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The Fauna of Akkeshi Bay
XIX. Littoral Pycnogonida

By

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(With Plate I and 11 text-figures)

Introduction

The Pycnogonida occurring in the neighborhood of Akkeshi Bay had been preliminarily investigated by Prof. Hiroshi Ohshima about twenty years ago. Unfortunately, his work has not been published since, with the only exception of a peculiar form *Tanystylum anthomasthi* which has been described by Hedgpeth (1949), based on Prof. Ohshima's notes and sketches. Hedgpeth recorded in the same paper about 11 species of pycnogonids from deep waters around Hokkaido, together with an apparently littoral species *Callipallene dubiosa* from Hakodate, all of which were taken during the "Albatross Expedition" in 1900 and 1906. Therefore, I hoped to re-examine the material collected along the coast of Hokkaido and to gather new material there. This study on new materials was rendered possible by the courtesy of the gentlemen in various institutions of the Hokkaido University, as follows: Dr. Sigeru Motoda, Mr. Mayumi Yamada and Mr. Fumio Iwata.

The materials here dealt with were mostly collected by Mr. F. Iwata along the shore of Akkeshi Bay, and also include several specimens obtained at the other localities in Hokkaido by shore collecting. Although the collection is thus not extensive, it was found to comprise eight species listed below, of which 2 seem to be new to science.

List of Species

Family Nymphonidae
- *Nymphon striatum* Lossina-Losinky.

Family Phoxichilidiidae
- *Phoxichilidium hokkaidoense* sp. nov.

Family Ammotheidae
- *Achelia echinata* Hodge.
- *Achelia alaskensis* (Cole).
- *Achelia ohshimai* Utinomi.
- *Achelia segmentata* sp. nov.
- *Lecythorhynchus hilgendorfi* Böhm.

Family Tanystylidae
- *Tanystylum anthomasthi* Hedgepth.

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The type specimens and examples of all the species are deposited in the museum of the Akkeshi Marine Biological Station, and duplicates are in the museum of the Seto Marine Biological Laboratory of Kyoto University. Besides, *Nymphon longitarse* Krφyer is known to occur rather commonly near Oshoro (according to Dr. S. Motoda's correspondence).

A few outstanding points of interest resulting from the study of this collection might be mentioned here. The discovery of a large number of specimens of *Achelia echinata* distinctly indicates the invasion of this widespread North Atlantic form into the West Pacific through the North Polar Sea, and the occurrence of the southern Japanese form *Achelia ohshimai* proves the northward extension of its distributional range.

It is also noteworthy that *Achelia segmentata* sp. nov. resembling somewhat the North Atlantic deep water form *Achelia brevichelifera* is found in the littoral region. Furthermore, my special attention was paid to the ecological peculiarities as shown by three examples of the associated habit with certain coelenterates, namely (1) *Phoxichilidium hokkaidoense* and certain hydroids, (2) larva of *Achelia alaskensis* and a hydromedusa and (3) *Tanystylum anthomasthi* and an octocoral. The first example followed to make a revision of the family Phoxichilidiidae as to the status of the genera *Phoxichilidium* and *Anoplodactylus*, in view of the prevailing concept that the ecological observation is always important in an aid of taxonomy, if circumstances be allowable.

Before going further, I wish to express my sincere thanks to the gentlemen mentioned above for the loan of specimens, in particular to Mr. F. Iwata of the Akkeshi Marine Biological Station who took much trouble to collect the material at my request. My indebtedness is also due to Prof. T. Uchida, Director of the Akkeshi Marine Biological Station, for his kind admission in publishing this paper, to Assn't Prof. M. Katada in charge of the library of the Shimonoseki College of Fisheries for the free use of the Ohshima's Memorial Library on Pycnogonida, and to Prof. H. Ohshima for his valuable information on the pycnogonids of Akkeshi Bay ever examined by him and criticism on this paper.

Family NYMPHONIDAE Hoek, 1881

Genus *Nymphon* Fabricius, 1794

Nymphon striatum Lossina-Losinsky

(Fig. 1)

? *Nymphon longitarse* var. *minus* Schimkewitsch, 1913, p. 244; Schimkewitsch, 1930, p. 441, fig. 121.

Nymphon striatum Lossina-Losinsky, 1929, p. 538, fig. 1; Lossina-Losinsky, 1933 (after Hedgpeth, 1949, pp. 318-321); Ohshima, 1936, p. 863 (name only).

Daikoku-jima, mouth of Akkeshi Bay. June 23, 1952. 1 ovigerous male, F. Iwata coll.

Remarks. This handsome specimen coincides well with *Nymphon striatum* occasionally recorded from the Siberian coast of the Japan Sea, but not so far found in the Japanese coast.

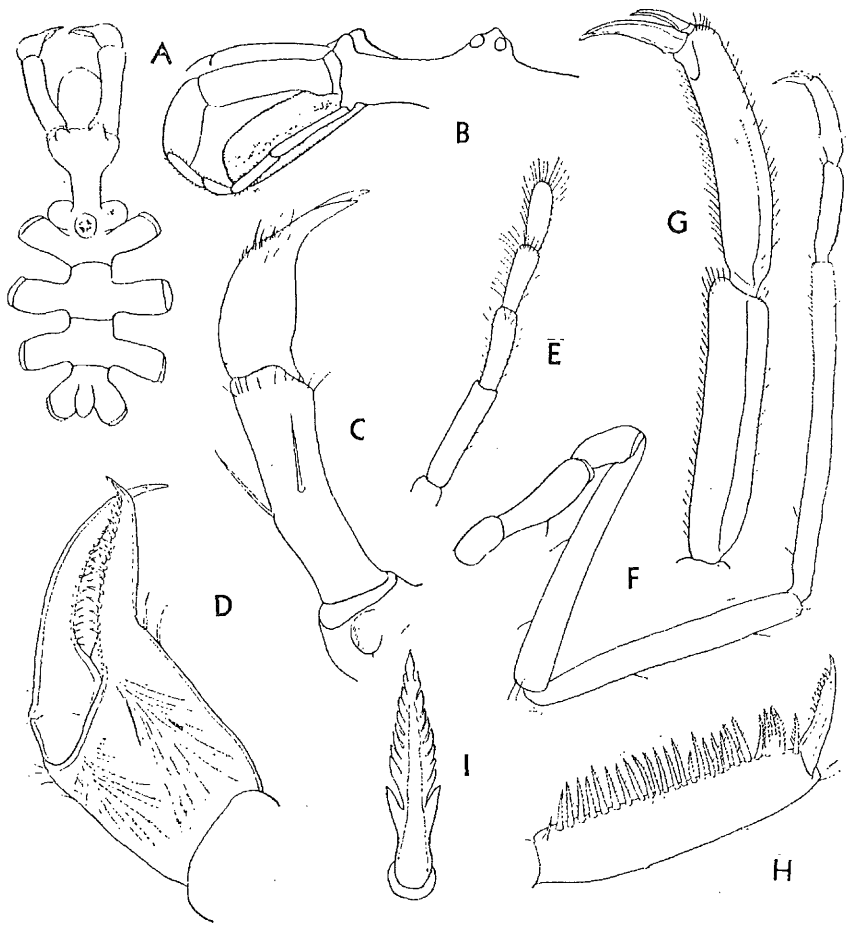

Fig. 1. *Nymphon striatum* Lossina-Losinsky. (♂)
A, dorsal view, legs omitted. ×12; B, lateral view of anterior region. ×18; C, chelifore. ×27; D, chela. ×53; E. palpus. ×33; F. third leg. ×12; G, terminal joints of legs. ×33; H, terminal joint of oviger. ×80; I, denticulate spine of oviger. ×330.

This species is characterized by the presence of a prominent conical tubercle on the thickened distal end of the trunk at the base of the chelifore. Slight difference from the original description of Lossina-Losinsky is found in the armature of legs. The propodus lacks any

large spines in the middle of the sole and the auxiliary claw is about half as long as the terminal claw. The oviger carries 2 or 3 large globular egg-masses. The oviger spines are finely denticulated, with about 8–9 pairs of serrations. Its spine formula is 15:12:12:26::10. The terminal claw is less than half as long as the terminal joint and armed with a row of close-set minute spinulues.

Measurements of male (in mm)

Length of proboscis	1.1	Third leg:	
Length of trunk	3.2	Coxa I	0.35
Width across second lateral processes	1.9	Coxa II	1.35
		Coxa III	0.5
Width of median portion of trunk	0.5	Femur	2.4
		Tibia I	2.5
Length of abdomen	0.47	Tibia II	3.0
Length of scape	1.0	Tarsus	0.85
Length ef chela	0.8	Propodus	0.95
Length of palpus	1.4	Terminal claw	0.4
		Auxiliary claw	0.2

Family PHOXICHILIDIIDAE G. O. Sars, 1891
Genus *Phoxichilidium* Milne-Edwards, 1840

Phoxichilidium hokkaidoense sp. nov.

(Figs. 2–3; Pl. I, fig. 1)

Muroran. May 22, 1951. 18 males and 32 females (holotype and paratypes), on hydroids, M. Yamada coll.

Daikoku-jima, mouth of Akkeshi Bay. June, 1951. 5 males and 3 females (paratypes), on hydroids, F. Iwata coll.

