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ZOOLOGICAL RESULTS OF A TOUR IN THE FAR EAST.

MYSIDACEA, TANAIDACEA AND ISOPODA.

By W. M. Tattersall, *D.Sc., Keeper of the Manchester Museum.*

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MYSIDACEA, TANAIDACEA AND ISOPODA.

By W. M. TATTERSALL, *D.Sc., Keeper of the Manchester Museum.*

(Pls. XV, XVI, XVII.)

Dr. Annandale has kindly entrusted to me for examination the Crustacea belonging to the three orders Mysidacea, Tanaidacea and Isopoda (marine or aquatic species only) which he procured during his tour in the Eastern parts of Asia. The collection contains sixteen species, seven Mysids, one Tanaid and eight Isopods and has proved of exceptional interest. I am much indebted to Dr. Annandale for the opportunity of examining it.

The collections were made mainly in brackish or freshwater lakes and while the number of species collected is not large, some interesting results were obtained.

In L. Biwa, Dr. Annandale found an *Asellus* which I am unable to distinguish from the cosmopolitan *Asellus aquaticus* of Europe and America. This discovery fills a gap in the known distribution of this species and links up its known occurrence over the greater part of Europe and Northern Asia with the records of the same species from America. It is a survival of the time when Japan was connected by land with the rest of the continent of Asia and with North America by the land bridge to Alaska.

The most interesting specimens in the collection belong to a species of *Caecidothea* found in a well in Otsu. This genus has hitherto only been found in North America. The Japanese species is of further interest in the fact that it possesses distinct eyes and may thus be regarded as a more primitive species than its North American congeners, which are all blind. Otherwise it is a true *Caecidothea*, affording no characteristics to distinguish it generically. The record is a most interesting one from the point of view of geographical distribution.

The remaining species from Japan in the collection were found as follows :—

MARINE SPECIES.

Siriella watasei, Nak.
Gastrosaccus vulgaris, Nak.
Anisomysis ijimai, Nak.
Rhopalophthalmus egregius, Hansen.

BRACKISH WATER.

Neomysis awatschensis, Brandt.
L. Kasumi-ga-ura.

Fresh water.

Tachaea chinensis, Thiel.

Ogura Pond, near Kyoto.

Ichthyoxenus japonensis, Richardson.

Lake Biwa.

Among the Mysidacea *Siriella watasei*, *Gastrosaccus vulgaris* and *Anisomysis ijimai* are so far only known from the seas in the neighbourhood of Japan, while *Rhopalophthalmus egregius* has a wide distribution in the tropical and sub-tropical parts of the Indian and Pacific Oceans from India to Japan.

On the other hand the brackish water species, *Neomysis awatschensis*, is an immigrant from the North, known hitherto from Kamtschatka.

The two Isopods, *Tachaea chinensis* and *Ichthyoxenus japonensis*, are representatives of genera widely distributed in fresh and brackish water in India, Indo-Malaysia and the islands of the East Indies.

From China the following species were obtained, all from fresh water :—

Tai-Hu.

Tachaea chinensis, Thiel.

Exosphaeroma oregonensis, Dana.

Whangpoo River, below Shanghai.

Neomysis nigra, Nak.

Cleantis annandalei, Tattersall.

Exosphaeroma oregonensis, Dana.

Exosphaeroma chinensis, Tattersall.

Of these species, *Tachaea chinensis* is common to Japan and China and is a representative of a southern and tropical fauna. The other species have probably entered the brackish waters of China from the North and are evidence of a northern element in the fauna. *Neomysis nigra* is known from Japan and is very closely allied to the northern *N. awatschensis*. *E. oregonensis* is known from brackish water in Alaska and from several places along the western shores of N. America to as far South as California. The brackish water species of these groups of Crustacea found in China and Japan appear to suggest therefore at least two distinct sources of origin for that fauna.

The Mysids, *Neomysis awatschensis* and *N. nigra*, are distinctly immigrants from the North and there is no suggestion of a southern element in the Mysidacean fauna of the brackish waters of Japan and China. Both species are of the nature of relict species.

Among the Isopods of the same fauna *Tachaea chinensis* found in both China and Japan is of southern origin, while the two species of *Exosphaeroma* and *Cleantis annandalei* probably entered from the North. The purely freshwater species *Asellus aquaticus* and *Caecidothea kawamurai* are survivors of a fauna of much earlier times, when Japan was in land connection with both America and the rest of Asia.

The collections from the Talé-Sap are small and include the following species :—

MARINE.

Rhopalophthalmus egregius, Hansen.

FRESH TO BRACKISH WATER.

Nanomysis siamensis, gen. and sp. nov.
Apseudes sp.
Ligia exotica Roux.

The Mysid *Nanomysis siamensis* affords the only real evidence of the affinities of the brackish water fauna of this lake.

It is closely related to a species I have described from similar habitats in India (*Potamomysis assimilis*, W.M.T.) and shows no kind of relationship with the species found in China and Japan.

Four species have been described as new to science,

Nanomysis siamensis, gen. et sp. nov.
Caecidothea kawamurai, sp. nov.
Exosphaeroma chinensis, sp. nov.
Cleantis annandalei, sp. nov.

I desire to express my thanks to my wife for the drawings illustrating this paper.

Order **MYSIDACEA**.

Sub-order MYSIDA.

Family MYSIDAE.

Sub-fam. *SIRIELLINAE*.

Genus **Siriella**, Dana.

Siriella watasei, Nakazawa.

S. watasei, Nakazawa, 1910, p. 256, pl. viii, figs. 8, 36.

Locality :—Tateyama, mouth of Tokyo Bay, Japan, two females (presented by Dr. Nakazawa).

In the absence of males, these specimens agree very closely with the description given by Nakazawa. The species is only known as yet from Japanese waters.

Sub-fam. *GASTROSACCINAE*.

Genus **Gastrosaccus**, Norman.

Gastrosaccus vulgaris, Nakazawa.

G. vulgaris, Nakazawa, 1910, p. 253, pl. viii, figs. 6, 23, 24, 29, 35.
G. vulgaris, Zimmer, 1918, p. 15, text figs. 1-4.

Locality :—Osaka Market, Japan, 24. xi, 15, one male.

Zimmer has completed the description of this species by an account, with figures of the first two and last two pleopods of the male. He notes that, in the female, the first pair of pleopods are only one-branched instead of two-branched as described by Nakazawa. The species is known, so far, only from Japan and Formosa.

"Among large quantities of *Acetes japonicus*, Kish., on sale in the market, probably from the mouth of the Yeddo River. *N. A.*"

Sub-fam *RHOPALOPHTHALMINAE.*

Genus **Rhopalophthalmus,** Illig, 1906.

Rhopalophthalmus egregius. Hansen.

R. egregius, Hansen, 1910, p. 49, pl. vi, figs. 3a-k, pl. vii, figs. la-d.

R. egregius, Nakazawa, 1910, p. 255, pl. viii, figs. 12, 22.

R. egregius, Tattersall, 1915, p. 151.

R. egregius, Colosi, 1918, p. 6,

Locality:—Coast of Ariak Sea, Japan, several fathoms, twenty specimens of both sexes (presented by Dr. Nakazawa).

Across the channel from Singgora, Talé Sap, Siam, 4½ metres, 24. i. 1916, two males, 10 mm.

This species is evidently widely distributed in the temperate and tropical parts of the Pacific Ocean and is now known from off Java (Hansen), Japan (Nakazawa), Chilka Lake, Orissa (Tattersall), Torres Straits and Pacific Ocean between New Caledonia and New Zealand (Colosi) and Siam.

Sub-fam. *MYSINAE.*

Nanomysis, gen. nov.

First, second and fifth pleopods of the male, rudimentary, one-jointed and of the same form as the female. Third pleopod of the male with a single-jointed inner ramus and a three-jointed outer ramus which is nearly three-times as long as the inner ramus, the two terminal joints small, the first joint with three long setae on the distal end of the outer margin, the second joint with a single seta on the outer distal corner, the third joint with a single terminal seta longer than the joint.

Fourth pleopod of the male very long, extending to the end of the telson, inner ramus single-jointed, outer ramus four-jointed, the first joint half as long as the whole ramus and almost twice as long as the inner ramus, second joint slightly longer than the third, the terminal joint small and bearing two spiniform setae about four times as long as the joint, third joint with a single long and powerful seta on its outer distal corner twice as long as the third joint and reaching beyond the terminal setae.

Antennal scale narrowly lanceolate and two-jointed, setose all round. Masticatory lobes on the second, third and fourth joints of the endopod of the first thoracic limb well developed.

Tarsus of the posterior thoracic limbs four-jointed.

Inner uropod without spines on the inner margin.

Telson short, apex convex, not split, armed with a comb of spines between two stronger lateral spines, margins with spines along their entire length.

With the aid of Zimmer's key (1915) to the genera of the tribe *Mysini*, it is found that this genus falls into group II D and has its nearest ally in the arctic genus *Stilomysis*. It is to be distinguished from this genus mainly by the much different form of the telson, the absence of a row of spines on the inner margin of the uropods, the presence of lobes on the internal margin of the third and fourth joints of the endopods of the first thoracic limbs and by its very much smaller size.

Superficially and especially in the females, it resembles the genus *Potamomysis*, as recently redefined by me, and can only be distinguished by a close examination of the shape of the telson. But whereas in *Nanomysis*, the third pleopod of the male has a well developed outer ramus, in *Potamomysis* it is a single-jointed plate as in the female.

Nanomysis siamensis, sp. nov.

(Pl. XV, figs. 7-10.)

Locality:—All the specimens in the collection were captured in the Talé Sap, Siam, in January, 1916, at the following stations:—

St. 5. $\frac{1}{2}$ mi. E.N.E. of the mouth of the Patalung River, 2 metres, 13. i. 16, many, fragmentary. $\frac{9327}{10}$. (Fresh water.)

