

Even after becoming acquainted with this artful dodge, the hare must be stalked with caution. Being all white except the tips of its ears, it is not easily seen when nearly buried in the snow, and when discovered the sportsman must dissemble, and pretend that he has not seen it, walking in an oblique direction, approaching, but at the same time as if passing by, never looking directly at the game. When near enough he should wheel suddenly round and fire. If this plan be not adopted, the hare will very generally bolt round the rock, and escape under its shelter. This may be called *pot* shooting, but the best of sportsmen have often to do the same thing with ptarmigan in the Scottish mountains, when these birds fly round a rock and are out of sight in an instant, if not shot before taking wing.

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Copepoda of Madeira and the Canary Islands, with Descriptions of New Genera and Species. By ISAAC C. THOMPSON, F.R.M.S. (Communicated by Prof. HERDMAN, F.L.S.)

[Read 17th November, 1887.]

(PLATES X.-XIII.)

DURING the spring of 1887, in company with Mr. W. S. M'Millan, of Liverpool, I visited Madeira and the Canary Islands with the object of collecting and examining the pelagic fauna at the various convenient stopping-places.

We took dredge and tow-net, and all the necessary appliances for the examination and preservation of specimens, and were fortunate in securing a large mass of material.

It is intended in this paper to treat of the Copepoda only ; and as the dredging operations were neither so practicable, nor fruitful in results as the tow-netting, it was to the latter that we devoted chief attention, all the Copepoda collected being free-swimming species.

We used one of the very fine-meshed tow-nets of the 'Challenger' pattern, and immediately preserved the captures in a medium which I have always found useful for small Crustacea, composed of glycerine, alcohol, and water in the following proportions :—

Glycerine.....	1 part	} adding 1 per cent. of carbolic acid.
Proof-spirit...	2 parts	
Water .....	1 part	



In this solution the colours (and they are very varied in the Copepoda) are well preserved, and the tissues are rendered sufficiently transparent for observation under the microscope without further treatment.

We longed to cast a tow-net while traversing the fifteen hundred miles of Atlantic waters that intervened before reaching our first destination, Madeira, and improvised a long tough canvas bag, weighted, with a wide-necked bottle at the bottom end, for the purpose; but the speed of the vessel was too great to allow of any captures. The mails could not give way to the study of biology, so our genial captain would not allow any temporary stoppage; but the death of a poor fireman on the fourth day out necessitating a funeral pause of a few minutes, we took advantage of the opportunity by getting a haul; and the tow-net brought up sufficient to occupy us and relieve the monotony of the rest of the voyage. The haul was almost entirely composed of Copepoda: *Calanus finmarchicus*, *Centropages typicus* and *C. brachiatus*, *Dias longiremis*, and a few other species, nearly all found on our British coasts.

The deep-blue transparent waters of Madeira proved very fruitful both in number and variety of Copepoda, Funchal Bay being our hunting-ground during two visits. Thence to Teneriffe, where we anchored for a few hours in the Santa Cruz harbour, and, as at Madeira, collected enough Copepoda to occupy us many months in examining and working out.

Grand Canary was our next destination, and there we spent many days dredging, collecting, and tow-netting at various parts of the island. The absence of any shelter or harbour at Las Palmas rendered dredging difficult, for we had to take eight men to manage the boat, the sea being seldom at all smooth. And, from some cause or other, the tow-netting results obtained here were certainly much poorer than those of the more sheltered bays of Madeira and Teneriffe.

Returning to Teneriffe, we crossed the island from Santa Cruz to Orotava, grandly situated on the north side directly under the Peak, and famous for its splendid climate and scenery. We found the waters of the ocean here very plentiful in Copepoda, and on various occasions collected a large amount of them. One of these occasions was long after sunset, and it is worthy of note that the Copepoda then taken were little different in point of number or species from those taken in daylight, although with



the night-haul were a largely increased number of Schizopoda, some of them highly phosphorescent.

From a pretty thorough examination of the material obtained at the various islands of the Canaries and Madeira, it seems evident that their Copepodan fauna varies in quantity rather than specifically. For, excepting several cases where one or two specimens only of a species were found, which probably indicated the rarity of that species, their geographical distribution appeared to be general amongst the islands.

Sixty-four species in all were obtained, as enumerated below. Of these six are new to science, and three of them required new genera. (See Plates X. to XIII.)

Of the sixty-four species, twenty-two are known in British waters; and of these, thirteen belong to the family Harpacticidæ.

Following the classification given by Brady\*, the sixty-four species are distributed into families as follows:—

Calanidæ .....	30 species.
Cyclopidæ .....	4 „
Harpacticidæ .....	16 „
Corycæidæ .....	11 „
Artotrogidæ .....	3 „

### *Description of the Species collected.*

#### Family CALANIDÆ.

CALANUS FINMARCHICUS, *Günner*.

C. VALGUS, *Brady*.

C. PROPINQUUS, *Brady*.

This species, like the two preceding, is widely distributed. A high power of the microscope ( $\times 400$ ) shows very fine hairs on the inner margin of the terminal spines of the swimming-feet, not mentioned by Brady in his description of the species.

