SOME PENAEIDS OF THE RED SEA

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INTRODUCTION AND HISTORICAL

Five species of economic Penaeids are recorded in Suez Gulf and the Red Sea proper. These are : *Penaus trisulcatus* Leach, *Penaeus japonicus* Sp. Bate, *Penaeus semisulcatus* de Haan, Metapenaeus *Philippii* (Sp. Bate) *var. (new) Attaqa* and *Metapenaeus stebbingi* (Nobili).

The present study deals with ; taxonomy, food contents, geographical and local distribution, larval stages whenever possible, fishing gears and methods of the five species.

MATERIAL AND METHODS

Penaeus trisulcatus Leach, *Penaeusjaponicus* Bate, *Penaeus semisulcatus* de Haan, *Metapenaeus philippi* (Sp. Bate) *var.* (*new*) *attaqa* and *Metapenaeus stebbingi* (Nobili) specimens were procured from Attaqa Bay and the great Bitter Lake by means of shore-seines and otter-trawls. Their larvae were also obtained by tow-netting in Suez Gulf and the Great Bitter Lake both horizontally and vertically.

To study the life-history of any of the above mentioned species, the larvae were procured from plankton hauls. They were reared in glass aquaria to get higher stages.

The following types of diets are offered for nutrition :

1.—Plankton.

2.—Eggs and larvae of Mollusca

3.—Powdered yolk of hen's eggs.

Aeration is made by means of a water syphon.

Camera Lucida drawings are made of specimens mounted in glycerine. The appendages are dissected and similarly drawn with the aid of Camera Lucida. Only very fine details such as the setules on the plumose setae are added free hand. Fresh specimens are always dealt with, killed by 3% formalin, drawn and dissected just after killing.

Living specimens of *Penaeus trisulcatus* Leach, *Penaeus japonicus* Bate, *Penaeus semisulcatus* de Haan, *Metapenaeus philippii* (sp. Bate) *Attaqa* and *Metapenaeus stebbingi* (Nobili), were kept in big glass aquaria and cement tanks in the laboratory, to observe their feeding habits, moulting, regeneration of lost parts, making and spawning pocesses.

Distribution of *Penaeus trisulcatus* Leach, *Penaeus Japonicus* Bate, *Penaeus semisulcatus* de Haan, *Metapenaeus philippii* (sp. Bate) *var* (*new*) *Attaqa*, and *Metapenaeus stebbingi* (Nobili), is plotted on maps.

Statistics of the catch of *P. trisulcatus* Leach, *P. Japonicus* Bate, *P. semisulcatus* de Haan, *M. philippii* (Sp. Bate) *var.* (*new*) *Attaqa* and *M. stebbingi* (Nobili) are obtained from the Coastguards and Fisheries Department.

The fishing gears and methods used for catching *Penaeus trisulcatus* Leach, *Penaeus Japonicus* Bate, *Penaeus semisulcatus* de Haan, *Metapenaeus philippii* (sp. Bate) *var.* (*new*) *attaqa*, and *Metapenaeus stebbingi* (Nobili), are described.

1.—*Penaeus trisulcatus* Leach 1815

Syn. Penaeus caramote Risso.

Penaeus Kerathurus.

Habitat and Distribution : *P. trisulcatus* inhabits the sandy and muddy sand bottom where it hides its whole body in sand during the day with the eyes, end of rostrum and antennae protruding out. *It had migrated through the Suez Canal from the Mediteranean to the Red sea where it established itself and now forms the bulk of the catch of economic penaeids from Suez Gulf.*

It can live in water having a low salinity i.e. in estuaries and can inhabit regions having high salinity. It is a resistant species and can be maintained easily.

The main places for fishing *P. trisulcatus* leach in Suez Gulf by otter-trawlers are; (Map No. 1) :

(1) El Hadida north of the Gulf to El-Sochna from depths ranging from about 18 to about 22 fathoms.

(2) Sudr, at depths ranging from about 22 to about 25 fathoms.

(3) Mattamer, at depths ranging from about 25 to about 27 fathoms.

(4) El-Hammam, at depths ranging from about 28 to about 30 fathoms.

(5) El-Zaafarana, at depths reaching about 40 fathoms.

A small percentage of the catch of *Penaeus trisulcatus* Leach is also got by means of purse-seines along the shore of Suez Gulf from Suez till El-Adabian (Map No. 1), from depths ranging from 5 to 8 fathoms.

Penaeus trisulcatus Leach is recorded in the Red Sea proper at Al-Ghardaqa in the Channel between Gifatin island and Abou Mingar and around Safaga Island but no fishing is carried out.

Geographical Distribution :

Penaeus trisulcatus Leach is a Mediterranean species especially in the Eastern Mediterranean particularly the coasts of Tunisia and its coastal lakes which are in communication with the sea where it is abundant, from the Eygptian Mediterranean coasts, from Alexandria in the west to El-Arish in the east and also from the Gulf of Alexandrette (Syria).

The species is an inhabitant of littoral and shallow water though it descends sometimes to considerable depths. *Penaeus caramote* (*trisulcatus*) Risso inhabits the Adriatic, Naples Bay, Ionian Sea, Aegean Sea, but also occurs on the West Coast of Africa being Known from Benguella. It is also recorded from Mauritania, Senegal and Cameroun till Portugal. It is doubtful whether *P. caramote* occurs also on the South Coast of England (Barnard, 1950 and Heldt, 1938).

Food and Feeding Habits :

By examination of a number of specimens fished by ottertrawls and purse-seines, the following food types are found in the stomach and intestine; the main bulk is diatoms that may be Coscinodiscus, fragments of red filamentous algae, filaments of green algae, crustacean remains i.e. antennules, antennae, legs, etc... scales of fishes, unidentified eggs (few), fragments of molluscan shells, parts of radiolarian shells and foraminifera. All mixed with divided debris and fine sand gravels.

The feeding method of *Penaeus trisulcatus* Leach in the laboratory is observed. Specimens were put in big glass aquaria which were prepared to match the habitat in which the animal lives. It seems that fish is a favorite type of food for them. It is also observed that they eat each other when no food is available i.e. they are cannibalistic.

Moulting :

Specimens kept in glass aquaria in the laboratory moulted in March and April, when the temperature of water is ranging between 19.5°C and 21°C. Specimens ready to moult do not feed but keep quiet motionless. The process of moulting was observed. The new exoskeleton is somewhat soft. It takes about 3 - 4 hours to become completely calcified and hard. Just after moulting the animal keeps motionless for sometime although it feeds when pieces of fish are given. When fully mature females moult, the two yellowish or olive green flaps of the receptaculum seminis disappear after moulting. No sexual change occurs to the adult males after this process. A *male penaeus trisulcatus* Leach was observed to moult twice in the laboratory in a period of 23 days. The animal was 15 cm. before moulting and 15.8 cm. after moulting i.e. there is an increase of 0.8 cm. in lenght of this specimen.

Spawning and Metamorphosis :

By dissection of female *Penaeus trisulcatus* Leach specimens, it was observed that the ovaries become fully ripe and the eggs well developed from October and during the winter months. The spawning season is in early spring and summer.

Fully mature male and female *Penaeus trisulcatus* Leach specimes were kept in winter, spring and summer in big glass aquaria, in order to observe the mating and spawning processes. Unfortunately no mating and no spawning occured.

From plankton hauls collected from Attaqa area by means of fine plankton nets of 129 M. p. I., the following larval stages of *Penaeus trisulcatus* Leach were procured:

(1) *Third Nauplius* (Fig,1 Pl. I)

Larva was obtained from plankton hauls.

Lenght of body 0.4 mm. Larva faint yellow with orange reddish chromatophores on the body, the bases of the antennules antennae and mandibles.

Posteriorly the body possesses a furca with two lobes. Each caudal ramus carries a long and a short spine.

The basal half of the antennule (Fig. 1, Pl. I) is divided into 10 distinct segments. The distal half is non- segmented and carries 2 long terminal plumose stae and 1 short non-plumose sata. A short non-plumose seta is present on the outer surface.

The exopodite of the antenna (fig. 1, Pl. I) is divided into 5 segments. The first basal segment is longer than the other 4 segments. It carries 1 non-plumose seta on its inner side and each of the succeeding 3 segments carries an inner plumose seta at its base. The last distal segment carries 2 terminal plumose setae and 1 inner plumose seta at its base. The endopodite is non-segmented and carries 2 inner short non-plumose setae and 3 long terminal plumose setae.

The mandible (Fig. 2, Pl. I) has got a swelling at its base. In this swelling the mandible of the future protozoea is developed. Both endopodite and exopodite are non-segmented and each carries 3 terminal plumose setae.

Laterally, both maxillae and maxillipedes I & II can be seen as small projecting duds.

(2) *Seventh Nauplius* (Figs. 3 & 4) Pls. II. & III).

Length of body 0.46 mm. Larva is transparent yellow with orange reddish chromatophores scattered on the body, caudal rami and the bases of the antennules, antennae and mandibles.

The posterior border of the carapace, begins to appear on the dorsal side, but not on the two sides.

The nauplius ocellus is a black spot in between the antennules.

The antennule (Fig. 5, Pl. IV) is 12-segmented. It carries 2 plumose, 2 non-plumose terminal setae and 1 small terminal spine. It also carries a hair on its outer side and a non-plumose seta on its inner side. The 3rd distal segment carries a small hair on its inner side.

The protopod of the antenna (Fig. 6, Pl. IV) is formed of the coxa and basis. The endopod is non-segmented. It carries 3 plumose terminal and I sub-terminal setae. The exopod is 4 - segmented. The first basal segment carries 1 median hair. The second and third segments, each carries a plumose seta at its base. The fourth segment carries a basal and 4 terminal plumose setae.

The mandible (Fig. 7, Pl. IV) is swollen at its base and the processes of the future mandible of the protozoea can be distinguished inside. Each of the endopod and exopod carries the usual 3 plumose terminal setae.

The maxillae, first and second maxillipedes (Fig. 4, Pl. IV) are free and Non-functional.

Each furcal ramus (Fig. 3, Pl. II) carries 6 spines, the fourth spine is the longest and the first, fifth and sixth are small. The spinal formula is thus 6 + 6

(3) *Eighth Nauplius* (Figs. 8 & 9, Pls. V & VI)

Length of body 0.52 mm. The larva is transparent, yellow with orange reddish chromatophores on the three pairs of appendages especially at their base, also on the two caudal rami and few are on the body.

Each caudal ramus (Fig. 8, Pl. V) carries 7 spines. The spinal formula is 7 + 7 . The fourth spine from outside is still the longest.

The border of the carapace is very clear dorsally at the level of maxilla II. Posteriorly the body is divided into 4 segments.

The nauplius ocellus is still present and 2 frontal organs can be easily seen projecting from the anterior border of the body.

The antennule (Fig. 10, Pl. VII) is 15-segmented. At the apex it carries 2 long plumose terminal setae and 1 short non-plumose seta. There is also a short sub-terminal hair.

The endopodite of the antenna (Fig. 11, Pl. VII) is non-segmented and carries 2 plumose and 1 non-plumose terminal setae. The exopodite is 5-segmented. The fifth distal segment carries 4 terminal plumose setae and a small spine. At its base and on its inner side there is a plumose seta. Each of the third and fourth distal segments, carries a plumose seta at its base and on its inner side.

In the swelling present at the base of the mandible (Fig. 12, Pl, VII), can be distinguished different parts of the mandible of the future first protozoea.

The maxillae and maxillipedes (Fig. 9, Pl. VI) are more elongated than in the previous stage and are not contained in the concavity of the body. They have the characters and the aspect which they will have in the future protozoea.

The differences between the eighth nauplius stage and that of Mme. Heldt, lies in the following; the exopodite of the antenna of the nauplius in case of Heldt's carries 8 plumose setae, 1 non-plumose seta and 3 rudimentary setae. The endopodite carries 5 plumose setae, 2 non-plumose setae and 2 rudimentary ones.

(4) *First Protozoea* (Fig. 13, Pl. VIII)

Length of larva (from the anterior margin of the carapace to the bifurcation of the tail) ranges between 0.76 mm and 1.1mm. That of Heldt (1938) ranges between 0.98 mm. and 1.17mm.

The body is transparent and ± yellowish in colour. On the carapace are disposed dense orange reddish chromatophores. At the base of each antennule there is a reddish pigmentation. There are orange reddish pigments in the antennae and the segmented part of the body especially on the sides of the last thoracic segments. At the base of the first pair of maxillipedes and on the endopodites of the second pair of maxillipedes there are orange reddish pigments. On the caudal rami, in addition to the yellowish pigments; there are reddish orange ones.

The carapace is ± octagonal and fixed posteriorly to the body at the junction between the second maxilla and the first pair of maxillipedes and its posterior border occupies the middle of the 9th segment. Thus, it covers the anterior part of the body which comprises the first eight segments of the cephalo-thorax and which carries the eyes and the seven pairs of succeeding appandages i.e. the antennules, antennae, mandibles, maxillules, maxillae and the first two pairs of maxillipedes.

The eyes are in the form of two ganglionic masses under the cuticle of the anterior border of the carapace. Ventrally between the two ganglionic masses persists the ocellus of nauplius which is blackish in colour. There is also on the ventral surface, just in front of the two ganglionic masses, 2 small horns which are the frontal organs.

The elongated part of the body which follows the carapace does not possess any appendages. The anterior half of the body is segmented and thus represents the 9th to the 14th segments of the cephalo- thorax. There are no spines on any of these segments. In early hatched protozoea, the body behind the 14th segment is divided internally into 2 segments which represent the first 2 abdominal segments. In late protozoea there are 5 segments, but the 6th abdominal segment is not yet separated from the telson.

The body ends by a large furca. Each furcal (caudal) ramus carries 7 finely plumose setae ; the middle one is the longest. The most internal one meets its fellow of the other furcal ramus towards the middle line. The most external one is situated dorsally and is directed backwards or posteriorly. The two caudal or furcal rami diverge forming an angle between them.

Under the labrum, the paragnaths are in the form of two lobes provided with radiating plumules.

The appendages, with the exception of the mandibles and the first maxillae are natatory in function.

The first pair of antennae or antennules (Fig. 13, Pl.VIII)-with the setae-measures 0.71 mm. It - without the setae - is slightly shorter than the carapace. It presents at its base 5 well-defined and short segments, followed by a long segment which occupies half the length of the antennule. It is terminated by a segment which is slightly shorter than the preceding one. Thus the first pair of antennae (antennules) is composed of 7 segments; the 6th of which is the longest. The setae which they carry are arranged in the following order: 3 lateral internal; the first of which is inserted at the base of the 6th segment, 2 external, 3 terminal of which two are long and finally one subterminal which is short. Of the two long terminal setae, one is granulated and the other carries short and widely spaced hairs.

The second pair of antennae (Fig. 13, Pl. VIII), is of the same length as the first; its two branches are nearly equal in length. The protopodite consists of 3 segments and the endopodite of 2 segments; carrying 4 internal seatae and 5 apical ones. The exopodite consists of 9 segments and carries 6 internal, 4 terminal and 2 external setae.

The mandible (Fig. 14, Pl. IX) is distinctly divided into 2 parts; the incisor process and the molar process. Between the two processes there is a strong tooth and a straight plate borded on one of its sides by fine setules. The right and left mandibles are identical in shape.

The two pairs of maxillae are found on the two sides of the buccal zone and their free extremities are directed forwards.

The first maxilla (Fig.15, Pl. IX) consists of 2 endites carrying strong setae; the first endite carries 7 setae and the second 4. The endopodite is divided into 3 segments; the first (proximal) two carry 2 long setae and the last (distal) one 5. The exopodite is reduced and in the form of a rounded disc provided with 4 long finely plumose setae.

The second maxilla (Fig. 16, Pl. IX), its basal part consists of 4 endites with their free borders rounded. The first carries 9 setae and each one of the other 3 carries 4 strong setae. The endopodite is divided into 5 segments; the first (distal) carries 3 setae, the next three segments each carries 2 setae and the last (proximal) segments carries 3 setae. The exopodite, which will be the future scaphognaphite carries 3 long, finely plumose setae.

The two pairs of maxillipedes (Fig. 17 and Fig. 18, Pl. IX) are slightly different. They are biramous with the endopodite 5-segmented; the first is not well-defined at its base and the exopodite is not segmented. The internal borders of the endites are richly provided with plumose setae especially the first pair of maxillipedes.

(5) *Second Protozoea* (Fig. 19, Pl. X)

The anterior part of the body is covered by the carapace and is joined to the cylindrical posterior part which ends by the furca.

The body is elongated and measures 1.72 mm.

In addition to the nauplius ocellus, there are two large stalked compound eyes at the anterior part of the carapace. The carpace is hexagonal contrary to the preceding stage which is octagonal. At its anterior part the rostrum is curved ventrally.