Daikoku-jima, mouth of Akkeshi Bay. August 25, 1953. 3 females (paratypes), clinging to a hydroid *Eudendrium annulatum* Norman*, F. Iwata coll.

DESCRIPTION OF HOLOTYPE (MALE). Trunk cylindrical, tapering somewhat posteriorly, completely segmented. Lateral processes about as long as width of main trunk, between the first 2 pairs slightly separated by about one-third of their own diameter, but the rest closely in contact. No tubercles, processes or spines on trunk and lateral processes. Cephalic segment rectangular in outline, about half as long as wide, without any indication of neck. Eye tubercle directed slightly forward, low conical, bluntly pointed, about half as high as width at

* I am indebted to Mr. M. Yamada for identification of this hydroid.

base, with 4 large well-developed eyes.

Abdomen almost horizontal, small, a little longer than last pair of lateral processes, adorned with minute setae all over.

Proboscis cylindrical, constricted at base, obtusely truncate at end, thick, half as long as broad.

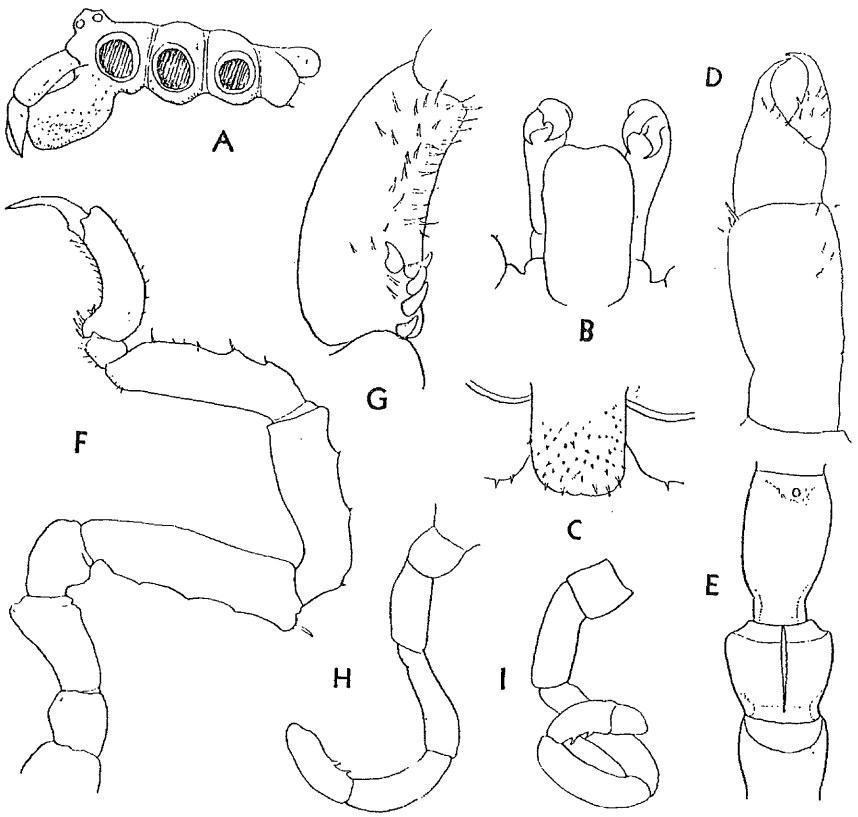

Fig. 2. *Phoxichilidium hokkaidoense* sp. nov. (♂)
A, lateral view of trunk. ×15; B, ventral view of proboscis and chelifores. ×33; C, abdomen. ×67; D, chelifore. ×67; E, two coxal joints of second leg, with lateral process, ventral view. ×33; F, first leg. ×27; G. ventral view of propodus. ×67; H, I, oviger. ×33.

Chelifore stout, overhanging proboscis; scape nearly reaching the end of proboscis, slightly clavate; chela hanging down almost vertically, with short acuminate fingers adorned with a few setae, a little longer than palm.

Oviger inserted ventrally ahead the base of first lateral process, curved in a S-form, 5- or 6-jointed. Third joint slightly longer than

second, often with a slight constriction near the base. Fourth joint bare, a little shorter than third. Fifth joint shorter than the preceding joint, usually unsegmented, but often marked with a slight indication of nonarticulated segmentation near the end; in any case proximal half armed with 2 or 3 close-set, unguiform spines near the base and distal half bare, palpiform.

Legs long, rather stout, without conspicuous tubercles or setae except for the terminal joints. First coxa about as long as the adjoining lateral process, somewhat swollen distally, with a distinct chitinous medial ridge. Second coxa longer than first coxa, with a prominent constriction at base and swollen ventrodistally, where genital opening is situated in the last 2 pairs of legs. Third coxa slightly longer than first coxa but shorter than second coxa. Femur elongate, about as long as coxal joints together, with 3–4 indistinct tubercles equidistantly on

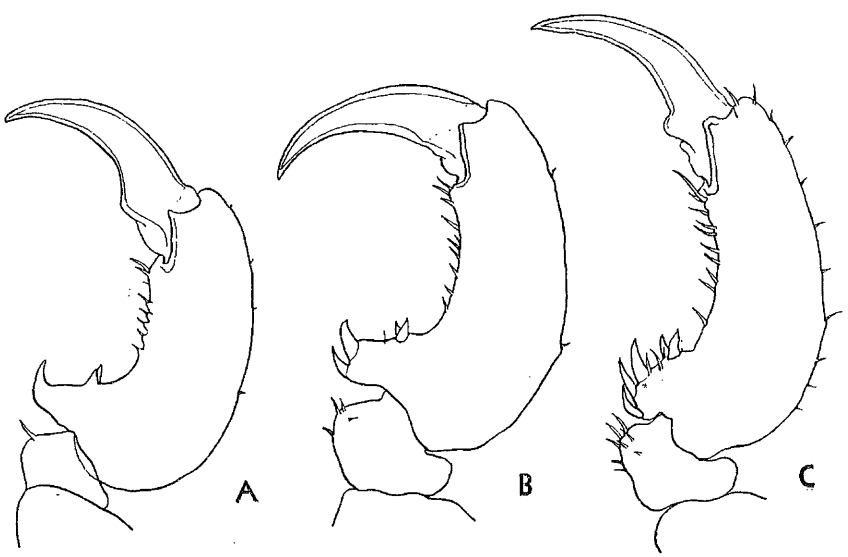

Fig. 3. *Phoxichilidium hokkaidoense* sp. nov.
A, B, C, Variation of tarsus and propodus and their armature. ×67.

the dorsal surface; no cement gland could be distinguished. First and second tibia subequal in length, both with 2 or 3 setose tubercles on the dorsal surface almost equidistantly. Tarsus small, almost round, setose ventrally alone. Propodus curved, medium strong, with prominent basal projection (heel) bearing 1–3 large simple spines, followed by a pair slightly smaller, and numerous setae scattered all over the surface of sole; no distal lamina at all. Terminal claw strong, with a knob at

the base of ventral side, as visible when extended. Auxiliary claws wholly absent.

Colour: Adult specimens are lemon yellow which colours the whole cuticle, except for the eye tubercle which is brownish. When alive, the femur and first tibia are marked each with a red triangular pattern in the mid-dorsal surface, according to Mr. Iwata's note. But such red colour disappears when placed in alcohol.

Female: The female represents the same general characteristics as the male. Besides the usual sexual differences, the second coxa lacks the genital protuberance, and the distal end of the joint is only feebly swollen. The femur is more plump than in the male and almost smooth.

Measurements of holotype (in mm)

Length of proboscis	0.74	Coxa II	0.53
Length of trunk	1.44	Coxa III	0.4
Width across second lateral processes	1.25	Femur	1.17
Length of abdomen	0.23	Tibia I	1.0
Length of chelifore	0.70	Tibia II	0.9
Third leg:		Tarsus	0.17
Coxa I	0.4	Propodus	0.8
		Terminal claw	0.53

Remarks. This species, comprising many specimens of both sexes, appears to be related to the boreal species *Phoxichilidium femoratum* (Rathke) which is common in the North Atlantic and Northeastern Pacific. It can easily be distinguished from the latter by the characters, as follows: (1) the narrowly separated lateral processes, (2) the horizontal abdomen, (3) the second coxal joint constricted at base, (4) the absence of auxiliary claws, and (5) the body colour of lemon-yellow, instead of vivid red. According to Lebour (1945), *P. femoratum* lives principally on *Syncoryne eximia* and another species *P. tubulariae* on *Tubularia larynx* in shallow water along the northern coast of British Islands. The Japanese species is apparently common below low tide-mark, associated with the hydroids (at least at Akkeshi *Eudendrium annulatum*).

Discussion on the Relationship between *Phoxichilidium* and *Anoplodactylus*

As often discussed by earlier workers, the distinction between the genera involved in the family Phoxichilidiidae is a puzzling problem still remained unsettled among taxonomists. Among them, *Phoxichilidium*, *Anoplodactylus* and *Halosoma* have often been confused with one another, because of the insufficient criteria of distinction between the genera and

the imperfect descriptions and illustrations of the species. In particular, all the known species of *Anoplodactylus* have been enumerated and keyed by Williams (1941) and Sawaya (1950), without comment on their affinities with the allied genera. In fact, some species included in the list of both authors would probably be closer to *Phoxichilidium* or *Halosoma* than to *Anoplodactylus*.