C. TONSUS, *Brady*.

C. GRACILIS, *Dana*.

Both found very sparingly.

\* 'Monograph of British Copepoda,' Ray Society, 1876-78 & 1879.



*CALANUS PAVO*, Dana.

This species occurs in considerable numbers in the gatherings from Madeira and Teneriffe ; but the elegant peacock-tail plumes figured by Dana (Crustacea of U. S. Exploring Expedition) have become detached in all the specimens.

*PARACALANUS PARVUS*, Claus.

One or two specimens only of this rare form were taken at Orotava, Teneriffe.

*EUCALANUS ATTENUATUS*, Dana.*E. SETIGER*, Brady.

Brady remarks upon the "mimetic resemblance" of this species to *Calanus finmarchicus*. Our specimens do not bear out this remark ; and the absence of terminal spines to the swimming-feet of this species is a distinguishing feature.

*RHINCALANUS CORNUTUS*, Dana.*R. GIGAS*, Brady.*PSEUDOCALANUS ELONGATUS*, Boeck.*PLEUROMMA ABDOMINALE*, Claus.*LEUCKARTIA FLAVICORNIS*, Claus.*SCOLECITHRIX DANÆ*, Lubbock.*S. MINOR*, Brady.*EUCHÆTA PRESTANDREÆ*, Philippi.*CANDACE TRUNCATA*, Dana.*C. NIGROCINCTA*, n. sp. (Pl. X. figs. 1-6.)

Length  $\frac{1}{10}$  inch. Head-somite distinct from thorax. Body oval, rounded in front ; posterior segment terminated by two lateral spines. Anterior antennæ 23-jointed, bearing several spinous processes on inner margin, and short setæ at the termination of each joint. The 8th, 9th, 10th, and 11th joints (fig. 1) are deeply pigmented with a blackish-brown colour, the same pigment tinging the setæ of the posterior antennæ and the terminal spines of the swimming-feet. Posterior antennæ (fig. 2) similar to that of *C. truncata*, but with fewer terminal setæ. Anterior foot-jaws (fig. 3) 2-jointed, large and powerful, with two small claw-like spines on basal joint, and five large ones on second joint. Posterior foot-jaws small, 7-jointed. First four pairs of swimming-



feet (fig. 4) alike; inner branch has one joint only; outer edge of main branch is finely serrated. Pigment does not extend above the terminal spine, which is somewhat bent and finely serrated and clothed with dark hairs on dorsal side. Fifth feet of male (fig. 5) each 3-jointed, the right foot having extension on inner side of middle joint, both terminated by two small claws. Abdomen of male (fig. 6) 3-jointed, the third being nearly equal in size to the other two; caudal segments about twice as long as broad, terminated by short strong setæ.

Several specimens of this strongly marked form were taken at Orotava, Teneriffe, all of which appear to be males.

It has strong points of resemblance to both *Candace pachydactyla* and *C. truncata*, Dana, but is evidently distinct from both. The dark rings on the anterior antennæ distinguish it at a glance.

CANDACE BREVICORNIS, n. sp. (Pl. X. figs. 7, 8.)

Several specimens of a *Candace* were taken at Orotava and at Santa Cruz, Teneriffe, which, although corresponding in most respects with *C. truncata*, Dana, differ in some particulars which are of sufficient importance to render it specifically distinct.

In the first place the anterior antennæ are composed of eighteen joints only, while *C. truncata* has twenty-four. Then the first four pairs of swimming-feet (fig. 8) are the same as in *C. truncata*, except that in our specimens, to which I propose to give the name *C. brevicornis*, the setæ are all elegantly plumed, much resembling minute black feathers. No fifth feet can be made out in any of the specimens obtained. Abdomen only 2-jointed, the caudal segments being long and straight, while in *C. truncata* they are somewhat stumpy and divergent. The basal joint of the abdomen is less triangular than in *C. truncata*. Our specimens are probably all females.

DIAS LONGIREMIS, *Lilljeborg*.

ACARTIA LAXA, *Dana*.

A. DENTICORNIS, *Brady*.

In all our specimens of both species of *Acartia* there is a long recurved spine at distal end of first joint of each anterior antenna, which does not appear to have been previously described.

DREPANOPUS FURCATUS, *Brady*.

Several females of this species were found, but no males; a



similar experience to Brady's. His specimens of this species ('Challenger' Report on the Copepoda, p. 77) were sparingly found in three remarkably distinct areas.

TEMORA DUBIA, *Lubbock*.

Very abundant in all the gatherings.

ISIAS CLAVIPES, *Boeck*.

First abdominal segment of female has two remarkable trifid spines on ventral side, not described by Boeck or Brady. I first noticed this point in specimens taken in Liverpool Bay. The fifth feet of male also differ considerably from Brady's drawing.

CENTROPAGES BRACHIATUS.

C. TYPICUS.

C. VIOLACEUS.

Our specimens of the latter are most profusely and elegantly adorned with violet plumose setæ.