St. 8. $\frac{1}{2}$ mi. off shore a little south of the mouth of the Patalung River, $2\frac{1}{2}$ metres, 14. i. 16, about fifty specimens. $\frac{9328}{10}$, $\frac{9388}{10}$. (Fresh water.) TYPES.

St. 10. Koh Si Hah, 17. i. 16, eight specimens. $\frac{9329}{10}$. (Fresh water.)

St. 25. Narrow channel opposite Ban Lem Chak, near Singgora, $6\frac{1}{2}$ metres, 25. i. 16, one female, 4 mm., $\frac{9326}{10}$. (Sp. grav. 1·00425.)

Description:—Carapace produced in front only slightly in the form of a rostral projection with a pointed apex; the external portion of the frontal margin of the carapace on each side behind the eyes armed with a series of small spinules, those on the extreme outside the largest, the series gradually decreasing in size towards the centre; pleon with the first and fourth segments shortest and equal in size, second and third slightly longer and equal, fifth segment slightly longer than the fourth, sixth segment $1\frac{1}{4}$ times as long as the fifth, telson (Pl. XV, fig. 8) only $\frac{3}{4}$ of the length of the last segment of the pleon, about as long as broad at the base, not cleft, lateral margins armed along their entire length with about 10 small spines with an additional larger spine at the outside corners of the apex, latter slightly convex, half as broad as the base of the telson, and armed with a comb of twelve spines between the larger spines at each corner; inner uropod two and a half times as long as the telson, without spines on its lower inner margin; outer uropod only slightly longer than the inner, about $\frac{1}{10}$ longer.

Second joint of the antennular peduncle very short, first and third joints about equal in size, male appendage well developed and densely hirsute, inner flagellum not much more than one-third, certainly less than one-half of the length of the outer one and much more slender.

Antennal scale (Pl. XV, fig. 7) narrowly lanceolate in shape, about seven times as long as broad, two-jointed, distal joint one-seventh of the entire length of the scale, margin of the scale setose all round; the scale extends for $\frac{2}{5}$ of its length beyond its own peduncle and one-third of its length beyond the antennular peduncle; the second joint of the antennular peduncle is longer than the third and there is a prominent spine on the outer corner of the basal joint from which the scale springs.

Labrum without a spine; masticatory lobes well developed on the second, third and fourth joints of the endopods of the first thoracic limbs; tarsus of the third to the eighth thoracic limbs four-jointed.

First, second and fifth pleopods of the male, as in the female, consisting of a single-jointed uniramous plate.

Third pleopod of the male, (Pl. XV, fig. 9) biramous, inner ramus a single-jointed plate, outer ramus nearly three times as long as the inner ramus, three-jointed, first joint twice as long as the inner ramus, with three long setae on the outer margin near the distal end, second and third joints together about one-third of the first joint the second joint slightly the longer and having a single seta on its outer distal corner, third joint terminated by a single long seta, longer than the third joint but shorter than the second and third joints combined.

Fourth pleopod of the male (Pl. XV, fig. 10) very long, reaching to the posterior end of the telson, biramous, inner branch a single-jointed plate, outer branch four times as long as the inner, four-jointed, the first joint twice as long as the inner ramus, the second joint about half as long as the first, third joint slightly shorter than the second with a single very strong plumose spine on the outer corner, which is nearly twice as long as the joint and extends well beyond the spines on the terminal joint, latter quite short and terminated by two long spines four times as long as the joint.

Length of adult male, 5 mm.

This interesting little species is apparently very abundant in the Talé Sap, more abundant in the inner lake than in the outer. In the inner lake the water is quite fresh, whereas in the outer lake the corrected specific gravity of the water at the time these specimens were taken was 1·00425.

The species is therefore a true lacustrine form. It is readily distinguishable by the spinules on the carapace, the form of the telson and the character of the male pleopods. It is very closely allied to the Indian *Potamomysis assimilis* which lives in very similar habitats, but differs in the form of the telson, and particularly in having the third pleopod of the male rudimentary and of the same form as in the female.

Genus **Neomysis,** Czerniavsky.

Neomysis nigra, Nakazawa.

(Pl. XV, figs. 5-6.)

N. nigra, Nakazawa, 1910, p. 248, pl. viii, figs. 3, 17, 30.

Locality:—Whangpoo River, 5-10 miles below Shanghai, $5\frac{1}{2}$-$7\frac{1}{2}$ metres, 10. xii. 15, nine specimens up to 10 mm. A note on the label reads "Water fresh permanently, but affected strongly by tide. Very muddy. Bottom firm sandy mud" and a further label says that this species was "only caught at or near the bottom."

It is with some doubt that I refer these specimens to *Neomysis nigra*, Nak. Though the specimens measure up to 10 mm. in length, the males are still immature, to judge by the condition of the fourth pair of pleopods. Nakazawa's specimens, though measuring only 7-8 mm, were, from his description, fully mature. But otherwise I have failed to find any noteworthy point of difference and I tentatively refer them to this species until more material is available.

I may perhaps be allowed to supplement Nakazawa's description in a few particulars.

The segments of the pleon diminish successively in size from the first to the fifth, and the sixth segment is one and a half times as long as the fifth.

The telson (Pl. XV, fig. 6) is slightly longer than the last segment of the pleon. It is one and a half times as long as broad at its base. The apex is truncate, one quarter as broad as the base of the telson, and bears two pairs of spines, an inner shorter pair and an outer longer pair, which are about as long as the apex of the telson is wide. The lateral margins bear 18-19 spines extending the whole way down their length.

The inner uropod is about one and a half times and the outer uropod nearly twice as long as the telson.

I have given a figure of the telson and the eye of one of my specimens for comparison with the same parts of *N. awatschensis*, Brandt, a very closely allied species, also occurring in this collection. The two species differ in the following points:—

(1) In *N. nigra* the rostrum is broadly triangular with a pointed apex. In *N. awatschensis* the rostrum is a broadly rounded plate.

(2) *N. nigra* appears to have a broader and stouter eye than in *N. awatschensis*. In *N. nigra* the eye is slightly less than one and a half times as long as broad, with the peduncle half as wide as the eye is long and the pigment occupying the distal half of the eye (Pl. XV, fig. 5). In *N. awatschensis*, the eye is rather more than one and a half times as long as broad, the peduncle only $\frac{2}{5}$ as wide as the eye is long and the pigment occupying less than half of the eye, (Pl. XV, fig. 2).

(3) In the form of the fourth pleopod of the male.

In my most mature male, the fourth pleopod does not extend the whole length of the last segment of the pleon and has the first joint of the outer branch only one and a half times as long as the second, while the terminal setae are only two-thirds the length of the last joint.

Nakazawa says that the outer branch of the fourth pleopod of the male reaches to the middle of the telson, that its proximal joint is four times as long as the distal and that the terminal filaments are longer than the distal joint.

In *N. awatschensis*, the fourth pleopod of the male reaches to the middle of the telson, the proximal joint of the outer branch is double the length of the distal and the terminal setae are rather more than half as long as the distal joint (Pl. XV, fig. 4).

This species is also very closely allied to *N. intermedia*, Czern., but differs in the form of the rostrum and, to judge from Czerniavsky's figures, also in the form of the fourth pleopod of the male.

N. nigra was found by Nakazawa in the Lake of Hamana, a brackish inlet of the sea, and also in the Gulf of Tokio, both localities in Japan. Its occurrence in practically a similar habitat in China is interesting.

Neomysis awatschensis, Brandt.

(Pl. XV, figs. 1-4.)

Mysis awatschensis, Brandt, 1851, p. 126.
Mysis awatschensis, Czerniavsky, 1882, p. 22, pl. xviii, figs. 13-17.
N. awatschensis, Zimmer, 1904.
N. awatschensis, Derzhavin, 1913, p. 197.

Locality:—Lake Kasumi-ga-ura, Japan, 15. x. 15, near bottom, about 30 ft., abundant, up to 10 mm.

This species does not appear to have been redescribed since Brandt published his short account of the species in 1851, except for Czerniavsky's brief diagnosis drawn up from specimens in the Petrograd Museum. This description is based on female examples and it is necessary to supplement it by an account of the pleopods of the male.

The rostrum is in the form of a broadly and evenly rounded plate, not pointed at the apex.

The first five segments of the pleon are more or less subequal while the sixth segment is one and a half times as long as the fifth. The telson (Pl. XV, fig. 3) is as long as the sixth segment of the pleon, one and three quarter times as long as broad at its base, apex truncate, one quarter of the breadth of the telson at its base. The lateral margins of the telson bear about fifteen spines ranged along the whole of their length and the apex bears two pairs of spines, an inner shorter pair and an outer longer pair.

The inner uropod is one and a half times as long as the telson and the outer uropod twice that length.

The eye (Pl. XV, fig. 2) is slightly more than one and a half times as long as broad, the peduncle two-fifths as wide as the length of the eye and the pigmented portion occupying less than one-half of the eye.

There is a prominent spine on the labrum.

The peduncle of the antennules is about one-half of the length of the antennal scale. The latter projects for two-thirds of its length beyond the antennal peduncle and has two prominent spines on the basal joint from which it springs, one on the outer distal corner and the other on the inner lower corner. The scale (Pl. XV, fig. 1) is about eleven times as long as broad, the terminal joint one-fifth of the total length and acutely pointed.

The tarsus of the third to the fifth thoracic limbs is seven-jointed, of the sixth and seventh limbs six-jointed and of the last thoracic limb eight-jointed. The flagellum of the exopod is nine-jointed and the basal joint of the latter has a small spine on its outer distal corner. The lobes on the inner margin of the third and fourth joints of the endopod of the first thoracic limbs are well developed.

