

cealed themselves under the banks, and we did not desire to disturb them after identification was complete. On the fourth loch visited we saw a brood of six young Wigeon and several old birds, in addition to other wild-fowl. All the young Wigeon seen appeared to be of the same age, which we estimated at ten days. A conspicuous and unvarying feature in the ducks with broods was an extreme solicitude for their young. They kept flying round our party, often within easy gunshot, uttering their peculiar croak, so long as we intruders remained in the neighbourhood of their progeny. Following Mr. Evans's example, of which I approve, I do not think it judicious to be more specific as to locality.

I believe that this is the first occasion on which the breeding of the Wigeon, in a wild state, has been reported, with proofs, south of the Forth.

NOTES ON SOME RARE FRESHWATER AND MARINE COPEPODA FROM SCOTLAND.

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PLATE IV.

ONE of the Authors of the following Notes, in a paper recently published in the "Annals of Scottish Natural History," refers very briefly to the recent discovery of two freshwater Copepods in Loch Leven, Kinross-shire, that have not previously been recorded as members of the British fauna. Though both species have been described in continental works, we do not know of any description of them in English, and have therefore prepared, and now submit, the following descriptions, with illustrative drawings, based upon specimens obtained in Loch Leven. We also take this opportunity to record some observations on the habits

of two marine Copepods that have been added to the British fauna within the last year or two.

We first describe the species from Loch Leven.

CANTHOCAMPTUS SCHMEILII, *Mrazek*, Plate IV. Figs. 1-13.

1893. *Canthocamptus schmeilii*, *Mrazek*, "Beitrag zur Kenntniss der Harpacticidenfauna des Süßwassers" ("Zoologische Jahrbücher," Siebenter Band), p. 116, Taf. VII. Figs. 107-117.

DESCRIPTION.—*Female*.—Length .8 mm. ($\frac{1}{31}$ of an inch). The cephalothoracic segments serrated on the posterior margins both dorsally and laterally; the abdominal segments with the posterior edges serrated only on the dorsal aspect, while laterally they are fringed with setæ; the whole integument of the thorax and abdomen covered with minute hairs. The antennules (anterior antennæ) somewhat shorter than the first cephalothoracic segment, and eight-jointed: the fifth and seventh joints are shorter than any of the others, the seventh only about half the length of the end joint. The proportional lengths of all the joints are shown by the annexed formula:—

Proportional lengths of the Joints	13	13	14	12	8	11	6	12
Number of the Joints	1	2	3	4	5	6	7	8

The secondary branches of the antennæ (posterior antennæ) are two-jointed: the first joint bears one seta, but the end joint is furnished with two terminal setæ—one slender, and one stout and spiniform (Fig. 4). The mandible-palp consists of a single very small joint and bears two terminal hairs. The inner branches of the first pair of swimming feet are considerably longer than the outer branches, they are two-jointed, the first joint reaches to about the end of the outer branches, the second is equal to about three-fourths of the length of the first joint, and is also more slender and provided with two apical setæ—one very long, the other about half the length; the marginal spines of the outer branches are moderately stout and elongate; a moderately stout spine springs from the interior distal angle of the second basal joint, and extends to about the middle of the first joint of the inner branches (Fig. 5). The inner branches of the second, third, and fourth pairs are also two-jointed and much shorter than the outer branches, and the first joint of all the inner branches of these three pairs is considerably shorter than the second joint; in the fourth pair the inner branches are furnished with only one seta, which is terminal and spiniform (Fig. 6). The secondary joint and the inner produced part of the basal joint of the fifth pair are subquadrangular in outline: the secondary joint does not extend much beyond the end of the basal

joint, and is provided with five setæ, four at the apex and one on the outer margin,—the middle seta is short, but the others are elongate and plumose; the inner produced part of the basal joint is also furnished with five setæ, all of which are plumose and arranged as shown by the drawing (Fig. 10). Caudal stylets narrow, subconical, and equal to about three-fourths the length of the last abdominal segment: they each bear a long spiniform terminal seta and several very small hairs (Fig. 12).