Although *Anoplodactylus* erected by Wilson (1878) is hardly distinguishable from *Phoxichilidium* morphologically, it has been generally accepted as a separate genus, mainly in having the forward projecting cephalic segment and the 6-jointed oviger. Recently, Stock (1951) considers the reduction or absence of the auxiliary claws as important character of *Anoplodactylus* differentiating from *Phoxichilidium*. This character, however, does not hold good, as Sars (1891) and Lebour (1945) have already noted, since even in the group of *Phoxichilidium*, the auxiliary claw is small in *P. virescens* (Hodge, 1864) and *P. compactum* (Hilton, 1939), "extremely rudimentary" in *P. capense* (Flynn, 1928) and wholly absent in *P. pygmaeum* (Hodge, 1864) and this *P. hokkaidoense*, as described above. The presence or absence of auxiliary claws is not of generic significance, as in examples of the genera *Nymphon* and *Pycnogonum*.

On the other hand, concerning the generic status of *Halosoma* of Cole (1904), opinions are diversified. Most of recent workers (e. g. Hilton, Marcus, Hedgpeth) retain it as a distinct genus, but Loman (1912) as a subgenus of *Anoplodactylus*. Stock in a recent paper (1953) doubts its validity as subgenus.

Up till now a great number of species have been described and referred to either of these genera, partly based on the insufficient diagnoses generally accepted. Although further prospective increase in the number of species may make the division convenient, questions here arise as to whether these genera are rightly the natural groups or merely artificial combinations made for convenience. I do not think, however, that the division is as artificial as it appears in most of taxonomic papers—the fault is not in our species but in ourselves. To throw some light upon this difficult problem, the find of *P. hokkaidoense* may provide some interesting hints.

On the whole, *Phoxichilidium* and *Anoplodactylus* have been separated by rather vaguely defined characters, so that definite distinction between them could not be made morphologically. The usual principal characters, for example, the auxiliary claws, the femoral cement gland, the number of segments of oviger, the shape of cephalic segment, the segmentation of trunk and the interval between lateral processes, are all very diversi-

fied between species and even in one species. The majority of these characters are not of so much systematic importance as earlier authors recognize, but only reliable for specific distinction.

Accordingly, a revision of this family, comprising a large number of species, although a long and tedious work, is much needed. In addition to the fact that many species are more or less imperfectly described without ecological notes, the characters which serve to distinguish one species from another have never been comprehensively studied. As it is not possible to devote time to a complete revision at present, a tentative key for the distinction between the genera *Phoxichilidium* and *Anoplodactylus* is only proposed.

As far as the generic characters are defined as earlier authors do, *Phoxichilidium*, *Anoplodactylus* and *Halosoma* would be congeneric and should be united to one genus. But, if each distinctive character, or set of characters, reconsidered from another aspect, are combined, the separation of these groups would become more justified. Indeed, some exceptions, inevitable in systematization, may be found for each separate character. Although there is no morphological character that is definitely distinctive and constant everywhere, the chief differences between the two (or three) groups may be as a rule adaptive in accordance with their mode of life and environment.

The chief differences between *Phoxichilidium* and *Anoplodactylus* on which I rely for the separation of the group are summarized below:

Phoxichilidium	*Anoplodactylus*
Body and legs rather stout.	Body and legs usually slender.
Cephalic segment wider than long, not prolonged forward.	Cephalic segment prolonged forward with a more or less distinct neck.
Eye tubercle usually low, conical, bluntly tipped.	Eye tubercle usually high, sharply pointed.
Oviger short, principally 5-jointed, with third joint about equal to the second, and with unhairy terminal one, often segmented again but nonarticulated.	Oviger long, principally 6-jointed, with third joint about twice as long as the second, and with hairy 2 (or more) articulated terminal joints.
Usually living in shallow waters or between tides.	Usually living in deep waters, sometimes bathypelagic.
Usually associated with hydroids in all or larval life.	Usually benthic in habitat, but larva often in medusae.
Predominantly boreal in higher latitudes	Predominantly tropical in temperate latitudes.

If following this procedure, the two species of *Phoxichilidium* recorded by Hedgpeth (1949) from deep sea of Japan, i. e. *P. ungellatum* and *P. horribilis*, must be transferred to *Anoplodactylus*. Dohrn's (1881) three species, *P. angulatum*, *P. robustum* and *P. exiguum*, of which the

last one is synonymous with *P. pygmaeum* (Hodge, 1864), are certainly real *Phoxichilidium*. However, the Brazilian species *Anoplodactylus pygmaeus* described by Marcus (1940), which was afterwards renamed *A. brasiliensis* by Hedgpeth (1948), may be retained in *Anoplodactylus*, as can be inferred from his figures. As to the dubious genus *Halosoma* of Cole (1904), much cannot be said at present owing to the lack of specimens referable to it in my hand. However, it seems to me from literature that the genotype *H. viridintestinale* described from Dillon Beach, California, and Helfer's (1938) *Peritrachia pycnosoma* from Kobe and recently found at low tide near Misaki, are more allied to *Phoxichilidium*, although Stock (1953) refers the latter to *Anoplodactylus*, as distinct from the allied Atlantic form *P.* (or *Halosoma*) *robustum*.

In connection with these morphological differences, in particular Dogiel's (1913) and Lebour's (1916, 1945) accounts on the ecology and life history of this group seem to be very important. Their ecological works are apparently suggestive of the generic distinction between *Phoxichilidium* and *Anoplodactylus*. Dogiel, in his work on the larval pycnogonids at Millport, states that the hatched larva of *Anoplodactylus petiolatus* first enters into polyps of the hydroid *Syncoryne* in the same way that *Phoxichilidium femoratum* does. Lebour points out that Dogiel's species is not the same as *A. petiolatus* but certainly *Phoxichilidium virescens*, while his *A. pygmaeus*, larvae of which are hatched and reared in the polyps of *Obelia*, is rightly identical.

On the other hand, *A. petiolatus* as its allies is known as a rather fairly deep-water inhabitant and its larvae are found sometimes in the manubrium of various medusae, such as *Obelia*, *Phialidium hemisphericum*, *Amphinema dinema* etc. (Lebour, 1916; Franc, 1951). Some species of the same genus may be planktonic in life at least temporarily, being occasionally taken by a tow-net* (Carpenter, 1905; Flynn, 1928; Ohshima, 1933b).

As already stated, Dogiel records the larva of *P. virescens* inhabiting the hydroid *Coryne* (=*Syncoryne eximia*) from the northern waters of British Islands, and recently Bourdillon (1952) records the same inhabiting another hydroid *Coryne muscoides* from the coast of Marseille.

Lebour (1945), based upon the number of segments of the oviger for generic distinction, places *P. virescens* rightly in this genus, but she is wrong in regarding Hodge's *pygmaea* and Dohrn's *angulatum* as *Anoplodactylus*. It seems apparent that these species referable to *Pho-*

* Recently I have found two immature specimens apparently similar to Ohshima's larva of *Anoplodactylus* in plankton samples in 0–5 m vertical haul taken by Mr. I. Yamazi in Onagawa Bay, on August 28, 1951.

xichilidium usually inhabit certain hydroids as their intermediate host in larval life and even as the permanent host, so far as the life histories of the larval forms have hitherto been known.

The geographical range of both the genera is apparently different. The species referable to *Phoxichilidium* are restricted to the boreal-Arctic or the boreal-Antarctic region, mainly in shallw waters, while those of *Anoplodactylus* is predominantly tropical and usually in deeper waters. The former is thus represented as an example of bipolarity in distribution among pycnogonids. None of the species referred to *Anoplodactylus* has been recorded from both polar regions. Its genotype *A. petiolatus*, apparently indigenous to the Atlantic, is widely distributed along the European coast from Norway to Tierra del Fuego, ranging from the littoral to 660 m in depth, sometimes on drifting algae in the mid-Atlantic region. The separation of *Anoplodactylus brasiliensis* from the North Atlantic form *Phoxichilidium pygmaeum*, as mentioned above, is supported from the geographical point of view also. Nevertheless, the latter species is probably the most southward-extending form among the *Phoxichilidium* species, now I understand. *Halosoma* appears to be transitional between *Phoxichilidium* and *Anoplodactylus* as inferred from its scattered records of occurrence.

Family AMMOTHEIDAE Dohrn, 1881

Of this family, the typically littoral genus *Achelia* appears to be well represented in the Japanese waters. As far as I am aware, nine species (*A. echinata* var. *japonica* Ortmann, *A. superba* Loman, *A. orientalis* Schimkewitsch, *A. alaskensis* Cole, *A. pribilofensis* Cole, *A. borealis* Schimkewitsch, *A. bituberculata* Hedgpeth, *A. kiiensis* and *ohshimai* Utinomi) have hitherto been recorded. Thus it is not so surprising that the material from Hokkaido here dealt with includes two other species, one of which is a North Atlantic species *A. echinata* and the other a new species *A. segmentata* characterized by the unusually segmented trunk.

