

External Organs in Dermaptera, especially Forficulidæ.

By
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Many years ago the present writer arranged the material of Forficulidæ in our Zoological Museum, referring the animals to the genera and—as far as possible—to the species described in the useful revision of the group found in „Das Tierreich“ 11. Lief., 1900, worked out by A. de Bormans and H. Krauss. Though the collection was of very moderate size as compared with the number of species known already in 1900, I acquired, of course, a certain knowledge of the suborder, and observed a few features hitherto overlooked. In 1904 I had the good luck to obtain from my late friend Chr. Aurivillius a few specimens of a species of the interesting genus *Hemimerus* Walk., enabling me to work out a paper (published in Entomologisk Tidskrift, Stockholm, 15. Årg., 1904, p. 63—93, Pls. 2—3) on the exoskeleton and the propagation of that curious type, and point out its relationship to the Forficulidæ. In my opinion, *Hemimerus* and the Forficulidæ constitute two families or two suborders of the order Dermaptera. And in the present paper the writer shall mention various external structural features or organs in the Forficulidæ. But it must be stated that my otherwise excellent microscope can only enlarge at most 600 times, which is insufficient for investigation of sense-organs.

a. "Evaporating-Surfaces".

In Naturhist. Tidsskrift 3. Række B. VI, 1869 J. C. Schiödte published an interesting paper on Rhynchota, and it was instantly translated in English: *On some new Fundamental Principles in the Morphology and Classification of Rhynchota*. (Ann. Mag. Nat. Hist. 4 ser. Vol. VI, p. 225—249, 1870). In that paper the well-known odoriferous glands in Hemiptera are mentioned, and Schiödte points out a special structure at the opening of each gland, viz. "the evaporating-surface, which surrounds the opening and is intended to retain the secretion while it evaporates, and to prevent it from running down over the neighbouring parts". "To this end the surface is very finely granulated, and at the same time undulated-rugose". Schiödte mentions the detail of structure, shape and situation of the openings and the structure of the evaporating area in the majority of types mainly of Danish Hemiptera.

Now it is a well-known fact that adult specimens of at least most species of Forficulidæ possess two pairs of abdominal odoriferous glands, the openings of which are found sublaterally at the hind margin of third and fourth tergite. In one of these tergites the hind margin is most frequently more or less distinctly incurved or nearly incised or even produced at the opening of the gland, and in front of the opening the posterior part of the tergite is besides folded upwards, thus forming a strongly vaulted portion. In some forms the openings are very conspicuous in both tergites, but in the great majority of species they are much less pronounced in one of the tergites than in the other. The tergites behind the openings show very rarely any vestige of an evaporating surface behind any of the openings of the two pairs of odoriferous glands, but a single species of the Forficulidæ in the Copenhagen Museum is a striking exception. That species is from Brazils (Rio de Janeiro) and Monte Rita in Paraguay, and

I refer it to the genus *Brachylabis*. The anterior part of the fourth tergite has just behind the openings of the two glands in third tergite a pair of moderately large, opaque areas, each about 0.3 mm. broad and a little broader than long, and seen with an enlargement of about a hundred times this area is very finely granulated and besides undulated-rugose. On the fifth tergite a minute opaque area of the same kind is observed at the opening of each gland of fourth tergite. It may be added that many years ago I saw in the British Museum (Natural History) a South American species (probably belonging to *Brachylabis*) with a pair of opaque evaporating areas. But this interesting feature is evidently very rare among the Forficulidæ.

b. Trichobothria.

In a treatise on trichobothria in various orders of Arachnida, Myriopoda and Insecta (in Entomol. Tidskrift, Stockholm, Årgang 18, 1917) the present author mentioned the types in which he had observed these interesting sense-organs, and referred to the statements of other authors found by me in the literature.

In the same journal, Årgang 19, 1918, Alb. Tullgren published an interesting paper on certain features in Hemiptera, in which he pointed out the existence and distribution of trichobothria on abdominal sternites of a number of families and genera belonging to Swedish Heteropterous Rhynchota. Besides he mentioned that I had overlooked Berlese's statements (in 1909) on the occurrence of real trichobothria on the cerci of *Mantis*, *Decticus*, *Gryllus*, and *Gryllotalpa*.

In my paper quoted I have written (p. 253): "But many years ago, while arranging the collection of Forficulidæ in the Copenhagen Museum, I found sensory hairs rather similar to trichobothria on the forceps of a single fine form, *Chelisoches superbus* Dohrn. On the outer third of the upper side near the basis of each ramus of the

forceps is seen about six somewhat deep but only moderately well limited impressions, and from the middle of each impression projects an extremely fine, moderately long hair. That we have here a kind of trichobothria with the calicle only moderately developed is, in my opinion, quite certain. — I was unable to find trichobothria on any other species of Forficulidæ in the Copenhagen Museum, but our collection of this group is somewhat imperfect, and it is probable that trichobothria can be found in some other tropical forms. By a renewed inspection of our collection of Forficulidæ I did not discover trichobothria in any other species.

c. Equipment of the Tarsi.

