LIST OF THE RHODE ISLAND

Copepoda, Phyllopoda, and Ostracoda,

WITH

NEW SPECIES OF COPEPODA.

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A LIST OF THE RHODE ISLAND COPEPODA, PHYLLOPODA, AND OSTRACODA WITH NEW SPECIES OF COPEPODA.

THREE PLATES.

LEONARD W. WILLIAMS.

The Entomostraca, the class to which these orders belong, is a group of crustacea which in vast numbers inhabits nearly all bodies of water, fresh or salt. The economic value of these minute forms at first glance seems slight, but their importance as a food supply, the effect of the numbers which live as parasites on fish, and the work they perform in destroying other still more minute forms, injurious to fish, make them a group by no means negligible by the practical fish culturist. Many small fish undoubtedly depend on copepods and phyllopods for food. The stomachs of young pickerel (*Esox reticulata*) which we examined were filled with the remains of phyllopods, while larval lobsters were proved conclusively to prefer copepods and phyllopods to other food. Many food fish subsist partially at least on entomostracas, and the appearance of "schools" of fish may depend directly or indirectly on the presence of these crustacea. The entomostraca, therefore, are one of the most important links in food supply between the lower plants and animals and the higher animals.

This list makes no pretence at completeness, but merely brings together all previously recorded species and those identified in the tows taken during a year and a half. Further work could easily enlarge the list, as the entomostracal fauna of the State is very rich and has received but little study. No especial attempt has been made to obtain fresh-water forms, but such as have been identified are included. The marine forms were largely secured by towing

during the winter in upper Narragansett Bay, and in summer in the Wickford region and in Charlestown Pond, a brackish inlet from the ocean.

A special examination was made of the common mollusks to find whether they were inhabited by copepods. The mussels and scallops yielded negative results, but the common clam (*Mya arenaria*) was found to be almost invariably the host of a new copepod which occurred also in the quahog (*Venus mercenaria*) and in the sea clam (*Mactra solidissima*). It had been hoped to secure a large number of the forms parasitic on fish, but diligent search throught the summer discovered only a few species, the fish in Narragansett Bay being apparently unusually free from parasitic copepods. Our thanks are here due to Mr. Henry C. Tracy for specimens of a number of parasitic forms.

The species starred in the list are recorded from Rhode Island for the first time.

Copepoda.

Argulus laticauda Smith.

On tautog and eel. Wickford and Charlestown Pond.

Argulus megalops Smith.

On flounder. Matunuck.

*Argulus funduli Kröyer.

On Fundulus heteroclitus. Wickford.

Caligus rapax Milne Edwards.

On the skate, dogfish, and many other fish. Cox Ledge. (M. J. Rathbun: Fauna of New England, 5. List of the Crustacea. Boston Soc. Nat. Hist.)

*Lepeopthheirus edwardsi Wilson.

On flounder. Wickford.

Dinematura latifolia Steenstrup & Lütken.

On Lamna cornubica. Cox Ledge. (Rathbun's List.)

*Lernæenicus radiatus (Lesueur).

On menhaden. Wickford and off Montauk Point.

Clavella uncinata (O. F. Müller).

On cod and haddock. Cox Ledge. (Rathbun's List.)

Calanus finmarchicus (Gunnerus).

Narragansett Bay. January. This species, so well known as the food of the pollock whale, appeared in winter tows only.

Pseudocalanus elongatus (Boeck).

Narragansett Bay. January and February.

Centropages hamatus (Lilljeborg).

Narragansett Bay. Common throughout the year.

Pseudodiaptomus coronatus Williams.

Narragansett Bay and Charlestown Pond. Abundant throughout the year. Many pairs *in copula* were taken during the summer in Mill Cove, Wickford.

Our attention has been called to the similarity between this species and P. pelagicus Herrick from the Gulf of Mexico, and we admit the striking resemblance in general features. We suspect that Herrick's description and drawings, upon which we depended and which certainly cannot be harmonized with our specimens, may represent a species of which ours is a northern variety. A comparison of the type specimens would be necessary to settle this point. We may note in passing that the structure which Herrick describes as a spermatophore is, in our specimens, a reduced egg-sac containing two, occasionally three, eggs.

Temora longicornis (O. F. Müller).

Narragansett Bay. Abundant throughout the year.