The fourth pleopod of the male (Pl. XV, fig. 4) is very long, reaching to the middle of the telson. The proximal joint of the outer ramus is twice as long as the distal joint which in its turn is one and a half times as long as the two terminal setiform processes.

I have already alluded to the close relationship of this species to *N. nigra* and pointed out that it may be distinguished by the characters of the rostrum, eye and fourth pleopod of the male.

It is, however, even more closely allied to *Heteromysis intermedia*, Czerniavsky, which is a true *Neomysis*, and Zimmer has suggested that the two species are probably synonymous. A fuller description of *N. intermedia* is badly needed. Nakazawa has recorded the latter from Japan but has not offered any detailed description of his specimens. The only serious point in which it differs from *N. awatschensis* is in the form of the fourth pleopod of the male. Czerniavsky describes this appendage as having four joints in the exopod, the first and second of which are equal in length and each as long as the inner ramus, the third and fourth joints quite minute and sub-equal, and the two terminal setae short but longer than the combined third and fourth joints. His figure bears out this description, but I am bound to confess that the figure depicts an appendage which does not look to be fully formed and which belongs in reality to an immature male. Until this point is cleared up by an examination of fully adult specimens it is impossible to regard the two species as synonymous.

N. awatschensis is recorded from Kamtschatka by Brandt, Czerniavsky and Derzhavin. The latter author records it as abundant in the brackish water of the rivers of the Kamtschatka peninsula which drain the large series of relict lakes found there. Its habitat in Japan is of precisely the same nature.

"There is an important fishery for these little Mysids in Kasumi-ga-ura, a lagoon of almost fresh water on the Pacific Coast of the Main Island of Japan. They are caught in a peculiar kind of large trawl, the bag of which is formed of very coarsely woven stuff. *N. A.*"

Genus **Anisomysis**, Hansen, 1910.

Anisomysis ijimai, Nakazawa.

A. ijimai, Nakazawa, 1910, p. 252, pl. viii, figs. 5, 14, 27, 33.
A. ijimai, Zimmer, 1915, p. 171.

Locality:—Tateyama, mouth of Tokyo Bay, Japan, numerous specimens (presented by Dr. Nakazawa).

Zimmer has rightly referred *Cryptomysis lamellicauda*, Hansen, to the genus *Anisomysis* and called attention to its very close resemblance to the present species. The only striking point of difference is in the number of curious processes on the inner margin of the second joint of the mandibular palp, 7-8 in *A. ijimai* and 13 in the only known specimens of *A. lamellicauda*. At first I was inclined to consider these species as synonymous but I think perhaps it would be well to await the the examination of further specimens from the type locality of *A. lamellicauda*, especially of male specimens, before deciding this point.

Zimmer, whose recent work on the Mysidacea, has added very largely to our knowledge of the group and whose attempt to systematise the species of the tribe Mysini is of the greatest value, refers both the genera *Cryptomysis*, Hansen, and *Kreagromysis*, Illig, to the synonymy of *Anisomysis*, and the latter genus, therefore, now includes the following species :—

A. laticauda, Hansen ;
A. ijimai, Nakazawa ;
A. lamellicauda, Hansen ;
A. mixta, Nakazawa ;
A. bifurcata, Tattersall (=*Kreagromysis megalops*, Illig) ;
A. australis, Zimmer.

These species agree fundamentally with one another in the form and characters of the pleopods of the male (the male of *A. lamellicauda* is unknown, but in view of the very close affinity of this species with *A. ijimai* there can be little doubt that it also has male pleopods like the other species). In view of this fundamental agreement among this group of species, Zimmer naturally raises the question of the value of the form of the telson as a character of generic importance. In the group generally, the form of the telson has been very largely used as a generic character in the past, and in the main, rightly so. But, for the present, it looks very much as if *Anisomysis* was a genus characterised by great variability in the shape of the telson, with a greater degree of constancy in the other characters. As Zimmer points out, if the shape of the telson is a character of generic importance, the above six species will fall into four genera, viz.:—

ANISOMYSIS	*A. laticauda*.
CRYPTOMYSIS	*A. ijimai*, *A. lamellicauda*.
KREAGROMYSIS	*A. bifurcata*.
A new genus	*A. mixta*, *A. australis*.

Future research may demonstrate the existence of groups of species which fall naturally into these genera and justify their separation, but in the present extent of our knowledge Zimmer's arrangement is the more acceptable.

Order TANAIDACEA.

Fam APSEUDIDAE.

Genus **Apseudes**, Leach.

Apseudes sp.

Locality:—½ mi. off shore a little south of the mouth of the Patalung River, 2 metres, Talé Sap, 14. i. 16, one specimen.

This specimen belongs almost certainly to a new species but, in the imperfect state of the specimen owing to the breaking off of the uropods, it is inadvisable to give it a name.

It belongs to that group of the genus, of which *Apseudes talpa* Mont., is the type, which is characterised by the presence of eyes, the absence of a spiniform rostral projection and the presence of a prominent spine on the labrum.

In the present specimen, the rostral plate is in the form of a low triangle with an obtusely rounded apex, the height of the triangle less than one-third of the basal distance between the eye lobes. The latter are well developed and the visual elements consist of five scattered groups of about six or seven ocelli each, with intervals between them devoid of ocelli or pigment.

There are no ventral spines on the body nor any prominent spine on the antero-lateral corners of the first free thoracic segment.

The outstanding feature of the specimen is the slenderness of the chelate leg. The carpus is about four times as long as broad, longer than the propodus, of approximately equal width throughout and without any prominent spines. The hand is long and slender and not swollen, while the finger is about one-half the length of the hand. The limb has no distinctive armature.

The third thoracic limb has one stout spine on the merus, two on the carpus and two on the propodus, hidden among the longer setae arming these limbs. The specimen measures 4 mm. in total length.

From information sent with the collection, this specimen was collected in absolutely fresh water in the inner lake of the Talé Sap. I do not know of any previous record of this essentially marine genus from practically fresh water.

" The water at the point at which this specimen was obtained is, almost certainly, always quite fresh, though it is affected to a slight extent by the tides, at any rate at times. *N. A.*"

Order ISOPODA.

Sub-order *ASELLOTA*.

Fam. ASELLIDAE.

Genus **Asellus**, St. Hilaire.

Asellus aquaticus (Linn.).

A. aquaticus, G. O. Sars, 1897, p. 97, pl. XXXIX.
A. aquaticus, Racovitza, 1919, p. 37, text figs. 1-6.
Asellus, sp., Hilgendorf, 1874, p. 39.

A. hilgendorfii, Bovallius, 1886, p. 13.
A. hilgendorfii, Hilgendorf, 1893, p. 1.

Locality:—Stations 5,6,8,10,14 and 22, Lake Biwa, Japan, abundant, length up to 10 mm.

It was a matter of great interest to discover this cosmopolitan species in the collections from Japan. After careful examination, I can find no vital points of difference between these specimens and those I have examined from this country. The Japanese form is perhaps somewhat smaller and slightly narrower and there are fewer setae on the second pleopod of the male, but these differences are very slight.

In 1874, Hilgendorf recorded a species of *Asellus* from Japan in the following words "In Graben der Stadt Yedo ist von mir eine Süsswasser-Assel aufgefunden worden. Die fragliche *Asellus*-Art is von der Europaeischen (dem *A. aquaticus*) in mehrfacher Beziehung verschieden: der Lieb ist schmaler, das vierte Beinpaar stark verkurzt und am letzten Segment iste die Spitze einfach gerundet (in der Mitte nicht eingekerbt). Ein Vergleich mit den Nordamerikanischen Arten ist mir nicht möglich."

On the strength of this, Bovallius in 1886 named the species found by Hilgendorf as *A. hilgendorfii* without having seen specimens and merely quoting the above passage from Hilgendorf as a diagnosis of the species.

In 1893, Hilgendorf published a few notes on this species. He says that his previously published remarks were written after a comparison of his Japanese specimens with the description and figures given by Bate and Westwood.

On comparing his Japanese specimens with actual specimens of *A. aquaticus* from Europe he found that the differences in the shape of the posterior end of the metasome and in the comparative lengths of the fourth and fifth thoracic limbs, which he had noted as characterising the Japanese form, did not in reality exist. He does note, however, that in *A. aquaticus* from Europe the fifth thoracic limbs are only 1/8 shorter than the fourth, while in the Japanese specimens, the fifth thoracic limbs are from 1/4-1/3 shorter than the fourth. He notes as further differences that (1) *A. hilgendorfii* is a more slender form than *A. aquaticus*, 3 1/3 times longer than broad as against 2 1/2 times in *A. aquaticus*, (2) the second antenna is only 3/5 of the total length of the body as against 4/5 in the European form and (3) that the uropods in *A. hilgendorfii* have a shorter and broader basal joint and shorter branches. He goes on to remark that in the number of ocelli of the eyes, and, what is of great importance, in the form of the pleopods of the male, the Japanese species agrees absolutely with the European one.

With regard to the differences named by Hilgendorf I find (1) the European species is about three times as long as broad, certainly over 2 3/4, (2) that there is no appreciable difference in the length of the antenna in Japanese and European specimens, (3) that the character of the uropods is not a safe one to rely on, as these appendages are constantly found in a regenerated form after having been broken off, (4) that the difference in the length of the fourth and fifth thoracic limbs in two measured specimens, one of a Japanese specimen and the other of a British are as follows:—in the Japanese specimen the fifth thoracic limb was ·8 of the length of the fourth and in the British specimen ·85.

These differences, therefore, are seen to be very slight and of little importance, and in view of Hilgendorf's positive statement that the pleopods of the male agree perfectly with those of European specimens, may be ignored. I think, therefore, that there is very little doubt that *A. hilgendorfii* should be relegated to the synonymy of *A. aquaticus*. This widely distributed species is now known to occur all over the Palaearctic regions of Europe and Asia and is also found in N. America.

