups were *Tarisaria* Stål, *Trigonosomaria* Stål, *Graphosomaria* Stål and *Podoparia* Stål. His primary couplet ran (with terminations slightly amended):

"1 (16) Scutello frenis destituto, apicem abdominis plerumque attingente . . ." *Tarisini*, *Trigonosomini*, *Graphosomini*.

"16 (1) Scutello plerumque frenis instructo et abdomine brevior, raro frenis destituto . . ." remaining Pentatominae.

Next came:

"17 (20) Marginibus lateralibus anticis thoracis postice prope angulos laterales in dentem productis . . ." *Podopini*.

"20 (17) Marginibus lateralibus anticis thoracis prope angulos laterales in dentem haud prominulis . . ." remaining Pentatominae.

These diagnoses are given in order to show that Stål considered the four tribes as of equal value *inter se* and of no higher rank than groups such as *Halyini*, *Sciocorini*, *Pentatomini*, *Strachini*, etc. In a later work (1876: 28), the master lumped the four tribes together under a definition based primarily on the large scutellum. However, he indicated in this key that only certain of the included genera formed part of Podopinae Dallas. Thus it was Stål's view that (1) Dallas' group, Podopinae, was a good group coinciding with his own *Podoparia*; (2) Podopinae formed a division of subfamily Pentatominae; (3) *Tarisini*, *Trigonosomini* and *Graphosomini* were of equal value *inter se*.

Subsequent authors lumped all four together and introduced *Graphosom(at)inae* as a subfamily name to comprehend them *in toto*. The only important revision, by Schouteden (1905), grouped *Tarisini*, *Trigonosomini* and *Graphosomini* together as a tribe, *Graphosomataria* Schout., left the *Podops* group as a second tribe, *Podoparia* (giving an adequate definition of it) and brought them together as subfamily *Graphosomatinae*.

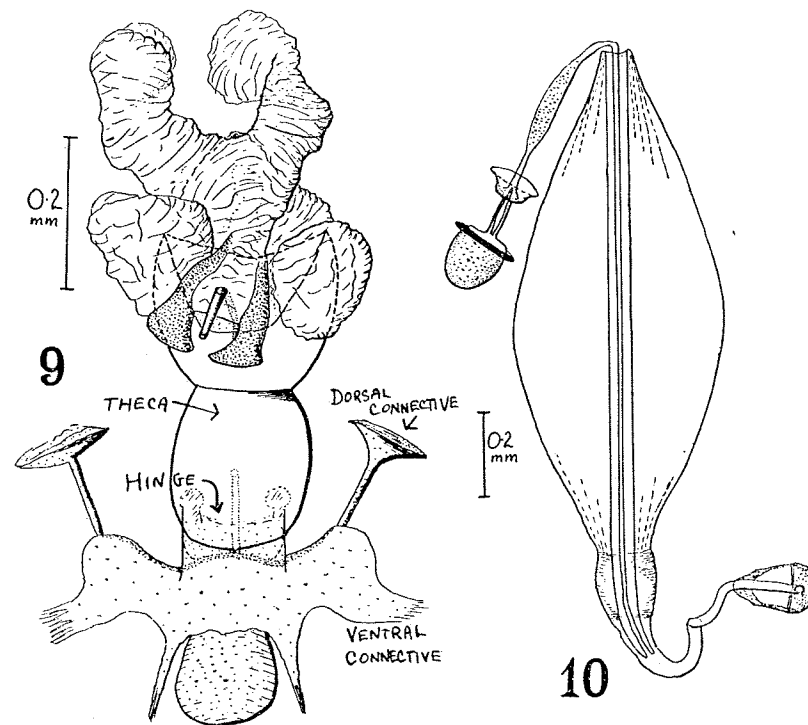
Unfortunately, the sole character that struck authors was the size of the scutellum. This is very large and covers a considerable part of the dorsum but the character is not at all exclusive. Many world genera have a scutellum equally as large and yet are placed, correctly, in Pentatominae. American authors, e.g., Blatchley (1926), Brues and Melander (1945), and Froeschner (1941), have even gone further and raised Podopinae to family status, defining it thus:

Scutellum very large, U-shaped . . .; tibiae not strongly spinose; connexivum of abdomen with seven visible dorsal segments; sides of pronotum with a prominent tooth or lobe in front of humeral angles and another or front angles; hamus wanting; eyes protuberant or stylated.

Now only one of these characters is confined to the group (tooth or lobe in front of humeral angles) and even this is wanting in some genera; by no stretch of imagination can it be considered a family character.

