

## REMARKS ON THE BASIC PLAN OF THE TERMINAL ABDOMINAL STRUCTURES OF THE MALES OF WINGED INSECTS.

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The genitalia of male Hymenoptera, Neuroptera, Mecoptera, Diptera, Trichoptera, Lepidoptera, Hemiptera (Homoptera) and Strepsiptera have been compared with those of the lower orders in a paper which appeared in "Psyche," (June, 1920). The added knowledge gained from this study of a wider range of forms, and from an examination of the condition occurring in arthropods related to insects, together with the light thrown upon the nature of the parts in the lower insects in Dr. Walker's recent description of the genitalia of the male of *Grylloblatta campodeiformis* (Can. Ent., LI, 1919, p. 131) have enabled me to come to a better understanding of the fundamental composition of the terminal structures of the Hexapoda, and the following suggestions are here offered in an effort to clear up some of the uncertainties concerning the interpretation of the parts in insects in general and in the higher forms in particular.

Embryologists have maintained that the abdomen of an insect is primarily composed of twelve segments—or eleven segments, with a "telson"—and since the abdomen of the Protura (which are among the most primitive representatives of the Hexapoda) is composed of twelve segments, there is some evidence for considering that twelve is the original number of segments entering into the composition of the abdominal region of insects in general. It is only in exceptional cases, however, that traces of the structures interpreted as the vestiges of a twelfth segment are retained (as in certain odonatan nymphs), and the retention of even eleven complete segments is by no means of common occurrence in the lower pterygotan orders, since the eleventh tergite ("11'" of Fig. 5) is usually lost through atrophy of fusion with the preceding tergites, though certain latero-ventral parts of the eleventh segment are frequently retained to form the so-called paraprocts "e" (Figs. 1 and 5) of lower insects.

The paraprocts "e" (Figs. 1 and 5) are usually much reduced, and unite with the tergites of the tenth or other segments to form the anal papilla or proctiger (a structure bearing the anus) in higher forms (Fig. 6, "h"). The paraprocts, "e", are represented as though distinct, in the diagram of the parts of a sawfly shown in Fig. 3; but this does not correspond to the actual condition occurring in any known sawfly, since the paraprocts in these insects usually form the floor (and sides) of the anus-bearing structure whose tergal region is made up largely of the tenth tergite—which usually unites more or less closely with the ninth tergite in the sawfly group.

The cerci, 'f', borne on the paraprocts "e" (Figs. 1, 3 and 5) are homologous with the multiarticulate flagelliform uropods of such Crustacea as the Tanaidacea (Chelifera). The exopodite, or outer branch of the biramous appendage forming the uropod, is sometimes wanting in these flagelliform uropods of the Tanaidacea, thus suggesting that when only one of the branches is retained, the endopodite, or inner one, remains to form the cerci of insects. When both branches of the uropod are retained in the Tanaidacea, they are borne upon a single segment or protopodite (if one may judge from the published figures of these structures, and from the condition exhibited by *Apseudes spinosus*) and on this account I have been led to conclude that Walker, 1919 (Ann. Ent. Soc.