On the two sides of the rostrum and at a small distance from it, springs out from the anterior part of the carapace two supra-orbital spines situated dorsal to the eye-stalks. The two lateral spines represent a short external ramification at their middle.

Posterior to the carapace, the body is 11-segmented. The first 6 segments represent the thorax and the remaining 5 the abdomen. The thoracic segments are with rounded sides while the abdominal segments are cylindrical. The body is slightly enlarged behind the 5th abdominal segment and the furca has got 7 spines as in the previous stage.

Larva is faint yellow, with orange reddish chromatophores on the body and appendages especially at the bases. Also on the basal parts of the two caudal rami. The antennule (Fig. 20, Pl. XI) consists of three major parts. The basal part is divided into 3 segments. The third segment carries an inner hair in the middle. The third part consists of 1 segment and carries a hair and 3 terminal setae at its inner basal region; 2 of the setae are plumose and 1 non-plumose.

The antenna (Fig. 21, Pl. XI) consists of a protopod formed of 2 segments: the coxa and basis. The exopodite is formed of 8 segments. The 3rd segment carries 1 inner plumose seta and 1 outer simple hair. Each of the 4th, 5th and 7th segments, carries 1 inner plumose seta. The 8th segment carries 4 terminal and 1 sub-terminal plumose setae. The endopodite is formed of 2 segments. The basal segment carries 1 simple inner hair at its base and 1 inner plumose seta at the middle. The distal segment carries 2 basal and 4 terminal plumose setae.

The mandibles (Figs. 22 and 23, Pl. XI) are not identical contrary to the case of the first protozoea. The right mandible is the same as in the previous stage, i.e. it consists of a molar process carrying a number of blunt teeth and an incisor process carrying 4 sharp or pointed teeth. In the region between the incisor process and the molar process, the mandible has got 5 pointed teeth (Heldt, 1938 :3 teeth only). The incisor process of the left mandible carries 6 sharp teeth and the molar process carries 7 blunt teeth.

The maxillule (Fig. 24, Pl. XII) consists of 2 - segmented. mented protopod. The basal segment carries 7 plumose spines and the 2nd or distal segment carries 8 plumose spines in 2 groups of 4 plumose spines each. The endopodite is 3 segmen-ted. Each of the basal and second segments carries 1 plumose seta. The 3rd or distal segment carries 4 terminal and I sub-terminal plumose setae. The exopo-dite is bud-like and carries 4 plumose setae.

The maxilla (Fig. 25, Pl. XII) consists of a protopod composed of 4 segments. Each segment carries 3 plumose setae. The endopod is 5-segmented. The

lst or distal segment carries 2 terminal and 1 sub-terminal plumose setae. Each of the 4 succeeding segments carries 2 plumose setae. The scaphognathite is plate - like and carries 5 plumose setae.

The protopodite of the first maxillipede (Fig. 26, Pl. XII) is divided into coxa and basis. The endopodite is formed of 5 segments. An inner plumose seta is distinguished on the lst 4 segments. The 5th distal segment carries 4 terminal and 1 sub-terminal plumose setae. The exopodite is not segmented and carries 3 erminal and 1 outer plumose setae.

The protopodite of the second maxillipede (Fig. 27, Pl. X11) is formed of the coxa and basis ; each of the coxa and basis is formed of 2 endites. Each of the 4 endites is carrying a pair of inner plumose setae. The endopodite is formed of 5 segments ; each of the lst and 2nd basal segments carries 2 inner plumose setae. The 3rd and 4th segments each carries 1 plumose inner setae. The 5th or distal segment carries 4 terminal and 1 sub-terminal inner plumose setae. The exopodite is simple and carries 3 outer setae : 2 of which are plumose and 1 non - plumose, 2 terminal and 1 inner plumose setae.

The second maxillipede is smaller than the first one. It is almost identical to it except that the exopodite carries 5 plumose setae.

(6) *Third Protozoea* (Figs. 28 and 29, Pls. XIII and XIV)

It measures 2.59 mm. form the the tip of the rostrum to the bifurcation of the forked telson.

The colour is the same as in the previous stage.

The carapace measures 0.82mm. The rostrum is very long. The supra-orbital spines are not with external ramification. The eye-peduncles are elongated.

The part of the body from the first abdominal segment to the furca measures 1.79 mm. Each of the first 5 abdominal segments carries a median spine dorsally at the posterior border of the segment, the length of which increases from the lst abdominal segment towards the 5th. The 5th abdominal segment carries a spine on each side, in addition to the median dorsal spine. On each of its sides, the 6th abdominal segment carries two spines ; one is dorsal and the other is ventral.

The uropods (Fig. 28, Pl. XIII) on each side of the body are projecting from the hind margin of the 6th abdominal segment. They are biramous. The exopodite is a little longer than the endopodite and carries 3 plumose setae (5 plumose setae, Heldt, 1938). The endopodite carries no setae (Heldt, 1938 ; 2 setae).

The third maxillipedes and the 5 pairs of peraeopods (Fig. 29, Pl. XIV) are free. They are projecting from the 6 thoracic segments in the form of a voluminous mass. The third maxillipede is hairy.

In addition to the 7 spines which were present in the second protozoea, the furca (Fig. 31, Pl. XV) has got an internal spine so that the spinal formula is now 8+8. All have got spinules except the external dorsal one.

The antennule (Fig. 32, Pl. XVI) has the same length as in the previous stage. It is 4-segmented. The 4 segments are nearly equal in length. The 4th distal segment carries 3 terminal setae ; 2 of them are plumose and 1 non-plumose. One plumose seta and one hair are present at its base.

The antenna (Fig. 33, Pl. XVI) did not change from that in the previous stage. It increased in length. It consists of a protopodite formed of the coxa and basis. The endopodite is 2-segmented. At the base of the lst basal segment is a hair and at its middle there is a plumose seta. The 2nd or distal segment carries 2 basal plumose setae and 4 terminal plumose setae and a hair. The exopodite is 8 - segmented. The 4th basal segment carries 2 basal plumose setae, 1 outer and 1 inner. The 5th segment carries 1 inner basal plumose seta. The 6th segment carries 2 basal plumose setae ; 1 inner and 1 outer. The 7th segment carries a basal inner, 1 sub-terminal and 4 terminal plumose setae.

The difference in structure between the right and left mandibles (Figs. 34 and 35') Pl. XVI) increases than in the previous stage. In the right mandible, the incisor process is separated from the molar process by an intermediate region in which there are only 1 blunt + 2 acute teeth. The molar process consists of a number of protruberances while the incisor process consists of 2 acute teeth. In the left mandible there are 6 acute teeth between the incisor process and the molar process. The molar process consists of a number of protruberances and the incisor process is formed of 3 acute teeth. The two pairs of maxillae did not change from those of the second protozoeal stage.

The maxillule (Fig. 36, Pl. XVII) consists of a protopodite formed of coxa and basis. The coxa carries 7 plumose spines and the basis carries 2 rows of 8 plumose spines. The exopodite is bud-like and carries 4 plumose setae. The endopodite is 3-segmented. The distal segment carries 4 plumose terminal and 2 basal setae. Each of the 2nd and lst segments carries 2 plumose setae.

The maxillae (Fig. 37, PL.XVII) consists of a protopod formed of 4 endites. Each endite is carrying 3 plumose setae. The endopodite is 5 - segmented; the distal segment is carrying 2 terminal plumose setae. Each of the 4 segments carries 2 plumose setae. The scaphognathite is plate-like and carries 5 plumose setae.

The first maxillipede (Fig. 38, Pl. XVII) consists of a protopodite formed of 4 endites. Each endite is carrying 2 outer plumose setae. The exopodite is non-segmented and carries 2 terminal, 1 sub-terminal plumose setae, 1 sub-terminal non-plumose seta and a hair. It also carries 1 inner, 2 outer non-plumose setae and a hair. The endopod in longer than that of the second maxillipede and is 5 - segmented. The 5th distal segment carries 3 terminal and 1 subterminal plumose setae. The 4th distal segment carries 1 outer plumose seta. The 3rd carries 1 outer plumose and 1 non-plumose setae. The 2nd carries 2 outer plumose setae and the 1st or basal segment 2 outer plumose setae.

The second maxillipede (Fig.39, Pl. XVLI) consists of the protopodite having 4 endites. Each endite carries 2 plumose setae. The exopod is non-segmented and carries 3 terminal and 1 sub-terminal plumose setae. The endopod is 5 - segmented. The distal segment carries 3 terminal and 1 subterminal plumose setae. Each of the 4 succeeding segments carries 2 plumose setae.

(7) *First Post-Larva* (Fig. 40, Pl. XVIII)

Total length of larva (from tip of rostrum to end of telson) : 5mm. Carapace-length (from tip of rostrum to hind margin of carapace) : 1.42 mm.

Larva is faint yellow in colour with violet pigments on the scales of the second antennae, ventral side of the cephalo - thorax, abdominal segments, on the telson and bases of the uropods. In addition, there are very few small orange chromatophores scattered on the carapace and abdominal segments.

The rostrum (Fig. 41, Pl. XIX) is more than half the eyestalk in length and with 3 dorsal teeth. The carapace is provided with a pterygostomial spine and a hepatic spine. There is no supra-orbital spines on the anterior edge of the carpace and at the base of the rostrum.

There is a spine on the postero-median line of each of the 4th - 6th abdominal somites. That on the 6th somite being the largest and that on the 4th somite is very short. The spines on the latero-median line of the 5th and 6th somites are very short. The 6th somite is much longer than the preceding 5 somites.

Each of the first 5 abdominal segments, is carrying a pair of well-de veloped and uniramous pleopods. They are the main swimming organs.

The telson (Fig. 42, Pl. XIX) is nearly rectangular and there is scarcely any notch at the posterior margin. The spinal formula is 8+8. There are 5 pairs of spines on the posterior margin ; the 2 outer ones are the longest and biggest and 3 pairs of spines on the 2 lateral margins.

The uropods (Fig. 42, Pl. XIX) have the exopodites as long as the endopodites and both are shorter than the telson. There is a pointed spine on the outer border of the exopodite near its tip.

The first basal segment of the antennular peduncle (Fig. 43, PL. XX) is longer than the other two segments and is more than twice the length of the 2nd segment. The 3rd segment is slightly shorter than the 2nd segment. The 1st segment turns slightly back and upwards and the statocyst is at its base. On the first basal segment the ventral spine is reduced.

At the tip of the 3rd segment, the endopodite and exopodite are clear ; the endopodite is 3 - segmented, while the exopodite is 2-segmented. The exopodite is about 2/3 rd the length of the endopodite.

The exopodite, or antennal scale (Fig. 44, Pl. XX) is sheath - shaped ; the lower half being narrower than the upper half. At its tip it is surrounded by long inner plumose setae.

The endopodite or flagellum is shorter than the exopodite and is 4-segmented (Heldt, 1938 : 3 - segmented).

The protopodite is 2-segmented and the distal segment is with a spine at the base of the antennal scale.

The mandible (Fig. 45, Pl. XX) ; its incisor process is provided with 2 pointed teeth and the molar process with a strong cutting edge carrying very few small teeth. The mandibular - palp is 2 - segmented. The basal segment is longer than the distal segment and carrying 3 strong plumose setae and 3 non-plumose setae. The distal segment is carrying 4 strong plumose setae at its tip.

The protopodite of the maxillule (Fig. 46, Pl. XX) is formed of both coxa and basis. The coxa is provided with a number of strong plumose setae and the basis with a number of strong non-plumose setae. The endopodite has degenerated with no articulations and caries 4 strong plumose setae. The exopodite disappeared.

The protopodite of the maxilla (Fig. 47, Pl. XX) is formed of 4 endites. The 3 anterior endites are provided with more non-plumose setae than the posterior 4th endite. As in the maxillule, the endopodite is degenerated. Contrary to the maxillule, the exopodite or scaphognathite has enlarged and is surrounded by a number of short plumose setae on its outer border.

The endopod of the first maxillipede (Fig. 48, Pl. XX) is unsegemented. The exopod has lost its setae, is wide at its base and a little shorter than the endopodite. A large epipodite is present at its base. The protopodite is greatly widened with strong plumose and non-plumose masticatory setae along its inner margin.

The protopodite of the second maxillipede (Fig. 49, Pl. XXI) consists of the coxa and basis. The endopodite consists of 5 segments of which the distal 3, curve inwards. The exopodite is very greatly reduced and is in the form of a small bud.

The protopodite of the third maxillipede (Fig. 50, Pl. XXI) consists of 2 segments ; coxa and basis. The coxa is without setae while the basis is carrying 2 inner setae. The endopodite consists of 5 segments ; the 2nd segment being the longest, followed by the lst and 4th with the 5th the shortest. The exopodite is greatly degenerated and is not setose.

The first 3 pairs of peraeopods (Figs. 51 & 52, Pl. XXI) are chelate and consist of a protopodite of 2 segments and an endopod of 5. The chela is formed by the propodus and dactylus of the endopod. The exopodite is greatly degenerated and without setae. The third pair is the longest.

The 4th and 5th peraeopods have the same number of segments as the first three, but do not bear chelae. Instead the 5th segment of the endopod is slightly curved and pointed. The exopodite is also greatly degenerated and without setae. They are almost identical, except that the 5th peraeopod is slightly longer than the 4th.

The pleopods (Fig.53, Pl. XXI) are fully developed in the post-larval stages and serve for swimming.

The peduncle of the 2nd pair of pleopods (Fig. 53, Pl. XXI) is unjointed and uniramous.

Fishing Gears and Methods :

Penaeus trisulcatus Leach is fished from Suez Gulf by two types of gear :

(1) The otter-trawl.

(2) The purse-or shore-seine.

(1) *Otter - trawl* :

The bulk of the catch of *Penaeus trisulcatus* Leach from Suez Gulf is fished by means of otter - trawls from depths ranging between 18 and 45 fathoms, in sandy and muddy sandy bottom.

Otter - trawls work by day and night, but the catch of *Penaeus trisulcatus* Leach is more by night.

The season of fishing of *Penaeus trisulcatus* Leach in Suez Gulf by otter - trawls is from September until the end of June. The peak of the season is during autumn and the early part of winter i.e. during October, November, December and the first half of January. From the second half of January it begins to decline until the end of the season.

It is forbidden to use otter - trawls in Suez Gulf during July and August ; the spawning period of most economic fishes inhabiting the Gulf.

(2) *Purse—or Shore-Seine* :

A small part of the catch of *Penaeus trisulcatus* Leach in Suez Gulf is fished by purse - or shore - seines.

Purse - seines are used in Suez Gulf along the shore down to depths ranging between 10 and 15 meters. They are employed by rowing and sail boats which use from 8 to 15 men and boys. The net being used by throwing the first wing from the shore and leaving it fixed by some men. The bag is then thrown and by returning back to the shore, the other wing is thrown. The two wings are then pulled from the shore.

Shore - seines are employed for fishing only by night until dawn. They are used the whole year round and the maximum catch of *Penaeus trisulcatus* Leach is in summer.

2. *Penaeus Japonicus Sp. Bate* 1888.

Habitat and Distribution: *Penaeus Japonicus* Bate has the same habitat as *P. trisulcatus* Leach. It is caught from the same places and depths. *P. Japonicus* Bate, had migrated through Suez Gulf to the Mediterranean where it reached the coasts of Syria, Palestine and Libanon. It forms a good part of the catch of penaeids fished by otter-trawlers from the Egyptian Mediterranean Coasts from Alexandria in the west to El-Arish in the east.

P. Japonicus Bate is recorded from the East Coast of Africa & South African waters. This species seems to be much rare in South African waters than either *P. semisulcatus* de Haan or *P. indicus* (Barnard, 1950).

Kubo (1949) mentioned that this species is recorded in the following places: Ambiona, Red Sea, Manila Bay and Bantagan, Philippine, Taiwan, East Coast of Tyosen, Amoy, Hainan Island, Indian Seas, East Indies, Japan, Fiji Islands, Orissa Coast, Andamans, Hooghy Delta, Off Indus Delta. By migration through Suez Canal to Gulf of Alexandrette, Syria.

Food and Feeding Habits:

The method of feeding of *P. Japonicus* Bate is the same as in *P. trisulcatus* Leach.

Examination of the stomach and intestine contents of some specimens of *P. Japonicus* Bate caught from El-Anbak (Bitter Lakes, Suez Canal); showed that the food is the same as in *P. trisulcatus* Leach.

Moulting:

The process of moulting in *P. Japonicus* Bate is the same as in *P. trisulcatus* Leach.