Eurytemora americana Williams.

Narragansett Bay. Throughout the year.

Eurytemora hirunoides (Nordquist).

Narragansett Bay and Charlestown Pond.

Eurytemora herdmani Thompson & Scott.

Wickford. Abundant in summer.

Acartia tonsa Dana.

Narragansett Bay and Charlestown Pond. Summer.

Acartia clausii Giesbrecht.

Narragansett Bay. Throughout the year.

Tortanus setacaudatus Williams.

Narragansett Bay and Charlestown Pond. Though occurring in winter tows in the bay, this species was not found at all in summer tows in the Wickford region.

Oithona plumifera Baird.

Narragansett Bay. February.

Oithona similis Claus.

Wickford. Summer.

*Oithona nana Giesbrecht

Wickford. This is the first record of the occurrence of this species in American waters .

*Cyclops serrulatus Fischer.

Wickford and Fruit Hill ponds.

*Cyclops lucidulus Koch.

Fruit Hill.

*Cyclops leuckarti Claus.

Mill Pond, Wickford.

Longipedia coronata Claus.

Narragansett Bay and Charlestown Pond.

Ectinosoma normani T. & A. Scott.

Charlestown Pond. Summer.

Ectinosoma curticorne Boeck.

Wickford and Charlestown Pond.

Microstella norvegica (Boeck).

Narragansett Bay.

Tachidius littoralis Poppe.

Upper Narragansett Bay.

Tachidius brevicornis (Müller).

Charlestown Pond. Summer.

Parategastes sphæricus (Claus).

Wickford and Charlestown Pond.

Diosaccus tenuicornis (Claus).

Wickford and Charlestown Pond.

Dactylopusia vulgaris (G. O. Sars).

Wickford and Charlestown Pond.

Thalestris serrulata Brady.

The record for this species rests on one specimen from Rocky Point.

Harpacticus uniremis Kröyer.

Upper Narragansett Bay.

Harpacticus chelifer (Müller).

Wickford and Charlestown Pond. Many of the specimens show points of resemblance to H. gracilis.

Idya furcata (Baird).

Narragansett Bay. Common.

*Ilyopsyllus natans n. sp. Plate I.

Body heavy, short, and pear-shaped, except that its ventral edge is almost straight while its back is correspondingly elevated. Color, opaque reddish-brown with scattered brilliant red spots. Rostrum, strong, large, and jointed at base; its apex with two down-curved, ciliated, movable spines. Eye, large, red, T-shaped, with three lenses in front, one on each side, and one in the middle in base of rostrum. The 1st of the ten segments is very large, strongly convex above, and has nearly straight ventral and posterior edges. The following segments taper rapidly to the small abdomen. Thoracic segments of nearly equal width; ventro-lateral angles of first three free thoracic segments form triangular, acute processes, that of the 2nd and 3rd has also an accessory tooth. Preanal abdominal segments of equal width; anal segment very short with a blunt, median, dorsal projection. Posterior edge of the abdominal segments spinose on the belly and sides. Furca short, spinose, with a small, jointed dorsal seta, a minute inner bristle, and two terminal setæ; inner terminal seta as long as body, its proximal half broad and naked, its distal

half tapering abruptly and plumose exteriorly; outer seta one fourth as long as inner, plumose exteriorly.

Female:—First antenna short, less than half as long as the head segment, and six-jointed; 1st joint large, quadrate, with a row of coarse spines on the inner side of its upper surface; 2nd joint as broad as the first, very short, and prolonged in front into a rounded prominence fringed with blunt spines; 3rd joint smaller, bearing on its anterior distal angle a large esthetask, one third longer than the antenna, and supported by a 2-jointed accessory branch; 4th, 5th, and 6th joints small, about equal, and bearing a number of bristles. Second antenna longer and heavier than the first, three-jointed; 1st and 2nd joints large, a little longer than broad, the 2nd spined on the upper edge at the end; 3rd joint more slender, bearing six strong, curved spines of unequal length. Mandibles and maxillæ reduced and adapted for sucking. Mandible pointed at the end, bearing a two-jointed palp and forming with its mate a tube-like trough. First joint of palp small; 2nd joint elongated and bearing two bristles, one slender and long, the other shorter and plumose on both edges. First maxilla (?) about a third as long as the mandible, and similar in shape, but with two or three slender teeth at apex. The maxillæ appear to be partially enclosed in the mandibular tube. The 2nd maxilla was not found. The maxillipeds are partially united, having a common quadrate basal joint; each branch is further made up of two joints, the first long and slender, the second minute and bearing a rather long seta.