"In Lake Biwa this species was taken in depths of from 180 to 260 feet and appeared to belong to the deep-water fauna, with the molluscs *Pisidium casertanum* (Poli), *Valvata biwaënsis* and *V. annandalei*, Preston, the leech *Ancyrobdella biwae* Oka and the Planarian *Bdellocephala annandalei*, Ijima and Kaburaki, with which it was taken in great abundance. Curiously enough, however, it was also taken in artificial concrete breeding tanks for fish at Hikone near the east side of the lake and, in very large numbers, in an ornamental stone basin containing only a few cubic feet of water and dead leaves in a temple-grove at the same place. *N. A.*"

Genus **Caecidothea**, Packard.

Caecidothea kawamurai, sp. nov.

(Pl. XV, figs. 11-18.)

Locality:—From a well inside a house in the city of Otsu, Japan, 8. i. 1915, collected by Dr. T. Kawamura, three specimens, two males 16-17 mm., one female 11 mm. The well was a shallow one in which light penetrated to the bottom.

Description:—Body (Pl. XV, fig. 11) narrowly elongate in shape, seven times as long as broad, of even width throughout.

Head nearly twice as broad as long, frontal margin slightly concave.

Eyes present as a group of three ocelli on each side of the head, about the centre of the lateral margins.

Thoracic segments more or less subequal in size, and quadrangular in shape; each segment has an impressed line running across the segment at the anterior end; in addition the first segment shows a V-shaped impressed line or groove; lateral parts of the thoracic segments with a few short and scattered setae.

Pleon about one quarter of the whole length of the body, one and three quarter times as long as broad, posterior margin slightly produced into an obtuse lobe between the bases of the uropods.

First antennae short, not extending beyond the distal end of the fourth joint of the peduncle of the second antennae, peduncle equal in length to the first three joints of the peduncle of the second antennae, third joint the longest and narrower than the first two, flagellum composed of thirteen joints.

Second antennae more than half as long as the body, first three joints of the peduncle short, fifth joint one and a half times as long as the fourth and somewhat narrower, flagellum composed of nearly one hundred joints.

The mouth parts present no special points of distinction. They agree essentially with those of *C. stygia,* as figured by Packard.

I give herewith figures of the maxillipede, second, third and eighth thoracic limbs (Pl. XV, figs. 12-15) of the male, which will serve to denote the details of these appendages. The second thoracic limbs are prehensile with the propodal joint dilated and armed with two spines on the proximal part of the palmar margin. They differ from those of *C. stygia,* in having the propodus less dilated and without triangular processes. In this character they approach *C. richardsonae,* Hay, and *C. smithsii,* Ulrich. There is very little difference between the sexes in the form of the second pair of thoracic limbs, those in the female being of essentially the same form as those in the male but slightly smaller.

The first pleopod of the male (Pl. XV, fig. 16) has the sympod armed with four coupling hooks. The ramus consists of a broadly oval plate, twice as long as broad and furnished with setae on the outer and posterior margins, the inner margin being unarmed.

The second pleopod of the male (Pl. XV, fig. 17) differs from the same appendage in *C. stygia* in having a long curved process from the basal joint of the endopod which turns inward along the inner margin of the sympod. The whole appendage is, in fact, curiously like the same appendage in *Asellus aquaticus.*

The third pair of pleopods of the male (Pl. XV, fig. 18) consist of a short sympod, an oval uni-jointed endopod and a very large two-jointed exopod having the posterior margin truncate and armed with a few plumose setae.

The fourth and fifth pairs of pleopods of the male consist of a short sympod and two rami, the endopod unjointed, the exopod slightly larger than the endopod and two-jointed.

The uropods in the male are longer than the pleon, basal joint long and narrow equal to half the length of the appendages, endopod equal in length to the basal joint but narrower and terminated by a tuft of setae, exopod about half the length of the endopod and still narrower, also terminated by a tuft of setae.

In the female the uropods are slightly shorter than the pleon and the exopod is about two-thirds of the length of the endopod. I am unable to say whether this apparent sexual difference is constant, because there is only one female in the collection. The uropods of Asellidae are very easily broken off and it is difficult to distinguish regenerated appendages from those which have had a normal growth without injury.

This species is distinguished at once from all the other species of the genus by the presence of distinct though very small eyes. In this respect it is the most primitive species of the genus. It may also be distinguished by the relatively shorter antennae, the form of the second thoracic limbs and especially by the form of the first pleopod of the male. The latter is curiously similar to the same appendage in *Asellus aquaticus,* which is considered to be the most primitive of the species of *Asellus,* and *C. kawamurai* is, I think, the most primitive of the species of *Caecidothea.*

This new form removes one more of the characters separating the genus *Caecidothea* from *Asellus*, the presence of eyes in the latter and their absence in the former. There remains only the general form of the body and the size of the head and pleon to separate the two, and among the known species of *Asellus* and *Caecidothea* there are all grades of shape, which would make a continuous series of connecting forms. The validity of the genus *Caecidothea* is indeed doubtful.

This species is a most interesting addition to the fauna of Japan. Its nearest allies are all American species, found in subterranean caves and springs in Kentucky, Tennessee, Texas and so on.

Sub-order *FLABELLIFERA*.

Fam. CYMOTHOIDAE.

Genus **Tachaea**, Sch. et Mein.

Tachaea chinensis, Thielemann.

(Pl. XVI, figs. 16–18.)

T. chinensis, Thielemann, 1910, p. 18, text figs., 12-20.

Localities :—

CHINA.

N.E. end of Tai Hu, near Moo Too, China, 1. xii. 15, 2 females, 7 mm.

Outskirts of Shanghai, in ditches and ponds, adhering to the carapace of *Caridina nilotica* subsp. *gracilipes* and *Palaemonetes sinensis*, 3 immature, 3-4·5 mm.

JAPAN.

Ogura Pond, near Kyoto, from *Leander paucidens*, 6 specimens, 6-9 mm. Lake Kasumi-ga-Ura, on the east coast 15. x. 15, from the carapace of *Leander paucidens*, sixteen, 6-9 mm.

These specimens, both from China and Japan, differ from the description and figures given by Thielemann in two particulars, (i) there is a distinct lacinia mobilis on the mandible (Pl. XVI, fig. 16), tipped by two or three small setae (ii) the single strong curved spine on the first maxilla (Pl. XVI, fig. 17) is longer than Thielemann shows and more like that figured by Stebbing for *T. spongillicola*.

These small differences bring *T. chinensis* much more closely in agreement with *T. spongillicola* and I am inclined to doubt whether they are really separate species. But I have not seen specimens of Stebbing's species and the question cannot be decided until specimens are compared from both localities.

Hansen (1890) in his monograph on this and allied genera, figures a six-jointed maxillipede for the type species *T. crassipes* and states in the diagnosis of the genus that the second and third joints are fused, thus accounting for the reduction in number of the joints of the appendage from seven to six.

Stebbing (1907) in describing *T. spongillicola*, says that the maxillipedes are decidedly only six-jointed and he explains the reduction in this species as due to the fusion of the sixth and seventh joints. A careful comparison and measurements of his figure show that in his specimen the second and third joints were not fused and that the explanation of the reduction in the number of joints is really due to the fusion of the sixth and seventh. *T. spongillicola* therefore is not in agreement with the generic diagnosis of *Tachaea* in this respect.

Thielemann describes and figures the maxillipedes of *T. chinensis* as five-jointed, and it is evident that, in this case, the second and third, and sixth and seventh joints are fused.

T. chinensis would then appear to combine the characters of *T. crassipes* and *T. spongillicola* as far as the maxillipedes are concerned. But these appendages are very small and delicate and the joints very difficult to make out and the condition which I have noticed in these Chinese and Japanese specimens may possibly explain the apparent differences in the three species. On the elongate second joint there are traces, visible at the sides, of a suture, but it is not continued across the joint. I take it that this represents a partial separation of the second and third joints and a similar incomplete suture is visible on the terminal joint indicating the partial separation of the sixth and seventh joints (Pl. XVI, fig. 18).

But in neither case could I trace the suture right across the joints, and I should describe the maxillipedes as five-jointed with partial separation of the second and last joints into two. It looks to me as if Stebbing saw a similar partial suture between the second and third joints, but not between the sixth and seventh joints in his species, while Thielemann does not mention either. My point is that the apparent differences in the descriptions and figures of the maxillipedes of the three species are not nearly so important as they seem at first and may be explained by the delicacy of the appendages and the difficulties of seeing the sutures.

There are three species of *Tachaea* known from fresh water, *T. lacustris*, Weber, from Sumatra, *T. spongillicola* from Calcutta, and *T. chinensis* from China and Japan. These three species are very closely related to one another and structurally there seems very little to distinguish them. But each has a very distinct habit. *T. lacustris* was found on Cyprinoid fishes, *T. spongillicola* in the canals of a freshwater sponge and the present specimens of *T. chinensis*, both from China and Japan, were found clinging to the carapaces of various freshwater Macrura, *Caridina*, *Palaemonetes* and *Leander*.

Thielemann's type specimens were obtained in the market at Shanghai, so the present collection provides the first indication of its habit and mode of life. I could not detect any differences between the Chinese and Japanese specimens. Both are characterised by a profuse development of black arborescent chromatophores on the body and the appendages.

"All my specimens were from pure fresh water, and were associated with small prawns of various genera. The common Indian species (*T. spongillicola*, Stebbing) is also found adhering to the external surface of the carapace of small freshwater prawns, especially when young, as well as in the canals of *Spongilla*. In neither species is the association of a permanent nature. *N. A.*"

Genus **Ichthyoxenus**, Herklots.

Ichthyoxenus japonensis, Richardson.