Spawning and Metamorphosis:

Male and female *P. Japonicus* Bate specimens were kept in winter, spring and summer in big glass aquaria in the lab., to observe the mating and spawning processes. Unfortunately no mating and no spawning occured. From plankton hauls collected by means of fine plankton nets of 129 M.P.I., the following larval stages of *P. Japonicus* Bate were procured. Plankton hauls were taken from Suez Bay.

(1) *First Protozoea* (Fig. 1, Pl. XXII)

The larvae were obtained from plankton from Suez Bay.

Body-length (from the anterior part of the carapace to the tip of the notch between the two forks of the telson) is 0.70mm. and body - width is 0.34 mm.

The body is pale yellow and translucent. The tip of the lst and 2nd antennae, and the posterior end of the body are more brownish - yellow than the other parts.

The carapace is octagonal and a little longer than half the body-length. It covers the body losely from the anterior end to the 8th somite. A pair of frontal organs is present slightly posterior to the anterior margin. Also a pair of compound eyes is present.

The posterior cylindrical half of the body consists of 6 thoraic somites. The following part is slightly swollen and with 2 somites, faintly visible beneath the cuticle.

The well-developed telson with its semi - spherical notch looks like a forked tail. The spinal formula is 7+7.

The antennule (Fig. 2, Pl. XXIII) has 3 long segments ; the lst is divided into 5 smaller segments. The 2nd segment is the longest, with 1 external and 3 internal setae. The 3rd segment is provided with 4 setae at its tip and 2 on its outer margin. The 3rd apical seta is very long exceeding the body-length. The 2nd and 3rd apical setae have few setules.

The antenna (Fig. 3, Pl. XXIII) is as long as the antennule. The protopodite has 3 segments, the endopodite 2 and the exopodite 10. The 1st segment of the endopodite, which is longer than twice the length of the 2nd segment, has 4 internal plumose setae ; 2 of which at the joint between the lst and 2nd segments and 1 between the lst segment and the protopodite. The 2nd segment is with 4 long and 1 short apical plumose setae. The exopodite has 12 plumose setae ; 10 of which occuring internally to the tip one following the other and the remaining 2 outside.

The mandible (Fig. 4, Pl. XXIII) has lost both endopodite and exopodite in this stage and nothing remained but a small part of the protopodite. The masticatory surface is serrated with the incisor process having larger but fewer teeth and the molar process having smaller but more number of teeth. The mandible has got a small mandibular - palp.

The protopodite of the maxillule (Fig. 5, Pl. XXIII) is divided into 2 lobes on its inner side. The first lobe bears 7 and the second 5 plumose setae internally. The endopodite is composed of 3 segments. The first apical segment is bearing 5 apical plumose setae, the 2nd 2 and the 3rd 3 plumose setae internally. The exopodite has 4 plumose setae on its outer border.

The maxilla (Fig. 6, Pl. XXIII) is like the maxillule but is somewhat larger. The protopodite has 5 small internal lobules. The lst basal lobule has 7 plumose setae and each of the remaining 4 having from 2 to 4 internal plumose setae. The endopodite is 4-segmented. The lst apical segment bearing 3 apical long plumose setae and the rest 2 internally. The saphognathite is — circular with 5 plumose setae on its outer border.

The labrum covers the mandible. The labium is situated below the mandible and is bifurcated at the end with small thick setae.

The protopodite of the first maxillipede (Fig. 7, Pl. XXIII) consists of 2 segments. The lst segment has 4 and the 2nd 12 internal plumose setae. The endopodite is composed of 4 segments. The terminal segment is with 5 apical plumose setae, while each of the remaining 3 segments has 2 or 3 inner plumose setae. The exopodite has 3 apical and 4 outer plumose setae. No jointing is present between it and the protopodite.

The second maxillipede (Fig. 8, Pl. XXIII) resembles the first, but is somewhat smaller. The protopodite is faintly articulated into 2 joints and has 5 plumose setae on its inner margin. The endopodite is composed of 4 segments ; the distal segment having 5 apical plumose setae and each of the remaining 3 segments 1 inner plumose seta. The exopodite, is slightly shorter than the endopodite and has 3 apical and 3 outer plumose setae.

(2) *Third Protozoea* (Figs. 9 & 10, Pls. XXIV & XXV)

Length of larva (from tip of rostrum to apex of notch in the telson) is 1.85 mm and body — width is 0.54mm. Carapace — length is 0.75mm. (from tip of rostrum to hind margin of carapace) and its breadth (greatest - width) is 0.54mm. Its shape is the same as in the 2nd protozoea. The small spines at the tips of the pair of supra - orbital spines disappear. Two pedunculated compound eyes are present at the anterior margin of the carapace.

The body is pale yellow & translucent, except that the tips of the lst and 2nd antennae and the posterior end of the body are more brownish - yellow than the other parts of the body.

All the abdominal somites and uropods are developed. The 6 pairs of thoracic appendages, have slightly developed in this stage. The endopodite of the 3rd maxillipede being slightly longer than the exopodite and having 3 short apical setae.

The first 5 abdominal somites are almost the same in length, each of them being provided with a spine on the dorsal median line at the lower edge. The 5th somite has, besides, a pair of postero-lateral spines, and the 6th abdominal somite bein the longest and has a pair of lateral and postero - lateral spines.

The uropods are rudimenteary.

The fucral spines increased to 8+8 by the addition of a pair of small spines on the inner margin of each furcal process.

The antennular peduncle (Fig. 11, Pl. XXVI) consists of 4 segments. The lst proximal segment is carrying a short internal seta. The 3rd segment is carrying a short internal seta and the 4th distal segment 3 apical setae ; 2 of them are long, plumose and the 3rd is simple and short.

The antenna (Fig. 12, Pl. XXVI) is as long as the antennule. The protopodite is 3—segmented, the endopopite having 2 and the exopodite 11 segments. The lst segment of the exopodite which is longer than twice the length of the 2nd segment, has 4 plumose setae internally, 2 of which at the joint between the lst and 2nd segments and 1 between the lst segment and the protopodite. The 2nd segment bears 4 long and 1 short plumose setae at its tip. The exopodite has 12 plumose setae ; 10 of them occuring internal to the tip, and the remaining 2 external.

The molar process of the mandible (Fig. 13, Pl. XXVI) broadens and numerous small teeth appear inside. The incisor process having 7 acute teeth.

The protopodite of the maxillule (Fig. 14 PL.XXVI) is 2- lobed. Each lobule is carrying 7 plumose setae. The endopodite is still 3 - segmented. The lst segment is provided with 3 plumose setae. The 2nd 2 and the 3rd 5 plumose setae. The exopodite is still in the form of a small spherical lobe and has 4 long plumose setae.

The maxilla (Fig. 15, Pl. XXVI) is like the maxillule, but somewhat larger. The protopodite which is not articulated has 5 small lobules ; the lst having 7 plumose setae and the other, from 2 to 4 plumose setae. The endopodite consists of 4 segments ; the terminal one having 3 long plumose setae at its tip and each of the remaining 3 segments having 2 plumose setae on their inner margins. The exopodite is provided with 6 outer plumose setae.

The protopodite of the first maxillipede (Fig. 16, Pl. XXVII) consists of 2 segments. The 2nd segment is with 4 endites. The lst on the inner margin having 4 setae and the 2nd 12. The endopodite is composed of 4 segments, having 5 setae at the terminal segment, while each of the remaining segments has 2 or 3 setae. The exopodite which is slightly shorter than the endopodite has 3 apical setae and 5 on the outer side. No articulation is seen between the exopodite and the protopodite. All the setae are plumose.

The second maxillipede (Fig. 17, Pl. XXVII) resembles the first, but it is somewhat smaller. The protopodite is faintly articulated into 2 joints and has 4 setae on its inner margin. The endopodite is composed of 4 segments; the distal segment having 5 apical setae and each of the remaining segments 1 seta. The exopodite, which is slightly shorter than the endopodite, has 4 apical setae and 3 setae on its outer margin. All the setae are plumose.

(3) *Second Mysis* (Figs. 18&19, Pls. XXVIII & XXIX)

The body-length (from tip of rostrum to the tip of the notch formed between the two arms of the telson) is 2.14 mm. and body-width (the widest part of the carapace) is 0.68 mm

The body is pale yellow with reddish brown pigments especially on the tip of the first antennae, mouth parts, abdominal segments and the base of the telson.

The carapace (Fig. 20, Pl.XXX) measures about 1/3 rd the body-lenght. The pair of supra-orbital spines which lies at the front margin and at both sides of the base of the rostrum became smaller.

The front part of the rostrum is slightly curved and is slightly longer than the stalked-eyes. On its dorsal side appears 1 tooth.

The abdomen is slightly more than half the body - lenght. The anterior 5 segments are almost of the same length. The 6th segment, which is the longest, is slightly shorter than the whole lenght of all the 5 preceding segments The spines on the lst, 2nd, 3rd segments disappeared.

The antennular peduncle (Fig. 21, Pl. XXXI) is 3-segmented. The length of the lst segment is more than twice that of the 2nd. At the base of the lst segment the statocyst with 3 small setae is present. One spine occurs at the inner margin and slightly above the middle. The lenght of the 2nd segment is about twice that of the distal 3rd segment. It has several plumose setae on the outer and inner margins. The distal 3 rd segment, bears several plumose setae on the outer and inner margins aslo. The inner branch which is present at the end of the 3rd distal segment is about 2/3 rd that of the outer branch. It carries 2 sensory setae at its end and the outer branch 6 sensory setae.

A small spine appeared on the 2nd segment of the antennal protopodite (Fig. 22, Pl. XXXI). The exopodite terminates with a sharp spine at the tip. The number of plumose setae at the tip and on the inner margin has increased to 18 but their lengths became faintly short. The lenght of the endopodite is 2/3rd that of the exopodite and the setae are lacking.

Both incisor and molar processes of the mandible (Fig. 23, Pl. XXXI) are toothed. The mandibular-palp grows longer.

The protopodite of the maxillule (Fig. 24, Pl. XXXI) consists of 2 endites; each endite is carrying a number of plumose setae. The endopodite consits of 3 segments. The apical segment is with 5 apical plumose setae. Each of the 2nd and 3rd segments is carrying 2 inner plumose setae. The exopodite is with 4 plumose setae.

The structure of the maxilla (Fig. 25, Pl. XXXI) remains the same as that in the protozoel stage, except that the scaphognathite is developed much more. The number of plumose setae around the outer border is 16.

In the first maxillipede (Fig. 26, Pl. XXXI), there is no articulation between the proto-podite and exopodite. The exopodite is carrying 4 apical long plumose setae and 5 short plumose postero - lateral setae. The endopodite is 5 - segmented with the apical segment carrying 5 long apical plumose setae and each of the 4 succeeding segments 3 internal plumose long setae. At the base of the protopodite, appears a small mastigobranchial plate.

In the second maxillipede (Fig 27, Pl. XXXI) the exopodite carries 4 apical long plumose setae, 1 on the inner side and 1 on the outer side. The endopodite is 4-segmented with the apical segment carrying 4 apical long plumose setae and each of the succeeding 3 segments 2 or 3 long plumose setae on the inner side. The protopodite is 2-segmented with a number of long plumose setae on the inner side. At its base appears a small mastigobranchial plate as in the first maxillipede.

In the third maxillipede (Fig. 28, PL. XXXI) the protopodite has 2 segments, the endopodite 5 and the exopodite none. There is an articulation between the exopodite and the protopodite. The exopodite carries 4 long apical, 1 inner and 6 outer plumose setae. The 5th distal segment of the endopodite is carrying 5 apical long plumose setae. Each of the 4th and 3rd segments with 1 seta, the 2nd segment 2 and the 1st proximal segment 3 long plumose setae on the inner margin. The protopodite is carrying a number of long plumose setae on its inner margin.

The protopodite of the first to fifth peraeopods (Figs. 29-33, PlXXXII) consists of 2 segments. In addition to the 1st arthrobranchia at the base of the protopodite of each of the 1st to the 3rd peraeopods another one appeared. The endopodite of each peraeopod is longer than half the exopodite. The first 3 pairs being segm ented into 4 and the remaining 2 into 5. The tip of the first 3 pairs of peraeopods are not yet with clearly defined chelae. As to the first 3 paris of paraeopods; the lenghts of the 1st to the 3rd segments are nearly the same and the lenght of the 4th is about twice that of the others. The segments of the remaining 2 pairs of endopodites, from the first to the third segment, have the same length, while the fourth and fifth segments are slightly shorter than twice the other segments.

The telson (Fig. 34, Pl. XXXIII) is slightly less than 1/5th the total body-lenght. The tip of the notch is now on the same line as the 2nd lateral spine. The spinal formula is still 8+8.

The uropod (Fig. 34, Pl. XXXIII) is well - developed and with a spine at the outer edge of the protopodite. The exopodite is slightly longer than the endopodite but shorter than the telson. It bears a small spine on its outer distal margin. It also bears 17 plumose setae on the distal and lateral inner margins. The endopodite also bears 17 plumose setae on its distal and lateral inner marigns.

Fishing Gears and Methods :

The fishing of *P. Japonicus* Bate is practiced in Suez Gulf by the same methods as in *P. trisulcatus* Leacn. The two species form the catch of economic penaeids fished from the Gulf by otter- trawlers. The same procedure is also used for its fishing. It is also fished from the same places (Map N° 1).

The season of fishing of *P. Japonicus* Bate in Suez Gulf by otter-trawlers is the same as that of *P. trisulcatus* Leach and the peak of the season is also the same. No fishing of *P. Japonicus* Bate is practiced during July and August; the prohibited period of otter - trawlers.

A small part of the catch of *P. Japonicus* Bate in Suez Gulf is fished by purse- or shore - seines whose specifications are the same as those used for fishing *P. trisulcatus* Leach. It is also fished from the same places (Map No 1).

3.— *Penaeus semisultatus* de Haan 1948

Syn. Penaeus monodom ALC.

Habitat and Distribution : *Penaeus semisultatus* de Haan inhabits the muddy and sandy bottoms. It is the third major constituent of economic penaeids fished from Suez Gulf by otter-trawlers. It is found in the Red Sea proper, but it is not fished. Some specimens may reach about 25 cm. in lenght.

The most important places for fishing *P. semisulcatus* de Haan from Suez Gulf by otter - trawls are the same from which *Penaeus trisulcatus* Leach and *Penaeus Japonicus* Bate are fished (Map No 1) and also from the same depths; since the three species form the catch of economic penaeids by otter - trawlers.

Geographical Distribution :

Penaeus semisulcatus de Haan had migrated through Suez Canal to the Mediterranean where it reached the coasts of Syria especially in the Gulf of Alexandrette, Palestine and Libanon. It forms a good part of the catch of penaeids fished by otter trawlers from the Egyptian Mediterranean Coasts from Port - Said to El-Arisn in the east.

Penaeus semisulcatus de Haan, is recorded from the coasts of India, East Indies, Furmosa, Malayan Archipelage, Singaphore, phillippine Islands, Japan, South of New Giunea and Madagascar.

Balss (1914) recorded *Penaeus semisulcatus* de Haan at Suez and in the Red sea at Kunfuda, Kamaran Island, Hanfela Bay, Ras Turfa, Ghulejfaka, Abayil, Djedda, Aden, Perin and Djibouti.

Food and Feeding Habits :

Specimens of *Penaeus semisulcatus* de Haan kept in winter, spring and summer in aquaria in the laboratory, in which their habitat is matched are observed to feed. They eat fishes cut into small pieces vigorously and it seems (like *Penaeus ristulcatus* Leach) to be a favorite type of food. They are also nocturnal in habit like *Penaeus trisulcatus* Leach and they are omnivorous or scavengers. They ingest mud or muddy sand with the contained organic matter.

Examination of the stomach and intestine contents of some specimens of *P. semisulcatus* de Haan caught from El-Anbak (Bitter lakes, Suez Canal), showed that the food consists of: Diatoms (Coscinodisus ?, very common), spicules of sponges? (common), crustacean remains i.e. antennules, antennae, legs, etc. and their exoskeletons (common), debris (common) and mud.

Moulting :

Moulting always occured by night in the laboratory. It also occured-like in *Penaeus trisulcatus* Leach – in March and April and at temperatures ranging between 19.5°C and 21°C. The new exoskeleton is solid and calcified just after moulting. When fully mature females moult, the two yellowish or olive green flaps of the receptaculum seminis disappear after moulting, like in *Penaeus trisulcatus* Leach. No sexual change occurs to adult males after this process.

Fishing Gears and Methods :

The fishing of *Penaeus semisulcatus* de Haan is practiced in Suez Gulf by otter-trawls and trawlers whose specifications are the same as those used for fishing *Penaeus trisulcatus* Leach and *P. Japonicus* Bate since the three species form the catch of economic penaeids fished from the Gulf by otter-trawlers. The same procedure is also used for its fishing.