Genus *Achelia* Hodge, 1864

Achelia echinata Hodge

(Figs. 4–5)

Achelia echinata Hodge, 1864, p. 115, pl. XII, figs. 7–10.
Ammothea brevipes Hodge, 1864, p. 114, pl. XII, figs. 1–4 (juv.).
Ammothea fibulifera Dohrn, 1881, p. 141, pl. IV, figs. 1–22,
Ammothea echinata Sars, 1891, p. 120, pl. XIII, fig. 1; Stephensen, 1936a, p. 31; Stephensen, 1936b, p. 49, fig. 12.

Ammothea (Achelia) echinata Bouvier, 1923, p. 55, fig. 55; Schimkewitsch, 1929, p. 124, figs. 28–31.

Ammothea (Achelia) echinata var. *sinensis* Lou, 1936a, p. 19, figs. 7–9, pls. II–IV.

Akkeshi. March, 1951. 1 male and 3 females, F. Iwata coll.

Aikkapu, a cape in front of the Akkeshi Marine Biological Station. May 12, 1952. 3 females, on holdfasts of *Zostera marina*, F. Iwata coll.

Akkeshi. 1952. 3 males and 1 female, on holdfasts of *Zostera marina*, F. Iwata coll. (One male encrusted by adherent Foraminifera *Cilicides lobatulus*.)

Remarks. All the specimens from Akkeshi agree exactly with the excellent desciptions and figures of Sars (1891) which are copied in nearly all later works. They also agree with Dohrn's *Ammothea fibulifera*.

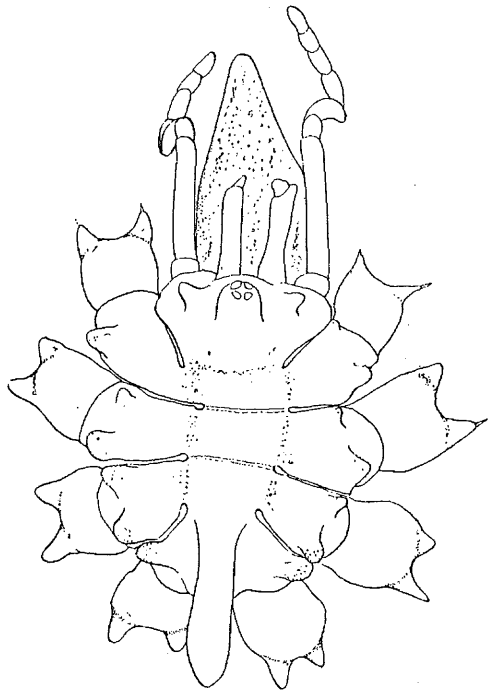

Fig. 4. *Achelia echinata* Hodge. (♀)
Dorsal view of trunk. ×33.

It is to be noted here that the oviger of the female is provided with more than 10 denticulate spines instead of only 6 as in Sars' specimen, although the number of denticulate spines in the male oviger agrees exactly with that of the Atlantic form. Such difference is not important, since it varies somewhat in shape and number with age. The same may be said for the number of peculiar conical processes of the second coxal joint. In the male, the first coxal joint is usually

beset with 2 pairs, while the second with 2 or 3 pairs; in the female the first coxal joint only with one pair.

This species is widely distributed in the North Atlantic from Norway to the Mediterranean, as far south as the Cape Verde Islands. Lebour

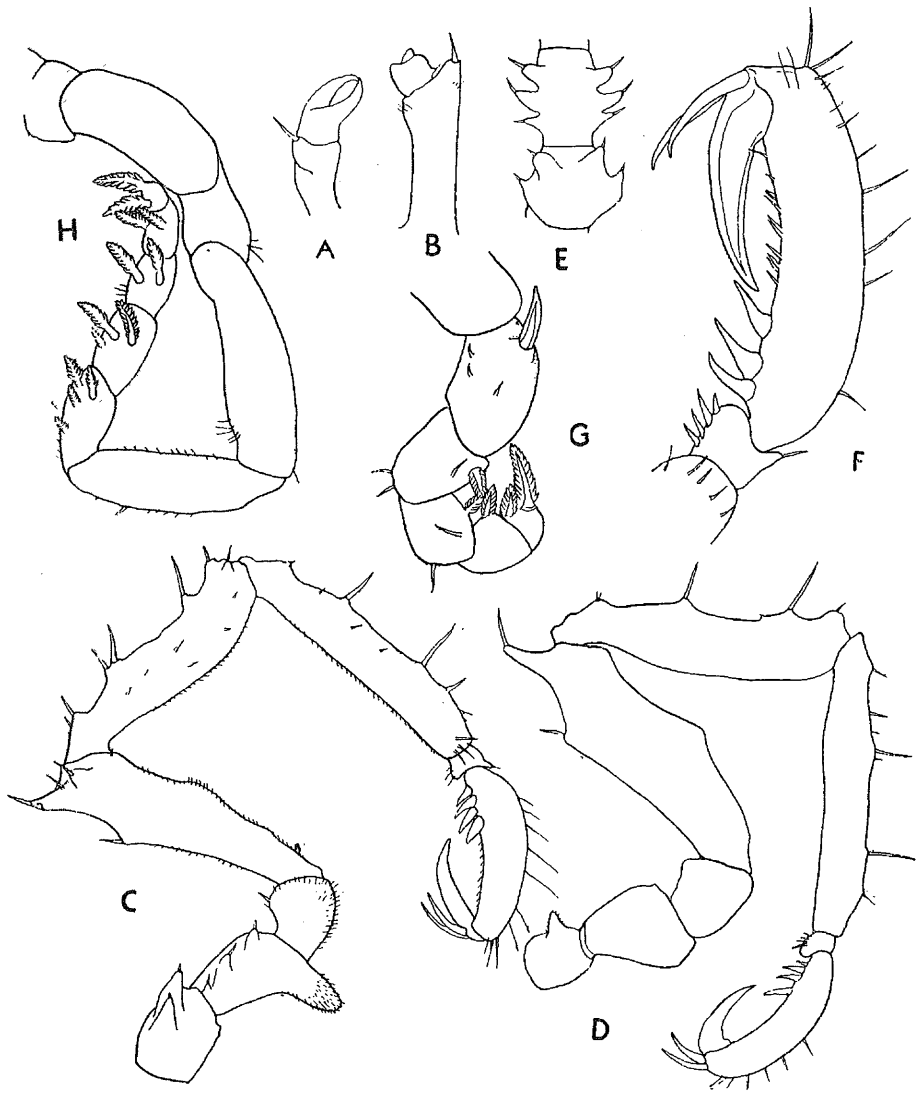

Fig. 5. *Achelia echinata* Hodge. (♂, ♀)
A, chelifore in young specimen. ×67; B, chelifore in adult. ×67; C, fourth leg of male. ×27; D, fourth leg of female. ×27; E, dorsal view of first and second coxae in male. ×27; F, tarsus and propodus in female. ×67; G, terminal joints of oviger in male. ×80; H, oviger of female. ×80.

(1945) mentions its range to extend to the Atlantic coast of North America, but Hedgpeth (1948) denies its occurrence there.

The records from the Pacific are so far only three. The record of Hilton (1943) from San Francisco Bay and Alaskan waters is probably certain, since he notes as "two well developed suture lines on trunk". Lou (1936a) also recorded from Tsingtao, China, under a varietal name *sinensis*. But it falls as a synonym of the typical species, being only separable in the relative length of chelifore and abdomen which is of no taxonomic importance. However, I doubt the validity of *Achelia echinata* var. *japonica* described by Ortmann (1890) from Kadsiyama* as to its affinity with the typical form of *Achelia echinata*. As can be seen in his imperfect description and figures even, it shows no characteristics proper to the typical form of *A. echinata*. It is probably another species, nearly allied to *A. ohshimai* or *A. alaskensis*, although apparently distinct from them on account of its completely segmented and unarmoured trunk. Therefore, it should be named *Achelia japonica*, placing into the specific rank.

Measurements of a female (in mm)

Proboscis	1.2	Femur	1.5
Trunk	1.4	Tibia I	1.5
Abdomen	0.5	Tibia II	1.5
Chelifore	0.4	Tarsus	0.1
Fourth leg:		Propodus	0.8
Coxa I	0.4	Terminal claw	0.5
Coxa II	0.5	Auxiliary claw	0.25
Coxa III	0.35		

Achelia alaskensis (Cole)

(Figs. 6-7)

Ammothea alaskensis Cole, 1904, p. 266, pl. XII, fig. 4; pl. XVII, figs. 4–12.
Ammothea (*Achelia*) *alaskensis* Schimkewitsch, 1929, p. 151, figs. 42–45.
Ammothea alaskensis Exline, 1936, p. 421; Okuda, 1940, p. 73, figs. 1–10 (metamorphosis).
Ammothea (*Achelia*) *alaskensis* Ohshima, 1933c, p. 144, fig. 1; Ohshima, 1936, p. 866 (name only).

Oshoro. August, 1952. 1 male, on *Sargassum*, M. Yamada coll.

Rishiri Island. August, 1952. 1 male, on Laminarian holdfasts, F. Iwata coll.

Monbetsu, on the Okhotsk coast. August, 1952. 1 male, on Rhodophyceae, F. Iwata coll.

Aikappu, in front of the Akkeshi Marine Biological Station. May 12, 1952. 1 female, on holdfasts of *Zostera marina* (together with *A. echinata*), F. Iwata coll.

* Probably Katsuyama of Province Awa, mouth of Tokyo Bay, erroneously pronounced and misspelt.