#### MECYNOCERA, n. gen.

Cephalothorax 6-jointed; head united with thorax; abdomen 4-jointed in the male, 3-jointed in the female. Anterior antennæ 23-jointed, very long. Outer branch of posterior antennæ 3-jointed, the inner branch 7-jointed. Mandibles and maxillæ well developed. Anterior foot-jaw 3-jointed and very muscular, and, like the posterior, clothed with strong plumed setæ. Swimming-feet alike in both sexes, fifth feet entirely wanting.

MECYNOCERA CLAUSI, n. sp. (Pl. XI. figs. 1-4.)

Length  $\frac{1}{25}$  inch. Rostrum bifid and very slender. Anterior antennæ 23-jointed, alike in both sexes, about twice the length of the entire animal (fig. 1); the 11th, 12th, and 13th joints of left antennæ only edged with fine saw-teeth (fig. 2). Basal portion of both antennæ bear several short setæ and a few long ones, and at intervals, and especially at apex, are several long whip-like setæ. Posterior antennæ very muscular; the outer branch 3-jointed, the inner 7-jointed and terminated by spreading setæ. Mandibles finely toothed. Maxillæ well developed, with two spreading setiferous branches and broad rounded palp. Anterior foot-jaw 3-jointed, and, like the posterior, which is small, bearing a large number of plumose setæ.

Swimming-feet (fig. 3) have small hooked spines at ends of joints, but no terminal spines besides the strong spinous setæ.



Fifth feet wanting in both sexes. Abdomen of male (fig. 4) 4-jointed, female 3-jointed, the basal joint of latter being somewhat heart-shaped, and having doubled circular genital apertures. The third abdominal joint is divided longitudinally, the intervening span being filled with hyaline membrane. Caudal terminations in female divergent, in male less so; both terminated by four plumous setæ on each side. Colour reddish brown.

Males and females were both plentiful, and taken by surface tow-net at all the places visited. Indeed this species seemed to be more widespread than any other.

Claus, in his memoir 'Die freilebenden Copepoden' &c., gives a figure (pl. xxxii. fig. 17) of a form which is evidently this species, although the anterior antennæ are not correctly represented. He has informed me in a letter that the material at his disposal was not sufficient to enable him to describe the species. I have therefore much pleasure in naming this form, which is so abundant at the Canary Islands, after the distinguished naturalist who first discovered it.

#### Family CYCLOPIDÆ.

OITHONA CHALLENGERII, *Brady*.

O. SPINIFRONS, *Boeck*.

O. PLUMIFERA, *Dana*.

O. SETIGER, *Dana*.

All four species of this delicately organized genus were found fairly plentifully and generally distributed. The long feathery red-coloured plumes of *O. plumifera* give the species a very graceful appearance, and readily distinguish it from the others.

#### Family HARPACTICIDÆ.

LONGIPEDIA CORONATA, *Claus*.

SETELLA GRACILIS, *Dana*.

Various specimens of this species collected differed considerably from each other in colour and form, but not sufficiently to be considered specific.

EUTERPE GRACILIS, *Claus*.

This minute species, hitherto considered very rare, we found widely distributed but not numerous.



DELAVALIA ROBUSTA, *Brady & Robertson*.

DIOSACCUS TENUICORNIS, *Claus*.

One specimen only found at Orotava, Teneriffe.

LAOPHONTE CURTICAUDATA, *Boeck*.

L. SERRATA, *Claus*.

DACTYLOPUS TISBOIDES, *Claus*.

THALESTRIS MYSIS, *Claus*.

T. RUFOCINCTA, *Norman*.

WESTWOODIA NOBILIS, *Baird*.

HARPACTICUS CHELIFER, *Müller*.

PORCELLIDIUM VIRIDE, *Philippi*.

IDYA FURCATA, *Baird*.

} All found generally  
distributed, but none  
plentiful.

#### MACHAIROPUS, n. gen.

Head longitudinally rounded, terminating in long thin bifid rostrum. Anterior antennæ 12-jointed, about two thirds the length of cephalothorax; sparingly setiferous. Posterior antennæ long; the outer branch 3-jointed, the inner 2-jointed. Mandibles have very fine claw-like teeth; the palpi is two-branched, with long fine hairs.

Maxillæ have four strong serrated curved spines and numerous setæ. Posterior foot-jaw 2-jointed, having long sword-like spines with enlarged bases. Anterior foot-jaw small. Abdomen 2-jointed.

MACHAIROPUS SANCTÆ-CRUCIS, n. sp. (Pl. XII. figs. 1-5.)

Length  $\frac{1}{15}$  inch. Rounded head (fig. 1) of a deep pink colour. Anterior antennæ (fig. 2) 12-jointed. Posterior antennæ (fig. 3) has long whip-like setæ, extending to the length of the anterior antennæ. Swimming-feet (fig. 4) have three joints to outer branch, and two joints to inner. Terminal spine narrow and finely serrated. Basal joints of swimming-feet have long spine on inner margin. Fifth feet (fig. 5) have one joint terminated by a long, stout, curved spine, with a small one at each side. First joint of abdomen is small, the second long, and wide in the middle. Caudal segments are about four times as long as broad, and are terminated by short non-plumose setæ.