As mentioned previously, otter-trawlers work by day and night but the catch of *P. semisulcatus* de Haan is more by night.

The season of fishing of *P. semisulcatus* de Haan in Suez Gulf by otter-trawlers is the same as that of *P. trisulcatus* Leach and *P. Japonicus* Bate and the peak of the season is also the same. No fishing of *P. semisulcatus* de Haan is practiced during July and August, the prohibited period of otter-trawlers. During the peak of the season i.e. during October, November, December and the first half of January, an otter-trawler catches every trip from about 30 to 40 boxes of *Penaeus semisulcatus* de Haan, *Penaeus trisulcatus* Leach and *P. Japonicus* Bate (the trip lasts about 7 days). Each box contains about 20 Kilograms. At the beginning of the season i.e. in September and at its end i.e. from the second half of January till May or June, every ottertrawler catches about only 10 boxes of *P. semisulcatus* de Haan, *P. japonicus* Bate and *P. trisulcatus* Leach.

4.—*Metapenaeus philippii* (Sp. Bate) *var.* (*new*) *Attaqa*

Habitat and Distribution :

Metapenaeus philippii (sp. Bate) *var.* (*new*) *attaqa* inhabits the sandy and muddy sand bottom where it hides its whole body with the eyes and antennae protruding out. It is really a shrimp as it is amall in size. It is caught in very small numbers with *P. trisulcatus* Leach and *P. semisulcatus* de Haan from Suez

Gulf by otter-trawls. The bulk of the catch of *M. philippii* (Sp. Bate) *var.* (*new*) *Attaqa* from the Gulf is got by purse-seines. It forms with *Metapenaeus stebbingi* (Nobili) the major constituents of economic penaeids fished from the Bay by this type of gear.

The most important places for fishing *M. philippii* (Sp. *Bate*) *var.* (new) *Attaqa* from Suez Bay by otter -trawls are the same from which *P. trisulcatus* Leach and *P. semisulcatus* de Haan are fished (Map No.1). It is also caught from the same depths.

The places from which *Metapenaeas philippi* (Sp. Bate) *var.* (*new*) *Attaqa* is got by purse-seines are those from which *Penaeus trisulcatus* Leach is procured by this gear (Map NO. 1) and also from the same depths i.e. along the shore of the Gulf from Suez till El-Adabiah and from depths ranging from 5 to 8 fathoms.

Geographical Distribution :

Metapenaeus philippii (Sp. Bate) *var.* (*new*) *Attaqa* is a sub-littoral or shallow-water form, although it sometimes descends to deep water. It is an Indo-pacific species and is recorded in Suez Gulf.

Fishing Gears and Methods :

Metapenaeus philippii (Sp. Bate) *var.* (*new*) *Attaqa* is fished from Suez Gulf by two types of gear:

(1) The otter-trawl.

(2) The purse-or shore-seine.

(1) *Otter-trawl* :

A very small percentage of the catch of *M. philippii* (Sp. Bate) *var.* (*new*) *Attaqa* from Suez Bay is got by ottertrawls. The otter-trawls and trawlers are the same used for fishing *P. trisulcatus* Leach, *P. Japonicus* Bate and *Penaeus semisulcatus* de Haan. It is also caught from the same places and depths. The procedure used is that employed for fishing the two previously mentioned species.

(2) *Purse-or shore-seine* :

The bulk of the catch of *M. philippii* (Sp. Bate) *Var.* (*new*) *Attaqa* from Suez Gulf is got by means of shore -seines whose specifications are the same as those used for fishing *Penaeus trisulcatus* Leach & *Panaens Japonicus* Bate. The procedure is also the same. It is also procured from the same places i.e. along the shore of Suez Gulf from Suez till El-Adabiah and from the same depths i.e. from 5 to 8 fathoms.

Purse-seines are employed for fishing *Metapenaeus philippii* (Sp. Bate) *var.* (*new*) *Attaqa* only by night until dawn. They are used the whole year round and the maximum catch is in summer.

5.—*Metapenaeus stebbingi* Nobili 1904

Syn. Penaeopsis stebbingi Nobili.

Habitat and Distribution :

Metapenaeus stebbingi Nobili inhabits the sandy bottom. It is also a shrimp. It forms with *M. philippii* (Sp. Bate) *var.* (*new*) *ataqa* the two major constituents of the catch of economic penaeids from Suez Gulf by purse-seine fishing. It is not got by otter-trawls.

The places from which *M. stebbingi* Nobili is caught by p-seines from Suez Bay are those from which *M. philippii* (Sp. Bate) *var.* (*new*) *taqa* is caught by this method (Map No.1) and also from the same depths.

M. Stebbingi Nobili is recorded also in the Red sea proper but is not fished.

Geographical Distribution :

M. stebbingi Nobili; like *M. philippii* (Sp. Bate) *var.* (*new*) *Attaqa*, is a sub-littoral or shallow-water form. It is also an Indo-Pacific species. It is recorded in the Red Sea proper, Suez Gulf and in Suez Canal. It established itself in Lake Timsah and the Bitter Lakes. It breeds in the latter where the salinity reaches at surface from 48.5% to 52% and at bottom from 51.1 to 53.5% which is more than that of the sea (Gurney, 1927). He states that *Metapenaeus stebbingi*? breeds in the Bitter Lakes and its eggs and larvae were procured from plankton hauls collected during October, November and December from these lakes and Suez Gulf at Port-Taufiq.

Metapenaeus stebbingi Nobili had migrated through the Suez Canal to the Mediterranean where it established itself and now is fished at Port-Said in quantities.

Food and Feeding Habits :

In the laboratory it is observed that specimens of *M. stebbingi* Nobili feed also in winter. They eat fishes cut into pieces vigorously, and it seems to be a favorite type of food, like *Penaeus trisulcatus* Leach and *Penaeus semisulcatus* de Haan. They are also nocturnal in habit. It is also observed that they eat anything whether of animal or plant origin i.e. they are omnivorous or scavengers. They ingest sand with the contained organic matter. It is noticed that they eat each other when hungry i.e. they are cannibalistic.

Moulting :

It occured in the laboratory in March and April, by night and at 19.5°C, 19.8°C, 20°C and 21°C. The method of moulting is exactly the same as in *P. trisulcatus* Leach. The new exoskeleton is somewhat solid and calcified.

Spawning and Metamorphosis :

Male and female specimens of *M. stebbingi* Nobili were kept in winter, spring and summer in big glass aquaria in which their habitat is matched, to observe the mating and spawning processes. Unfortunately no mating and no spawning occured.

Gurney (1927), states "*Metapenaeus stebbingi* Nobili breeds in the Bitter Lakes of the Suez Canal, where the water is more saline than that of the sea".

He gave a full description of the life-history of *Penaeopsis* (*Metapenaeus*) *stebbingi* Nobili : from the egg till the post-larval stage, from 17 plankton samples collected from the neighbourhood of Port-Taufiq and in the Bitter Lakes during the 3 months : October, November and December. He described the egg, 3 naupliar, 3 protozoeal, 3 mysis stages and one post-larval stage.

He recorded that the eggs of this species were obtained from October 21, 1924, from the Bitter Lakes and Port-Taufiq (Suez Gulf).

From Gurney's statements (1927), it can be concluded that the spawning season of *M. stebbingi* Nobili ? is during autumn and early winter.

From plankton hauls collected by means of fine plankton nets of 129 M.P.I., the eggs and the following larval stages of *M. stebbingi* Nobili, were procured :

(1) ***Egg*** **(Figs. 1 & 2, Pl. XXXIV)**

The eggs of *Metapenaeus stebbingi* Nobili? were obtained from plankton collected from the Great Bitter Lake.

The egg is demersal and spherical. The embryoic mass is also spherical, opaque and dark yellow in colour. It is surrounded by a large perivitelline space which is occupied by yolk. The yolk is clear and yellow in colour. The egg is surrounded from outside by a membrane which is blue turquoise in colour when viewed under the microscope. The egg diameter varies from 0.31 mm. to 0.50 mm. The diameter of the embryonic mass ranges between 0.22mm. and 0.25mm.

Some of the eggs were found to contain nauplii whose lengths vary between 0.28mm. and 0.35mm., and their widths between 0.16mm. and 0.32mm. The nauplius is of the usual simple type without trace of appendages behind the biramous mandibles and the body is simply rounded behind with a pair of terminal setae. The limbs, which are extended, bear long setae and show no signs of joints. A very delicate membrane partly envelops the nauplius. There is a large free perivitelline space between the nauplius and the egg membrane. The limbs are free and the setae long and conspicuous. The nauplius ocellus is present and blackish in colour. The nauplius is dark yellow in colour.

(2) *First Nauplius* (Fig. 3, Pl. XXXV)

It is obtained by hatching out of an egg in the laboratory. The body is opaque and dark yellow in colour. The appendages, i.e. antennules, antennae and mandibles are faint yellow with orange reddish chromatophores scattered on them and especially at their bases.

The body is oblong and in ventral view it is narrow and not greatly widened anteriorly. No segmentation is visible. It measures 0.32mm. in length . Its posterior edge is rounded and ends in a pair of smooth setae.

The nauplius ocellus is blackish in colour and is placed anteriorly on the ventral side. There are no frontal organs.

The nauplius carries 3 pairs of appendages which are natatory in function. They are all non-segmented.

The antennule (Fig. 4, Pl. XXXV) is uninamous. It carries 3 terminal, 3 internal and 1 external setae and a spine.

The antenna (Fig. 5, Pl. XXXV) is biramous. The 2 branches are nearly equal. The endopodite carries at its extremity 2 setae and a spine and on its internal side 2 short setae. The exopodite carries 3 internal and 2 terminal setae.

The mandible (Fig. 6,Pl. XXXV) is biramous and its length is about half that of the antenna. Its 2 branches are unequal. Each branch carries 3 setae. The endopodite is longer than the exopodite. It carries 2 terminal and 1 sub-terminal setae. The exopodite carries 3 terminal setae. No masticatory process is present.

All the setae on the appendages in this stage, as well as the two caudal or furcal spines, are non-plumose i.e. smooth.

(3) *Second Nauplius* (Figs. 7 & 8, Pl. XXXVI)

It is obtained in the laboratory by transformation of nauplius I into nauplius 11.

Length (from anterior part of the head to the tip of the bifurcation between the two caudal rami) is 0.36mm.

It is opaque yellow in colour, with few orange reddish chromotophores on the appendages, i.e. antennules, antennae and mandibles and on the two caudal rami.

The antennule (Fig. 7 Pl. XXXVI) is unjointed. It carries 2 terminal plumose setae and 1 terminal hair. There are also 2 hairs on its inner margin.

The exopodite of the antenna (Fig.7, Pl.XXXVI) is partly segmented and has more setae than in the first nauplius. It carries 5 plumose terminal setae : 3 long and 2 short and 2 internal plumose setae. The end opodite is non-segmented and carries 3 terminal plumose setae and 2 hairs on its inner margin.

The mandible (Fig. 7, Pl.XXXVI) has got protruberance on the protopodite representing the molar portion. Both endopodite and exopodite are non-segmented and carry 3 terminal plumose setae.

Behind the mandibles beneath the cuticle are swellings representing the paragnaths, maxillae I & 11 and maxillipedes 1 & 11.

There is a distinct trace of the shell-fold or carapace in the region of the lst maxilla.

The telson is differentiated as a broad plate with a small median incision dividing it into two caudal rami. Each ramus carries 6 spines. The spinal formula is 6+6.

Fishing gears & methods :

M .stebbingi Nobili is caught from Suez Gulf only by purse- seines. It forms with *Metapenaeus philippi* (Sp. Bate) *var.* (*new*) *Altaqa* the bulk of the catch of economic penaeids. The same procedure for catching *P. philippi* (Sp. Bate) *var.* (*new*) *Attaqa, P. japonicus* Bate and *Penaeus trisulcatus* Leach is also practiced. *M. Stebbingi* Nobili is also procured from the same places of the latter three species i.e. along the shore of Suez Gulf from Suez till Al-Adabiah and from the same depths i.e. from 5 to 8 fathoms.

Shore-seines are also used for fishing *Metapenaeus stebbingi* Nobili only by night. They are used the whole year and the maximum catch is also in summer like *Metapenaeus philippii* (Sp. Bate) *var.* (*new*) *Attaqa.*

Economic Penaeid Statistics

The catch of economic Penaeids in Suez Gulf is composed mainly of *Penaeus trisulcatus* Leach, *P. Japonicus* Bate and *Penaeus semisulcatus* de Haan caught by otter-trawlers. Their number from 1921 to 1961 and the catch in kgms. is shown in the following table (Table 1) (After the Coastguards and Fisheries Department) .

The fishing season by otter-trawlers is from September till June. During July and August otter-trawlers are forbidden from fishing in the Bay, as it is the spawning season of most economic fishes. The maximum catch of *Penaeus trisulcatus* Leach, *P. Japonicus* Bate and *Penaeus semisulcatus* de Haanby otter-trawls is during autumn and the early part of winter i.e. during October, Novemper and the first half of January. From the second half of January the

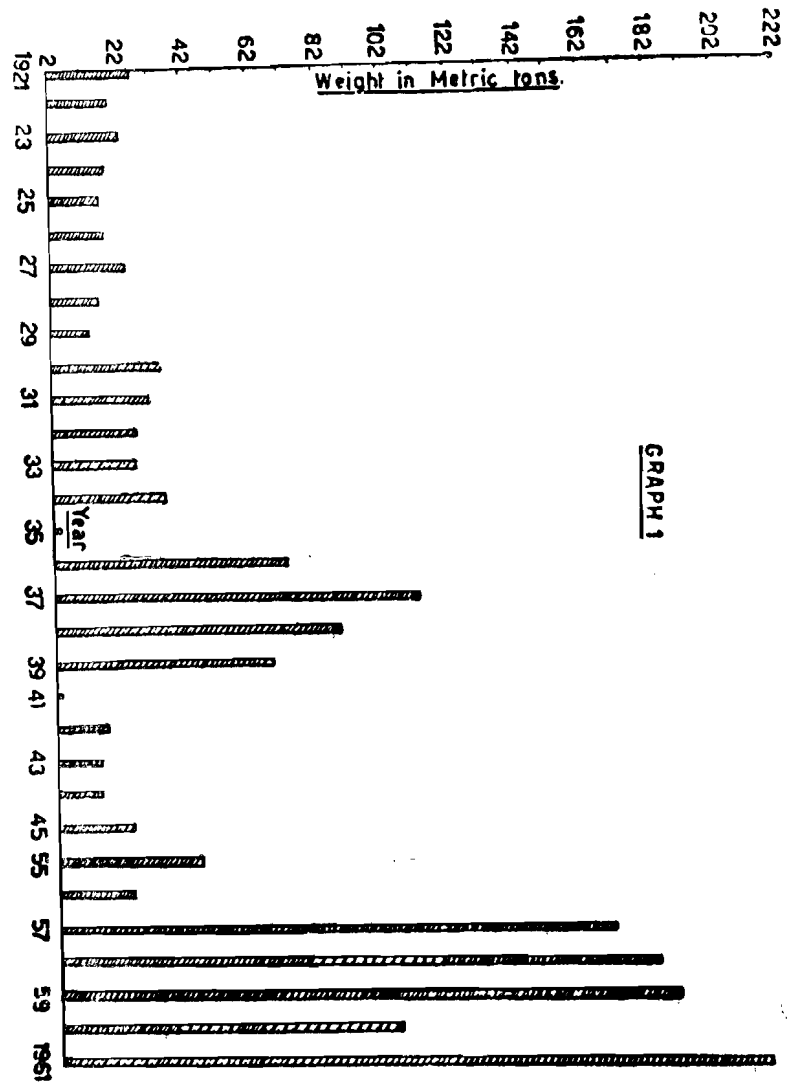
catch begins to decrease to the end of the season i.e. June. During the peak of the season, every otter-trawler catches per trip from 30 to 40 boxes of *Penaeus trisulcatus* Leach, *P. Japonicus* Bate and *Penaeus semisulcatus* de Haan (the box contains about 20 kgm). At the beginning of the season and at its end, every ottertrawler catches about 10 boxes only.