The basipodite of the 1st foot is formed of two broad, heavy joints, each spinose anteriorly, the second with two heavy curved spines at the distal angles; inner ramus 2-jointed, the 2nd joint somewhat longer than the first, with two terminal spines, the inner about a third longer than the outer and slightly plumose on the outer side; outer ramus 3-jointed, twice as long as inner, each joint spinose distally and with a strong curved spine at the external distal angle, last joint with two additional terminal spines. Second to 4th feet alike, both rami 3-jointed and with slender setæ sparingly and delicately plumose.

Fifth feet forming a symmetrical plate, each side of which is three-lobed, the external lobe bearing a short curved bristle.

Male:—First antenna 8-jointed; two basal joints like those of female antenna; 3rd joint shorter than in the female with similar accessory branch and esthetask; 4th joint of similar size and shape to the 3rd joint of the female antenna, but with an esthetask upon an unjointed projection; 5th joint smaller, broader than long; 6th joint longer than broad, concave in front; 7th and 8th joints small; 7th with a projecting knob in front, 8th with four moderately long bristles.

The 5 foot is similar to that of the female, but is more slender and lacks the bristles.

Length, 0.47 mm.

This species is very similar to I. coriaceus B. & R. (Brady & Robertson, Ann. and Mag. Nat. Hist., ser. 4, vol. xii, p. 132, pl. i), figs. 1–5. 1873; and Brady's Monograph of the British Copepoda, vol. ii, p. 148, pl. lxxxii, figs. 1–10. 1880), and to I. holothuriæ (Edwards) (C. L. Edwards, *Abacola holothuriæ*, Arch. f. Nat. p. 92, pl. 5, figs. 1–17. 1891), but differs markedly from them in its habit of swimming actively near the surface. It was taken in a number of surface tows in the channel of Mill Cove, Wickford. The rostrum and 1st antenna of the female are very similar to those of I. holothuriæ. The 1st foot of male and female and the mouth-parts are similar to those of I. coriaceus. This species has 5th feet entirely different from those figured by Edwards, and we do not find the organ between the fourth limbs of male figured by Brady.

*Lichomolgus fucicolus Brady.

Wickford and Charlestown Pond.

*Lichomolgus adherens n. sp. PLATE II.

Female.—Thorax ovate; cephalic segment forming more than half of thorax, three free thoracic segments nearly equally broad, outer angles rounded. Abdomen 6-jointed, $\frac{1\ \ 2\ \ 3\ \ 4\ \ 5\ \ 6\ \ 7}{18\ 22\ 15\ 30\ 18\ 16\ 20}$. First and 2nd (genital) segments broader than the others; pos-

terior edge of anal segment beset with spines. Furca with branches slightly divergent, each branch twice as long as broad and bearing two dorsal and four terminal setæ; dorsal setæ short, the outer slightly in advance of the inner; inner terminal seta one-half longer than furca, plumose; 2nd bristle as long as abdomen, jointed at base and plumose; 3rd bristle more than half as long as second and like it jointed at base and plumose; outer bristle shorter than furca, slender, naked. First antenna 7-jointed ; length of joints $\frac{1}{18}\ \frac{2}{22}\ \frac{3}{15}\ \frac{4}{30}\ \frac{5}{18}\ \frac{6}{16}\ \frac{7}{30}$ shorter than the cephalic segment; 1st two joints with many flaccid bristles, other joint with fewer bristles. Second antenna 4-jointed; 1st as long as other three combined; 2nd joint about one-third as long as 1st, expanded at tip and bent backward so that the distal limb of the antenna is nearly parallel to the proximal limb ; 3rd joint short with three or four strongly curved stiff bristles upon its distal lower angle; 4th joint with seven long curved unequal terminal bristles; the upper edges of the last two joints are fringed with short spines. Mandible strong with a hooked toothed and jointed terminal claw; palp(?) one-jointed with three strong, and as many slender, bristles. First maxilla(?) one-jointed with three irregular lancet-like bristles. Second maxilla two-jointed ; proximal joint much swollen with two lancet-like plumose bristles on its inner edge; distal joint small, with one large heavy claw and two heavy bristles. Maxilliped two-jointed; proximal joint bearing a small lobe (inner ramus ?) with two large bristles; distal joint long, broadly elliptical, with a single two-branched terminal claw, anterior branch bristle-like, posterior branch larger, broad, with four or more bristles on its posterior edge. First to 4th feet with both rami three-jointed. First foot with bristles and spines divergent; 4th foot scarcely differing from the third. Fifth foot two-jointed; distal joint elliptical, twice as long as broad, with two spines on the distal portion of the outer edge, one terminal spine and a short terminal bristle. Two egg sacs. Male not found. Length 1.2 mm.