In recent papers (Leston, 1952, 1953c, 1953d) I have shown that (1) wing venation, (2) position of the 2nd abdominal spiracle, (3) relative positions of the trichobothria, (4) development of the 8th male abdominal segment, (5) general structure of the aedeagus, provide major taxonomic characters in Pentatomoidea. To these should be added (6) type of spermatheca, (7) form of the hind coxae and 3rd metapleural sutures. Other characters of great value, though perhaps at a lower level, include: (8) the type of egg, (9) presence or absence of an egg-burster, (10) type of rostrum (*Asopinine*, *Pentatomine*, *Tessaratomine*, etc.), (11) method of wing-coupling, (12) number of tarsal segments, (13) number of antennal segments. Dupuis (e.g., 1949) has suggested some further characters that appear to be of value but these have not yet been assessed: they are (14) the shape of the gonapophyses in females (these differentiate *Acanthosomidae* from *Pentatomidae*), (15) the internal-lateral tergites, (16) the dorsal glands.

The *Podops* group has never been effectively defined in terms of basic morphological concepts; this I now do.



Podops inuncta (F.). 9, Aedeagus, erected, with basal plate. 10, Spermatheca.

PODOPINAE DALLAS 1851

Pentatomoidea (i.e., Heteroptera with a pair of trichobothria present in imagines on each side of sterna iii to vii, pectocephalic, apex of scutellum reaching to membrane, antennae 4- or 5-segmented (save Phloeidae), ocelli present (save some Urolabidae), wings usually with an Antevannal and two Intervannals). Trichobothria seated side-by-side. Wing with R+M and Cu parallel. 2nd abdominal spiracles invisible, situated beneath the metapleura. 8th male segment reduced, without distinct and sclerotic tergum, spiracles reduced, non-functional. Aedeagus with a developed, median, sclerotic, para-vesical appendage and the remaining appendages membranous. Theca vasiform. Endosoma retractable (cf. Scutellerinae *sensu mihi*, Leston, 1952). Spermatheca as in Pentatomoidea, Pentatomininae (cf. Tessaratomininae). Hind coxae without fringe (see McAtee and Malloch, 1933). Metapleural sutures invisible, hidden beneath epimeron. Rostrum as in Pentatomininae. Tarsi 3-segmented, pseudarolia present. Antennae usually (perhaps always) 5-segmented. Wing-coupling device as in Pentatomoidea (cf. Brachyplatidae). Gonapophyses (female genital plates) as in Pentatomoidea. Hamus wanting. Scutellum large, reaching almost or completely to the apex of the abdomen. Eyes protuberant or somewhat stalked. Lateral margins of pronotum usually, but not always, toothed, incised or tubercle-bearing. Antenniferous tubercles usually visible from above. Frena well developed. Usually (perhaps invariably) yellow-brown to dark-brown or black in colour. Eggs with (as far as is known) a distinct micropylar cap, distinct micropylar tubercles, an anchor-shaped egg-burster.

STATUS OF THE GROUP. As indicated above, the group is deserving of subfamily status in Pentatomoidea. However, it differs from Pentatomininae so slightly that it is probable that subsequent research on Pentatomoidea will lead to a further drop in rank for it is very obvious that groups such as Tessaratomininae, Natalicolinae, Dinidorinae and Scutellerinae (*sensu mihi*, 1952) are much further removed from Pentatomininae than is Podopinae.

A NOTE ON TARISINI DALLAS (GRAPHOSOM(AT)INAE AUCTT.). Stål treated this group as a composite of three, Tarisaria, Trigonosomaria and Graphosomaria. It would be outside the scope of this paper to state more than that Schouteden (1905) was possibly right in lumping the three together; their status as a whole cannot possibly be more (and is probably less) than tribal. Stål's three groups are, however, natural entities and should remain as such with subtribal rank. The correct nomenclature is:

Tarisini Stål 1872.

Graphosomini Jakovlev 1884 *et auctt.*

Subtribe 1. Tarisaria Stål 1872.

„ 2. Ventocoraria Oshanin 1912.

Trigonosomaria Stål 1872 *et auctt.*

„ 3. Graphosomaria Stål 1872.

It is to be hoped that the International Commission will soon validate the subtribal *-aria* as a termination.

BRITISH SPECIES OF PODOPINAE. *Podops inuncta* (F.) is the sole British representative of Podopinae and is so placed in the recent check list of British Pentatomoidea (Leston, 1953b). *Podops* Lap. and *Scotinophara* Stål are the only European genera.

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