Akkeshi. August, 1952. 1 female on Rhodophyceae, F. Iwata coll.
Akkeshi Bay. August, 1952. 13 larvae, inhabiting the hydromedusa *Polyorchis karafutoensis*, F. Iwata coll.
Daikoku-jima, mouth of Akkeshi Bay. August 25, 1953. 2 young females, on a hydroid *Eudendrium annulatum* (together with *Phoxichilidium hokkaidoense*), F. Iwata coll.

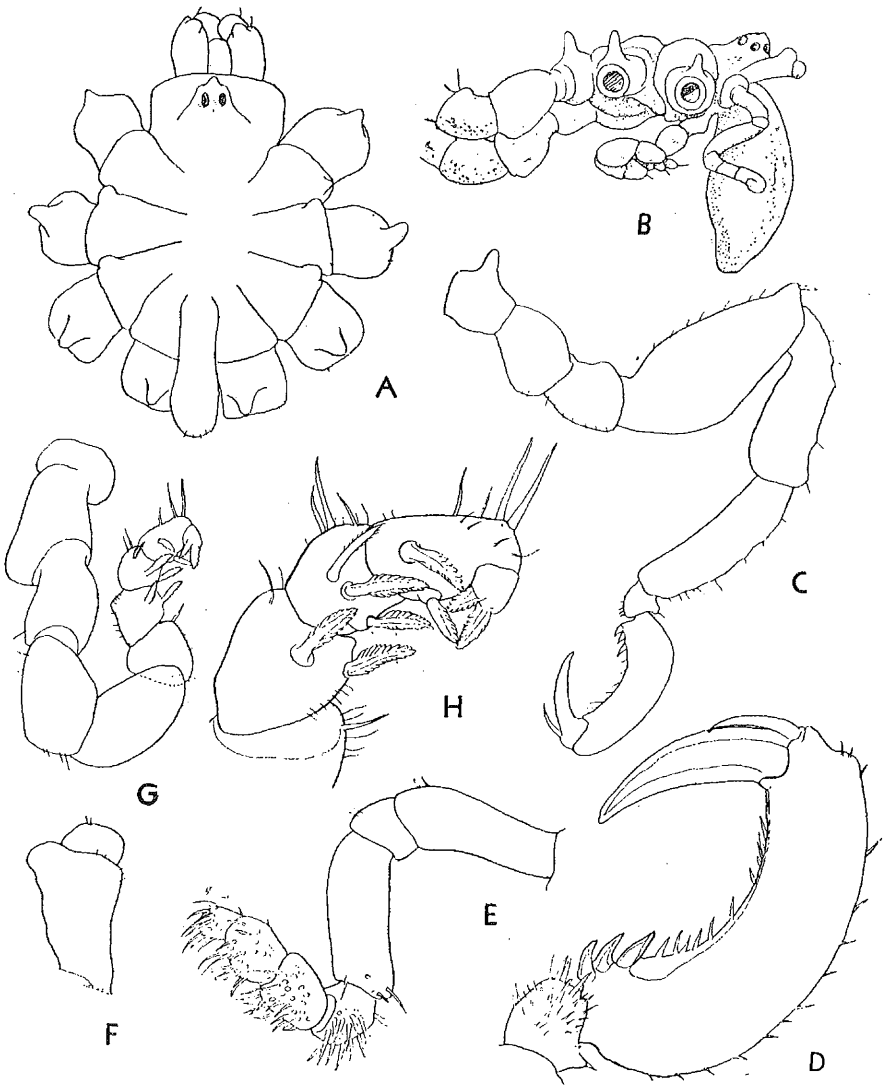

Fig. 6. *Achelia alaskensis* (Cole) from Akkeshi. (♀)
A, dorsal view of trunk. ×33; B, lateral view of trunk. ×21; C, third leg. ×27; D, tarsus and propodus. ×67; E, palpus. ×67; F, chelifore. ×67; G, oviger. ×63; H, terminal joints of oviger. ×150.

Remarks. The present material fortunately includes various stages of development from larva to adult, and thus can be traced the developmental changes in each of various structures characterizing this species.

As can be defined from the descriptions by Cole and Schimkewitsch, this species is mainly characterized by (1) the unsegmented smooth trunk, (2) the downward directed ovoid proboscis, (3) the low conical eye tubercle, (4) the long horizontal abdomen, (5) the short chelifore with a prominent dorsodistal process on scape, (6) the nature of oviger, (7) the first coxal joint with a dorsal protuberance and (8) the presence of one or two distal protuberances on the lateral processes. Concerning the last-mentioned character, Ohshima (1933c) has pointed out that the protuberances on the lateral processes are truly one pair instead of only one, against Cole's and Schimkewitsch's accounts.

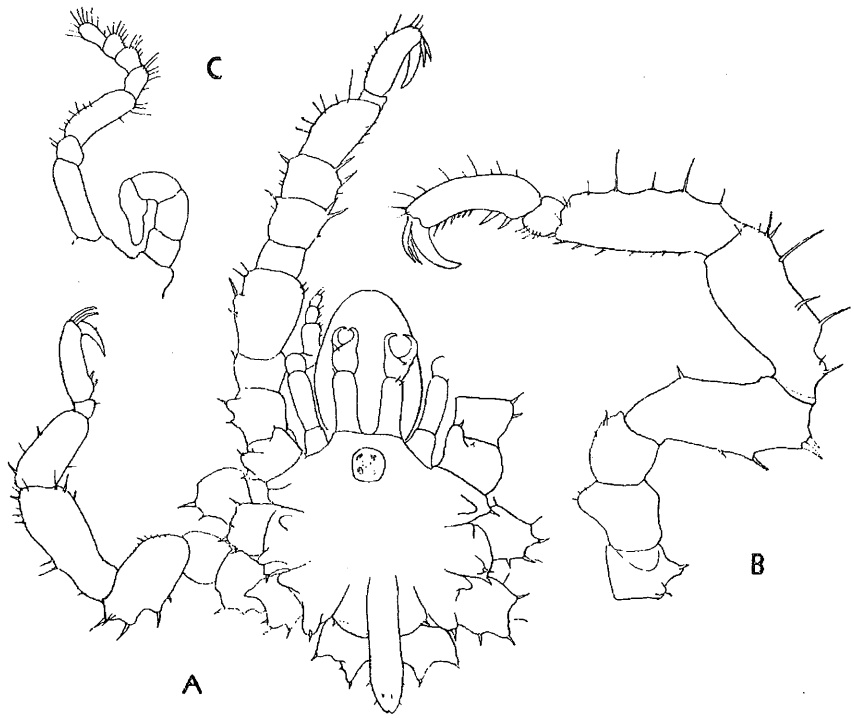

Fig. 7. *Achelia alaskensis* (Cole) from Oshoro. (juv.)
A, dorsal view, most of legs omitted. ×27; B, fourth leg. ×14;
C, palpus and oviger. ×14.

A crucial examination on the present material revealed that the lateral processes have always two protuberances, except for the first in which is but one backward, in younger specimens less than 1.3 mm in

length of trunk, as stated also by Okuda (1940) in his study on its post-larval development. In more advanced stages, however, either of the two protuberances becomes obsolete and even the remained one not better developed in proportion to that of the first coxal joint.

Among other differences between the young and adult may be noted the following: In younger stages, the proboscis is relatively large, broadly oval and not so vertically directed as in the adult; the chelifore is longer than half of the proboscis, with the chelae not yet reduced, but lacks a dorsodistal protuberance on the scape which is distinct in the adult; the propodus of legs bears only two spines on heel as yet.

It is interesting to note that the larvae of this pycnogonid rear on the hydromedusa *Polyorchis karafutoensis* Kishinouye, which is common in Saghalien and southeastern area of Hokkaido during summer but hitherto unknown elsewhere (Uchida, 1940). Okuda (1940), in his fine work on its larval development, states that the larvae of this species are found abundantly under the exumbrella and on the wall of the manubrium, with their proboscis bent perpendicularly to, and piecing into, the soft tissue of the host. The majority of larvae taken from the same medusa, which I have examined, correspond to the Okuda's Stage V, showing the rudiments of the fourth legs, except for a further developed one corresponding to Stage VI. The former measures 0.2–0.4mm in length of proboscis, 0.56–0.65 mm in length of trunk and 0.2–0.26 mm in length of abdomen. No adult specimen is found in the medusa and as mentioned above, the adults occur usually among hydroids, eel-grasses or sea algae on the basin. Therefore it seems probable that the young larvae are hatched out outside the host. But it remains still unknown how these larvae reach this medusa and what kind of medusae select the same pycnogonid found elsewhere than Hokkaido as host. These are the interesting questions to be answered by further investigations.

Besides Hokkaido, this species has been recorded from Popov Island, Alaska (Cole), Mamiya Strait, North Saghalien, Bering Sea (Schimkewitsch, Uchida), North Kuriles (Ohshima) and Puget Sound (Exline).