I. japonensis, Richardson, 1913, p. 561, text figs. 4–6.

Locality:—Lake Biwa, Japan, from *Acheilognathus* sp., February, 1915, six females, five males (presented by Dr. T. Kawamura).

Richardson's type specimens were taken from *Acheilognathus cyonostigma* (Jordan and Fowler) captured in Lake Biwa, and other specimens were found on various species of *Acheilognathus* and *Gnathopogon* from Lake Yago, Funayado, and Lake Biwa. The species is therefore fairly widely distributed in the freshwater systems of Japan. The present specimens are in agreement with Richardson's description and figures.

Family SPHAEROMIDAE.

Genus **Exosphaeroma**, Stebbing.

Exosphaeroma oregonensis, Dana ?

(Pl. XVI, figs. 1-5.)

E. oregonensis, Thielemann, 1910, p. 51, text figs. 41-47.

Locality:—Whangpoo River, about 10 miles below Shanghai, 6-7 metres, 10. xii. 15, on bottom of hard mud, eight specimens up to 6 mm. (water fresh but tidal).

Si Dong Ding, Tai Hu, China, $2\frac{1}{2}$ metres, 1. xii. 15, on muddy bottom with *Potamogeton* and other weeds, two specimens (fresh water).

S.E. end of Si Dong Ding, Tai Hu, China, 3. xii. 15, on lower surface of stones, about 50 specimens (fresh water).

I think this is the same species as that recorded from Japan by Thielemann (1910), but I am not so sure that it is Dana's species. Both this species and the following one have given me considerable trouble in their identification and I think it well to describe the appearance of the pleopods as they looked when dissected from spirit specimens, because it was mainly from this that I detected the presence of two species in this collection and also because the pleopods seem to me to depart from the descriptions of the pleopods of the Hemibranchiata as given by Hansen.

Pleopod 3 (Pl. XVI, fig. 3). Endopod with an opaque rather fleshy area on the inner proximal portion as indicated by the shading in my drawing. Otherwise both rami are transparent and I was not able to detect with certainty any regular branchial plications. Endopod with numerous plumose setae at the apex. Exopod two-jointed, distal joint edged with plumose setae all round, proximal joint without setae on the inner margin, but fringed with short setae on the outer edge.

Pleopod 4 (Pl. XVI, fig. 4). Endopod quite opaque and fleshy all over with two or three short plumose setae at the apex. Exopod two-jointed, inner proximal two-thirds, opaque and fleshy, rest transparent, a few short setae on outer edge of proximal joint, distal joint with a few (six or seven) plumose setae on its margins.

Pleopod 5 (Pl. XVI, fig. 5). Both rami thick and fleshy and opaque, exopod two-jointed, outer margin of proximal joint with a few short setae, distal joint of peculiar shape the pointed apex of the distal protuberance studded with small spines, a pad of similar spinules on the inner proximal margin of the distal joint ; endopod without setae.

None of the males which I dissected had an appendix masculina on the second pleopod but as none of my specimens measured more than 6 mm., they may not have been fully grown. I could not detect with certainty any definite branchial plications on any of the pleopods.

The general form of this species is shown on pl. XVI, fig. 1. This figure agrees very closely with Thielemann's figure and my specimens agree with his description very closely except that pleopod four has fewer plumose setae on each ramus.

As Thielemann points out this species differs from Hansen's description of the pleopods of the hemibrachiate Sphaeromids in having plumose setae on the fourth pleopods. Hansen says that the fourth and fifth pleopods are never furnished with such setae.

I have examined six specimens of *E. oregonensis*, Dana, sent me by the United States National Museum, from Sitka, Alaska, on the beach. Five of these are males measuring 10 mm. and one a female measuring 8 mm. The pleopods agree substantially with those I have described above, the fourth pair has plumose setae on each ramus, more numerous than in my specimens but otherwise the same. The males also possess an appendix masculina, from which I have concluded that if my specimens belong to the same species, the males are still immature.

All the males of these Alaskan specimens have a dense fringe of hairs on the fourth, fifth and sixth joints of the fourth and fifth pairs of thoracic limbs, but these hairs are not present in the single female. Hansen says that the thoracic limbs of the hemibranchiate Sphaeromids never exhibit sexual differences. If the above specimens from Alaska have been correctly interpreted, *E. oregonensis* forms an exception to this general statement. None of the Chinese specimens exhibit these hairs, but they are otherwise so closely in agreement with the Alaskan specimens that I have regarded them as immature and not fully grown, the appendix masculina of the second pleopods in the male and the fringe of hairs on the fourth and fifth thoracic limbs being both characters denoting sexual maturity.

If all the records ascribed to *E. oregenensis* refer to the same species, it has a very wide distribution in the shallow waters of Eastern Asia from China to Kamtschatka and Western America from Alaska to California. It is also capable of living equally well in pure sea-water or in fresh water as in China or Japan and in Alaska as recorded by Richardson.

It is possible that the specimens recorded by Thielemann from Japan and here from China are brackish water varieties of the type, characterised by their smaller size and the modification of their secondary sexual organs and it is also conceivable that the general appearance of the pleopods and the absence of definite plications in my specimens from China, may be correlated with the special habitat in which they were found.

Exosphaeroma chinensis, sp. nov.

(Pl. XVI, figs. 6-15.)

Locality:—Edge of Whangpoo River, between Shanghai and Wu Sung, China, on weeds and lower surface of stones, sixteen specimens up to 6 mm., $\frac{9928}{10}$. [Types.]

Whangpoo River, about 10 miles below Shanghai, 6-7 metres, 10. xii. 15, on bottom of hard mud, one specimen, $\frac{9359}{10}$.

This species is very closely related to the preceding one and it will be sufficient to point out the differences between the two. In general appearance the two forms are almost exactly alike and the figure which I have given of *E. oregonensis* would do equally well for this species. I have also figured the first and second antennae (Pl. XVI, figs. 6-7) the maxillipede and the second and eighth thoracic limbs (Pl. XVI, figs. 9-11) of *E. chinensis*. They present no marked differences from those of *E. oregonensis*, but will be useful for comparison with Thielmann's figures of the latter species.

E. chinensis differs from *E. oregonensis* in the following points:—

(1) The epistome is smaller and its postero-lateral processes much shorter than in *E. oregonensis*. Compare my figure (pl. XVI, fig. 8) with that given by Thielemann.

(2) The exopod of the uropod is much smaller compared with the endopod, than in *E. oregonensis*. Compare Pl. XVI, fig. 2 with Pl. XVI, fig. 15.

(3) In the pleopods.

(a) Although *E. chinensis* is only 6 mm. in length, the males possess an appendix masculina. (Pl. XVI, fig. 12).

(b) Pleopod three has both rami transparent without any opaque or branchial area.

(c) Pleopod four (Pl. XVI, fig. 13) has the endopod completely opaque and branchial and without plumose setae; the exopod is completely transparent, without branchial area, two-jointed, distal joint with several plumose setae on its margins.

(d) Pleopod five (Pl. XVI, fig. 14) has both rami opaque and completely branchial, exopod two-jointed, both rami without plumose setae, distal joint of the exopod not of peculiar shape and without the spinulose protuberance seen in my specimens of *E. oregonensis*.

A comparison of the figures I have given of the pleopods of *E. chinensis* with those given for *E. oregonensis* will bring out these differences.

To judge from the specimens in this collection, *E. chinensis* is common in the tidal waters connecting the Tai Hu with the sea but was not found in the Tai Hu itself, whereas *E. oregonensis* is most abundant in the Tai Hu and sparingly found in the Whangpoo River. In other words *E. oregonensis* can tolerate or even prefers a much more purely freshwater habitat than *E. chinensis*.

Sub-order *VALVIFERA*.

Family IDOTEIDAE.

While it is comparatively easy to decide that the species described below is new to science, it is a much more difficult matter to determine to which of the existing genera of the family it should be referred. In my endeavours to arrive at a proper conclusion of this question I have encountered many discrepancies in existing generic definitions and have experienced much of the confusion which still exists in this family, in spite of the work of recent authors. There is much diversity of opinion and no little inconsistency as to what constitutes a generic character and it is not an infrequent experience to find one character used as a basis for generic separation in one group of species and as cheerfully ignored in another group by the same author. Much of the existing chaos is due to the imperfect descriptions given by earlier authors and as these early species are retaken and recognised and their diagnoses brought up to date in the light of accummulated knowledge, order is slowly evolving itself out of the confusion. But much still remains to be done, and a thorough revision of the family is needed. This is not the place to attempt to do this, for the material at my disposal is inadequate. But I may perhaps be allowed to point out some of the discrepancies and inconsistencies which I have encountered in my search through the literature, in the hope that some other worker with more abundant material may eventually elucidate my difficulties.

Collinge (1918) in a paper on the oral parts of the Idoteidae has summarised the existing genera of the family in a table, giving the number of spines on the inner lobe of the first maxilla, the number of joints on the palp of the maxillipede and the number of complete segments and sutures in the metasome.

Excluding the Glyptonotinae and Mesidoteinae and the anomalous genera *Symmius*, Richardson and *Chiriscus*, Richardson, we find that the remaining genera in Collinge's table may be grouped into three divisions according to the number of joints in the palp of the maxillipede, as follows:—

Palp of the Maxillipede five-jointed.

Zenobiana, Stebbing; *Pentidotea*, Richardson; *Engidotea*, Barnard; *Cleantiella*, Richardson; *Paridotea*, Stebbing; *Glyptidotea*, Stebbing; *Pentias*, Richardson; *Crabyzos*, Spence Bate.

Palp of the Maxillipede four-jointed.

Idotea, Fabricius; *Euidotea*, Collinge; *Colidotea*, Richardson; *Eurymmerus*, Richardson; *Erichsonella*, Benedict; *Synisoma*, Collinge.

