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THE
TRANSACTIONS
OF THE
ENTOMOLOGICAL SOCIETY

OF
LONDON
FOR THE YEAR
1868.



LONDON:
PRINTED FOR THE SOCIETY BY H. G. ROWORTH,
11, RAY STREET, FARRINGTON ROAD,
SOLD AT THE SOCIETY'S APARTMENTS, 12, BEDFORD ROW,
AND BY LONGMAN, GREEN, READER AND DYER,
PATERNOSTER ROW.

1868.

XIV. *On some points in the Anatomy of the immature Cænis macrura of Stephens.* By A. E. EATON, B.A.

[Read 6th July, 1868.]

THE following observations are intended merely as a supplement to the researches of other anatomists, and do not touch upon any details in the organization of *Cænis*, besides those which have been the subjects of their studies in other genera of the *Ephemeridæ*; neither do I purpose reiterating the lines of investigation pursued by them in connection with this particular genus.

In the mature *Egg*, the germinal matter is segregated at one end in such a way as to assume the appearance of a somewhat lunate protuberance from it.* One might liken its outline to that of the seed of the horse-bean, with the expansion of the funiculus attached to it. This seemingly appendant condition of the germinal matter is not peculiar to this genus. In *Ephemerella*, Walsh, the mass in question constitutes nearly two-fifths of the egg, from the rest of which it is marked out by a slight constriction; but its form differs from that of the corresponding part in *Cænis*, in being sub-conical, instead of crescent-shaped. Mr. Haliday, also, represents the mature egg of *Phlæothrips pini*, Hal., with a small appendix at one end (Walk. Brit. Mus. Cat. Homoptera, part iv. pl. viii. fig. 15).

During its later *subaqueous stages of development* (which I have recently discovered) *Cænis* resides in the beds of rivers and streamlets, either near the surface of mud-banks, or under stones, according to the nature of the bottom. When it is dropped into water, it presently begins to swim slowly, remarkably slowly for an Ephemerid, by means of the vertical movements of the body usual in these insects, aided by feeble strokes with its sprawling legs.

The body is more than ordinarily pubescent; in some parts it is even hirsute. The *head*, in what I regard as the immature *C. halterata*, Fab., is armed with three rather short, obtuse, conical spines in the place of the ocelli; but in the type it is unarmed. The inner two divisions of the *labium* are obtusely ovate; the outer two are narrower, and somewhat curved: they are

* Compare with this the yolk of an Osseous Fish's egg,—say *Gasterosteus*, as represented in Journ. Anat. & Physiol. vol. I. pl. xi. 1. g. c.

all of them covered with pubescence. The tri-articulate labial palpi* are covered with a long pubescence, excepting at their joinings. Their flattened, robust, basal joints are as long as the other two together, or nearly so; and their acute apical joints are equal in length to about one-half of the second joints. The *maxillæ* are slightly curved and compressed, toothless and acute, and somewhat hispid along their concave inner edges. The maxillary palpus arises from a slight depression in the middle of the exterior surface of the maxilla, to which it is equal in length. The first of its four joints is very short, the second is as long as, but rather broader than, the fourth, and is slightly longer than the third joint. The fourth joint is hirsute at the tip, but the palpus is otherwise only sparingly pubescent. Externally the somewhat triquetrous *mandibles* are ciliate. The internal prominent process of each is slightly bevelled, and finely denticulate along its anterior edge towards its pointed apex, and is furnished with a small tubercle near the middle of its inner longitudinal edge. The outer tip of the mandible ends in two stout proect spines, and a more slender obliquely curved spine: the remaining part of the anterior edge is erose. The transverse *labrum* is ciliate, and slightly retuse. The bilamellar *tongue* consists of an emarginate thickened glabrous upper portion, bent upon an inferior bipartite ciliate plate, whose divisions are obovate and remote. At the joinings of the otherwise naked *antennæ* are verticils of scanty spreading hairs; the second joints of these organs are three times as long as the first.

The *prothorax* is transverse, as broad as the head, but rather narrower than the mesothorax. In the typical species the pubescent legs have compressed femora, and the oblique tips of the tibiæ are produced each into a short spine; *C. halterata* differs from the type in having uncompressed femora, and ciliate tibiæ and tarsi.