TABLE 1

Year	No. of otter trawlers	Weight (kgm.)	Year	No. of otter trawlers	Welght (kgm.)
1921	5	26813	1937	17	112160
1922	7	19724	1938	27	78150
1923	—	23405	1939	14	67877
1924	—	18710	1941	2	2240
1925	—	16650	1942	2	17210
1926	6	17535	1943	3	15250
1927	7	24500	1944	4	15540
1928	7	16325	1945	4	24690
1929	10	13270	1955	30	45710
1930	8	35465	1956	30	23980
1931	14	30950	1957	42	159500
1932	12	26151	1958	47	172570
1933	13	27200	1959	46	178244
1934	17	36132	1960	44	95098
1935	10	3326	1961	39	216067
1936	12	27870			

A small percentage of the catch composed mainly of *Metapenaeus stebbingi* Nobili, *Metapenaeus philippii* (Sp. Bate) *var.* (*new*) *Attaqa* and a small amount of *Penaeus trisulcatus* Leach and *P. Japonicus* Bate is fished from Suez by purse-seines used by rowing and sail boats, whose number varies from 10 to 15 . Purse-seines are used the whole year and the maximum catch of the 4 species is during summer.

The catch of economic penaeids forms a part of the total catch of otter-trawlers from Suez Gulf which is composed of economic fishes.



It can be seen from Table 1 and Graph 1 that the lowest production of economic penaeids in Suez Gulf was in the year 1941; in which it was only 2240 kgm. The maximum production was in the year 1961 in which it reached 216067 kgm. During the period from 1921 to 1961, there were two minima and two maxima in the production of economic penaeids in the Gulf. Every minima was followed by a maxima. The first minima was during the years from 1921 to 1935 and the second from 1941 to 1956. On the other hand the first maxima was from 1936 to 1939 and the second from 1957 to 1961.

DISCUSSION

Five species of economic penaeids are recorded in Suez Gulf and Red Sea proper. These are : *Penaeus trisulcatus* Leach, *Penaeus Japonicus* Bate, *Penaeus semisulcatus* de Haan, *Metapenaeus philippii* (Sp. Bate) *var, (new) Attaqa, and Metapenaeus stebbingi* (Nobili),

Concerning the habitat and geographical distribution; the five species are inhabitants of the tropical, sub-tropical and temperate regions. They are found in littoral, sub-littoral and shallow water, though they descend sometimes to moderate and even considerable depths such as *P. trisulcatus* Leach. All the species - except *Penaeus trisulcatus* Leach which is recorded in the Mediterranean- are Indo-Pacific.

P. trisulcatus Leach or *P. caramote* Risso, had migrated through the Suez Canal from the Mediterrannean to the Red Sea where it established itself and now forms the bulk of the catch of economic penaeids from Suez Gulf. It is recorded for the first time in the Red Sea.

On the contrary *P. semisulcatus* de Haan 1849, *P. Japonicus* Sp. Bate 1888 had migrated through the Canal to the Mediterranean, where it reached the coasts of Syria (especially in the Gulf of Alexandrette), Palestine and Libanon. They now form a good part of the catch of penaeids fished by otter-trawlers from the Egyptian Mediterranean Coasts from Port - Said to El-Arish in the east. The same with *M. stebbingi* Nobili 1904.

Penaeus trisulcatus Leach, *Penaeus semisulcatus* de Haan, *Penaeus Japonicus Bate, Metapenaeus stebbingi* (Nobili), and *Meta penaeus philippii* (Sp. Bate) *var. (new) Attaqa,* are caught from Suez Gulf only (the region between Suez and Zaafarana).

The species recorded inhabit either sandy sea bottom such as *P. trisulcatus* Leach, *M. philippii* (Sp. Bate) *var. (new) Attaqa* and *M. stebbingi* Nobili, or muddy sand bottom such as *P. trisulcatus* Leach, *P. semisulcatus* de Haan, *P. Japonicus Bate* and *M. philippii* (Sp. Bate) *var. (new) Attaqa,* or muddy bottom such as *P. semisulcatus de* Haan, and *P. Japonicus* Bate.

Concerning moulting, it occurs in spring and summer and mostly by night, although it occurs also during the day. Some male specimens of *Penaeus trisulcatus* Leach moulted in a period of less than one month. It was observed that after the adult females of economic penaeids moult, they loose their receptaculum seminis, while no sexual change occurs to the males after this process.

Concerning the spawning season of the different species studied, *P. trisulcatus* Leach females become fully ripe and the eggs well developed from October and during the winter months. The spawning season is in early spring and summer. For *Metapenaeus stebbingi* Nobili, Gurney (1927) recorded that the eggs of this species were obtained from October 21, 1924, from the Bitter Lakes and Port Taufiq (Suez Gulf). From Gurney's statements, it can be concluded that the spawning season of *M. stebbingi* Nobili ? is during autumn and early winter.

It was possible to procure the following larval stages of *Penaeus trisulctatus* Leach from plankton hauls collected from Suez Bay: third nauplius, seventh nauplius, eighth nauplius, first protozoea, second protozoea, third protozoea and first post-larva. It is the first time recorded that this species breeds in Suez Gulf.

The third nauplius is characterised by : the body possesses posteriorly a furca with two rami. Each furcal ramus carries a long and short spines. The exopodite of the second antenna is 5-segmented and with 7 setae. Laterally, both maxillae I and II and maxillipedes I and II project as small buds. The mandible has got a swelling at its base.

The seventh nauplius is characterised by : the posterior border of the carapace can be seen on the dorsal side, but it cannot be distinguished on the two sides. The maxillae, first and second maxillipedes are free from the body. Each caudal ramus carries 6 spines So that the spinal formula is 6+6.

The eighth nauplius is characterised by : each caudal ramus carries 7 spines, so that the spinal formula is 7+7. The border of the carapace is very clear and can be seen dorsally at the level of maxilla II. Posteriorly the body is divided into 4 segments. The nauplius ocellus is still present and 2 frontal organs can be easily seen projecting from the anterior border of the body. The exopodite of the second antenna is 5-segmented and with 7 plumose setae and a spine. The endopodite is non-segmented and carries 2 plumose and 1 non-plumose setae. At the base of the mandible in the swelling, can be distinguidshed the different parts of the mandible of the future first protozoea. The maxillae and maxillipedes are more elongated than in the previous stage. They have the characters and the aspects of the future protozoea.

The first protozoea is characterized by : no pedunculated eyes. Carapace neither having rostrum nor supra-orbital spines. The right and left mandibles are identical, 6 thoracic segments and 2-5 abdominal segments are present. Third maxillipedes are absent. Each furcal or caudal ramus with 7 spines.

The second protozoea is characterised by : stalked compound eyes. Carapace with rostrum and supra-orbital spines. Right and left mandibles are not identical. There are 11 segments at the posterior part of the body. The third maxillipede is absent. Furca with 7 spines on each ramus.

The third protozoea is characterised by : the supra-orbital spines are not bifid. A dorso-median spine is present on each of the first 5 abdominal segments. Furca is with 8 spines on each ramus. First antenna with 4 segments only . The third pair of maxillipedes, 5 pairs of peraeopods and the uropods are developed.

The first post-larva is characterised by : carapace is with a pterygostomial and a hepatic spine. There is no supraorbital spines. There is a spine on the posteromedian line of each of the 4th - the 6th abdominal somites. That on the 6th somite being the largest and that on the 4th somite is very short. The spines on the lateromedian line of the 5th and 6th somites are very short. The 6th somite is much

longer than the preceding 5 somites. Each of the first 5 abdominal segments is carrying a pair of pleopods which are well-developed, uniramous and serve for swimming. The telson is nearly rectangular and there is scarcely any notch at the posterior margin. The spinal formula is 8+8. The first antennal peduncle is 3 - segmented and bifurcated at the tip. The endopodite of the sceond antenna is shorter than the exopodite and is 4-segmented (Heldt, 1938:3-segmented). The thrid maxillipedes are well-developed. The first 3 pairs of peraeopods are chelate, while the 4th and 5th do not bear chelae.

The first and third protozoeae and the second mysis of *P. Japonicus* Bate were procured from hauling in Suez Gulf.

The first protozoea is characterised by : carapace octagonal in shape. A pair of frontal organs is present slightly posterior to the anterior margin. The posterior half of the body, which is not covered by the carapace consists of 6 thoracic somites. The abdomen is with 2 somites. The telson is in the form of a forked tail. The spinal formula is 7+7.

The thrid protozoea is characterised by : carapace hexagonal in shape, with rostrum and a pair of supra - orbital spines, at the anterior margin. The small spines at the tips of supra - orbital spines disappear. The uropods appear near the posterior end and all abdominal somites are fully developed.

The 6 pairs of thoracic appendages, have slightly developed. The ednopodite of the 3rd maxillipede beirg slightly longer than the exopodite and having 3 apical short setae.

The first 5 abdominal somites are almost the same in length; each of them being provided with a spine on the dorsal median line at the lower edge. The 5th somite has, besides, a pair of postero- lateral spines and the 6th abdominal somite being the longest and has a pair of lateral and postero-lateral spines. The spinal formula is 8+8.

The second mysis is characterised by : carapace measures about 1/3 rd the body-lenght. The pair of supra - orbital spines became smaller. The front pat of the rostrum is slightly curved and there is 1 tooth on its dorsal side. The first 3 pairs of peraeopods are chelate. The abdomen is well - developed and 6-segmented. The spine on the 3rd segment disappeared in addition to the spines present on the lst and 2nd segments. The uroped is well - de veloped and with a spine at the outer edge of the protopodite. The exopodite is slightly longer than the endopodite, but shorter than the telson. The telson is slightly less than 1/5 th the total body - length. The notch is small as a result of the drawing closer towards each other of the bifurcated ends. The spinal formula is still 8+8.

The eggs of *Metapenaeus stebbingi* Nobili were obtained from plankton collected from the Great Bitter Lake. The egg is demersal and spherical. It is surrounded by a mebmrane which is blue turquoise in colour when viewed under the microscope. The egg diameter varies from 0.31 mm. — 0.50mm.

The *first nauplius* is obtained by hatching out of an egg in the laboratory. *Its main characteristics are the following*: The body is oblong and no segmentation is visible. It is opaque yellow in colour with orange reddish chromatophores scattered on the appendages and especially at their bases. Its posterior edge is rounded and ends in a pair of smooth setae. The nauplius ocellus is placed anteriorly and there are no frontal organs. The nauplius carries 3 pairs of appendages which are non-segmented *i.e.* the antennules, antennae and mandibles. The antennules are uniramous while the antennae and mandibles are biramous.

The *second nauplius* is obtained in the laboratory by transformation of Nauplius I. *It is characterised by* : It is opaque yellow in colour, with few orange reddish chromatophores on the appendages, *i.e.* antennules, antennae and mandibles and on the two caudal rami. Its antennule is non jointed. The antenna; its expopodite is partly segmented and the endopodite is non - segmented. The mandibles have got protruberances on the protopodites representing the molar portions. Both endopodite and exopodite are non-segmented and carry 3 terminal plumose setae. Behind the mandibles are swellings representing the paragnaths, maxillae I and II and maxillipedes I and II. There is a distinct trace of the shell-fold or carapace in the region of the first maxilla. The telson is differentiated as a broad plate with a small median incision dividing it into two caudal rami. Each ramus carries 6 spines. The spinal formula is 6+6.

Concerning the fishing gears and methods, *P. trisulcatus* Leach is fished from Suez Gulf by two types of gear :

1.— The otter-trawl. 2) The purse - or shore - seine.

Penaeus semisulcatus de Haan and *Penaeus Japonicus Bate* are the other major constituents of economic penaeids fished from Suez Gulf by otter -trawlers.

Metapeneus philippii (Sp. Bate) *var.* (*new*)*Attaqa*, is caught with *Penaeus trisulcatus* leach, *Penaeus semisulcatus* de Haan and *Penaeus Japoenicas* Bate from Suez Gulf by otter-trawls. The bulk of the catch from the Gulf is got by purse - seines. It forms with *Metapenaeus stebbingi* (Nobil i) the major constituents of economic penaeids fished from the Bay by this type of gear.

Purse-seines are employed for fishing *M. philippii* (Sp. Bate) *var.* (*new*)*Attaqa* only by night until dawn. They are used the whole year and the maximum catch is in summer.

M. stebbingi (Nobili) forms with *M. philippii* (Sp. Bate) *var* (*new*) *Attaqa* the two major constituents of the catch of economic penaeids from Suez Gulf by purse-seine fishing. It is not got by otter-trawls.

Shore-seines are also used for fishing *M. stebbingi* (Nobili) only by night. They are used the whole year and the maximum catch is also in summer like *M. Philippii* (Sp. Bate) *var.* (*New*) *Attaqa.*

Concerning the fishery statistics of *P. trisuclatus* Leach, *P. semisulcatus* de Haan, *P. Japonicus* Bate, *M. stebbingi* Nobili and *M. philippii* (Sp. Bate) *var: (new) Attaqa*; the catch of economic penaeids in Suez Gulf is composed mainly of P. *trisucatus* Leach, *P. semisulcatus* de Haan and P. *Japonicus* Bate. The number of otter-trawers from 1921 to 1961 and the catch in kgms. in the same period is shown in the following table :

TABLE 2.

Year	No. of otter trawlers	Weight (kgm.)	Year	No. of otter trawlers	Weight (kgm.)
1921	5	26813	1937	17	112160
1922	7	19728	1938	27	78150
1923	—	23405	1939	15	67877
1924	—	18170	1941	2	2240
1925	—	16650	1942	2	17210
1926	6	17535	1943	3	15250
1927	7	24700	1944	4	15540
1928	7	16235	1945	4	24960
1929	10	13270	1955	30	45810
1930	8	35465	1956	30	23980
1931	14	30950	1959	42	159500
1932	12	26151	1958	47	172570
1933	13	27200	1959	46	178244
1934	17	36132	1960	44	95098
1935	10	3326	1961	39	216167
1936	12	72870			

From the above table; it can be concluded that during the Second World War years (from 1941 to 1945), the number of ottertrawlers was very low. After the war, their number began to increase.

The fishing season by otter-trawls is from September till June. During July and August, otter-trawlers are forbidden from fishing in the Bay as it is the spawning season of most economic fishes. The maximum catch of *Penaeus trisulcatus* Leach, *Penaeus semisulcatus* de Haan and *Penaeus japonicus* Bate by otter trawls is during the autumn and the early part of winter. *i.e.* during October, November, December and the first half of January. From the second half of January, the catch begins to decrease to the end of the season *i.e.* June. During the peak of the season, every otter- trawler catches per trip from 30 to 40 boxes of *P. trisulcatus* Leach, *Penaeus semisulcatus* de Haan and *P. Japonicus Bate* (the box contains about 20 kgm.) At the beginning of the season and at its end, every otter-trawler catches about 10 boxes only.

A small percentage of the catch, composed mainly of *Metapenaeus stebbingi* (Nobili), *Metapenaeus philippii* (Sp. Bate) *var.* (*New*) *Attaqa* and a small amount of *Penaeus trisulcatus* Leach and *P. japonicus* Bate is fished from Suez Bay by purse-seines used by rowing and sail boats, whose number varies from 10 to 15. Purse-seines are used the whole year and the maximum catch of the 4 species is during summer.

The catch of economic penaeids forms a part of the total catch by otter-trawlers from Suez Gulf which is composed of economic fishes.

It can be seen from the above table and Graph 1 that the lowest production of economic penaeids in Suez Gulf was in the year 1941 in which it was only 2240 kgm. The maximum production was in the year 1961 in which it reached 216067 kgm. During the period from 1921 to 1961, there were two minima and two maxima in the production of economic penaeids in the Gulf. Every minima was followed by a maxima. The first minima was during the years from 1921 to 1935 and the second from 1941 to 1956. On the other hand the first maxima was from 1936 to 1939 and the second from 1957 to 1961.

To increase the catch of economic penaeids ottertrawlers can catch *Penaeus trisulcatus* Leach from the Red Sea proper between Abou Mingar and Gifatin Islands. Also round Safaga Island *P. trisulcatus* Leach is recorded.

CONCLUSIONS

(1) Five species of economic penaeids are recorded in Suez Gulf and Red Sea proper. These are : *Penaeus trisulcatus* Leach, Penaeus Semisul Catus de Haan, *Penaeus Japonicus* Bate, *Metapenaeus philippii* (Sp. Bate) *var* (*new*) *Attaqa* and *Metapenaeus stebbingi* (Nobili).

(2) *Penaeus trisuclatus* Leach or *Penaeus caramote* Risso, had migrated through the Suez Canal from the Mediterranean to the Red Sea and now forms the bulk of the catch of economic penaeids from Suez Gulf. It is recorded for the first time in the Red Sea.

(3) On the contrary, *P. semisulcatus* de Haan 1849, *P. Japonicus* Bate and *M. stebbingi* (Nobili), had migrated from the Red Sea to the Meiteranean through the Suez Canal where they form a good fishery.

(4) *Metapenaeus philippii* (Sp. Bate) *var* (*new*) *Attaqa* is a new variery recorded for the first time is Suez Bay.

(5) *Pneaeus trisulcatus* Leach, *Penaeus semisulcatus* de Haan, *Penaeus Japonicus* Bate, *M. philippii* (Sp. Bate) *var Attaqa* and *M. stebbingi* (Nobili) are caught from Suez Gulf only.

