

THE METATHORACIC PTERYGODA OF THE HEXAPODA AND THEIR RELATION TO THE WINGS.

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ON the anterior margin of the prothorax and mesothorax of the Lepidoptera are two small sclerites known as the ptagium and tegula, respectively; while in certain other orders of Hexapoda (Hymenoptera, Neuroptera, and Trichoptera) a small piece has been found at the base of the mesothoracic wing which has been considered equivalent to the tegula. Further than a few suggestions based on limited observations, no attempt has been made either to ascertain the value of these pieces or to demonstrate the existence of similar homodynamous or homologous structures in the hexapods.

The purpose of the present paper is to call attention briefly to the general presence of a sclerite on the hexapod metathorax which seems homodynamous with the so-called tegula, to make some suggestions concerning terminology, and especially to point out that the present view concerning the metamerism of the antennate arthropods appears worthy of reconsideration.

The relation of the tegula, or pterygodum as I prefer to term it, to the pieces of the mesothorax, which is in many respects the most generalized of the three thoracic segments in the insects, is shown in Fig. 1. Bearing in mind now that the mesothorax and metathorax are equivalent,

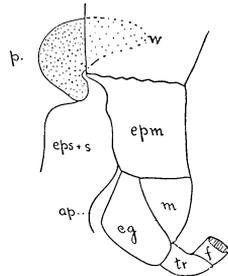


FIG. 1.—*Cossus ligniferda*. Left lateral portion of mesothorax. $\times 8$. *p*, pterygodum (stippled); *w*, wing; *eps+s*, episternum; *epm*, epimeron; *m*, meron; *s*, sternum; *ap*, antecoxal piece; *tr*, trochanter; *f*, femur. Cut portion of femur represented by parallel lines. Dotted line shows pterygodum extending behind the anterior wing. All figures are placed in the same relative position, so that the upper margin represents the dorsal part of the thorax, while the margin at the left is the anterior portion of the thorax.

the various components of each being reduplicated in the other segments, subject, however, to the factors governing the specialization of the different groups of insects, the existence of a corresponding piece in the metathorax would *a priori* be inferred. The presence of such a piece¹ is represented in the accompanying diagram (Fig. 2), while a homologous part can generally be demonstrated throughout the other orders (Figs. 3, 4). Furthermore, it is to be noted that in the typical form this is joined to the dorsal margin of the episternum, while the wing is articulated with the dorsal margin of the epimeron and not, as hitherto accepted, with the episternum.²

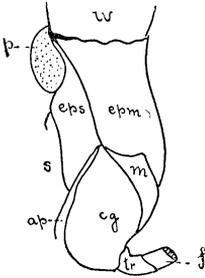


FIG. 2.—*Cossus ligniperda*. Left lateral portion of metathorax. $\times 8$. References as in Fig. 1.

In connection with the facts noted above, certain evidence is available, based on embryology as well as comparative anatomy, which adds weight to the inference that these two pieces are rudimentary³ wings and that the *thorax of the Hexapoda is composed of six somites which in the typical form bear the fundamentals of six pairs of wings.*

The development of the mesothoracic pterygodum⁴ (=tegula, parapteron, etc.) is of extreme interest in this connection and furnishes interesting evidence toward establishing the hypothesis I have put forward regarding its relation to the wing. This, however, is only one of a large number of facts which corroborate such a view and which appear explainable on no

¹From comparisons made throughout the Hexapoda it is evident that this does not correspond to the more or less chitinized part of the epimeron at the base of the wing in most Lepidoptera.

²The anterior margin of the wing is generally specialized at the base, so that it partially extends over the dorsal portion of the episternum, while an articulative process of the pterygodum may be received into a corresponding notch of wing. (See Fig. 3.) This condition, however, is secondary.

³There appears to be no evidence for regarding these as vestigial, since it is improbable that forms with six pairs of wings ever existed. The term "rudimentary," as generally used, does not seem inappropriate, although the word "fundament" is more concise.

⁴Owing to its greater size, this can be more conveniently studied than the corresponding piece on the metathorax.

other basis. To one of these I have already called attention (Walton, 1900), notably the formation of the coxa in Chilopoda and Hexapoda from two fused pieces to which I have applied the name "coxa genuina" and "meron."

I have adopted the name "pterygodum"¹ for the present in preference to others which have been suggested for the mesothoracic piece (tegula, parapteron, squamula, etc.), since it has priority over terms otherwise acceptable, and according to our present knowledge better indicates the function of the part. The term "parapteron," which Comstock

and Needham ('98), following Newport ('39), have used in reference to the mesothoracic pterygodum, appears inappropriate, for the reason that Audouin ('24) first used it to indicate a supposed sclerite on the anterior margin of the mesothoracic episterna in *Dytiscus circumflexus*, the part in question being merely an articulative process. Several years later, in a note to a translation of a paper by MacLeay ('32), Audouin stated his belief that the piece in the Hymenoptera termed squamula by MacLeay was homologous to the parapteron which he himself had described. This supposition was not only incorrect but was subsequent to the terminology adopted by Latreille.