Measurements of a female (in mm)

Length of proboscis	1.0	Width of cephalic segment	0.6
Length of trunk	1.2	Third leg:	
Length of abdomen	0.5	Coxa I	0.3
Length of chelifore	0.4	Coxa II	0.4
Length of palpus	1.2	Coxa III	0.35
Width across second lateral processes	1.0	Femur	1.0
		Tibia I	0.9

Tibia II	0.9	Terminal claw	0.4
Tarsus	0.1	Auxiliary claw	0.2
Propodus	0.7		

Achelia ohshimai Utinomi

(Fig. 8)

Achelia ohshimai Utinomi, 1951, p. 163, fig. 2.

Akkeshi. March, 1951. 1 female, F. Iwata coll.

Rishiri Island. August, 1951. 1 male and 1 female, on Laminarian holdfasts, F. Iwata coll.

Monbetsu, on the Ohkotsk coast. August, 1952. 1 young female, on a red alga (together with *Achelia alaskensis*), F. Iwata coll.

Four specimens obtained at three different localities undoubtedly belong to *Achelia ohshimai* which was first described by me from Tanabe Bay on the Pacific coast of middle Japan. The original description was based upon a single female specimen, so that the following description on a male specimen from Rishiri which is now designated as allotype is given as its supplement.

DESCRIPTION OF ALLOTYPE (MALE). Proboscis and trunk similar to those of the female holotype. Cephalic segment broader than trunk exclusive of lateral processes and provided with two, large and small, conical tubercles on each side of eye tubercle, as in female. Closely crowded lateral processes, bearing each a pair of tubercles dorsodistally and horizontal abdomen armed dorsally with a row of tubercles or setae, are also the same as in female.

Chelifore approximately one-third as long as proboscis, with small reduced chela, though still chelate in a young female from Monbetsu; scape about three times as long as reduced chela, with a prominent spinose projection dorsodistally and a slight spinose elevation in the middle.

Palpus similar to that of female.

Oviger 10-jointed, armed with a few unguiform spinules on the subequally elongated third to fifth segments, a stout reversed spine at base on the sixth and 6 denticulate spines on the terminal segments much twisted, i. e. 2 on the seventh, 1 on the eighth, 1 on the ninth and 2 on the tenth.

Third leg of male as represented in Fig. 8D; the male genital opening is situated at the ventrodistal corner of second coxa on a much elongated protuberance with a tuft of setae at the rounded tip and there is a prominent process for cement gland at the dorsodistal end of femur.

The propodus is arcuate, almost uniform in width throughout the length, and with 3 large spines on heel, of which the distal one is widely separated from the proximal two as in female. This character seems to be peculiar to this species. Terminal claw strong, a little longer than twice of auxiliaries.

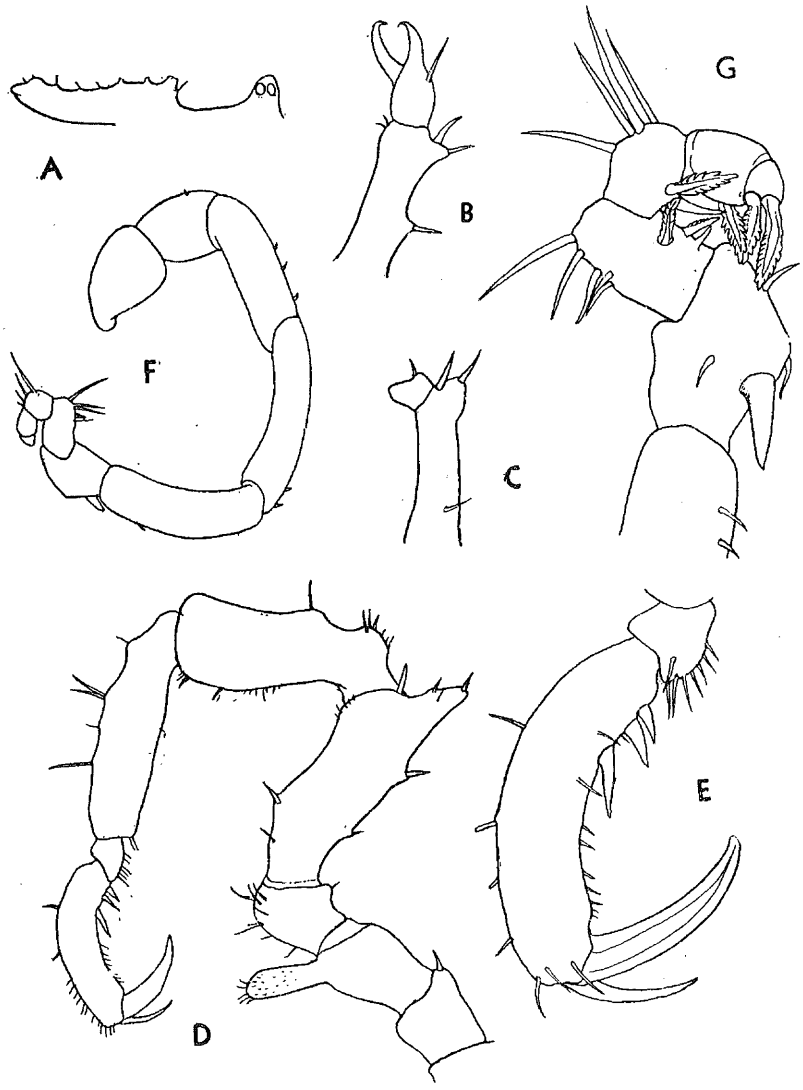

Fig. 8. *Achelia ohshimai* Utinomi from Rishiri, except for A and B. (♂) A, outline of trunk and abdomen, viewed from side (in female from Akkeshi). ×18; B, chelate chelifore (in young female from Monbetsu). ×67; C, chelifore. ×67; D, third leg. ×33; E, tarsus and propodus. ×63; F, oviger. ×42; G, terminal joints of oviger. ×190.

Measurements of a male (in mm)

Length of proboscis	1.4	Coxa II	0.4
Length of trunk	1.2	Coxa III	0.3
Length of abdomen	0.9	Femur	0.9
Length of chelifore	0.4	Tibia I	0.8
Width of cephalic segment	0.8	Tibia II	0.9
Width across second lateral processes	1.4	Tarsus	0.2
		Propodus	0.65
Third leg:		Terminal claw	0.4
Coxa I	0.4	Auxiliaries	0.25

Remarks. As already stated, the saddle-shaped trunk and the abdomen directed straight backward, armed with three spinose tubercles on the doral surface, are certainly remarkable characters in this species. In a female specimen from Akkeshi, however, the abdomen carries a series of eight smaller tubercles or setae only on the back (Fig. 8A), the number of tubercles may be thus variable.

Achelia segmentata sp. nov.

(Fig. 9)

Akkeshi. August, 1952. 7 females (holotype and paratypes), clinging to Rhodophyceae, F. Iwata coll.

DESCRIPTION OF HOLOTYPE. At first sight these interesting specimens show some resemblances to the genera *Phoxichilidium* or *Anoplodactylus* in the elongate, segmented trunk and the absence of oviger in the female. But, the presence of 9-jointed palpi, the 2-jointed subchelate chelifores and the nature of the ambulatory legs show the closest relationship with the genus *Achelia*. In these respects, together with the segmented trunk, these specimens seem to be an intermediate form between the genera *Achelia* and *Ammothea*.

Trunk narrow, smooth, completely segmented, lateral processes well separated by a narrow triangular interval. Cephalic segment wider than long, rounded anteriorly, with a large eye tubercle in the center of its dorsal surface, widely separated from the frontal margin. Eye tubercle a low conical, acutely tipped mound, gradually elevated from the dorsal surface of cephalic segment proper, and armed with 4 distinct but comparatively small eyes.

Abdomen short, a little longer than the last lateral processes, directed obliquely upward and truncate at end.

Proboscis a little shorter than trunk, rather cylindrical, directed obliquely downward.

Chelifore 2-jointed, with a small reduced subchela; in smaller specimens distal joint still chelate and scape a little shorter than proximal joints of palpus.