(6) The five species are nocturnal in habit, sea vengers and cannibalistic preying on each other.

(7) The process of moulting is nearly the same and as in all decopod crustacea occurs in spring and summer and mostly by night.

(8) The spawning season of *P. trisulcatus* Leach is in early spring and summer. For. *M. stebbingi* (Nobili) from Gurney's statements (1927), it can be concluded that the spawning season of this species is during autumn and early winter.

(9) The third, seventh, eighth nauplii, the first, second, third potozeae and first post-lava of *P. trisulcatus* leach were procured from plankton hauls collected from Suez Gulf. It is the first time recorded that this species breeds in the Gulf.

(10) The eggs of *M. stebbingi* Nobili were obtained from hauling in the great Bitter Lake during summer and the first and second nauplii by hatching out of eggs in the laboratory.

(11) The first and third potozoeae and the second mysis of *P. Japonicus* Bate were procured from hauling in Suez Gulf.

(12) *Penaeus trisuclatus* Leach, *Penaeus semisulcatus* de Haan, *Penaeus Japonicus* Bate, *Metapenaeus philippii* (Sp. Bate) *var* (*new*) *Attaqa* and *Metapenaeus Stebbingi* (Nobili) are fished from Suez Gulf by otter-trawls and purse-seines.

(13) The peak of the season of fishing *P. trisulcatus* Leach, *P. semisulcatus* de Haan and *P. Japonicus* Bate in Suez Gulf by otter trawlers is during autumn and the early part of winter *i.e.* during October, November, December and the first half of January.

(14) The peak of the season of fishing *M. philippii* (Sp. Bate) *var.* (*New*) *Attaqa* and *M. stebbingi* (Nobili) by purse-seines from Suez Gulf is in summer.

(15) The lowest production of economic penaeids in Suez Gulf was in the year 1941 in which it was only 2240 kgm. and the maximum production was in the year 1961, in which it reached 216067 kgm.

(16) To increase the catch of Economic Penaeids, Otter-trawlers can catch *P. trisulcatus* Leach from the Red Sea proper from between Abou Mingar and Gifatin Islands. Also round Safaga Island, *P. trisulcatus* Leach is recorded.

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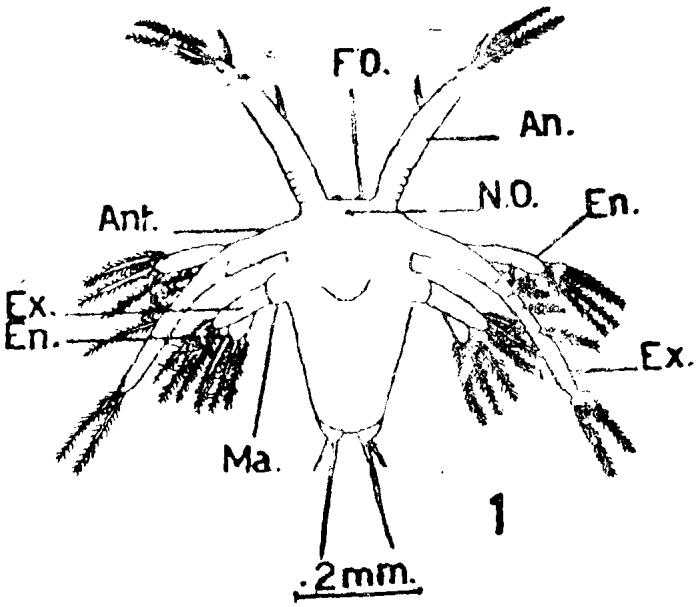
LIST OF ABBREVIATIONS

Ab.	: Abdomen	Abs.	: Arthrobranchs
An.	: Antennule	An.Pe.	: Antennular peduncle
Ant.	: Antenna	Ant. Sc.	: Antennal scale
Ant. Pe	: Antennal peduncle	Ant. Sp	: Antennal spine.
Ba.	: Basipodite	C.E.	: Cutting edge
C.R.	: Caudal ramus	Ca.	: Carapace
Ch.	: Chela	Cl.	: Claw
Co.	: Coxopodite	Da.	: Dactylus
E.	: Eye	E.Ma.	: Embryonic mass.
Eg. M.	: Egg mass	Em. M.	: Embryonic membrane
En.	: Endopodite	Ep.	: Epipodite
Ex.	: Exopodite	F.L.	: Frontal organ
F.Sp,	: Furcal spine	Fs.	: Feelers
H.Sp.	: Hepatic spine	I.P.	: Incisor process
Is.	: Ischium	L.	: Leg
Lr.	: Labrum	Ls.	: Legs
M.P.	: Molar process	Ma.	: Mandible
Ma. Pa	: Mandibular-palp	Ma. Pro	: Mandibular process
Mb.	: Mastigobranchia	Me.	: Merus
Mx.	: Maxilla	Mxp.	: Maxillipede
P.S.	: Perivitelline space	Pl.	: Pleopod
Pr.	: Protopodite	Ro.	: Rostrum
S.Or. Sp:	Supra – orbital spine	Sc.	: Scaphognathite
Te.	: Telson	Th.	: Thorax
Ur.	: Uropod		



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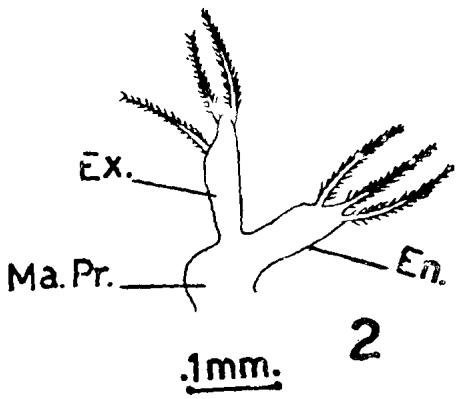

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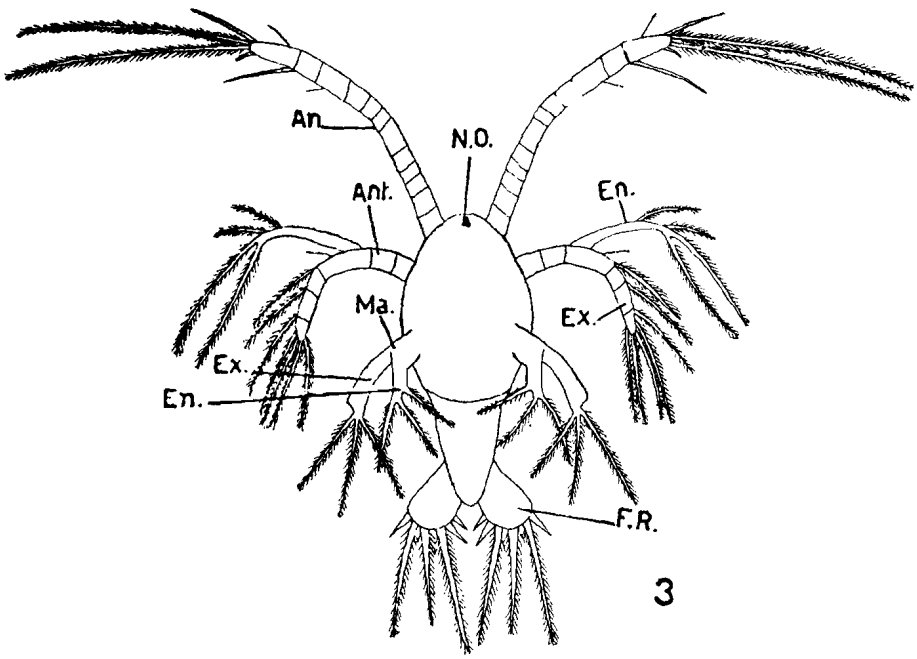

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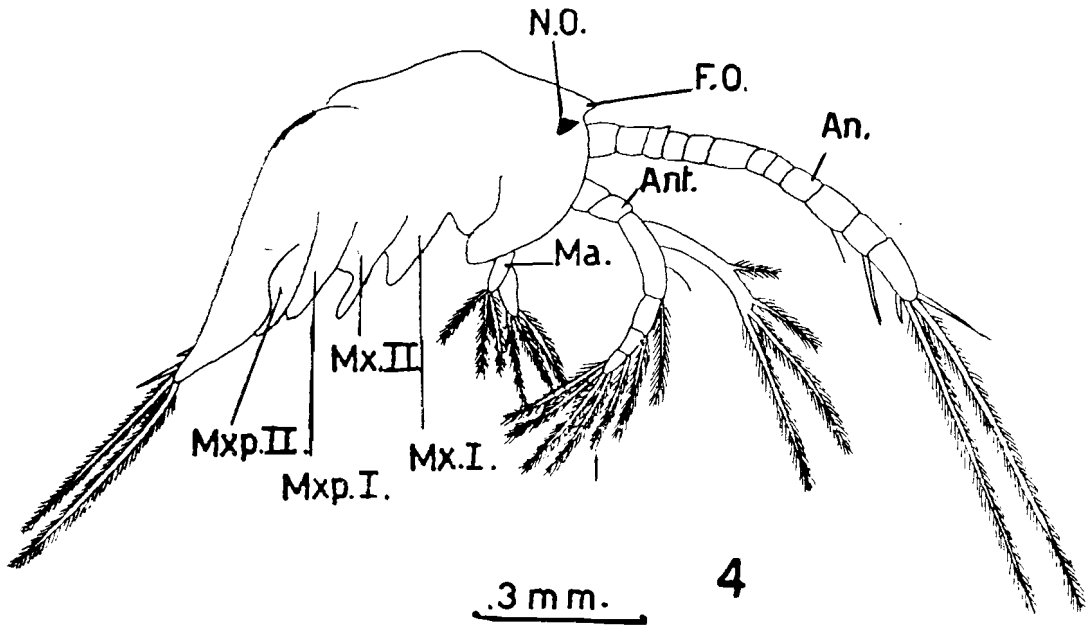

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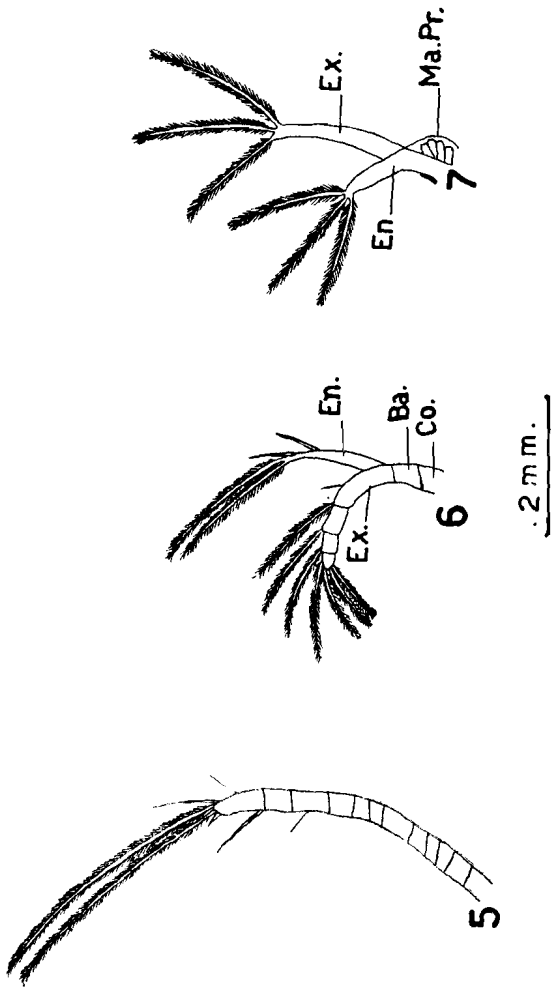
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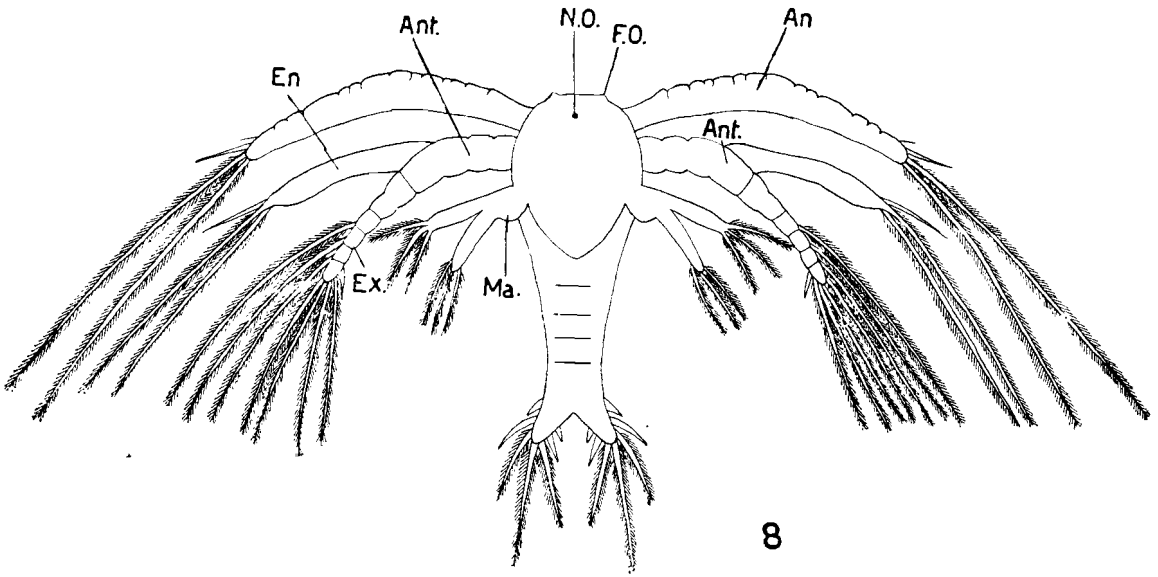
5