Wickford, very abundant under small stones between tides.

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*Lichomolgus major, n. sp. Plate III.

Lichomolgus major n. sp. Plate III.

Large, long female, (1.3 mm. male 1.9 mm. without caudal setæ), of transparent grayish or pinkish color. Body tapers regularly from the cephalic segment.

Female.—Three free thoracic segments of equal width and rounded at the sides. Abdomen 5-jointed, relative length of joints and furca $\frac{1}{8}\ \frac{2}{12}\ \frac{3}{7}\ \frac{4}{7}\ \frac{5}{11}\ \frac{6}{13}$. Furca six times as long as broad, with six setæ; one on outer edge nearer the proximal than the distal end of furca, a minute dorsal bristle, and four terminal setæ, inner and outer minute, 2nd twice the length of furca, 3rd one-half the length of furca. The lower portion of posterior edges of the abdominal joints and the lower surface of the furca fringed with heavy short spines. First antenna 6-jointed, a little more than one-half the length of head segment, beset with short bristles, relative length of joints $\frac{1}{16}\ \frac{2}{34}\ \frac{3}{20}\ \frac{4}{8}\ \frac{5}{12}\ \frac{6}{17}$. Second antenna 4-jointed, 1st joint long and directed forward and inward, 2nd and 3rd short, 4th slightly longer and armed below with heavy triangular spines, with two heavy terminal claws and three heavy terminal setæ. Labrum ending in an acute, backwardly directed spine. Mandible with an apparently movable terminal claw which has at base a hemispherical pad beset with recurved bristles. First maxilla with a single shoe-shaped joint from whose tip arises one long and two short bristles; lower surface with a similar trio of bristles. Second maxilla 2-jointed basal joint swollen, terminal joint heavy, straight, spine-like, with one bristle midway upon its posterior edge. Maxilliped absent (?).

First to 4th swimming feet with both rami 3-jointed. Many of the bristles and spines of the legs are irregularly swollen or constricted. The sternite between each pair of legs forms a ridge which is shaped like half of a dumb-bell and has several heavy, flat, spines on each rounded projection. The spines of all legs are entire. Distal joint of basipodite of 1st leg with a broad spine upon its internal angle. The edges of both rami and of the basipodite as well as the distal edge of the 2nd joint of the basipodite are fringed with heavy, triangular, acute spines. Fourth foot does not differ from the others. Fifth foot 2-jointed, 1st joint short with a single bristle upon a slight

stalk, distal joint three times as long as broad, with a conical end and with two heavy serrate outer spines, a long serrate terminal spine, and a short stalked bristle on its upper surface near the distal end. The outer angle of the basal, and the outer side and end of the distal joint are covered with short, heavy, unjointed spines.

Male.—Thorax like that of female. Abdomen 6-jointed, relative length, $\frac{1}{25}\ \frac{2}{50}\ \frac{3}{30}\ \frac{4}{33}\ \frac{5}{16}\ \frac{6}{48}\ \frac{6}{5}$. Second joint swollen, bearing on each side a fringe of spines and a single bristle. Abdomen otherwise as in female. Antenna and mouth parts as in the female except that a large 3-jointed maxilliped is present, 1st and 2nd joints of maxilliped of equal length; 2nd swollen and with a number of acute tubercles upon its inner side near the base and two rows of tubercles near the distal end of the joint, with a short bristle at the proximal end of each row of tubercles; distal joint sickle-shaped and serrate, enlarged at base and bearing there a small bristle. Feet as in female.

