

- IV. *On the external Anatomy of Tanais vittatus, occurring with Limnoria and Chelura terebrans in excavated Pier-wood.* By JOHN DENIS MACDONALD, M.D., F.R.S., Staff-Surgeon R.N., Assistant Professor of Naval Hygiene, Netley Medical School. (Communicated by W. T. THISELTON DYER, M.A., F.L.S.)

(Plate XV.)

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WHILE searching for *Limnoria terebrans* in excavated wood from Netley Hospital Pier my attention was diverted to another little Crustacean, rather smaller in size, but wearing the outward appearance of a chelate Decapod so completely that it was only by counting its legs and more minute inspection of the leading features of its structure I was enabled to determine it to be a veritable Isopod, though of an aberrant type.

It proved to be conformable with the characters of *Tanais Cavolini* (Edw.) = *Crossurus vittatus* (Rathke), which was originally found in the Gulf of Naples, the habitat assigned to it by Milne-Edwards; but it has since been shown to have a wider range. Its occurrence under the above-mentioned circumstances is worth recording; for I have also found it in perforated and decayed wood from the pier at Alum Bay, Isle of Wight; and I have no doubt that it would be captured in other localities if it were sought for in the burrows of *Limnoria*.

Quite exceptionally, in the Tanaidæ the head and first thoracic segment coalesce above to form a perfect little carapace or cephalothorax, which, in the little creature under consideration, is somewhat triangular in form, with an obtuse but distinct rostrum in front, from beneath which the two pairs of antennæ project forwards; and immediately to the right and left of these are the orbital notches for the eyes.

These latter organs are very prominent, in articulation with the carapace, and all but pedunculated. They are conical in form, with the apex directed forwards, and rather more convex or rounded on the outer than on the inner side. Round lenticular corneæ, not unlike those of *Limnoria*, but much smaller, are recognized by their brilliancy, and the relief of a central mass of black pigment radiating amongst the little nervous cups in connexion with them.

Having thus commenced with the eyes, I shall describe the members of the succeeding segments seriatim, which will render their homological relations more intelligible.

The two pairs of antennæ (figs. 1, 2, & 3) are nearly of equal length, rather shorter than the cephalothorax, and disposed in two lines, one above another. The superior antennæ (*a*, figs. 2 & 3), which are much stouter and somewhat longer than the inferior, are each composed of three joints, successively diminishing in their proportions, and setaceous at their distal ends. Several bristles of a ligulate form (fig. 2, *e*), with transverse striæ near their base, occur amongst the simple ones in the tuft at the tip of the terminal segment. A labyrinth-like excavation at the upper and inner side of the base of the first

articulation (fig. 2, *c*) represents the so-called olfactory organ of the Decapod. The second or inferior pair of antennæ are narrower than the superior, and composed of five joints, of which the first, third, and fifth are shorter than the second and fourth; and the ultimate joint is tipped with a brush of long and simple hairs, springing from what would appear to be an aborted multiarticulate filament.

The oral organs consist of a spatulate upper lip, fringed with short hairs (fig. 6, *a*), a pair of two-branched mandibles without palps (*b*), and articulated laterally with the buccal frame, two pairs of maxillæ (*c* & *d*), and a pair of five-jointed jaw-feet (*f*), inclosing, at their base, two membraneous plates, forming a lower lip (*e*).

The internal maxillæ (*c*) are in the form of rounded membraneous lamellæ, fringed with fine hairs, and presenting a single-jointed palpiform process near their summit externally.

The external maxillæ (*d*), on the contrary, are strong and sabre-shaped, with a spiny and setaceous extremity. Two oval leaflets (*d'*), connected with these internally, form a tongue-like organ in the mouth; and at their base externally, but concealed by the carapace, is a conical appendage (*d''*) or flagellum, with long diverging hairs at the tip. In the possession of this appendage, as Fritz Müller has pointed out, the Tanaidæ make a still further approach to the Decapoda. Thus, in his 'Facts and Arguments for Darwin',\* he remarks, "Whilst in all other Oniscoida the abdominal feet serve for respiration, these in our cheliferous Isopod (*Tanais dubius* (?) Kr.), are solely motory organs, into which no blood-corpuscle ever enters; and the chief seat of respiration is, as in the Zoeæ, in the lateral parts of the carapace, which are abundantly traversed by currents of blood, and beneath which a constant stream of water passes, maintained, as in the Zoeæ and the adult Decapod, by an appendage of the second pair of maxillæ, which is wanting in all other Edriophthalmata." In passing, I may mention that the figure of *Tanais dubius*, so called, *loc. cit.*, is rather more conformable to the genus *Leptochelia*. In this connexion Bate and Westwood's beautiful work on the British sessile-eyed Crustacea may be consulted with advantage. But to return to the subject, the joints of the jaw-feet (*f*) are furnished with rigid comb-like bristles, arising from the inner border of the third and fourth, and the free extremity of the fifth. The lower lip (*e*) is also fringed with fine short hairs.