Palp of the Maxillipede three-jointed.

Edotia, Guér.-Mén.; *Synidotea*, Harger.

Our species falls into the first of these three groups in having the palp of the maxillipedes five-jointed. The genera in this group are separated from one another mainly on the characters of the segmentation of the metasome. I reproduce here that part of Collinge's table which deals with this character.

	Metasome. Number of Segments.	Sutures.
Zenobiana ..	3-5	(1)
Pentidotea ..	3	1
Engidotea ..	2	2
Cleantiella ..	2	(2)
Paridotea ..	1	3
Glyptidotea ..	1	3
Pentias ..	1	3
Crabyzos ..	1	2

We may complete the table by adding that the type species of *Zenobiana* has one suture on the metasome and, according to Miers' figure of *Cleantis isopus*, the type of the genus *Cleantiella*, this genus has two sutures on the metasome.

It will be seen that the genera *Paridotea*, *Glypidotea* and *Pentias* are identical in the characters so far noticed and it is difficult to see on what grounds they are separated.

Cleantiella and *Engidotea*, which agree in the form of the maxillipedes and in the segmentation of the metasome, are distinguished readily by the flagellum of the second antenna which in the former is uni-articulate and in the latter, multiarticulate.

In attempting to place our species in one of the genera of this group we meet with our first difficulty. It has four segments in the metasome, and one suture, and is therefore apparently referrable to the genus *Zenobiana*. But this conclusion is open to a good many objections which it is necessary to inquire into.

Collinge's table of genera of the Idoteidae does not include the genus *Cleantis*, Dana. He presumably considers this genus as a synonym of *Zenobiana*, an opinion I have myself expressed previously. *Cleantis* was instituted by Dana in 1849 for the type species, *C. linearis*, Dana, captured off N. Patagonia. The genus and species were described and figured more fully in Dana's great work on the Crustacea of the United States Exploring Expedition. From that work, I have transcribed the following generic definition:—Outer antennae much the longer, not geniculate, five to six-jointed, without a flagellum. Feet of the fourth pair very much shorter than the third; last four pairs gradually increase in length. Outer abdominal plates or opercula having a small lamina attached inside at the articulation.

We may remark at once, that if Dana's type species really had uropods of the kind he describes (and his description is borne out by his figure, pl. 46, fig. 9k) none of the species subsequently added to the genus *Cleantis* have been correctly referred. No notice of this remarkable character of the genus *Cleantis* seems to have been taken by subsequent writers and I can find no reference to the form of the uropods in species referred to this genus except in the case of *C. strasseni*, in which Thielemann figures a uropod of the type more normally met with in Idoteidae, a flattened plate, divided by a suture near the distal end into a large proximal joint, the protopodite, and a small distal joint, the endopodite, with a strong plumose seta at its base on the outer corner of the basipodite. The form depicted by Dana, in which both endopodite and exopodite are present, is confined to the genera *Glyptonotus, Chiridotea*, *Macrochiridothea*, and *Mesidotea*. It seems almost certain that Dana was in error on this point, but the matter is one that wants clearing up before the status of the genus *Cleantis* can be satisfactorily settled.

Further with regard to the maxillipede, Dana only figures three joints in the palp. Here again Dana is probably in error, but it is most important to know how many joints there are in the palp of the type species, for this character is of first value for the classification of the species into genera.

Two other characters in Dana's definition of the genus deserve special mention. The flagellum of the antennae is uni-articulate and the fifth pair of thoracic limbs is conspicuously shorter than the remainder.

It will be recognised, therefore, that for two important characters, the palp of the maxillipedes and the form of the uropods, our information with respect to the type species of *Cleantis* is deficient or of doubtful accuracy.

It is clear that if Dana's description is borne out by subsequent examination of the type species, none of the species referred to the genus by later authors can remain within its limits. If Dana was in error on the two characters named, what is the extent of his error ?

It is now necessary to consider the species referred to the genera *Cleantis* and *Zenobiana*.

The genus *Zenobia* was instituted by Risso in 1826 for two species, *Zenobia prismatica* and *Zenobia mediterranea* both of Risso. These two species have since been shown to be synonymous. Miers, (1881) in his revision of the family treats *Zenobia* as a subgenus of the genus *Idotea*, characterised as follows:--" Post-abdomen composed of four or five distinct segments, visible in a dorsal view, (species small, or minute, with a few-jointed antennal flagellum). Zenobia ? " To this sub-genus, as thus defined, Miers refers both species of Risso and two new ones, *Idotea* (*Zenobia*) *whymperi*, Miers, and *I.* (*Z.*) *danai*, Miers.

Dollfuss (1895) restored Risso's name to full generic rank and in the same year Stebbing pointed out that the name was preoccupied and changed it to *Zenobiana*.

No other species of the genus have been described as such, but Issel (1913) definitely regards the genus *Cleantis* of Dana as a synonym and refers to all the species of *Cleantis* as species of *Zenobiana*. Bate and Westwood expressed very much the same opinion and in 1911 I pointed out that if this opinion was accepted, Dana's name had priority.

The following species of the genus *Cleantis* have been described subsequent to the type species, *C. linearis*, Dana :—

- *C. planicauda*, Benedict.
- *C. tubicola*, G. M. Thomson.
- *C. granulosa* Heller.
- *C. isopus*, Miers.
- *C. heathii*, Richardson.
- *C. occidentalis*, Richardson.
- *C. strasseni*, Thielemann.
- *C. japonica*, Richardson.

In addition, Miers, 1881, referred three species to the genus, which have since been placed in the genus *Erichsonella*, Benedict (=*Erichsonia*, Dana) and do not concern us here.

Of the above eight species of *Cleantis*, *C. isopus*, Miers has since been made the type of a new genus *Cleantiella*, Richardson, by reason of the "differences in the shape of the body, which is broader and more flattened, and in the character of the legs, and to the fact that the abdomen is composed of but two segments."

It will be useful to set out in tabular form the characters of the species of *Cleantis*, *Cleantiella* and *Zenobiana*, as regards the palp of the maxillipedes, the segmentation of the metasome and the flagellum of the antennae.

	Joints in palp of Maxillipede.	*Metasome.*		*Flag. of Antennae.*
		Segments.	*Sutures.*	
ZENOBIANA :—				
prismatica, Risso	5	4	1	1–4 ♂, 1 ♀
whymperi, Miers	..	4	0	1
danai, Miers	..	5	?	2
CLEANTIS :—				
linearis, Dana	3 ?	3	1	1
planicauda, Benedict ..	5	4	1	1
japonica, Richardson ..	5	4	1	1
occidentalis, Richardson ..	4	4	1	1
heathii, Richardson ..	4	3	1	3
granulosa, Heller	4	5	?	1
strasseni, Thieleman ..	4	1	3	5
tubicola, Thomson.. ..	..	..	..	..
CLEANTIELLA :—				
isopus, Miers	5	2	2	1

Apart from the uncertainty about the number of joints in the maxillipede palp in *Cleantis linearis*, Dana, we see that the remaining species in the above table have either four or five joints in this appendage. This difference has been used as a generic character in other members of the family.

The segmentation of the metasome and the number of sutures representing incomplete segments show the greatest diversity and, if this character is also to be used to separate genera, only two in the above list of species could be referred to the same genus, *Cleantis planicauda* and *C. japonica* and a new genus would be required for each of the other species!

The species in the above list show a great resemblance to one another in external form. They are all small, parallel-sided, linear species, the majority tubicolous in habit. The only marked exception is *Cleantiella isopus*, which has a quite different shape from the rest, and has, for this among other reasons, been made the type of a separate genus.

Most of the species agree in having the fifth thoracic limbs shorter than the remainder, without a dactylus and with peculiar spines on the inner surface. *C. isopus* again forms an exception, to judge from Miers' figure, and Richardson says definitely that in *C. heathii* there is no perceptible difference in the length of the legs.

Further, while the majority of the species have the flagellum of the second antennae composed of a single joint, *C. heathii* and *C. strasseni* have three and five joints in this flagellum. Moreover, in *Zenobiana prismatica*, the sexes differ in this respect according to Collinge, the male having 1–4 joints in the flagellum of the second antenna and the female only one with occasionally traces of a second. Issel has noted marked variation in this species in this respect. The species, *C. strasseni* appears to be quite an anomalous form. In the segmentation of the metasome it approaches the genus *Erichsonella*, but the second antennæ have a multi-articulate flagellum which is not characteristic of either *Erichsonella* or *Cleantis* according to the original generic definitions.

Enough has been said to indicate the great confusion which exists in the classification of this small group of species on lines similar to that employed for other members of the family.

More precise and detailed information is required about the existing species, with special attention paid to the maxillipedes, segmentation of the metasome and antennal flagellum. We require a detailed study of the variation of the segments and sutures of the metasome and of the joints in the antennal flagellum in any one species or group of species in order to arrive at a conclusion as to their value for classificatory purposes. It is not possible to attempt a revision of the above group of species here, for I have no material at my command, but it has seemed to me well to call attention to the discrepancies and anomalies which at present exist, in the hope that some worker with the material at his command will take the question up and elucidate it.

It will be seen, too, that it is almost impossible to be certain of the generic position of the new species described below.

I do not feel it would be right to burden literature with a new generic name when investigation may remove the difficulties mentioned above, and I therefore refer the species for the moment to the genus *Cleantis*, Dana, emphasising that the species has five joints in the palp of the maxillipedes, four segments and one additional pair of sutures in the metasome, a two-jointed flagellum to the second antennae in both sexes, the fifth pair of thoracic limbs markedly shorter than the rest, and the uropoda without exopodite and with a plumose seta.

Cleantis annandalei, sp. nov.

Pl. XVII, Figs. 1-11.