One specimen only, sex undetermined ; was taken by tow-net at Santa Cruz, Teneriffe.

SCUTELLIDUM TISBOIDES, *Claus.*

### Family CORYCÆIDÆ.

CORYCÆUS VARIUS, *Dana.*

C. PELLUCIDUS, *Dana.*

C. LIMBATUS, *Brady.*

C. VENUSTUS, *Dana.*

C. SPECIOSUS, *Dana.*

All five species of *Corycæus* we found in fair abundance and widely distributed.

COPILIA MIRABILIS, *Dana.*

Found very sparingly.

LUBBOCKIA SQUILLIMANA, *Claus.*

Several specimens of both sexes of this striking species were taken at Teneriffe and Grand Canary.

ONCÆA OBTUSA, *Dana.*

The remarkable variety of colour in this species is worthy of note, especially when fresh. It ranges from olive-green to purple, blue, magenta, scarlet, &c. The colours are mostly retained if mounted in Farrants medium soon after capture.

SAPPHIRINA INÆQUALIS, *Dana.*

S. SERRATA, *Brady.*

S. METALLINA.

} Fairly plentiful throughout  
the gatherings.

### Family ARTOTROGIDÆ.

ACONTIOPHORUS ANGULATUS, n. sp. (Pl. XII. figs. 6-11, and Pl. XIII. figs. 5, 6.)

Length  $\frac{1}{30}$  inch. Head united with first thoracic somite, which is rounded off at base (Pl. XII. fig. 6), the other somites of cephalo-thorax being angular. Rostrum (fig. 7) composed of two small projections with finely serrated edges. Anterior antennæ (fig. 8) 11-jointed, short, and gradually tapering from base to apex; second joint larger than the others, and from it proceed a number of long setæ; from seventh joint proceeds a long, narrow spine; there are several long setæ at the apex. Posterior



antennæ (fig. 9) two-branched, the first being 3-jointed and terminated by two long lancet-shaped spines; the second has one joint, and is terminated by a long sword-shaped spine. First and second foot-jaws (figs. 10 & 11) each have a long apical claw, the first is composed of two, the second of four joints.

First four pairs of swimming-feet nearly alike, both branches 3-jointed (Pl. XIII. fig. 5); base and second joint of chief branch have very fine serration on inner edge formed by minute hairs. Fifth feet (Pl. XIII. fig. 6) are composed of two stout joints, the outer bearing a number of long setæ, some of them plumose; the outer edge of both joints has fine hairy serration. Caudal segments and terminal setæ are the same as in *A. scutatus*.

Siphon very long and slender, reaching to the ends of caudal segments.

One specimen only of this new species was taken at Funchal Bay, Madeira. The angular shape of the posterior segments of the cephalothorax readily distinguish it from *A. scutatus*, which it resembles in general characters.

ARTOTROGUS NORMANI, *Brady & Robertson*.

Found very sparingly.

#### CYMBASOMA, n. gen.

Cephalothorax elegantly boat-shaped, 4- to 6-jointed; head united with thorax. Anterior antennæ 5- or 6-jointed, broad and muscular. No posterior antennæ or foot-jaws. First four pairs of swimming-feet have a large basal joint, the two branches being each 3-jointed and terminated by strong spinous setæ. Abdomen in female 2-jointed, the first much larger than the second; and from the centre of the latter are attached the ova on long narrow branches.

CYMBASOMA RIGIDUM, n. sp. (Pl. XIII. figs. 1-4.)

Length  $\frac{1}{8}$  inch. First joint of cephalothorax (fig. 1) equal in length to the succeeding five, the last being much smaller than the others, and appearing as though part of the abdomen. Eyes long and kidney-shaped, with conspicuous brain below. Anterior antennæ (fig. 2) about eight times as long as broadest part, and terminated by two claw-like spines; the inner side of each antenna has five hooked spines (fig. 2). From two raised circumferences near the centre proceed long spinous setæ, and several smaller setæ are situated near the apical portion of the antennæ.



First four pairs of swimming-feet (fig. 3) have strong muscular basal joints, from which proceed two 3-jointed branches with thick terminal setæ. Fifth pair of feet each composed of a long joint, at the apex of which are three strong spinous setæ. Abdomen very muscular; the caudal setæ are short, broad, and divergent, and are each terminated by three strong setæ.

One specimen only (a female) was taken in the tow-net at Orotava, Teneriffe. The lower part of the body is of a deep sepia colour. The animal is remarkably rigid and muscular.

Quite recently a second form, evidently belonging to this new genus, has been found in the channel between Puffin Island and Anglesea. It is probably a male, and I am describing it under the name *Cymbasoma Herdmani*. It will be figured along with other new species from Liverpool Bay in the second volume of the 'Proceedings of the Liverpool Biological Society.'