The value of the patagium on the prothorax has been more or less discussed, but until we know more concerning its development it is impossible fully to decide whether it is equivalent

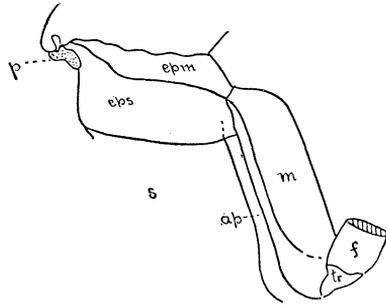


FIG. 3.—*Hydrophilus triangularis*. Left lateral portion of metathorax. × 8. Coxa genuina between ante-coxal piece and meron. Other references as in Fig. 1. Wing above epimeron, unlettered.

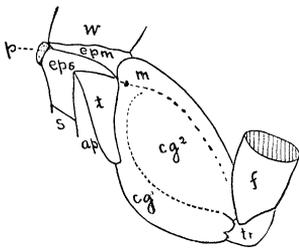


FIG. 4.—*Periplaneta orientalis*. Left lateral portion of metathorax. × 10. *cg*¹, anterior portion of coxa genuina; *cg*², posterior portion of coxa genuina, formed by the coxal groove for reception of femur; *t*, trochantin. Other references as in Fig. 1.

¹ (gr. πτερυγώδης <πτερυγοειδής = πτέρυγος [wing] + εἶδος [form].

to the wing, as suggested by Cholodkowsky ('86), or to the pterygodium (tegula), the view adopted by Haase ('86) and now so generally accepted. It should be observed, nevertheless, that the reasons given by Haase for reaching such a conclusion are far from adequate, since the only evidence to which he called attention, otherwise than a superficial resemblance, was that (1) chitinous folds of a similar nature but of secondary origin are present on the prothorax of certain Hymenoptera and Diptera, while (2) the patagia do not exist during the larval stage of the Lepidoptera, but commence their development in the first few days of the chrysalid stage. Unfortunately, however, Haase failed to demonstrate any homologous

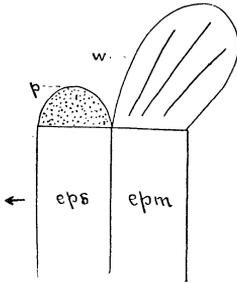


FIG. 5. — Typical form showing relations of pterygodium, wing, episternum, and epimeron in the thoracic segment of the Hexapoda. References as in Fig. 1.

structures in the Hymenoptera or Diptera, and had he attempted to do so it is evident, from the preceding, that proof of their secondary nature would have been difficult to establish. Moreover, the Anlage of a structure must exist *in potentio*, and the time during the post-embryonic stages at which it commences that which is known as development can alone be of no particular value in determining its paligenetic or cenogenetic character. The question as to whether the patagium represents a prothoracic pterygodium or a wing, must await a large amount of comparative work based on embryology, with the possibility of paleontological¹ evidence affording some help in the solution of the problem. The ratio of development between wing and pterygodium on the other thoracic segments allows the inference, however, that pterygoda may

¹ The prothoracic appendages of certain fossil insects (*Homoioptera woodwardi*, *Stenodicta lobata*, *Lithomantis goldenbergi*, *carbonaria*, etc.) so excellently figured by Brongiart (*Recherches pour servir à l'histoire des insectes fossiles*, Paris, 1894) cannot be homologized with the expanded margin of the prothorax in existing Mantidæ, as Woodward (*Quart. Journ. Geol. Soc.*, vol. xxxii, p. 60, London) suggested. Brongiart has already pointed this out. (Note sur quelques insectes fossiles du terrain houiller qui présentent au prothorax des appendices aliformes, *Bull. Soc. Philom.*, tome ii, 1890.)

exist in front of the patagia which then have the value of wings.

Another interesting question in this connection is the homology of the elytra of Coleoptera, for again further investigation must be awaited before a logical conclusion can be reached. The tracheation of the elytra, to which attention has been called by Comstock and Needham ('98), is not conclusive evidence that they are specialized wings, for in connection with the view I have here advocated this would be expected if they were homologous with the mesothoracic pterygoda of the Lepidoptera, and the suppressed wing was represented by the alulet so noticeable under the Elytra in *Hydrophilus*, etc.

From the preceding facts, to which I have called attention, it appears necessary to consider that the typical thoracic segment (Fig. 5) possesses the components of both pterygodum and wing, the former joined to the dorsal margin of the episternum, the latter articulated with the dorsal margin of the epimeron, while furthermore the morphological position of the pterygodum in respect to the wing indicates that it may have an important bearing in elucidating the metamerism of the antennate arthropods.

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