Locality.—Whangpoo River, China, about 10 miles below Shanghai, 5-7 metres, 10. xii. 15, one female, 13 mm., two males, 12 and 10 mm., $\frac{9358}{10}$. In fresh water.

Description.—Body (fig. 1) linear in shape, not parallel-sided but somewhat broader in the centre than either at the anterior or posterior ends, about $3\frac{1}{2}$ times as long as broad ; head somewhat vaulted, the front margin sinuate with a median depression, a deeply impressed groove, rather curved, running across the posterior part, eyes small, dorsally placed, rather in front of the middle of the lateral margins of the head ; second thoracic segment without coxal plates, the lateral parts produced forward ; third to eighth thoracic segments with distinct coxal plates visible in the dorsal view, those of the third to fifth segments small, not occupying the whole of the lateral margins of the segments ; those of the sixth to eighth segments extending the whole width of the segments ; metasome not quite half as long as the body, composed of four segments, that is three complete segments and the telsonic segment, with an additional pair of sutures on the anterior part of the latter, posterior margin of the telsonic segment terminating in two acute processes between which the apex is emarginate.

Antennules (fig. 2) small, extending to the distal end of the second joint of the peduncle of the antennae, the three joints of the peduncle successively narrower than the preceding joint, first and third joints equal in length and longer than the second, flagellum consisting of one minute joint tipped by a few short setae.

Antennae (fig. 3) reaching somewhat posterior to the hinder margin of the third thoracic somite, first three joints of the peduncle short, fourth and fifth long and about equal in length to each other, flagellum about one and a half times as long as the fifth joint of the peduncle and consisting of one very long joint and a very small terminal joint, the whole flagellum with a clothing of fine hairs on each margin, among which a few stronger setae can be detected.

First maxilla (fig. 4) with about eleven or twelve terminal spines, some of which are denticulate, on the outer lobe, and three plumose spines on the inner lobe.

Maxillipede (fig. 5) with the coxopodite in two portions, basipodite narrower than the epipodite, and a little shorter, inner lobe with two coupling hooks and an armature of strong plumose spines at the apex, palp of five joints, the first joint small, the second and third cup-shaped, the fourth joint the longest and oval in shape, the fifth joint small but distinctly marked off.

Second thoracic limb (fig. 6) rather stout, outer distal corner of the merus somewhat produced, with a group of long setae at the apex of the process, carpus small, propodus longer than the merus and carpus combined and somewhat expanded, dactylus long and narrow, not quite as long as the propodus and with a joint near the distal end ; the merus, carpus and propodus bear groups of spiniform setae on their inner margins, while the dactylus has two or three small spinules near its tip and a pencil of setae on the outer edge just where the terminal portion is marked off.

The third and fourth thoracic limbs (fig. 7) are of essentially the same form as the second, somewhat longer, with the carpus longer and more developed and the propodus not so much expanded.

Fifth thoracic limb (fig. 8) quite short, not much more than 2/3 of the length of either the fourth or sixth thoracic limbs, without a dactylus, with a clothing of fine hairs on the outer margins of all the joints, and groups of strong spines on the merus, carpus and propodus. Sixth to eighth thoracic limbs (fig. 9) increasing successively in length and of the form shown in the figure. In the eighth thoracic limb the carpus is about equal to the propodus, not quite twice as long as the dactylus. All the joints bear a fringe of fine hairs on the outer margins and the propodus and carpus several groups of strong setae.

The distal part of the uropod is shown in fig. 10. The endopodite alone is present and on the outer distal corner of the basal joint there is a strong and long plumose spine.

Second pleopods of the male (fig. 11) with an appendix masculina about equal in length to the branches, suddenly narrowing near the tip to an acute apex.

Length of an adult female, 13 mm. of an adult male, 12 mm., and of an immature male, 10 mm.

This interesting species, which I have great pleasure in associating with its discoverer, may be distinguished at once by the shape of the posterior end of the metasome. No other species assigned to the genera *Zenobiana*, *Cleantis* or *Cleantiella* is at all like it in this respect. It is also unlike the majority of species of these genera in not having the body of equal width throughout. It agrees with *Cleantis japonica* and *C. planicauda* in the maxillipedes and in the segmentation of the pleon, but both these species have parallel-sided bodies and evenly rounded extremities to the metasome.

The short fifth thoracic limbs suggest a similarity in habit to the tubicolous forms of the above three genera, but the shape of the body is hardly that of a tubicolous species. The minute terminal second joint of the peduncle of the second antenna is a feature which is probably common to other species though not so far noticed.

Sub-order ONISCOIDEA.

Family LIGIIDAE.

Genus **Ligia**, Fabricius.

Ligia exotica, Roux.

L. exotica, Chilton, 1916, p. 462, text-figs. 1-22.

Locality :—Station 22, Talé Sap, on shore of channel between Koh Yaw and mainland, two males, 18 mm.

Chilton in the memoir cited above has redescribed and figured this species very completely and I have nothing to add to what he has written.

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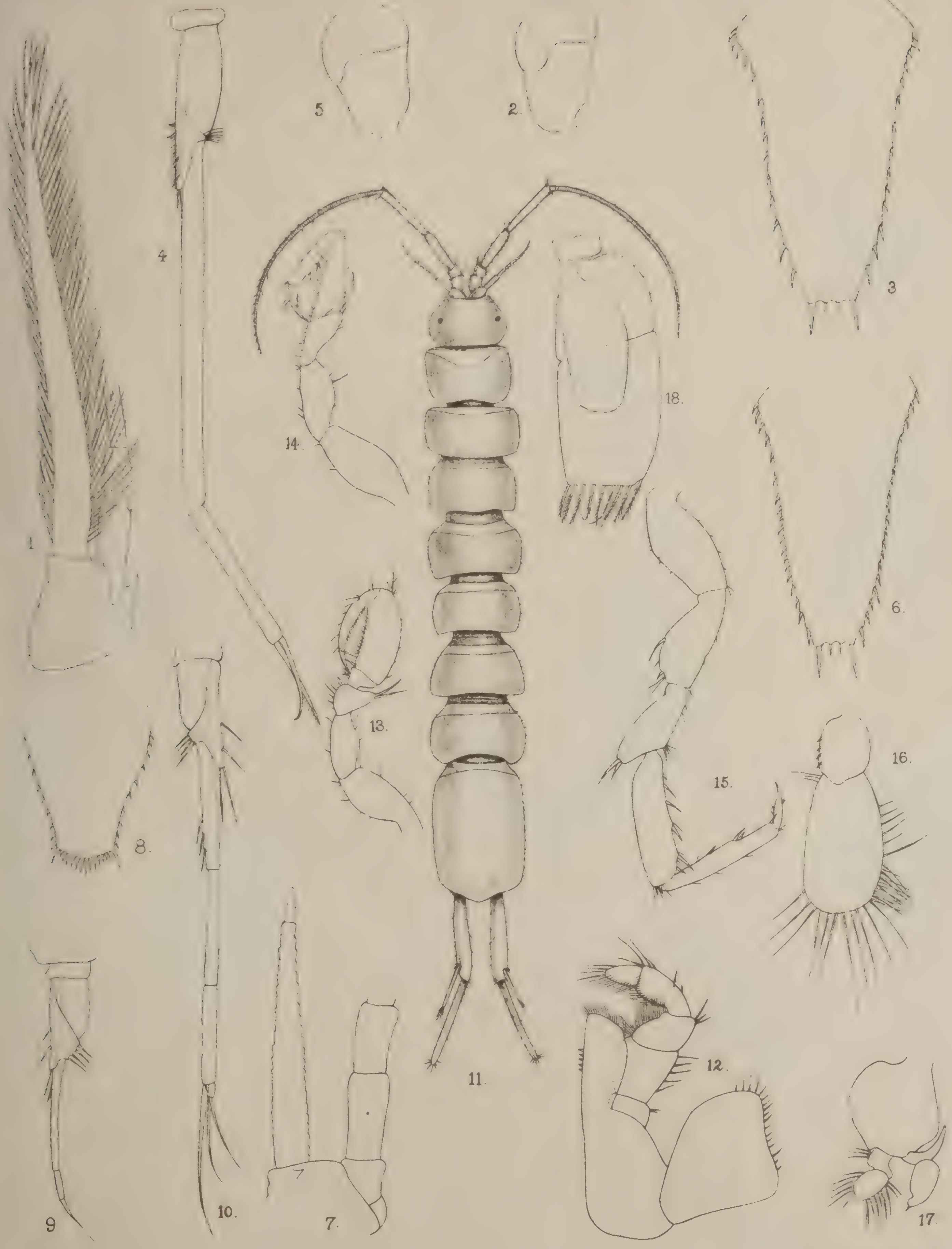
EXPLANATION OF THE PLATES.

Plate XV.

FIG. 1.—*Neomysis awatschensis*, Brandt. Antennal scale × 50.
,, 2. ,, ,, ,, Eye × 33.
,, 3. ,, ,, ,, Telson × 50.
,, 4. ,, ,, ,, 4th pleopod of male, × 50.
,, 5.—*Neomysis nigra*, Nak. Eye × 33.
,, 6. ,, ,, ,, Telson × 65.
,, 7.—*Nanomysis siamensis*, gen. et. sp. nov. Antennal scale × 100.
,, 8. ,, ,, ,, Telson × 100.
,, 9. ,, ,, ,, 3rd pleopod of male × 100.
,, 10. ,, ,, ,, 4th ,, ,, ,, × 100.
,, 11.—*Caecidothea kawamurai*, n. sp. Adult male × 7.
,, 12. ,, ,, ,, Maxillipede × 33.
,, 13. ,, ,, ,, Second thoracic limb × 14.
,, 14. ,, ,, ,, Third thoracic limb × 14.
,, 15. ,, ,, ,, Eighth ,, ,, × 14.
,, 16. ,, ,, ,, First pleopod of male × 14.
,, 17. ,, ,, ,, Second pleopod of male × 33.
,, 18. ,, ,, ,, Third pleopod of male × 33.