#### EXPLANATION OF THE PLATES.

##### PLATE X.

- Fig. 1. *Candace nigrocincta*, n. sp., male.  $\times 250$ .  
 2. Posterior antenna of ditto.  $\times 400$ .  
 3. First foot-jaw of ditto.  $\times 400$ .  
 4. Fourth pair swimming-feet of ditto.  $\times 400$ .  
 5. Fifth pair swimming-feet of ditto.  $\times 400$ .  
 6. Abdomen and caudal segments of ditto.  $\times 400$ .  
 7. *Candace brevicornis*, n. sp., female.  $\times 250$ .  
 8. Fourth swimming-foot of ditto.  $\times 400$ .

##### PLATE XI.

- Fig. 1. *Mecynocera Clausi*, n. sp., female.  $\times 250$ .  
 2. Eleventh, twelfth, and thirteenth joints of left anterior antenna of ditto, showing saw-teeth.  $\times 400$ .  
 3. Fourth swimming-foot of ditto.  $\times 400$ .  
 4. Abdomen and caudal segments of male ditto.  $\times 400$ .

##### PLATE XII.

- Fig. 1. *Machairopus sanctæ-crucis*, n. sp.  $\times 250$ .  
 2. Anterior antenna of ditto.  $\times 400$ .  
 3. Posterior antenna of ditto.  $\times 400$ .  
 4. Fourth pair swimming-feet of ditto.  $\times 250$ .  
 5. Fifth swimming-foot of ditto.  $\times 250$ .  
 6. *Acontiophorus angulatus*, n. sp., female,  $\times 250$ .  
 7. Rostrum of ditto.  $\times 400$ .  
 8. Anterior antenna of ditto.  $\times 400$ .



- Fig. 9. Posterior antenna of ditto.  $\times 400$ .  
 10. Anterior foot-jaw of ditto.  $\times 400$ .  
 11. Posterior foot-jaw of ditto.  $\times 400$ .

## PLATE XIII.

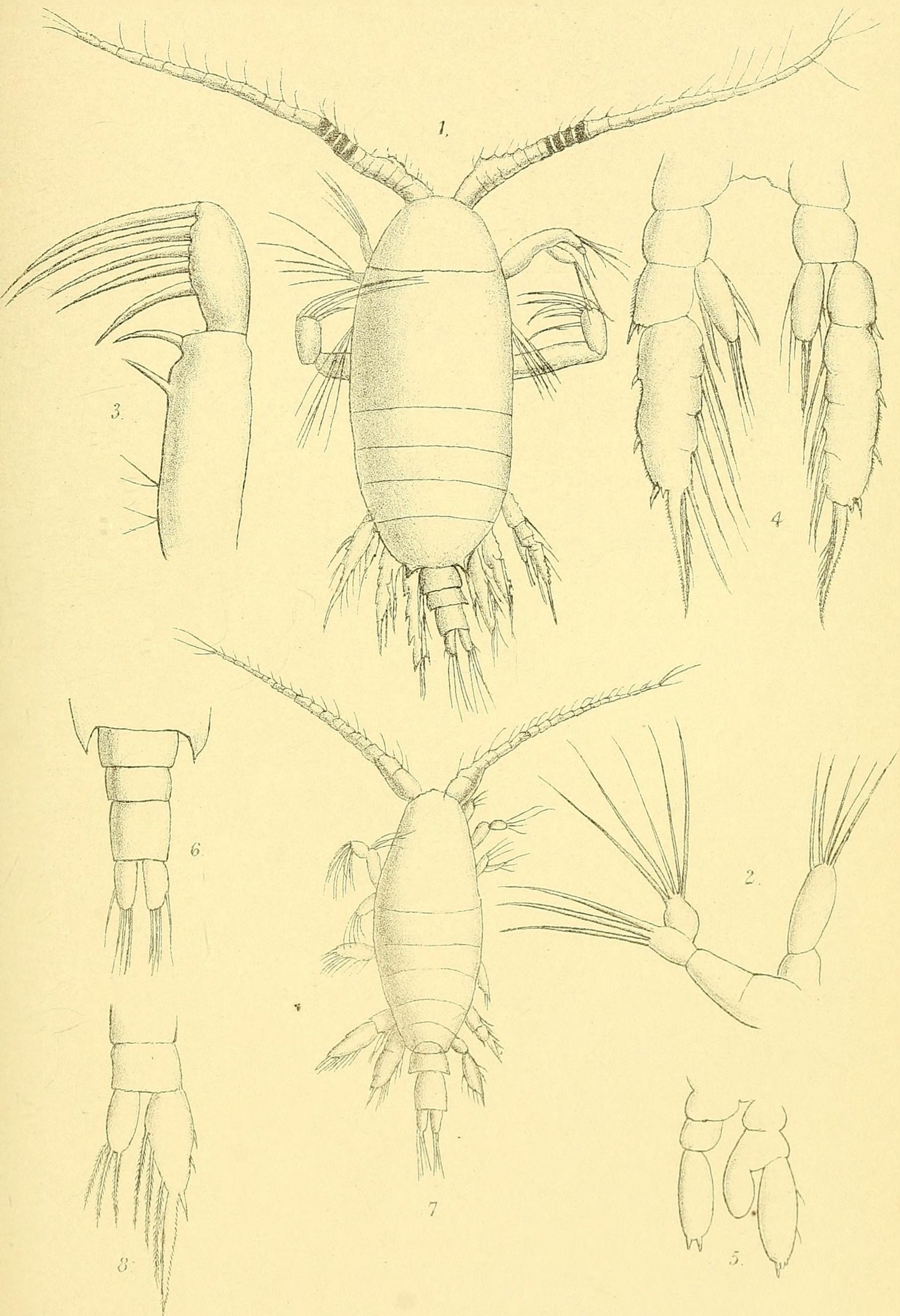
- Fig. 1. *Cymbasoma rigidum*, n. sp., female.  $\times 250$ .  
 2. Anterior antenna of ditto.  $\times 400$ .  
 3. First swimming-foot of ditto.  $\times 400$ .  
 4. Abdomen of ditto, with attached ova and caudal appendages.  
 5. First pair of swimming-feet of *Acontiophorus angulatus*.  $\times 400$ .  
 6. Fifth foot of ditto.  $\times 400$ .