Wickford and Matunuck, in the common clam (*Mya arenaria*) the quahog (*Venus mercenaria*) and in the sea clam (*Mactra solidissima*). Almost every clam and quahog which we opened contained one or more of these copepods in the mantle cavity. A very characteristic matanauplius which is very abundant in the Bay during the spring and summer, resembles this species, and though all efforts to rear the metanauplius were unsuccessful, we suspect that it is the young of this species.

Phyllopoda.

*Ceriodaphnia reticulata Jurine.
Mill Pond, Wickford.

*Sida crystallina (Müller)
Mill Pond, Wickford.

*Pseudosida tridentata Herrick.
Mill Pond, Wickford.

*Scapholeberis mucronata (O. F. Müller).
Wickford. Common throughout the eastern United States.

*Podon polyphemoides Leuckart.

Abundant in the tows taken in the middle of Narragansett Bay together with the following species. Summer.

*Evadne normanni Lovén.

Abundant in tows from Wickford to Newport. Summer. We have been able to find no previous American record for this or the preceding species.

*Camptocerus macrurus (O. F. Müller).

Mill Pond, Wickford.

*Polyphemus pediculus (Linné).

Mill Pond, Wickford.

Limnetis gouldii Baird.

Near Providence. (A. S. Packard, Twelfth ann. rept. U. S. geol. & geogr. sur. for 1878 (1883), pt. 1.)

Eubranchipus vernalis (Verrill).

Pawtucket, Newport. (Packard.)

OSTRACODA.

*Sarsiella zostericola Cushman.

Wickford. In tow taken at night. This species has been previously reported from the Wood's Hole region only.

*Loxoconcha impressa (Baird).

Wickford. On eel grass and in dredgings.

Plate I. ILIOPSYLLUS NATANS. n. sp.

♀	Female, x 20.
R	Rostrum, eye, and basal joints of first antenna of female, x 360.
F	Furca, x 44.
$A^1♂$	First antenna of male, x 360.
$A^1♀$	First antenna of female, x 360.
$P^5♀$	Fifth pair of swimming feet of female, x 360.
$P^5♂$	Fifth pair of swimming feet of male, x 360.
MP	Maxillipeds, x 360.
MX	Maxilla (first or second?), x 360.
M	Mandible, x 360.
$P^1♂$	First swimming foot of male, x 360.
$P^1♀$	First swimming foot of female, x 360.
A^2	Second antenna, x 360.