Following the jaw-feet just noticed are the seven pairs of legs common to all the Edriophthalmata, the first two and last five respectively corresponding with the two external pairs of jaw-feet, and the five pairs of legs appertaining to the thorax of the Decapod.

The two first limbs (fig. 7) are strongly chelate, and many times thicker than the ambulatory legs succeeding them. The fixed claw presents a trenchant upper border, more prominent in the middle, with which, at least in the female, the movable claw corresponds more or less closely. In the male, however, (fig. 15) both claws are more arcuate. As in the beak of the Crossbill, the opposable tips of the claws are curved with sufficient obliquity to cross over one another, the index taking the outer side. They are of a rich reddish amber tint, similar to that of the dental processes of the mandibles.

\* Translated by W. S. Dallas, F.L.S.

The first or basal portions of these limbs form two oval projections beneath the thorax ; the second is a small triangular piece, with which the third is so connected as to present a rounded projection posteriorly, while it extends forwards to articulate with the manus. In the female (figs. 1 & 7) eight or nine stout bristles spring in a row at the outer side of the base of the cutting-border of the manus, while in the male they are interrupted in the middle. Other bristles occur near the articulation, *i. e.* one on the inner and several on the outer side.

As already mentioned, the first thoracic ring having coalesced with the head, the six following pairs of legs arise from the six *apparent* thoracic segments. The first visible segment, distinct from the carapace, must, therefore, carry the second pair of legs. These have long curved thigh-pieces, with which the succeeding joints of the limbs are so articulated as to permit them to play their legitimate part as external jaw-feet, curving inwards and forwards round the basal prominence of the first pair. Their claws (fig. 8) are long, simple, styliform, and but slightly curved ; they are themselves rather longer than the other legs.

The claws of the third and fourth pairs (figs. 9 & 10) are simply uncinatè, while those of the last three pairs (figs. 11, 12, & 13), which are curved forwards, are also combed on either side, though this is not quite so apparent on the inner side in the last pair. Instead of it, however, they present a close row of stiff serrated hairs at the extremity of the penultimate joint, which is moreover roughened with rasping tubercles (13 *a*), quite like those which beset the whole surface of the body in *Limnoria*. In all the legs, with the exception of first and second pairs, the third segment presents a row of stout spines on either side of its articulation with the fourth.

The abdomen consists of five segments, the first three of which bear the respiratory lamellæ and swimmerets together. The fourth is much smaller than those preceding it, and without appendage. The fifth is rather more than twice the length of the fourth, broadly shield-shaped, with four rigid hairs projecting backwards from the middle of its posterior border. Besides the swimmerets there is a fourth pair of appendages (figs. 1, 4, 5, & 14), which are rather conspicuous on account of their projection beyond the terminal segment. They have a simple folded lamella on the inner side, and much resemble a pair of three-jointed antennæ, with stout diverging hairs at the distal end of each joint.

The inner ovate and acute leaflets of the abdominal appendages (fig. 4, *b*) lie flat, and are apparently motionless ; while the outer ones, which are rather semicircular (*a*), cross over them superficially towards opposite sides. Both borders of the deep leaflets and the outer border of the superficial ones, as well as that of the broad propodia, are beautifully fringed with long flat acute and feathery setæ (*d*). Similar feathery hairs form a transverse linear band or fascicle upon the dorsum of the first and second segments.

The generative pores lie side by side near the middle of the sternal plate, between the two last thoracic limbs.

The female (fig. 1) carries her eggs in a membranous expansion or saccule under the thorax ; and, from having observed the chelæ and other anatomical characters of the adult in the young soon after leaving the egg, I think it may be concluded that there is

no metamorphosis in this very interesting form. Any imperfection in the foregoing description will probably be made up in the figures.