Male.—Fig. 3 in the plate is a drawing of one of the male antennules, which are strongly hinged, as shown. In the male the second pair of swimming feet have the inner branches slender and two-jointed: the second is of considerable length, and reaches to nearly the end of the outer branches (Fig. 7). The inner branches of the third pair are three-jointed, the first two joints are short, but the second joint has the inner angle produced into a long spiniform appendage that extends considerably beyond the end of the third joint (Fig. 8). In the fourth pair the inner branches are two-jointed, and scarcely longer than the first joint of the outer branches: the two terminal setæ are bent inwards at an obtuse angle, which seems to be the normal position of them; the second joint in the outer branches is not only armed with a stout, elongate, and somewhat curved spine, but has also the exterior distal angle produced into a strong, conical, and slightly bent tooth-like process (Fig. 9). The male fifth pair are much smaller than those of the female: the basal joint is only slightly produced interiorly, and bears two setæ, one moderately long and stout and one very short; the secondary joint is furnished with three moderately stout setæ (Fig. 11). The caudal stylets are considerably shorter than those of the female, and the terminal setæ are more elongate (Fig. 13).

Habitat.—Amongst mud by the shore at the west end of Loch Leven, Kinross-shire; collected, June 1890.

REMARKS.—*Canthocamptus schmeilii* was described and figured by Dr. Mrazek in the "Zoologische Jahrbücher" in May 1893, from specimens obtained by him in two different localities in the neighbourhood of Pribram, in Bohemia, in 1891-92. The species is quite distinct and easily recognised. The peculiar angularity of the specimens is so characteristic that they can be identified with certainty with an ordinary hand-lens. The species differs from its nearest allies by the elongate form of the two-jointed inner branches of the first pair of swimming feet. The female also differs further in the form of the fifth pair of feet and of the caudal stylets, and the male in the structure of the inner branches of the second, third, and fourth pairs of feet. Dr. Mrazek in his description appears to have inadvertently taken the fourth pair of the male for the second, and he also represents the inner produced part of the basal joint of the male fifth pair as furnished with three setæ instead of two, but

otherwise his description and figures agree very well with the Loch Leven specimens. There can be no doubt that our drawings of the second, third, and fourth swimming feet in the male are correct, and represent them in their proper sequence. The difference in the number of hairs in the fifth pair of the male may be due to local variation.

Loch Leven, so far as we know, is as yet the only British locality where *Canthocamptus schmeilii* has been obtained; and though collected in 1890, the gathering in which the specimens occur was somehow overlooked until the present year.

CANTHOCAMPTUS MINUTUS, *Claus*, Plate IV. Figs. 14-20.

1863. *Canthocamptus minutus*, *Claus*, "Freileb. Copep.," p. 122, Taf. XII. Figs. 1-3, Taf. XIII. Fig. 1.

1893. *Canthocamptus minutus*, *Schmeil*, "Deutschlands freileb. Sussw. Copep.," p. 31, Taf. II. Figs. 1-14.

DESCRIPTION.—*Female*.—Length .6 mm. ($\frac{1}{42}$ of an inch). Body slender, rostrum small. Antennules moderately stout, shorter than the first cephalothoracic segment, eight-jointed; the fifth joint being shorter than any of the others. The proportional lengths of the various joints are as follow:—

Proportional lengths of the Joints	10	10	9	8	5	9	8	10
Number of the Joints	1	2	3	4	5	6	7	8

The secondary branches of the antennæ are small and two-jointed, the end joint is shorter than the other, the first joint bears one and the end joint three setæ (Fig. 16), the mandible-palp is very small and one-jointed. The inner branches of the first, second, and third pairs of swimming feet are three-jointed. The inner branches of the first pair are rather longer than the outer branches, the first and third joints are nearly equal in length and rather longer than the middle joint, the three joints are each furnished with a small seta near the distal end of the inner margin, and the end joint is also armed with two setæ—one long and slender and one short and spiniform; a moderately long plumose hair springs from the middle of the inner margin of the second joint of the outer branches, and the exterior marginal spines of the outer branches are stout and elongate (Fig. 17). In the second and third pairs the inner branches are considerably shorter than the outer branches. In the fourth pair the inner branches are two-jointed, and only extend to a little beyond the end of the first joint of the outer branches (Fig. 18). The fifth pair has the inner produced portion of the basal joint broadly but irregularly rounded and provided with six setæ: the setæ are divided into two groups of three setæ each, and with a comparatively wide space between each group; those of the