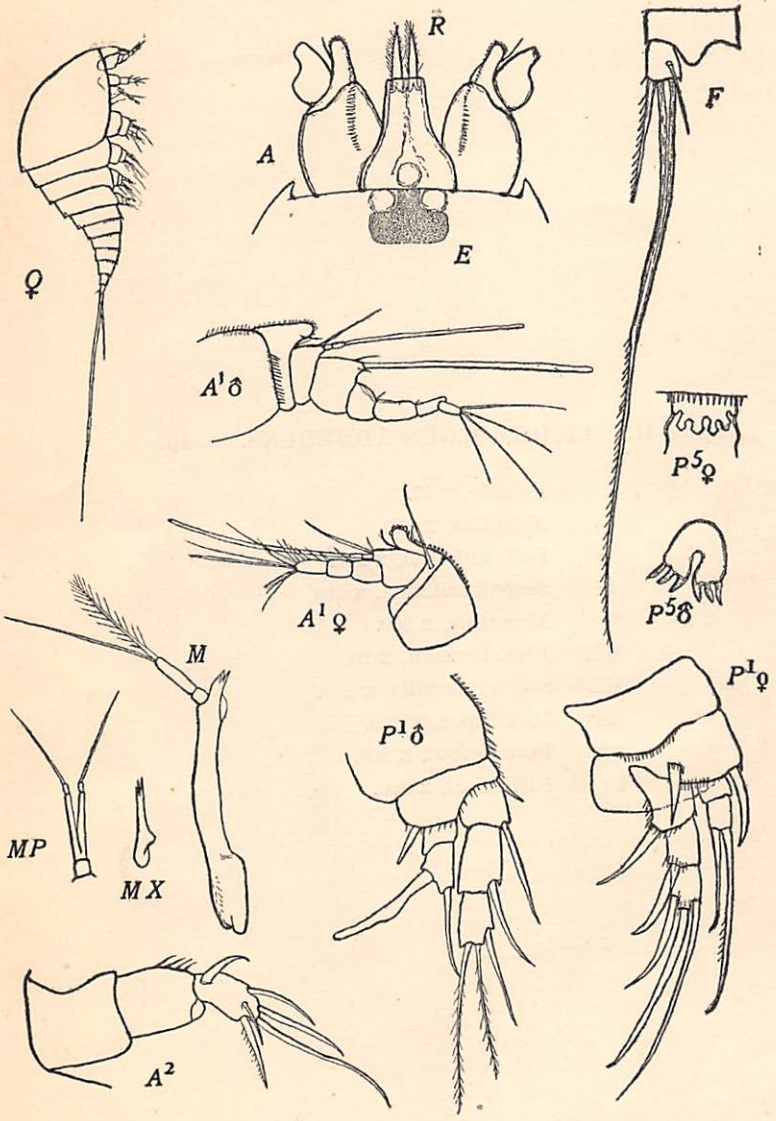

PLATE I.

Tliopsyllus Natans n. sp.

Plate II. LICHOMOLGUS ADHERENS. n. sp.

♀	Female, x 57.
N	Nauplius, x 370.
A^1	First antenna, x 260.
A^2	Second antenna, x 260.
M	Mandible, x 260.
MX^1	First maxilla, x 260.
MX^2	Second maxilla, x 260.
MP	Maxilliped, x 260.
P^4	Fourth foot, x 260.
P^5	Fifth foot, x 260.