Descriptions of some Genera and Species of *Galerucinae*.  
 By JOSEPH S. BALY, F.L.S.

[Read 2nd February, 1888.]

THE examination of some extensive genera of *Galerucinae*—*Haplosonyx*, *Cerotoma*, and others—in which the anterior acetabula are described as closed or entire, has convinced me that the views expressed by myself in the Ent. Month. Mag. vol. xxiii. p. 268 are correct. In any long series of individuals belonging to these various genera I have almost invariably found some species in which, whilst certain specimens have the acetabula closed, others have them open, in some instances these opposite states occurring on the different sides of the same individual. This is strikingly the case in *Cerotoma* and *Monolepta*. Under such circumstances it must, I think, be conceded that the state of the acetabula cannot be regarded as a primary, even if it can be retained as a secondary character. It becomes therefore necessary to discover some other and more stable means by which to divide the *Galerucinae* into primary sections. This, I venture to suggest, will be found in the form and structure of the hinder portion of the prosternum. In a large number of genera, for instance *Haplosonyx*, *Enidea*, and numerous others, the prosternum, as in the Chrysomelidæ and the earlier groups of the Phytophaga, is produced just before its base into a distinct lobe or process, the sides of the lobe (in cases where the acetabula are closed) being connected with the apices of the epimera, whilst the hinder margin of the lobe is free, and usually applied to the anterior surface of the mesosternum. In a second large section of the family, represented by *Galeruca*, *Aulacophora*, &c., this subbasal lobe is entirely absent, the prosternum being connected without





1 C Thomson del.

Mintern imp.

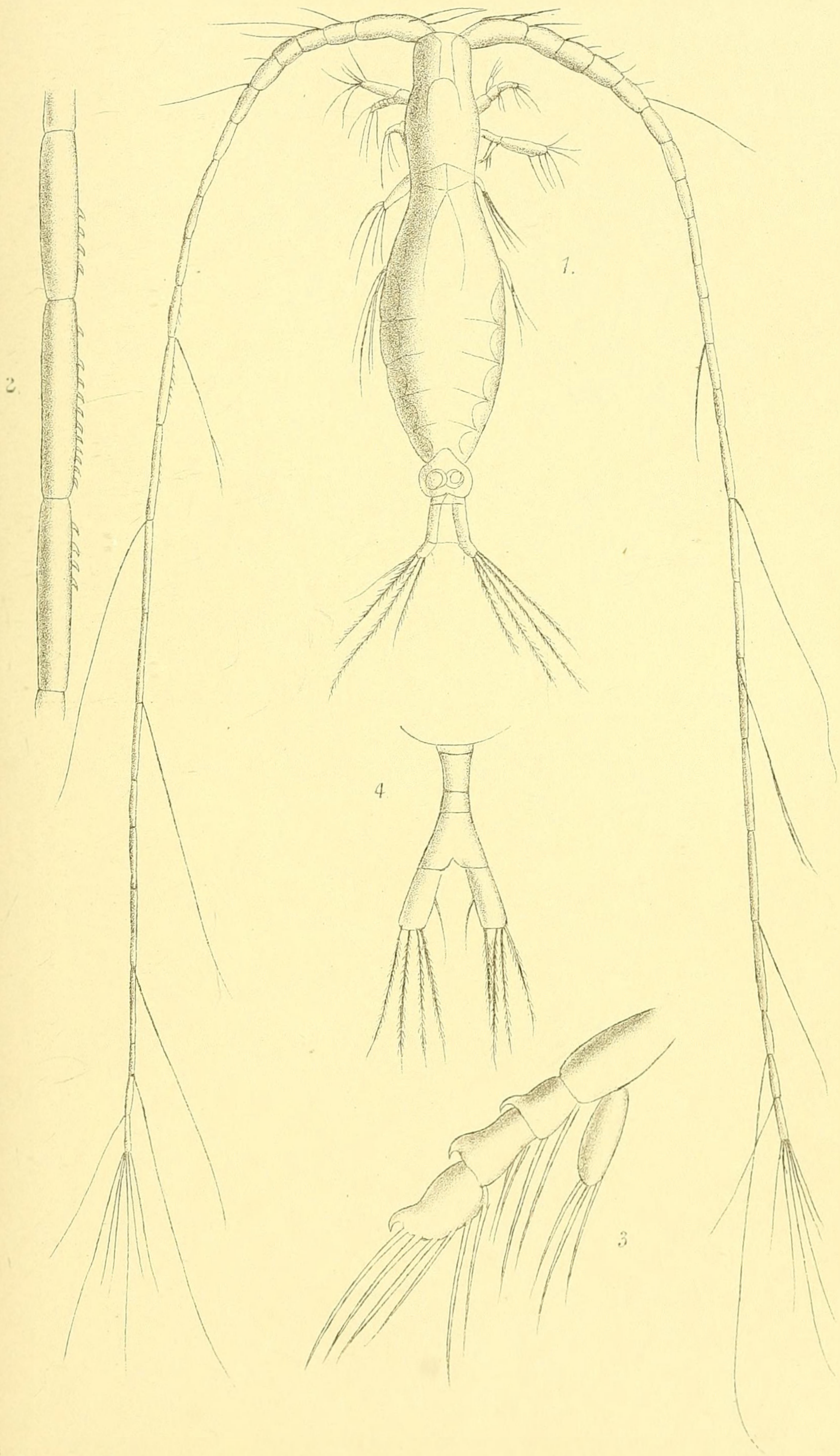
1-6. CANDACE NIGROCINCTA, n. sp.