inner group are all elongate and plumose, the middle one being rather longer than the other two; the outer group consists of one elongate and two very short setæ. The secondary joint is narrow, subcylindrical, and extends somewhat beyond the end of the basal joint; it also bears six setæ—three on the distal half of the outer margin, one small seta on the inner margin, and two apical setæ, one of which is long and stout and one very short (Fig. 19). The caudal stylets are short, and the anal operculum carries a fringe of short bifid spines on the posterior margin (Fig. 20).

Habitat.—Loch Leven, Kinross-shire, along with *Canthocamptus schmeilii*, but not nearly so common.

REMARKS.—This is a more typical *Canthocamptus* than the one previously described, and may be distinguished from other species of the same group by the structure of the first pair of swimming feet, as also by the bifid spines on the anal operculum, which appear to be peculiar to this species.

Loch Leven is, so far, the only Scotch locality where *Canthocamptus minutus* has been obtained; but since its discovery in Loch Leven we have obtained information of its occurrence in several localities in England. Mr. D. J. Scourfield obtained it last year at Wanstead Park and in the Isle of Wight, and this year in Wales; while one of the authors of the present memoir (Mr. A. Scott) has recently discovered it in a marshy drain near Leasowe Lighthouse, Cheshire.

The genus *Canthocamptus*, as described by several authors, seems to us to be too inclusive, and to contain forms so diverse in structure that a revision of the genus will ere long become necessary in order to facilitate the study of the various divergent species of which it is composed. We need only refer to the following among other diversities of structure to show how heterogeneous are the forms at present included in this genus. Thus, for example, in some species the secondary branches of the antennæ (posterior antennæ) are one-jointed, and in others two-jointed. In some species again the inner branches of the first pair of swimming feet are composed of two equal or nearly equal joints, while in others they are three-jointed: these inner branches are in various species either equal in length to, or considerably longer than, the outer branches. Moreover, in some species the inner branches of all the first four pairs of swimming feet are two-jointed or three-jointed, while in some the inner branches of the first pair or the first two or three pairs are three-jointed, and of the other pairs two-jointed. In 1880 Dr. Brady established the genus *Attheyella* for one or two aberrant forms of the *Canthocamptinæ*; but objection is taken by Continental authors to this genus, who regard it as synonymous with *Canthocamptus*. But *Canthocamptus* as it at present stands is not, as we have indicated, a very satisfactory genus.

The following are the notes on two species of Marine Copepods :—

DERMATOMYZON GIBBERUM, *T. and A. Scott.*

1894. *Dermatomyzon gibberum*, T. and A. Scott, "Ann. and Mag. Nat. Hist." (vi.), vol. xii. p. 144, Plate IX. Figs. 10-14.

This species was described from a single specimen obtained in a tow-net gathering collected in the vicinity of the Bass Rock, Firth of Forth. Its structure seemed to indicate parasitic habits, but there was nothing at the time of its discovery to show what animal formed its host. In the early part of this year one of the authors, while superintending some line-fishing experiments in the Firth of Forth, collected a number of specimens of the common Starfish (*Asterias rubens*) that were brought up attached to the hooks. These starfishes were subsequently washed in a bottle containing methylated spirit, and the result was that nearly one hundred specimens of *Dermatomyzon gibberum* were obtained, most of which, however, appeared to be immature, and only a few of them carried ovisacs. A short time after the capture of these specimens in the Firth of Forth, several examples of this starfish obtained in Liverpool Bay were examined, and these also, on being washed in methylated spirit, yielded a number of specimens of *Dermatomyzon gibberum*; but in this case, though the specimens were not so numerous as those taken in the Forth, a greater proportion of them were mature and carried ova. From these and other investigations made by us, we are inclined to think that this Copepod is probably parasitic on *Asterias rubens*, but whether it is confined to that starfish we are as yet unable to say.