This little creature obviously takes advantage of the burrows already formed by *Limnoria terebrans* and *xylophaga*, a species recently described by Hasse. It is nevertheless furnished with rasping and tearing organs to assist it in the pursuit of prey, as it would appear to be carnivorous; and with so powerful an armature the resistance of even the full-grown *Limnoria* would be unavailing.

The zones of feathery hairs on the first and second abdominal segments, as well as the fringes on their appendages, are usually clogged with débris, recalling a similar fact in relation to *Limnoria*, of whose boring properties there can be no doubt.

The flexure of the abdomen upon the body, as seen in fig. 1, is either to adapt it to the rounded end of the burrow, or to block up its passage with the assistance of the zones of bristles already noticed, which may also act as strainers to the respiratory currents, and probably effect their direction. The head of these little creatures is more frequently turned towards the mouth of the burrow, whereas the converse is the case with *Limnoria*, which is also less erratic. This latter genus takes up its range between the high- and low-water marks of neap tides, evidently enjoying a little diversity in being alternately wet and dry. Protective measures against its ravages should therefore be directed to that range; creosote and coal-tar appear to be the most effective preparations, notwithstanding the numerous and ingenious methods that have been tried to repel the attacks of these diminutive but vast destroyers. They commence their operations by making a series of dendritic grooves on the surface of the wood; and the young, which are developed finally in the main trunks of these grooves, penetrate at larger angles, but so usually attack the softer tissue of the rings, that the harder parts are the most persistent, maintaining their integrity chiefly in the longitudinal direction. The next generation works deeper into the wood; and from near the round fundus of each burrow young excavators may be seen making fresh borings on their own account. Next come the invaders of this new territory, which are chiefly *Chelura terebrans*, a reddish Amphipod very much larger than *Limnoria*, characterized by the remarkable form of the caudal extremity, and *Tanais vittatus*, the little Isopod, now I believe for the first time suspected of boring into pier-wood or timber exposed to the action of the sea.

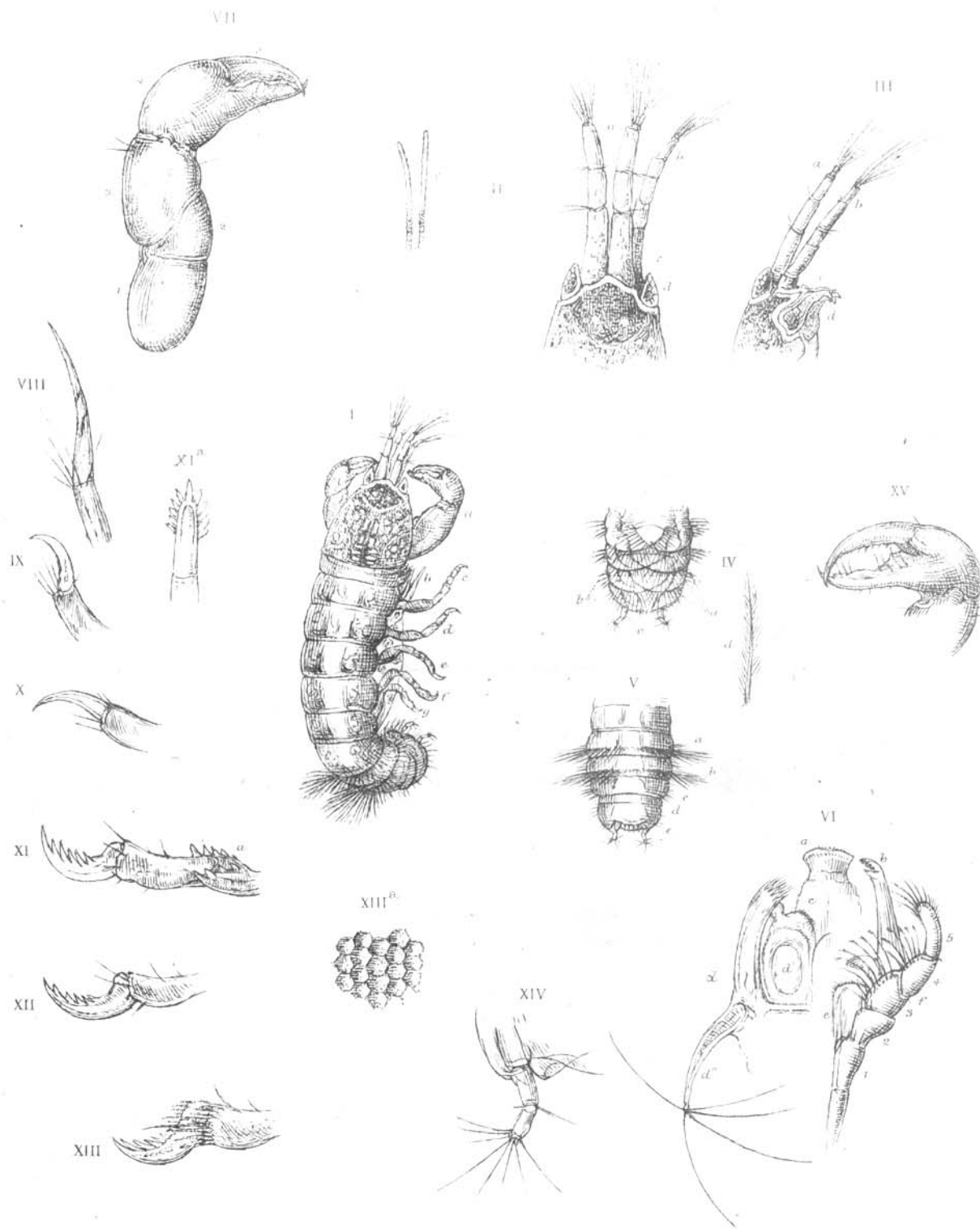
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## EXPLANATION OF PLATE.