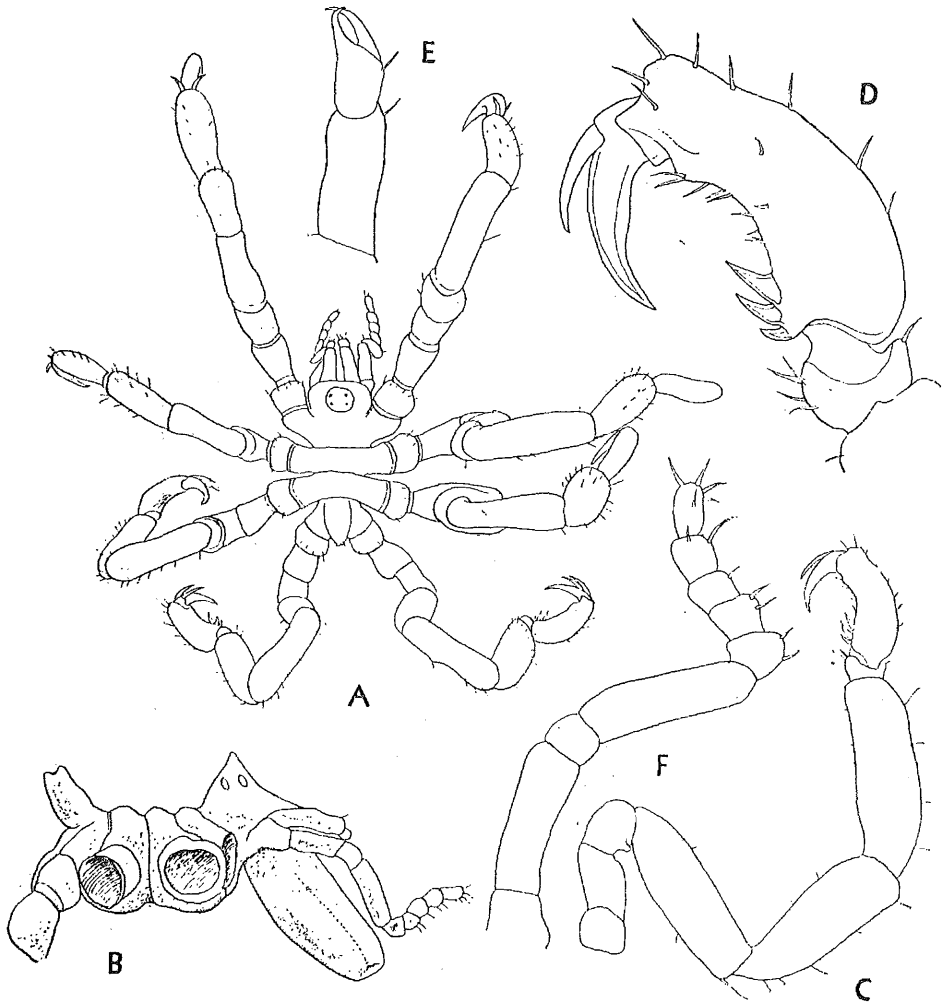

Fig. 9. *Achelia segmentata* sp. nov. (♀, holotype)
A, dorsal view of holotype. ×20; B, lateral view of trunk. ×33; C, third leg. ×33; D, tarsus and propodus. ×95; E, chelifore in young specimen. ×80; F, palpus. ×80.

Palpus slender, 9-jointed; the proximal joints together about as long as proboscis, without setae and terminal five joints bear each a few setae ventrally.

Oviger quite absent in any specimens.

Legs long, almost uniformly slender, without tubercles or protuberances, scarcely setose in most of the joints. Three coxal joints short, subequal in length; femur and two tibiae long, subequal in length, longer than the preceding three joints together, propodus slightly curved, widened proximally, with three close-set strong spines on heel; terminal claw about half as long as propodus; auxiliaries nearly two-thirds as long as terminal claw.

Measurements of holotype (female) (in mm)

Length of proboscis	0.7	Coxa II	0.26
Length of trunk	0.88	Coxa III	0.18
Length of abdomen	0.26	Femur	0.65
Length of chelifore	0.3	Tibia I	0.62
Width of cephalic segment	0.4	Tibia II	0.7
Width across second lateral processes	0.65	Tarsus	0.09
Third leg:		Propodus	0.4
Coxa I	0.16	Terminal claw	0.2

Remarks. As described above, the oviger is apparently lacking in all female specimens, 0.44 to 0.88 mm in body length. They may be immature, since the chelifore still retains the chelate state in the chela, with only two exceptions including the holotype. Further finds of male specimens may prove if the absence of oviger is a constant character for this species or the female alone. This new species appears to be allied to *Achelia brevichelifera* Hedgpeth (1948) from deep waters of the Atlantic coast of North America in the completely segmented trunk and 9-jointed palpus, but distinctly separable from it in the shape of the chelifore and propodus and also the absence of the oviger.

Genus *Lecythorhynchus* Böhm, 1879

Lecythorhynchus hilgendorfi Böhm

Lecythorhynchus hilgendorfi Utinomi, 1951, p. 166 (for references and synonymy).

Oshoro. June 7, 1950. 3 ovigerous males and 1 juvenile, S. Motoda coll.

Oshoro. June 29, 1951. 2 ovigerous males and 1 female, on *Sargassum*, M. Yamada coll.

Muroran. May 22, 1951. 1 ovigerous male and 1 female (overgrown by several worm-tubes and adherent Foraminifera *Cibicides lobatulus*), M. Yamada coll.

Muroran. July 16, 1950. 1 ovigerous male, and 4 females, M. Yamada coll.

Akkeshi. June 6, 1951. 1 ovigerous male, with 3 egg-masses, and 2 females, M. Yamada coll.

Akkeshi. Date unknown. 1 ovigerous male, with 4 egg-masses on oviger, 7 females and 1 juvenile, M. Yamada coll.

Akkeshi. March, 1951. 7 males, 24 females and 5 juveniles without ovigers, F. Iwata coll.

Remarks. As represented abundantly by this collection, this species is a very common littoral pycnogonid in Hokkaido, extending as far south as Kyushu and further towards the Chinese coasts (Lou, 1936b). The largest one of females examined here attains 5.5 mm in total length and 17 mm in length of the fourth leg; its proboscis is 2.7 mm, trunk 2.5 mm and abdomen 1 mm. Schimkewitsch (1929, p. 50) recorded the California form *L. marginatus* Cole (1904) from the Sea of Okhotsk and Helfer (1938) also from Kobe, middle Japan, but so far as the present materials are examined, no specimen referable to the latter is found. Its occurrence in Japan is, however, not certainly confirmed. On this pycnogonid are occasionally found various encrusting organisms, such as the bryozoans, the polychaete *Spirorbis spirillum* (cf. Okuda, 1934) and the adherent Foraminifera *Cibicides lobatulus* (Walker et Jacob) here examined.

Family TANYSTYLIDAE Schimkewitsch, 1913

Genus *Tanystylum* Miers, 1879

Tanystylum anthomasthi Hedgpeth

(Figs. 10-11; Pl. I. fig. 2)

Tanystylum anthomasthi Hedgpeth, 1949, p. 297, fig. 45.

Daikoku-jima, mouth of Akkeshi Bay. June, 1951 and June 23, 1952. 2 males and 4 females, attached to the capitulum of *Alcyonium pacificum* Yamada, F. Iwata coll.

SUPPLEMENTARY DESCRIPTION. This interesting species has been first described by Hedgpeth (1949), based upon the original manuscript and drawings made by Prof. H. Ohshima and submitted to him, so that Dr. Hedgpeth himself has never possibly examined the specimens. In examining this new material obtained from the type locality, comprising both sexes and their host, it was revealed that the host of this pycnogonid does not belong to *Anthomastus** but really to the littoral octocoral somewhat resembling a mushroom, which has recently been described by Yamada (1950) from the same locality under the name of *Alcyonium pacificum*.

* *Anthomastus* (misspelt as *Anthomasthus* in Hedgpeth's paper) is principally a deep-sea octocoral. In the formation of the capitulum, it resembles somewhat but differs from *Alcyonium* by the dimorphic polyps.

Unfortunately, the holotype on which the original description was based may have been afterwards lost at Fukuoka, as Prof. Ohshima informs me. Therefore, I deem it wise to designate as the neotype a selected one among female specimens examined here and also a male as allotype. The following is the description of the allotype, in comparison with the female on which the original description is based.

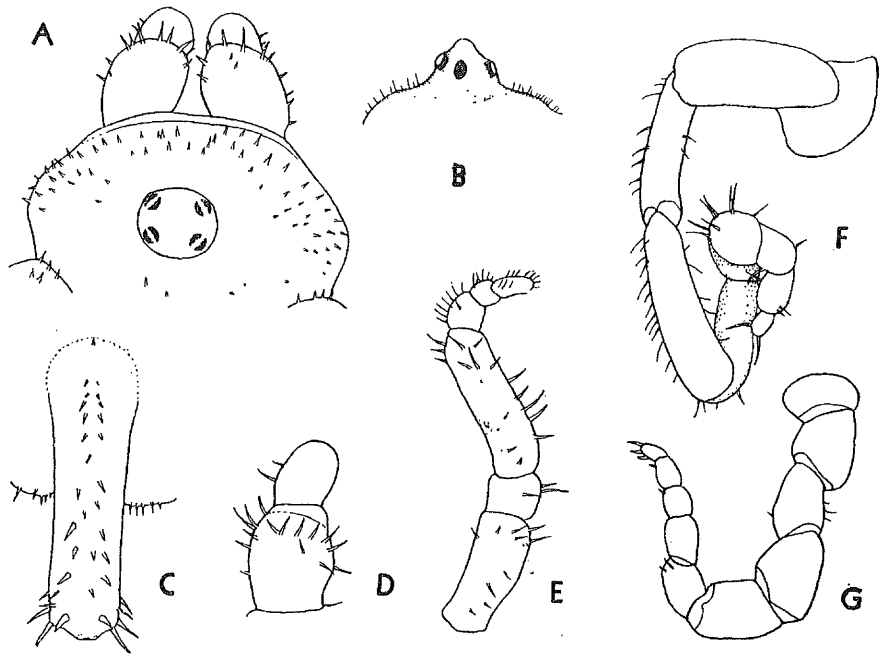

Fig. 10. *Tanystylum anthomasthi* Hedgpeth. (♂ except only G)
A, dorsal view of cephalic segment. ×33; B, lateral view of eye tubercle. ×26; C, abdomen. ×33; D, chelifore. ×33; E, palpus. ×26; F, oviger. ×33; G, oviger of female. ×33.