The colour of the animal is brick-red, with a few whitish streaks, so that in the fresh state *Dermatomyzon gibberum* is not unlike the young of the mollusc *Pectunculus glycymeris*. The colour, however, soon disappears when the animal is put into methylated spirit.

LICHOMOLGUS HIRSUTIPES, *T. Scott.*

1893. *Lichomolgus hirsutipes*, T. Scott, "Eleventh Annual Report of the Fishery Board for Scotland," part iii. p. 286, Plate IV. Figs. 1-12.

This is a comparatively large Copepod, being in some cases at least $\frac{1}{20}$ of an inch in length. It was first obtained among some trawled material collected in the Firth of Forth at the "Rath Ground," a shallow bank situated a short distance north of the Bass Rock. *Lichomolgus hirsutipes*, like the *Dermatomyzon* just described, appears to be more or less parasitic in its habits, but at the time of its discovery we did not know of any animal with which it was likely to be associated. During the same line-fishing experiments that are referred to in the notes on *Dermatomyzon gibberum*, various



Andrew Scott, del. ad nat.

R. & R. Clark imp.

FIGS. 1-13 CANTHOCAMPTUS SCHMEILII MRAZEK.
FIGS. 14-20 CANTHOCAMPTUS MINUTUS, CLAUS.

other things besides the starfishes mentioned were brought up on the hooks, and among others were a few large Annelids, probably belonging to a species of *Sabella*. These Annelids form tubes of fine mud, which is mixed with and held together by a glutinous substance secreted by the animal. These tubes were found to be invariably more or less covered by a growth of *Alcyonium*. In some instances these tubes contained the living Annelid, but several of them were empty. It was only when fishing in moderately deep water—15 to 20 fathoms or so—that these large worm-tubes were obtained. Though the *Alcyonium* had usually spread itself over a large portion of the tubes, the upper end—the end that corresponded with the head of the worm—was generally free from the enveloping Zoophyte. White specks were observed on nearly all the specimens, and were sparingly scattered over the upper part of the tube. These white specks all proved to be Copepods, which, when examined under the microscope, were without exception found to belong to the species mentioned above, viz. *Lichomolgus hirsutipes*.

Though we have not yet been able to ascertain if *Lichomolgus hirsutipes* is only to be obtained in the Firth of Forth associated with this Annelid, or whether it is associated with the same Annelid elsewhere in the British seas, the facts mentioned seem to indicate an association between the Copepod and Annelid not altogether accidental, and, if so, they may probably occur associated in the same manner in other localities where the conditions are suitable.

DESCRIPTION OF PLATE IV.

Canthocamptus schmeilii, Mrazek.

Fig. 1.	Female, lateral view	.	.	.	.	.	×	80
„ 2.	One of the Female Antennules	.	.	.	.	.	×	253
„ 3.	One of the Male Antennules	.	.	.	.	.	×	253
„ 4.	One of the Antennæ	.	.	.	.	.	×	253
„ 5.	Foot of first pair	.	.	.	.	.	×	380
„ 6.	Foot of second pair (female)	.	.	.	.	.	×	253
„ 7.	Foot of second pair (male)	.	.	.	.	.	×	380
„ 8.	Foot of third pair (male)	.	.	.	.	.	×	253
„ 9.	Foot of fourth pair (male)	.	.	.	.	.	×	253
„ 10.	Foot of fifth pair (female)	.	.	.	.	.	×	253
„ 11.	Foot of fifth pair (male)	.	.	.	.	.	×	380
„ 12.	Last Abdominal Segment and Caudal Stylets (female)	.	.	.	.	.	×	127
„ 13.	Last Abdominal Segment and Caudal Stylets (male)	.	.	.	.	.	×	127

Canthocamptus minutus, Claus.

„ 14.	Female, lateral view	.	.	.	.	.	×	80
„ 15.	One of the Antennules	.	.	.	.	.	×	253
„ 16.	One of the Antennæ	.	.	.	.	.	×	253
„ 17.	Foot of first pair	.	.	.	.	.	×	380
„ 18.	Foot of fourth pair	.	.	.	.	.	×	190
„ 19.	Foot of fifth pair	.	.	.	.	.	×	380
„ 20.	Last Abdominal Segment and Caudal Stylets	.	.	.	.	.	×	190