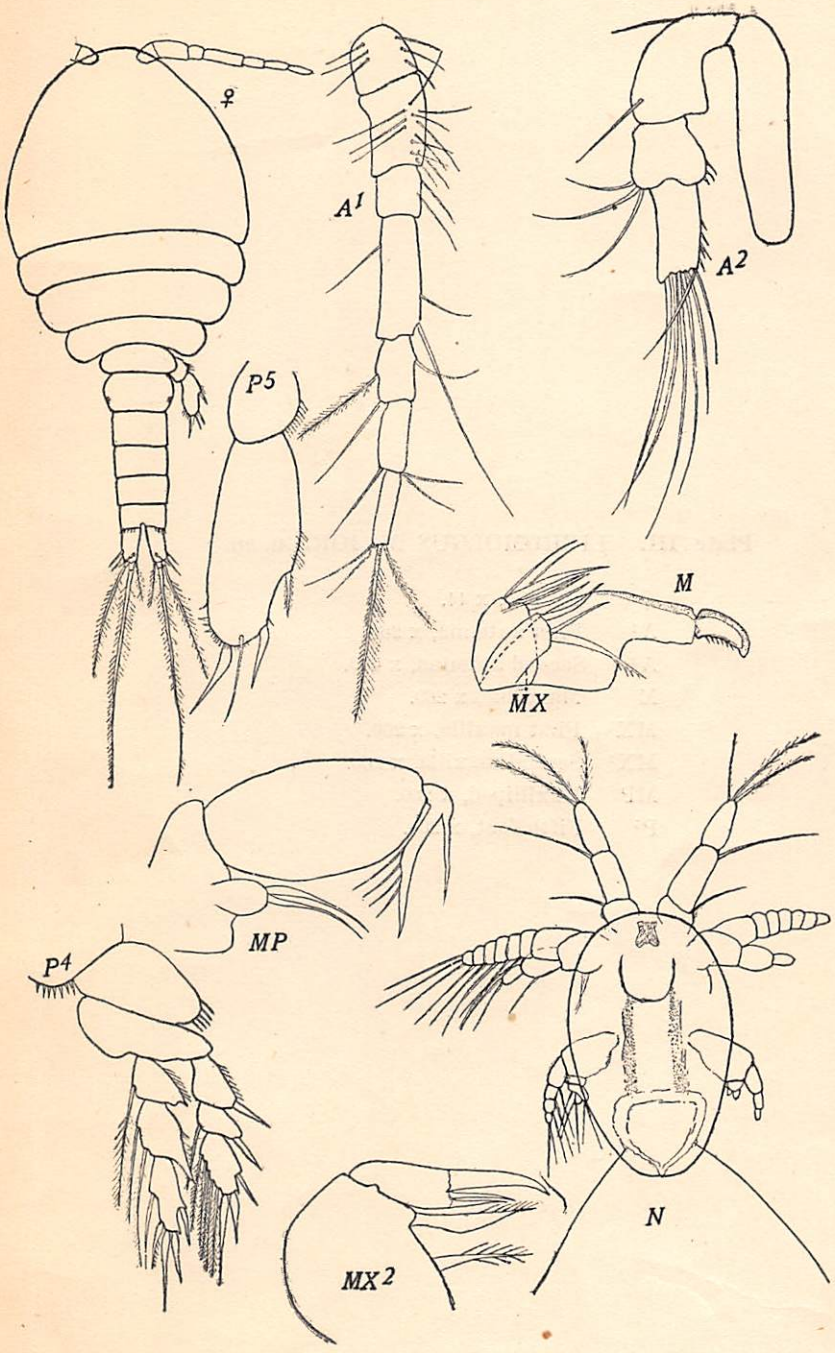

PLATE II.

Tichomolgus adherens n. sp.

Plate III. LICHOMOLGUS MAJOR. n. sp.

♀	Female, x 44.
A^1	First antenna, x 260.
A^2	Second antenna, x 260.
M	Mandible, x 260.
MX^1	First maxilla, x 260.
MX^2	Second maxilla, x 260.
MP	Maxilliped, x 260.
P^5	Fifth foot, x 260.

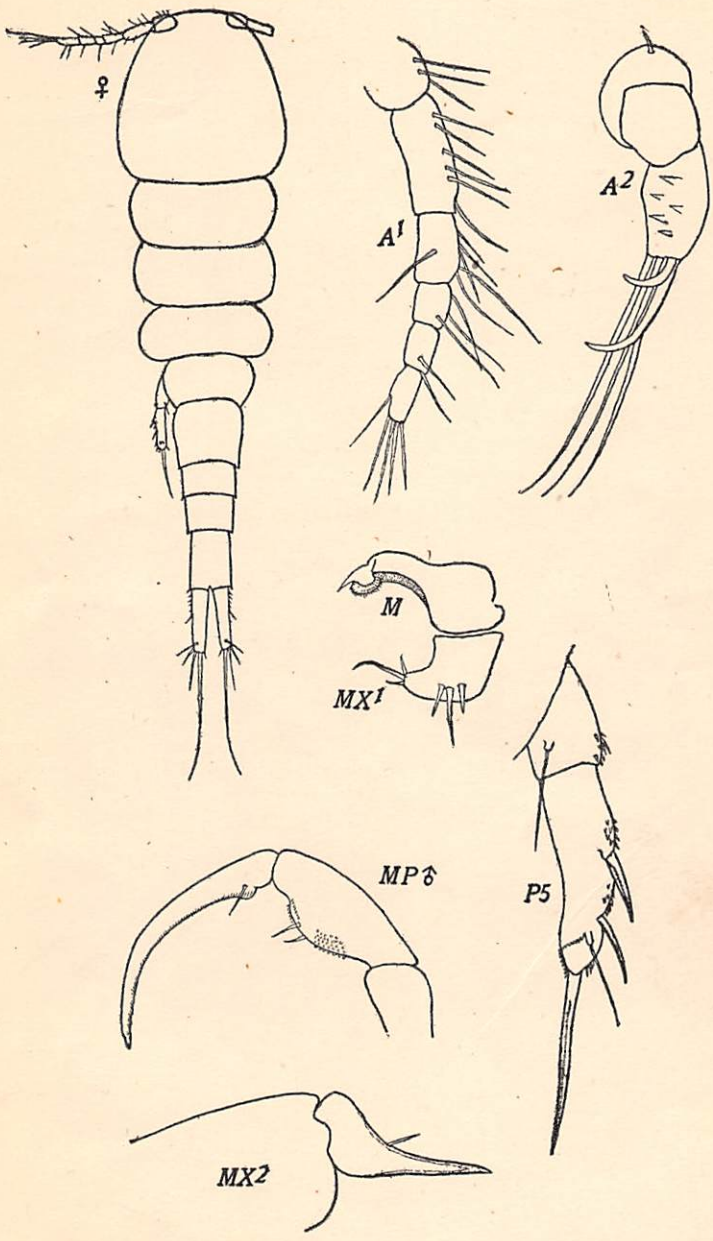

PLATE III.

Tichomolgus major n. sp.