### PLATE XV.

- Fig. 1. Enlarged figure of *Tanais vittatus* (female), showing the subtrigonal form of the carapace and its brown pigment tinting, the obtuse rostrum, projecting eyes and antennæ, and the 7 pairs of limbs (*a* to *g* inclusive), with the egg-pouch appearing between them.
- Fig. 2. The fore part of the carapace, with the eyes and antennæ on a larger scale: *a*, the superior antennæ; *b*, inferior antennæ; *c*, olfactory (?) excavation; *d*, the eye; *e*, ligulate hairs occurring in the terminal brush of the superior antennæ amongst the simple ones.

- Fig. 3. Lateral view of the same: *a*, superior, and *b*, inferior antenna; *c*, upper lip; *d*, mandibles, with dental processes at both apex and base.
- Fig. 4. Front view of abdomen, on nearly the same scale as fig. 1: *a*, superficial or external leaflet of the swimmerets; *b*, deep or internal leaflet of the swimmerets; *c*, the antennæform uropoda; *d*, feathery hair magnified.
- Fig. 5. Dorsal view of same: *a*, *b*, *c*, *d*, and *e* respectively the 1st, 2nd, 3rd, 4th, and 5th segments. *a* and *b* only bearing the transverse leaflets of feathery hairs. The uropoda are seen projecting backwards from beneath *e*.
- Fig. 6. The oral organs, highly magnified (front view): *a*, upper lip; *b*, mandible; *c*, internal maxillæ; *d*, external maxillæ; *d'*, lingual leaflet of *d*; *d''*, flagellum concealed in the respiratory chamber when *in situ*; *e*, lower-lip leaflet of the left side; *f*, corresponding jaw-foot, with its five segments, numbered 1 to 5 inclusive.
- Fig. 7. Chelate limb of the right side (female), with its five segments, numbered 1 to 5 inclusive.
- Figs. 8, 9, & 10. Claws of the next succeeding limbs of the same side.
- Fig. 11. Bipectinate claw of the 5th pair of legs: *a*, the spiny extremity of the third segment, common to all but the first pair of legs.
- Fig. 11 *a*. Front view of fig. 11.
- Fig. 12. Claw of the 6th pair.
- Fig. 13. Claw of the 7th pair, with its single external comb, and the serrate bristles and rasping tubercles of the penultimate joint.
- Fig. 13 *a*. The latter tuberculations more highly magnified.
- Fig. 14. Antennæform appendage of the fifth or last abdominal segment (left side).
- Fig. 15. Chelate limb of male (left side).



*Tanais vittatus.*

J.D. Macdonald, ad nat. del.

G.F. Argyon lith.