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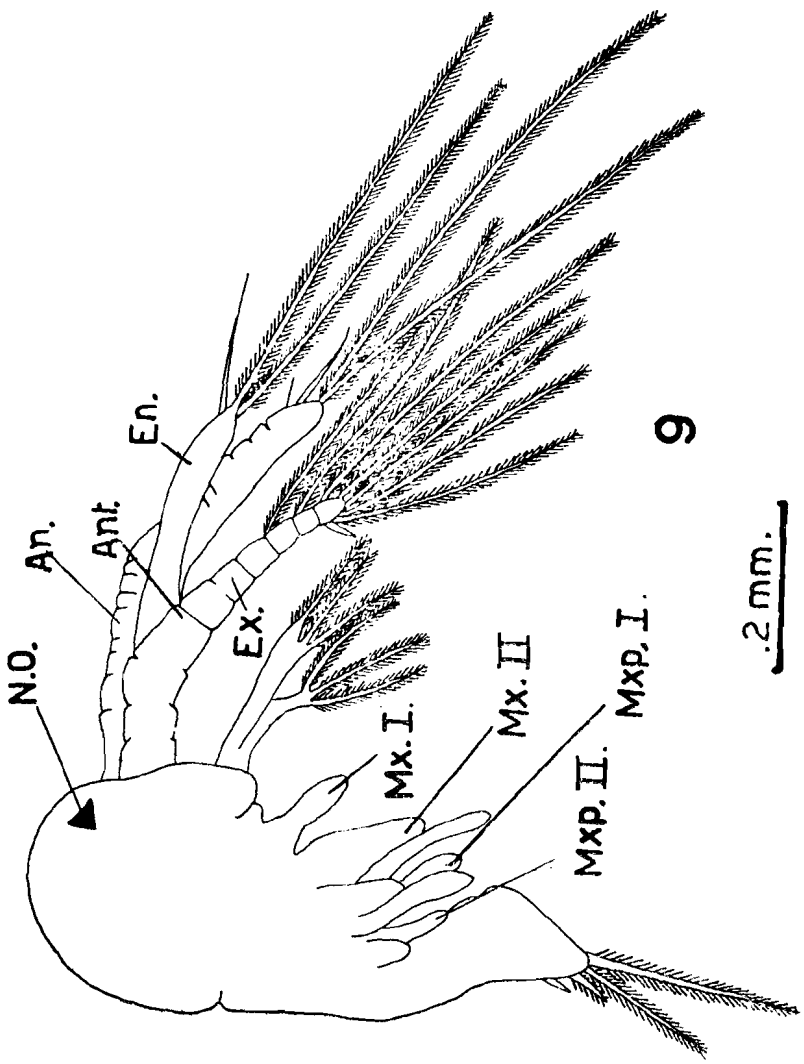
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Mxp. II.
Mxp. I.
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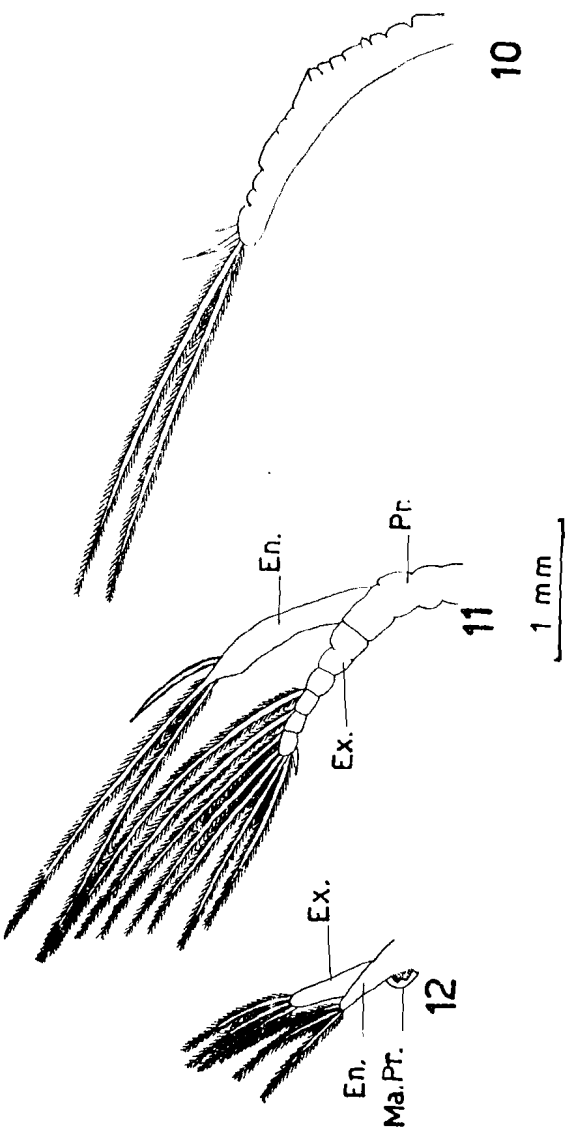
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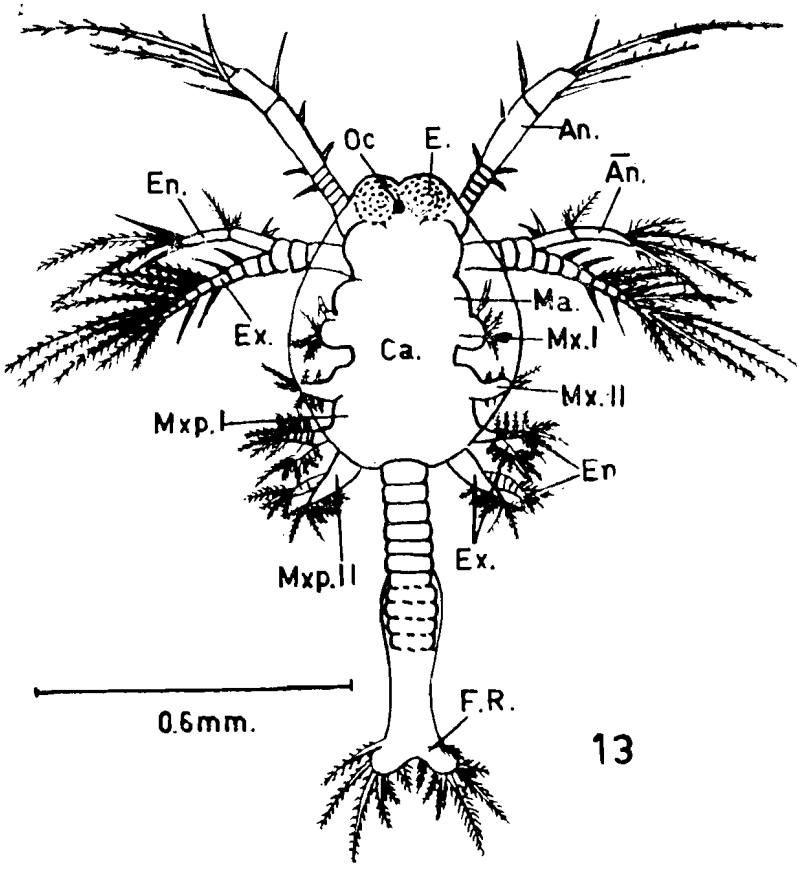

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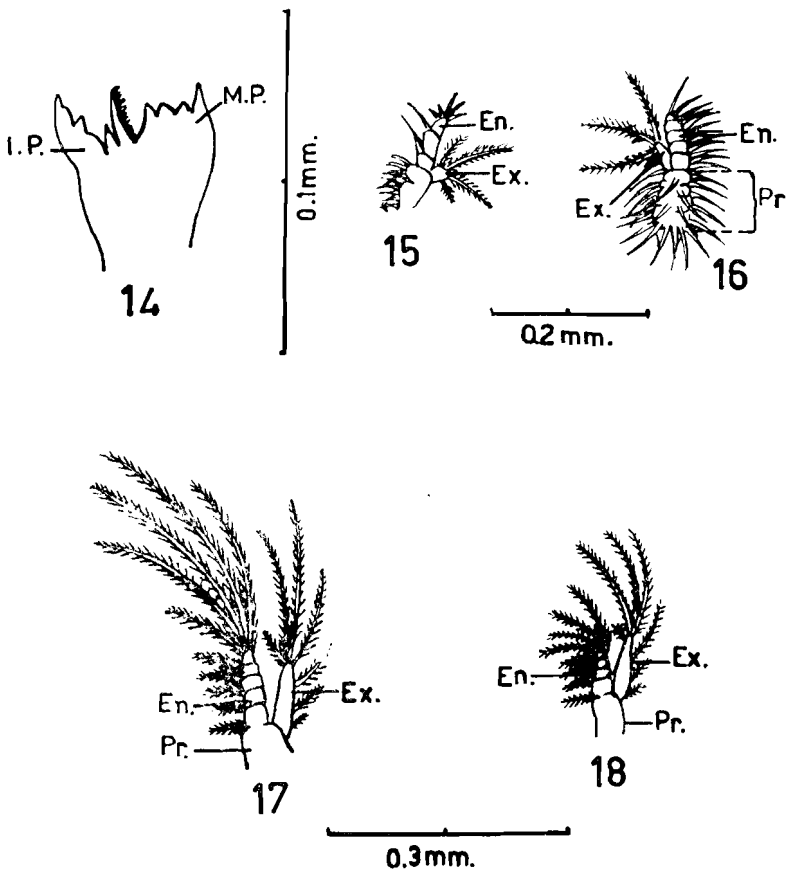
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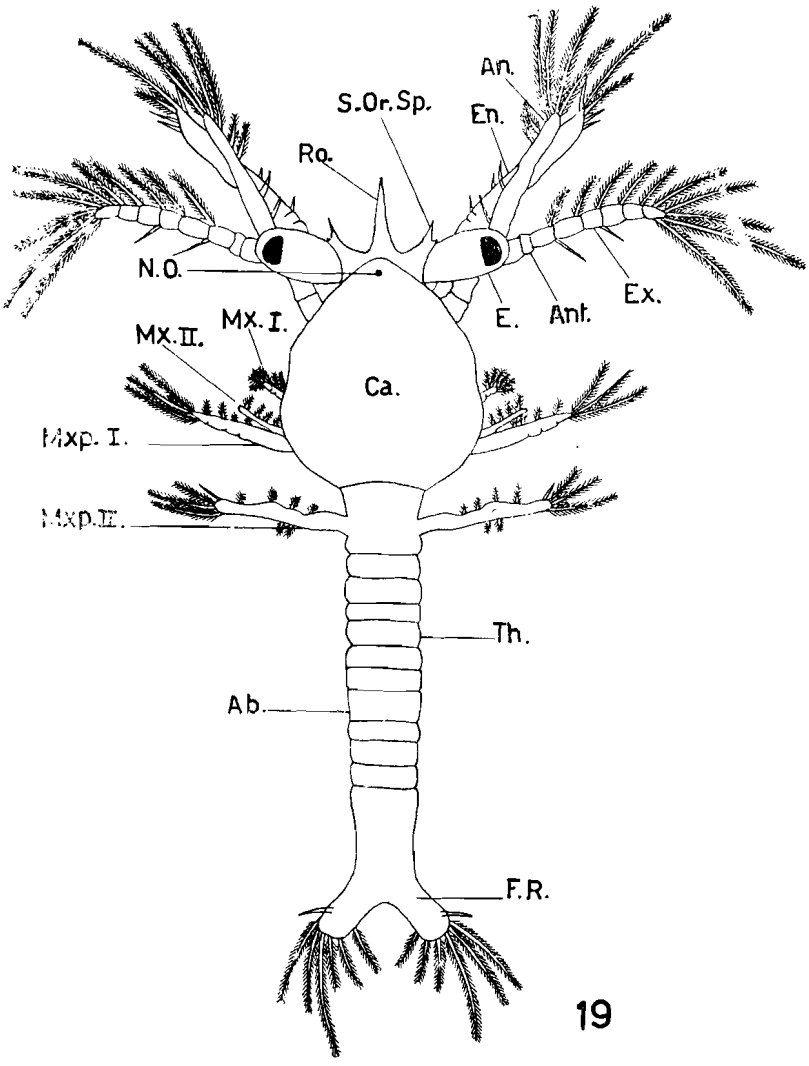

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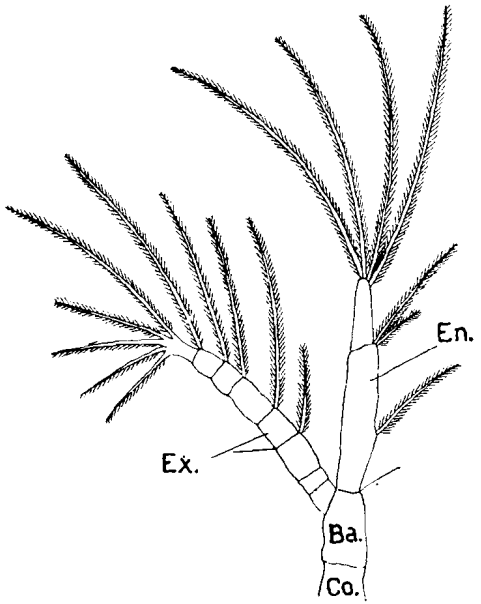

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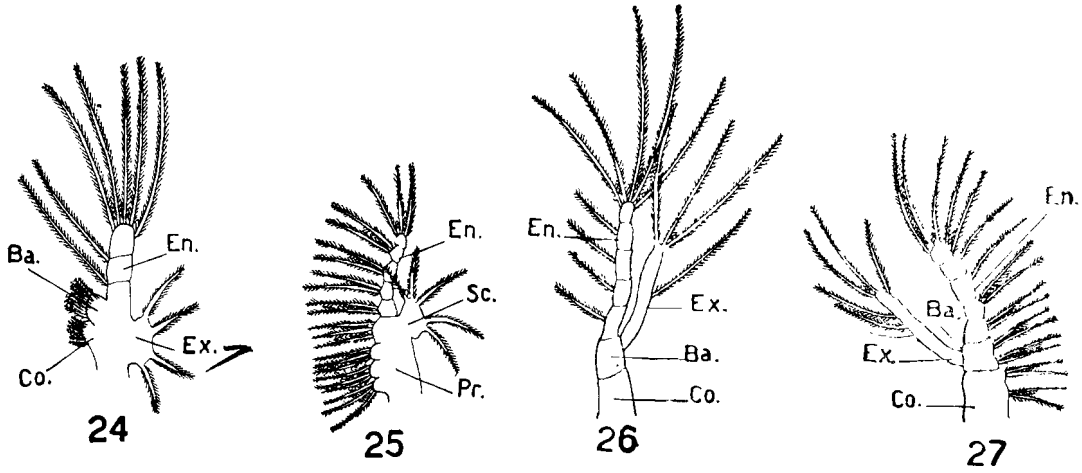
Pl. XI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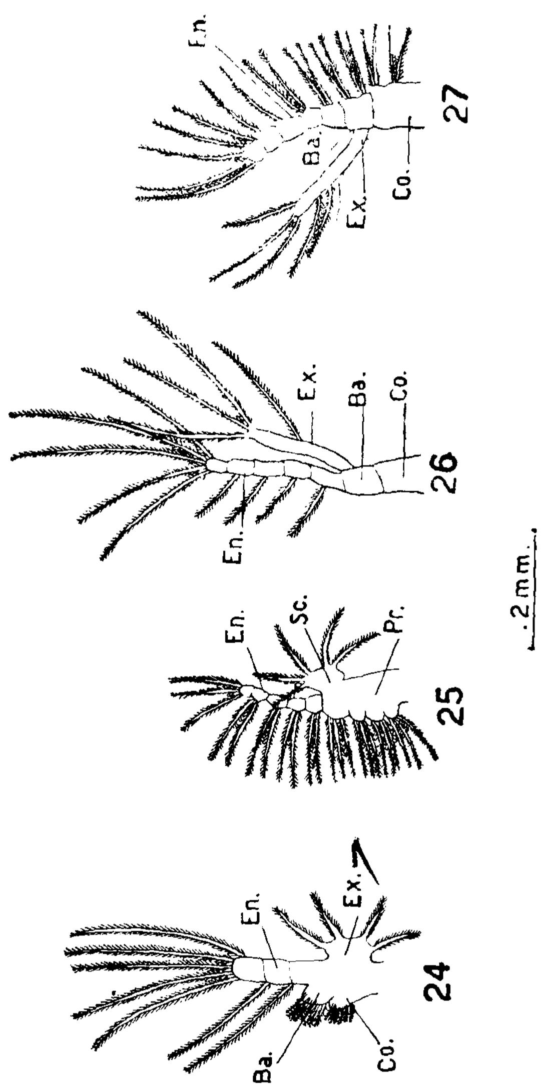

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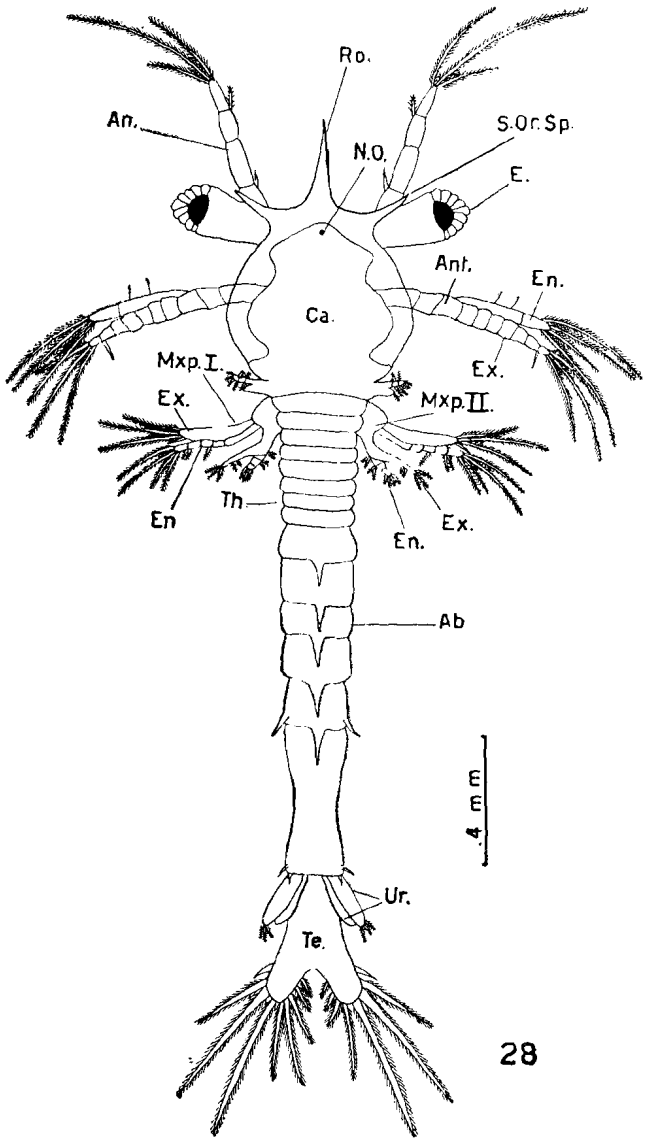