7-8. CANDACE BREVICORNIS, n. sp.









I. C. Thompson del.

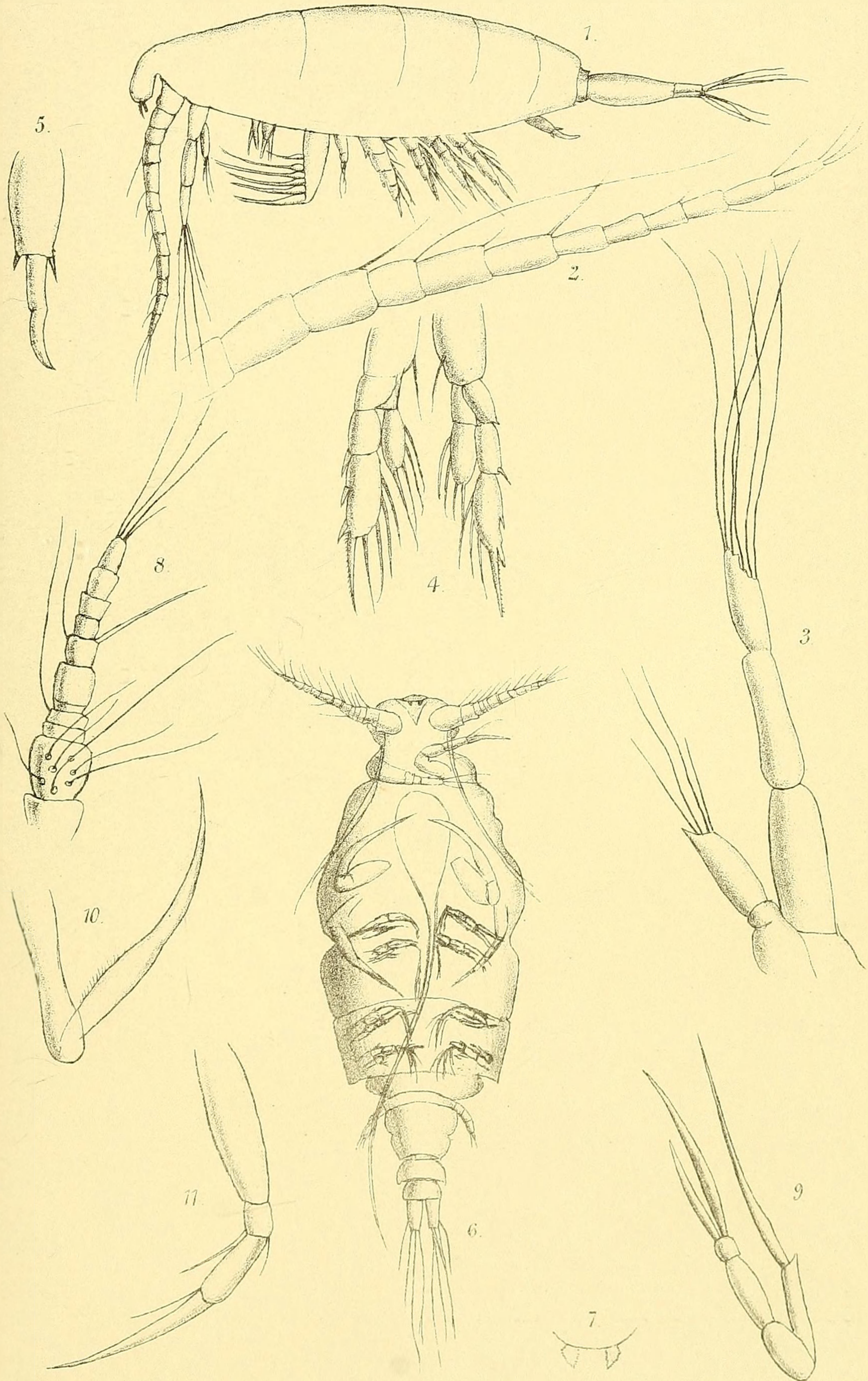
Mintern imp.