Plate XVI.

FIG. 1.—*Exosphaeroma oregonensis*, Dana, × 17.
,, 2. ,, ,, ,, Telson and uropods × 17.
,, 3. ,, ,, ,, Third pleopod × 33.
,, 4. ,, ,, ,, Fourth ,, × 33.
,, 5. ,, ,, ,, Fifth ,, × 33.
,, 6. ,, *chinensis*, n. sp. Antennule × 65.
,, 7. ,, ,, ,, Antenna × 45.
,, 8. ,, ,, ,, Epistome × 65.
,, 9. ,, ,, ,, Maxillipede × 65.
,, 10. ,, ,, ,, Second thoracic limb × 45.
,, 11. ,, ,, ,, Eighth ,, ,, × 33.
,, 12. ,, ,, ,, Second pleopod of male × 33.
,, 13. ,, ,, ,, Fourth pleopod of male × 33.
,, 14. ,, ,, ,, Fifth pleopod of male × 33.
,, 15. ,, ,, ,, Uropod × 33.
,, 16.—*Tachaea chinensis*, Thielemann. Mandible × 65.
,, 17. ,, ,, ,, First maxilla × 65.
,, 18. ,, ,, ,, Maxillipede × 65.



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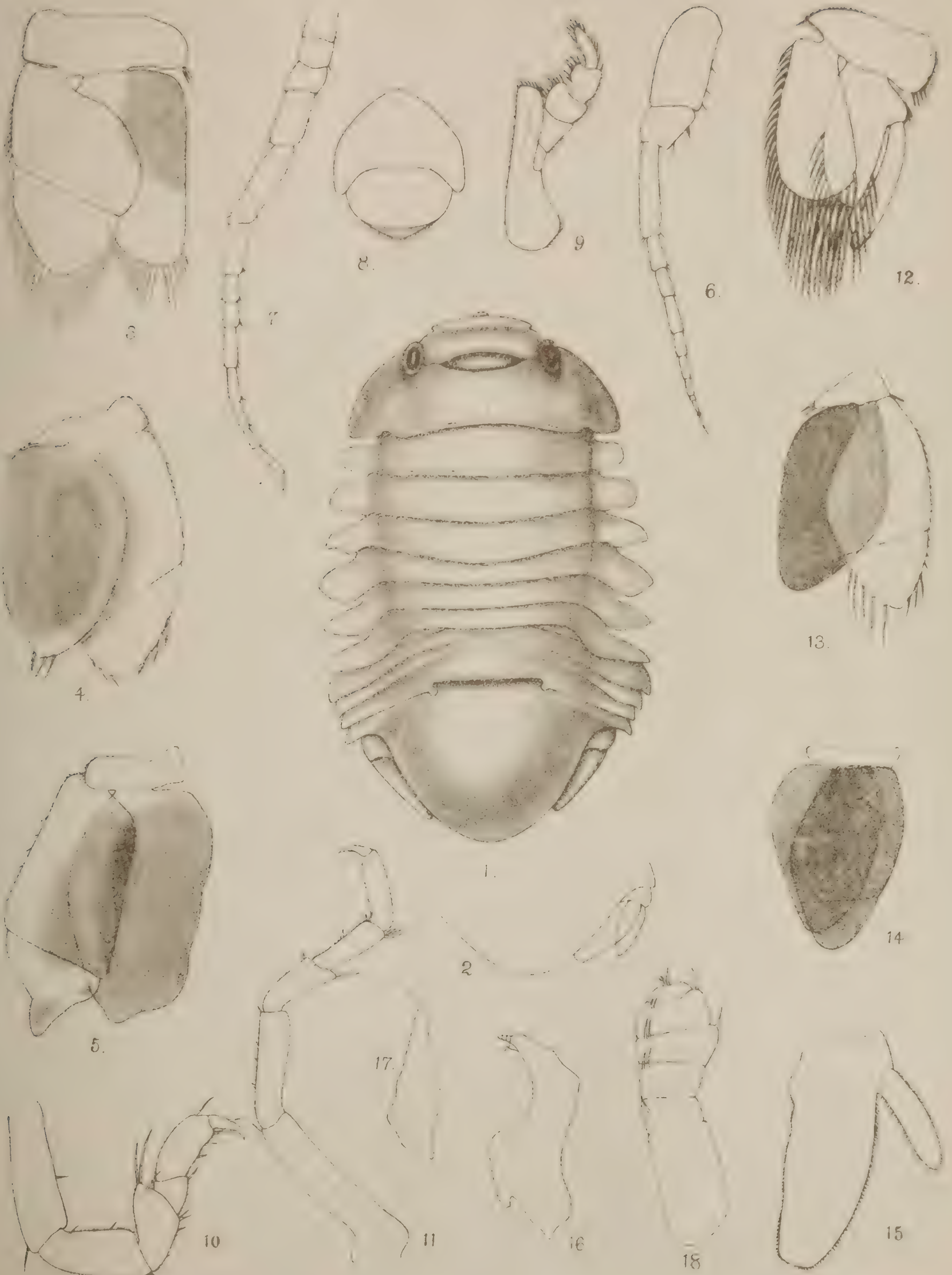

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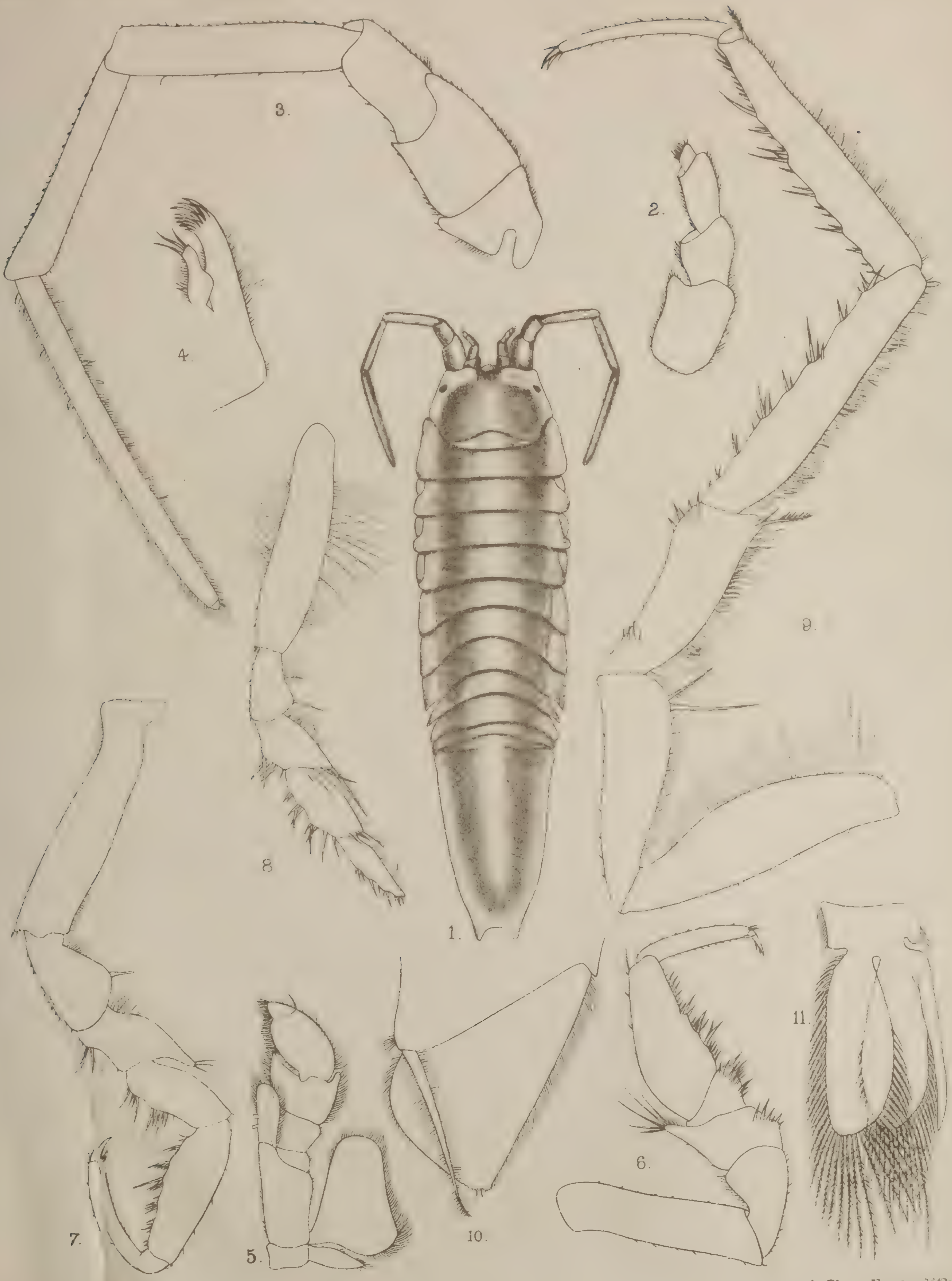
Plate XVII.

Cleantis annandalei n. sp.

FIG. 1.—Dorsal view of adult male × 33.
,, 2.—Antennule × 33.
,, 3.—Antenna × 33.
,, 4.—First maxilla × 20.
,, 5.—Maxillipede × 33.
,, 6.—Second thoracic limb × 20.
,, 7.—Third thoracic limb × 20.
,, 8.—Fifth ,, ,, × 20.
,, 9.—Eighth ,, ,, × 20.
,, 10.—Distal joint of uropod × 20.
,, 11.—Second pleopod of male × 20.



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