The first six and the last two *abdominal segments* are short—about one-third shorter than the remaining ones; the sides of the segments intervening between the first and the last two, are flattened out, and their postero-lateral angles are considerably produced, and ciliate; the last three abdominal joinings are clothed with stiff erect hairs. The arrangement and condition of the *branchial plates* is very peculiar. The first pair arise from the

* Prof. Westwood regards these as a second pair of maxillæ, and maxillary palpi.

antero-lateral angles of the foremost segment; they are erect, two-jointed (?), subulate, acuminate, and have long fringes. From their position, their minuteness, and the dirtiness of the animal, they are liable to be passed over; or they might be mistaken for rudimentary hind-wings. The second segment is ebranchiate, and its upper posterior margin is slightly produced, especially in the middle. The next five segments bear pairs of single branchial plates. The first pair is disproportionately large, and formed of obtusely oval incrassated lamellæ, which are truncate anteriorly, ciliate at the sides and tip, and conceal the other four completely. The left plate slightly overlaps the other, its truncate edge is applied to the second joining, fitting under the produced edge of the second joint, which keeps it steady during the act of respiration. Each of them is traversed by a longitudinal lambda-shaped crease whose prongs meet the anterior edge, and on the underside is membranaceous and permeated by a trachea, which runs at first obliquely inwards, and then lengthwise, giving off several rather straight branches in a dendroid manner. The remaining plates are very different from the first, being delicately membranous, semi-ovate, and deeply fringed. The trachea divides almost at the base of the gill into about six fastigate, only slightly divided, branches, whose branchlets, without undergoing much diminution of calibre, run up each of them into one of the filiformly dissected fringe-processes. The gills are successively smaller backwards, each in its turn is extensively covered by its immediate predecessor, and the contiguous fringes of adjacent lamellæ are interlaced with one another in repose. In the action of breathing, the protecting plates are raised slightly, and remain motionless, whilst the other pairs are briskly agitated forwards and backwards. The intrusion of mud between them is effectually guarded against by the before-mentioned cilia and fringes. The tenth segment bears the caudal setæ, which have spreading hairs inserted upon their joinings in two opposite rows. The ventral ganglionic chord, and the alimentary canal, offer no extraordinary peculiarities.

Dimensions:—body 6·5; setæ, med. 3·8, ext. 4. millim.

Although foreign to the title of the paper, I may mention that the adult insect holds its wings horizontally extended in repose, seldom erecting them; and also that the forceps of *C. halterata*, Fab., are apparently jointless,

whereas those of the typical species (if they are not mucronate) seem to be bi-articulate.

To conclude, it will be seen that, in its preparatory states, *Cænis* differs considerably from other *Ephemeridæ* in their corresponding stages of development, so far at least as we are at present acquainted with them. But at the same time, it sufficiently resembles the young of *Ephemerella* and *Palingenia*, in those points wherein it differs from *Baëtis*, Leach (*Cloë*, Burm., Pict. p.) to authorise the opinion of those who associate it with the former two genera rather than with the last. In *Baëtis*, although the wings of the adult insect are not very unlike those of *Cænis*, the labium and its palpi are very differently constructed, the branchial lamellæ are entire, and in its subaqueous stages the insect climbs the water weeds, or runs over the surface of the bottom, and swims with a quick dashing motion. These peculiarities of *Baëtis* contrast with the burrowing habits, the production of the edges of the respiratory plates into fringing processes which contain subdivisions of the branchial tracheæ, etc., of *Cænis*,—particulars wherein it is approximated to *Palingenia* and *Ephemerella*. With these two genera, *Cænis* is moreover connected by *Oligoneuria*, Pict., which approaches, in its adult condition, *Polymitarcys* and *Campsurus* (genera which I have dismembered from *Palingenia*, Burm., Pict., typified respectively by *P. virgo*, Ol., and *C. latipennis*, Walk.), as may be shown by a comparison of their heads, forceps, and other organs, and the duration of their subimago states. On the other hand, *Cænis* is also related to *Leptophlebia*, Westw., and *Ephemerella*, Walsh. Thus a great similarity exists between its labium, labial palpi, legs, and abdominal segments, and the corresponding parts of the last-named genus, to whose gills the protecting gills of *Cænis* admit a tolerably close comparison. Further, the branchial lamellæ of *Leptophlebia*, and its forceps, are constructed much in the same way as the membranous gills of *Cænis*, and the forceps of *Oligoneuria*. Seeing, then, that *Leptophlebia* and *Ephemerella* are in some degree connected with *Ephemerella* by *Potamanthus*, (restricted, type *P. luteus*, L., Pict.), and that they are also related to *Cænis* and *Oligoneuria*, and that these in their turn are allied to *Campsurus* and *Polymitarcys*, I am inclined to consider *Cænis* and *Oligoneuria* collateral with the group of genera to which *Ephemerella* and *Campsurus* belong.