In all Dermaptera the tarsi are 3-jointed, and each tarsus has a pair of well-developed claws. The tarsi of *Hemimerus* have been described and figured by the present writer in the paper mentioned (1894); the two proximal joints are nearly equal in size and shape, extremely expanded, about as broad as long, and on the lower soft surface very densely clothed with the usual fine and, excepting towards the margin, "short fixing hairs (such hairs are found in the same way f. inst. on the 3 basal joints of the tarsi of *Cerambycidæ*)"; the third joint is rather slender, a little clavate and has near the end a small area studded with similar fixing hairs. It may be added here that each of these fixing hairs terminates in an oval, pellucid plate which is rather small and conspicuously longer than broad, with its terminal margin regularly convex. These fixing hairs are somewhat similar to those in *An-cistrogaster* (see below), but on the whole a little more oblong and not as large as some of the hairs in the last-named type.

In the Forficulidæ the first tarsal joint is generally moderately slender, round and much, or very much, longer than broad; second joint is proportionately short or very or ex-

tremely short, distinctly a little cleft, or, and more frequently, distally expanded below the insertion of third joint, with rounded angles, or produced into a pair of short and broad lateral lobes. Third joint is shorter than or as long as the first, round. But the statement found in "Das Tierreich" p. 4: "Die Sohle der Tarsalglieder ist stets stark behaart" is very misleading, as the equipment differs extremely in various respects. It may be mentioned here that according to "Das Tierreich" p. 14 the genus *Tagalina* H. Dohrn has the two proximal joints quite short, very expanded, equal in length and together not longer than the third joint, which is very slender — thus the two proximal joints are apparently similar to those in *Hemimerus*.

The equipment with spines, setæ, and hairs on the tarsal joints shows very interesting and apparently hitherto unknown differences between types of Forficulidæ. Here only four types shall be mentioned, but I suppose that at least the great majority of species agree in the main with one of these types.

In *Anisolabis mauritanica* Lucas 17 strong spines were found on the lower side of the first tarsal joint, while 3 spines were observed on second joint, and the third joint was without any spine. All three joints had below and on the sides a proportionately moderate number of setæ, which taper more or less conspicuously in thickness from the base to the acute end, but real thin hairs were not found.

In *Forficula auricularia* L. no spines are found on the tarsi. Third joint has a number of acute setæ of various length both above, on the sides, and below; similar setæ are found above and on the sides of the two other joints, and besides on the lower surface of nearly, or more than, the proximal half of first joint. The lower broad surface of second joint and almost or less than the distal half of the lower surface of first joint possess extremely

dense clothing of moderately short, very thin, cylindrical hairs which often are a little curved towards the obtuse end.

In *Spongiphora croceipennis* Serv. the equipment of the tarsal joints differs very considerably from that in the two previous types. All three joints without spines, while both above and on the sides they have a good number of normal setæ which taper to the acute end. The third joint is on the lower side densely adorned with sub-vertical setæ, on the whole rather long though not equal in length; these setæ are somewhat thin, taper distinctly in thickness from the base to a little from the end, and their distal part is generally more or less procurved, while their terminal portion is an oblong, extremely thin, pellucid, subtriangular plate with the transverse terminal margin more or less convex. Second joint is on the lower side densely set with somewhat more robust, sub-vertical setæ, the terminal part of which is curved considerably or much forwards, but a terminal flattened triangle is always wanting, and the end seems to be acute. The distal part of the lower side of first joint has a number of setæ similar to those on second joint.

In *Ancistrogaster* sp. (from La Moka in Venezuela) the equipment is again different. Spines are wanting. Third tarsal joint has a moderate number of setæ, some of which are very long, but the major part rather short. Second joint has similar setæ excepting on the distal half of the lower side and on the broad, rounded, cushion-shaped end. That area is densely clothed with thin, curved hairs, and each hair terminates in an oval, pellucid plate, which is somewhat or a little longer than broad. In first joint the lower surface has a large number of normal setæ, but distally it has an oblong-triangular area with hairs of the same kind as those on the distal part of second joint.

d. Sense-Organs on the Legs.

In the above-named paper (1894) on *Hemimerus* the

author wrote: "The trochanter is stout, cut off from the femur by a rather oblique articulation; both on the upper and the lower side is found a group with 4-9 small sense-pits (fig. 2, 4 and 6, s); on the lower side of the two posterior pairs of legs 4 or 6 of them are arranged in a row, the others lying a little apart; on the upper side and on the first pair the arrangement is somewhat more irregular". It may be added that I looked for sense-organs in all joints of the legs in *Hemimerus*, but except on the trochanter nothing could be found.

The examination of the legs in types of Forficulidæ shows an almost complete agreement as to these sense-organs with *Hemimerus*. Such organs are found only on the trochanter of all legs, and they differ from *Hemimerus* only at most in quite unimportant particulars. For instance in *Spongiphora* the trochanter of all legs have on the anterior surface two organs near each other, and a little higher up an oblique row of five organs, while some organs, generally two or three together, are found towards or near the upper margin of the trochanter and on the posterior side. The nature of these sense-organs is unknown.

e. Sense-Organs on the Palps.