Trunk compact, circular in outline, very plump. Lateral processes contiguous but not coalesced. Cephalic segment slightly prolonged anteriorly, a little longer than half of its own width and roundly margined. There are no dorsal tubercles or processes, but the back is minutely setose, especially around the margins. The ventral surface is almost bare. Eye tubercle situated in the center of cephalic prolongation, erect, about as high as broad at base, roundly conical and with 4 distinct eyes, each of which is always divided into two, outer and inner, retinal layers.

Proboscis a little shorter than trunk, tapering to a blunt rounded tip, constricted around the base and directed downward.

Chelifore short, 2-jointed; basal joint plump, slightly longer than wide, setose distally; distal joint about half as long as basal, rounded, with only 2 setae on the outer surface.

Palpus 7-jointed, nearly reaching the end of proboscis; proximal four joints rather stout, setose in particular dorsally; terminal three joints successively smaller, shorter than the preceding fourth joint and setose ventrally.

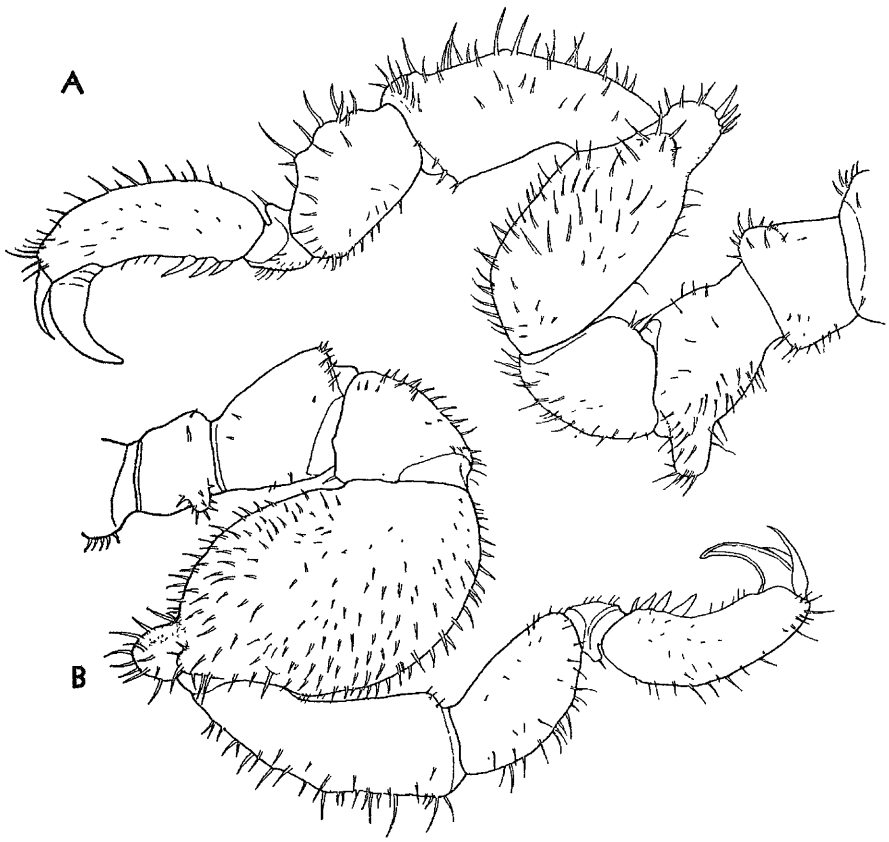

Fig. 11. *Tanystylum anthomasthi* Hedgpeth. (♂, ♀)
A, third leg of male. ×25; B, third leg of female. ×25.

Abdomen about twice as long as the last lateral processes, cylindrical horizontal, and armed with a series of setae along the dorsomedial line and longer setae terminally on each side.

Oviger longer in male than in female and twisted in a complicated manner. First joint roughly triangular in outline in ventral view, wider than long; second to fourth elongate, subequal; fifth slightly shorter;

seventh to tenth terminal joints successively smaller, armed each with a few long setae only.

Legs bent in a S-form, covered with a considerable number of fine hairlike setae. First coxa with a small setigerous rounded tubercle on the dorsodistal end. Second coxa slightly longer than the other two coxae and with a prominent genital process on the ventrodistal end in the last two pairs of legs in male:, such genital process not prominent in female. Femur longest of all joints, armed with a very prominent setigerous rounded protuberance and an additional smaller one on the dorsodistal end; it is not so much swollen as that of female in which it is about twice as wide as tibiae in lateral view. First tibia two-thirds as long as femur and second tibia more than half as long as first, both joints slightly inflated dorsally. Tarsus very short, with small process dorsally. Propodus rather stout, slightly tapering distally, slightly curved, with three prominent (rarely smaller one too) basal spines, but not forming a heel. Terminal claw half as long as propodus, rather stronger in male than in female, with auxiliaries a little more than half as long as terminal claw.

Uniformly yellow or straw-colored in alcohol.

Measurements of both sexes (in mm)

	♂	♀
Length of proboscis	1.7	1.7
Length of trunk	2.6	2.2
Length of abdomen	1.0	1.0
Length of chelifore	0.7	0.7
Width of cephalic segment	1.35	1.35
Width across second lateral processes	2.6	2.2
Third leg:		
Coxa I	0.5	0.6
Coxa II	0.7	0.8
Coxa III	0.6	0.6
Femur	1.6	1.3
Tibia I	1.3	1.0
Tibia II	0.8	0.7
Tarsus	0.18	0.18
Propodus	0.9	0.9
Terminal claw	0.4	0.4
Auxiliary claws	0.25	0.25

Remarks. This species seems to be unique for the genus in having the 7-jointed palpus and the coating of numerous hairlike setae. It is worth of note for future investigators that this species and the host alcyonarian have hitherto been recorded only from Akkeshi Bay, Hokkaido.

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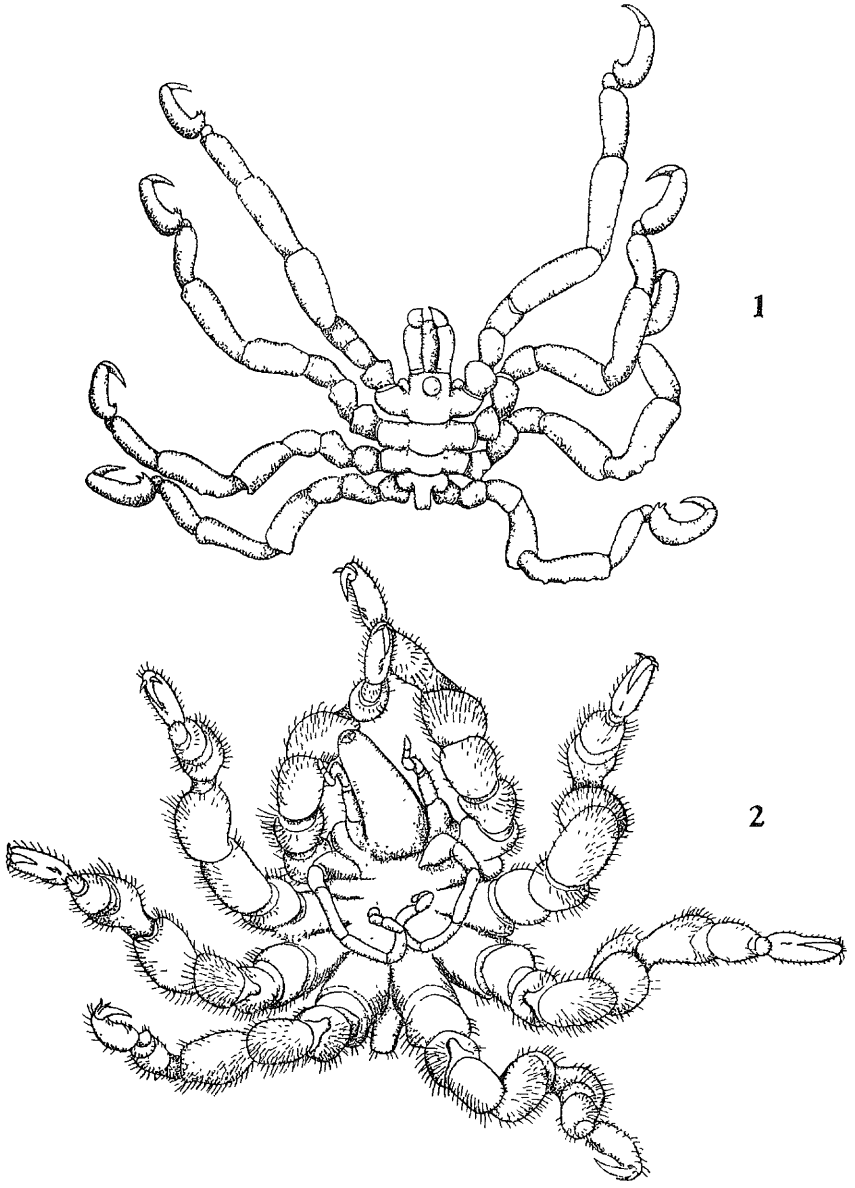
EXPLANATION OF PLATE I

Fig. 1. Dorsal view of *Phoxichilidium hokkaidoense* sp. nov. (♂, holotype). ×10.
Fig. 2. Ventral view of *Tanystylum anthomasthi* Hedgpeth. (♂, allotype). ×12.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