1-4. MECYNOCERA CLAUSI, n. sp.









I. C. Thomson del.

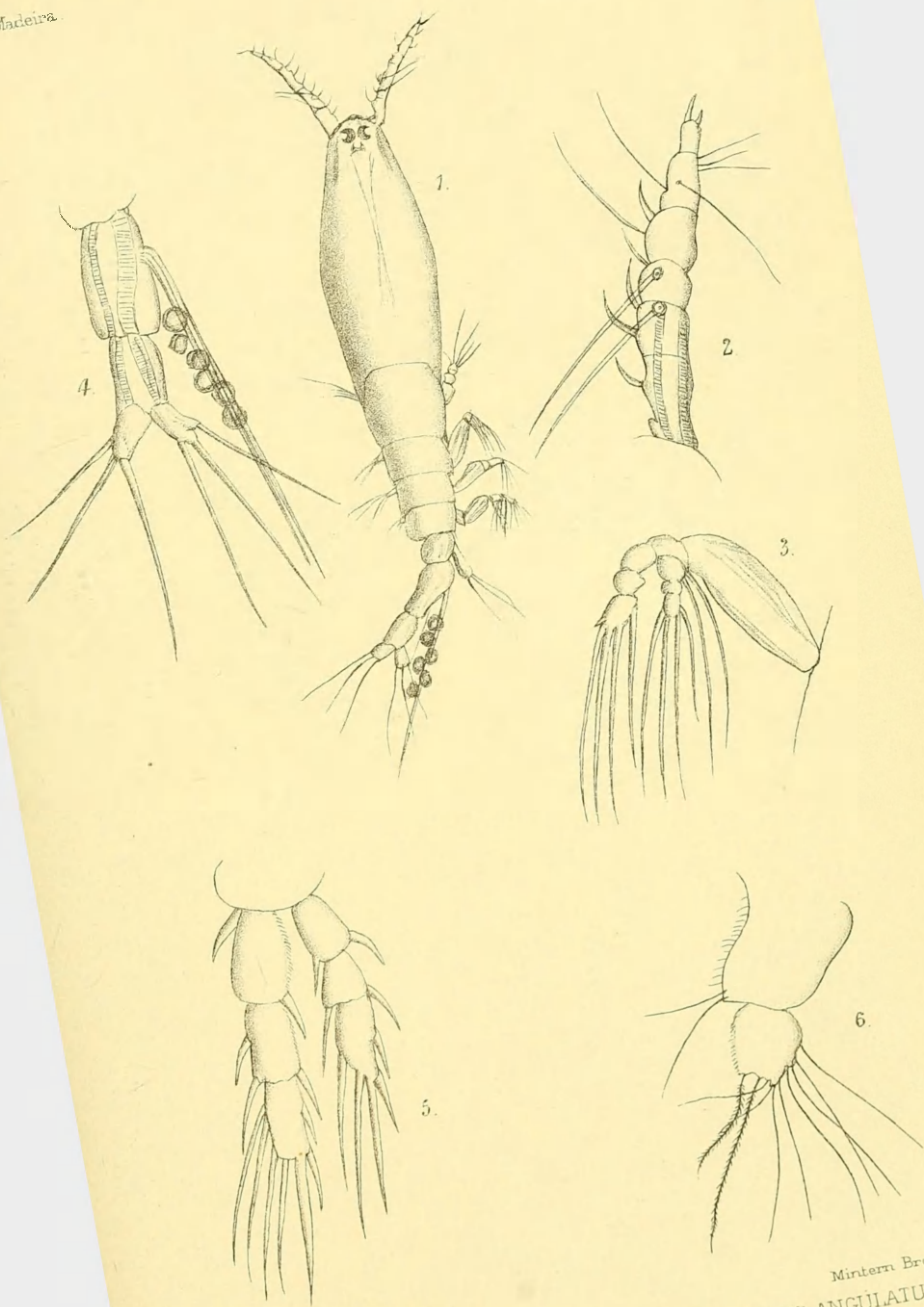
Montern imp.

1-5. MACHAIROPUS SANCTÆ-CRUCIS, n. sp.  
6-11. ACONTIOPHORUS ANGULATUS, n. sp.









I. C. Thompson del.

1-4. CYMBASOMA RIGIDUM. n. sp.

Mintern Bros. imp.

5-6. ACONTIOPHORUS ANGULATUS. n. sp.