In all Dermaptera the maxillary palps have 5 and the labial palps 3 well developed joints. In 1894 I wrote on *Hemimerus* that the apex of fifth joint of the maxillary palps possesses, as the third joint of the labial palps, "an exceedingly small, cylindrical joint, the terminal face of which is set with a number of very small sense-pits, and round this little joint the terminal face of 5th joint is provided with a number of larger and smaller annular pits, each with a spine-like, rather long sense-hair". The statement on these minute sensory joints is correct, but after the examination of the Forficulidæ I entertain strong doubts as to any sensorial function of the "spine-like, rather long" hairs inserted on the terminal face of

fifth joint of the maxillary palps (and third joint of the labial palps) around the insertion of the minute joint.

The minute sensorial joint exists on the end of the maxillary and the labial palps in all four genera of *Forficulidæ* more closely investigated. The joint in question is cylindrical, well chitinized and coloured as the joints of the palp, excepting on its terminal, feebly or strongly vaulted terminal face, which is colourless.

In *Spongiphora croceipennis* the third joint of the labial palp is fourteen times longer than the sensorial joint, and this joint has its coloured portion twice as long as broad, while in the maxillary palp the fifth joint is eighteen times longer than the sensorial joint, which also is twice as long as broad, but distinctly longer than the corresponding joint on the labial palp.

Furthermore it must be mentioned that the sensorial joints of the labial palp differ considerably in aspect from those on the maxillary palps, but in the four types examined differences are also found in the sensorial joints of the labial palps, and the same is the case between the sensorial joints on the maxillary palps. In the common *Forficula* the vaulted terminal area of the sensorial joint on the labial palps possesses a transverse row of five sub-conical small processes, and apparently at least three still somewhat smaller processes. In *Spongiphora* the terminal area has a considerably larger number of quite small processes; in *Ancistrogaster* the processes are very small and apparently few in number, while in *Anisolabis* the sensorial joint is considerably thicker but scarcely longer than in the three other types, consequently its terminal area is considerably larger and the processes more numerous, but the majority are difficult to discern.

The sensorial joints of the maxillary palps are in all four types more uniform, adorned on the considerably or highly vaulted, colourless terminal area with a good number of organs, which apparently are pits with a more

or less distinct, central, and perhaps slightly protruding point at the middle, but real processes as in the labial palps could not be discovered; in a few cases a very distinct darker ring was seen around the pit.

It may be remarked that I have been unable to point out with certainty other sense-organs in any of the mouth-parts in Forficulidæ, excepting on the labrum. In *Forficula* the lower surface of that plate has somewhat inside the lateral and antero-lateral margins minute spines inserted in pits and arranged in an irregular row; these spines are certainly organs of taste. And at the anterior margin is seen a pair of very large, very oblong, transverse organs covered by very thin cuticula clothed with extremely short and thin hairs; the nature of these two organs is unknown.

f. Sense-Organs on the Antennæ.

In the treatise on *Hemimerus* the antennæ are described (p. 67). The equipment of the joints with setules is mentioned, "and besides on the anterior side near the apex of each [joint of the flagellum] is found a flat area set with numerous short, tenon-like sense-setæ, projecting from round holes of rather different size"; fig. 5 on Pl. II shows the place and size of these areas in the two terminal joints.

In none of the four types of Forficulidæ examined such areas are found. In *Ancistrogaster* sp. the antennal joints have a high number of normal setæ, most of them moderately short, but several robust and long or very long, and all articulated in circular pits. But most joints have near their end one, two or at most three circular pits which are much larger than any of the pits with long setæ, and these gigantic pits have no setæ, while their circular limit is dark brown or nearly black. Particulars as to internal structure of these pits I am unable to make out.

In *Forficula* and *Spongiphora* the antennal joints have very numerous normal, acute setæ of various length. Spread between the insertions of these setæ a number of generally small or rather small pits are seen, but their setæ are pale, proportionately quite short or rather short, decreasing very moderately in thickness towards the almost obtuse end. I am apt to suppose that these pale setæ are a kind of sense-organs; at least I was unable to discover any other organ on the antennal joints. In *Anisolabis mauritanica* such sensory setæ are at most only few and difficult to detect.

g. Organs on the Elytra and the Wings.

Only *Forficula auricularia* has been investigated.

The basal part of the elytra has on the upper side a number of minute spines which, judging from their shape and insertion, may be organs of sense.

The wings have two kind of organs, both apparently internal. Close at the articulation of the wing to the pieces between wing and thorax and somewhat behind the front margin of the firm plate in question is seen on the lower surface a large, circular and well chitinized ring, the chitine of which indicates that the ring is in reality shaped as a hoop or very short tube. — The other organ is a row of four (or five) very oblong and very dark or nearly black spots situated at some distance from each other in the firm, very long plate of the proximal part of the wing, somewhat behind the anterior margin of that plate and along the margin of the anterior rib. These spots show a certain structure indicating that they may be a kind of sense-organs.