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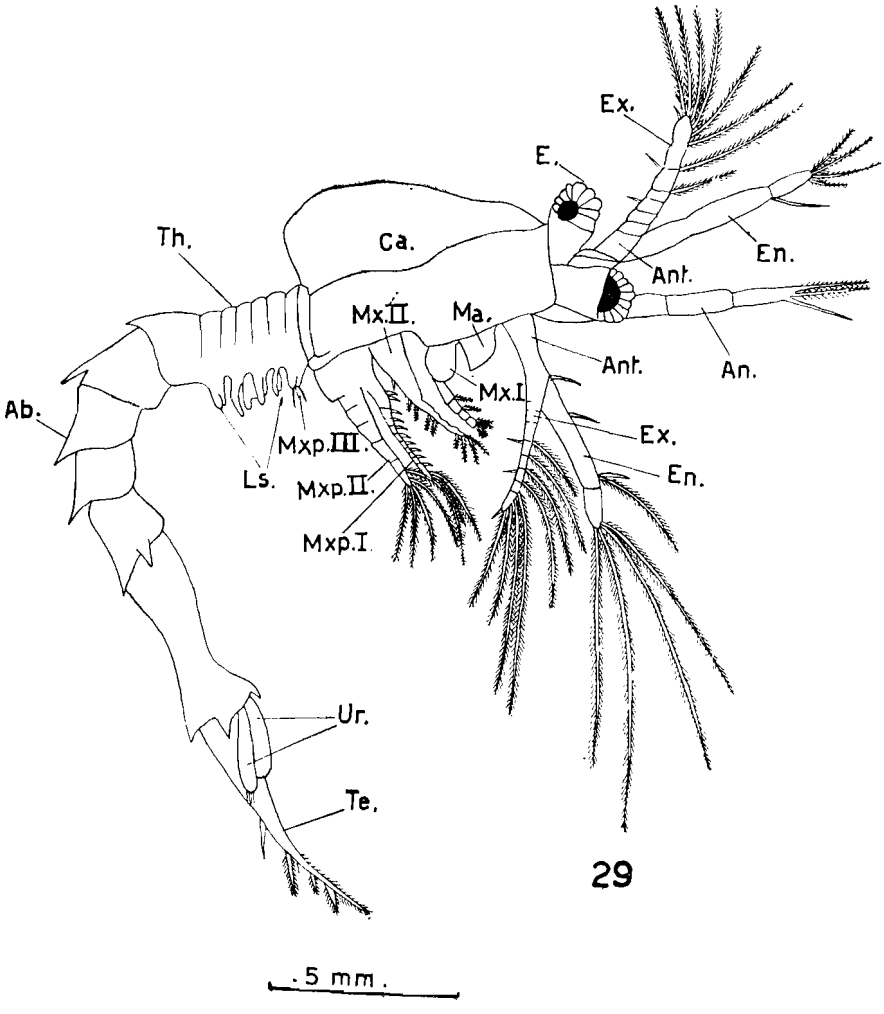
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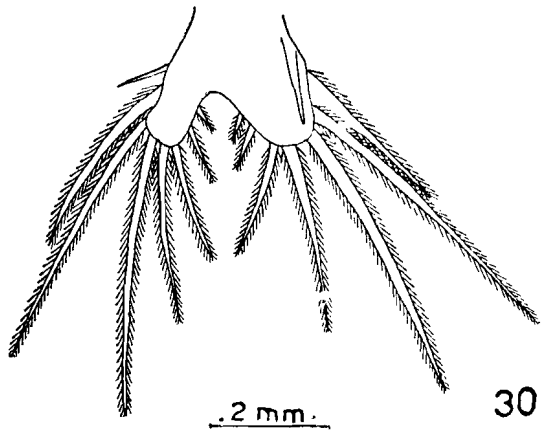

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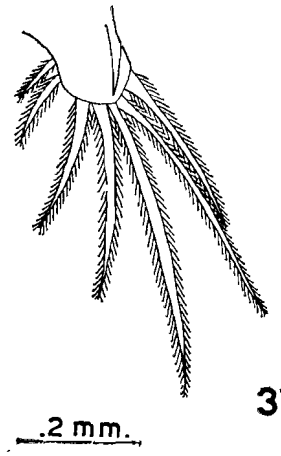

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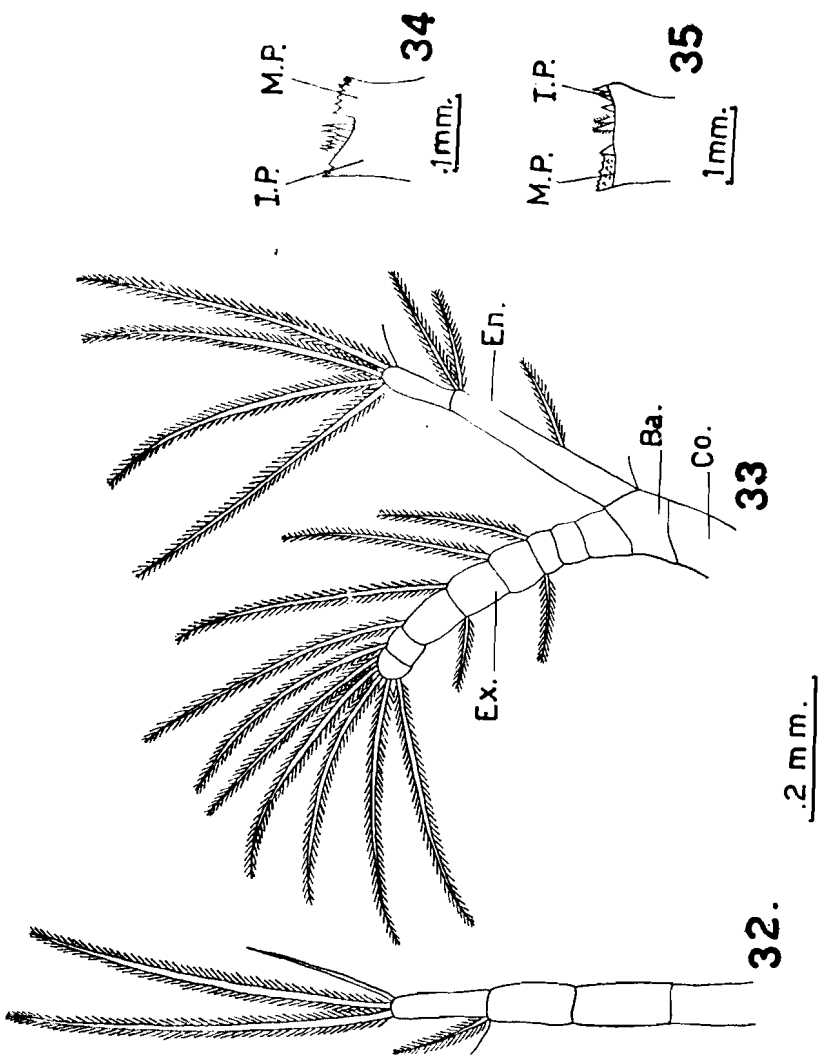
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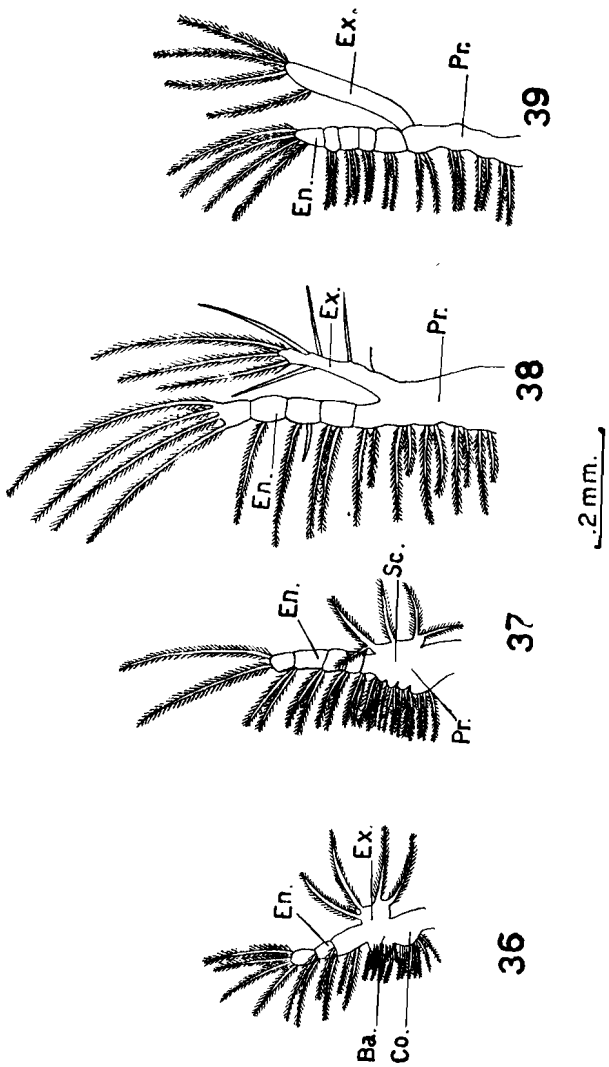
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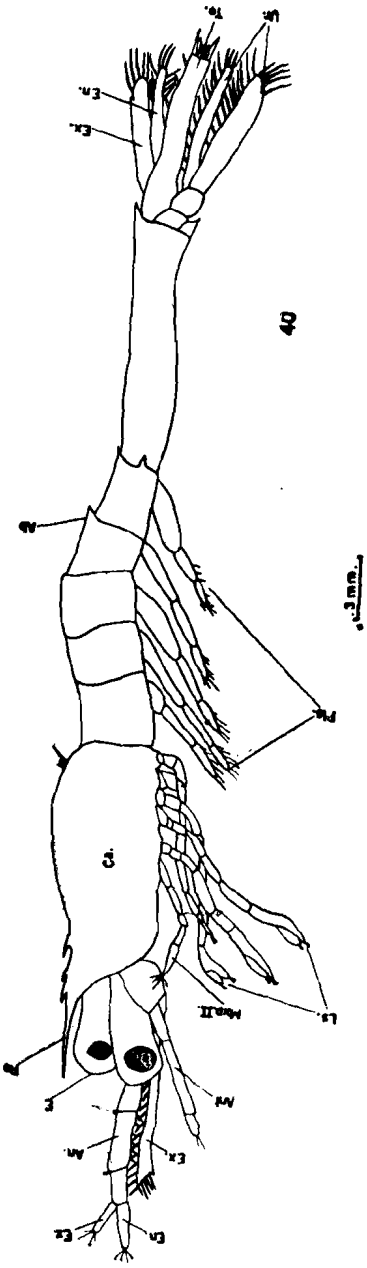
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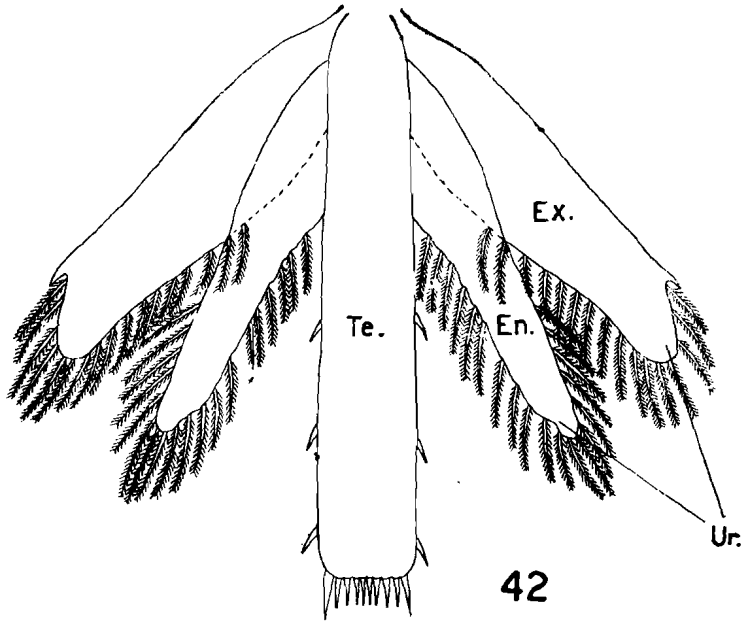

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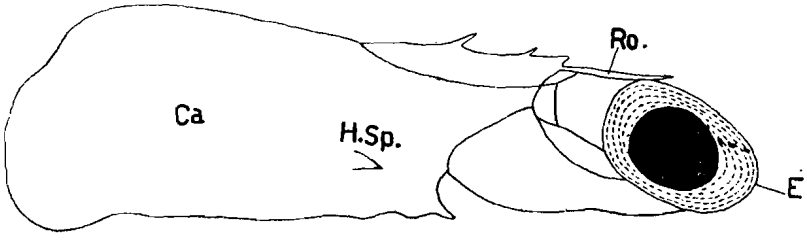

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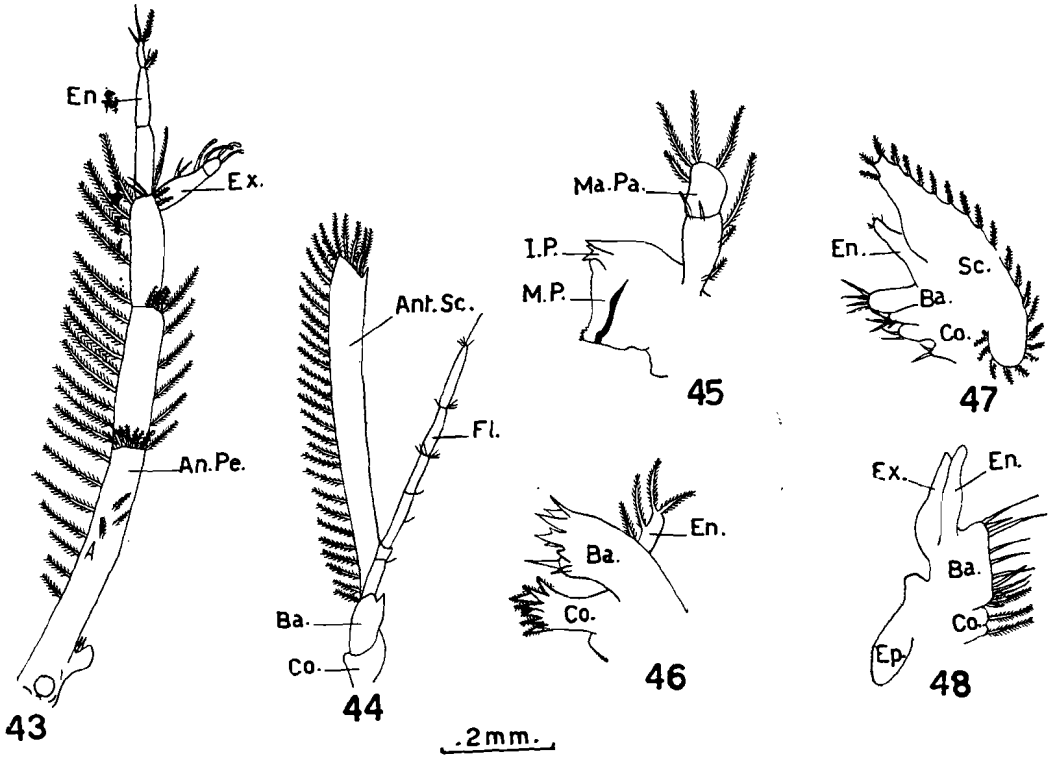
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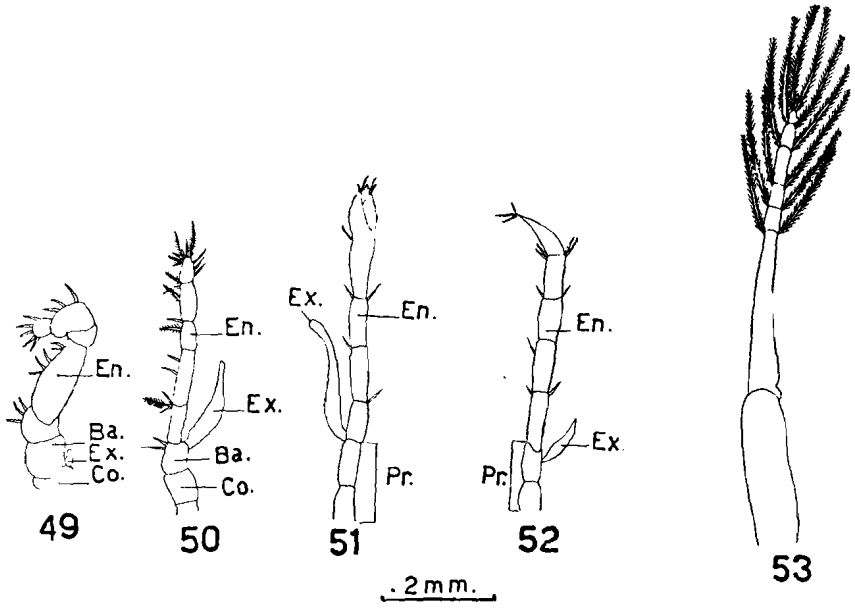
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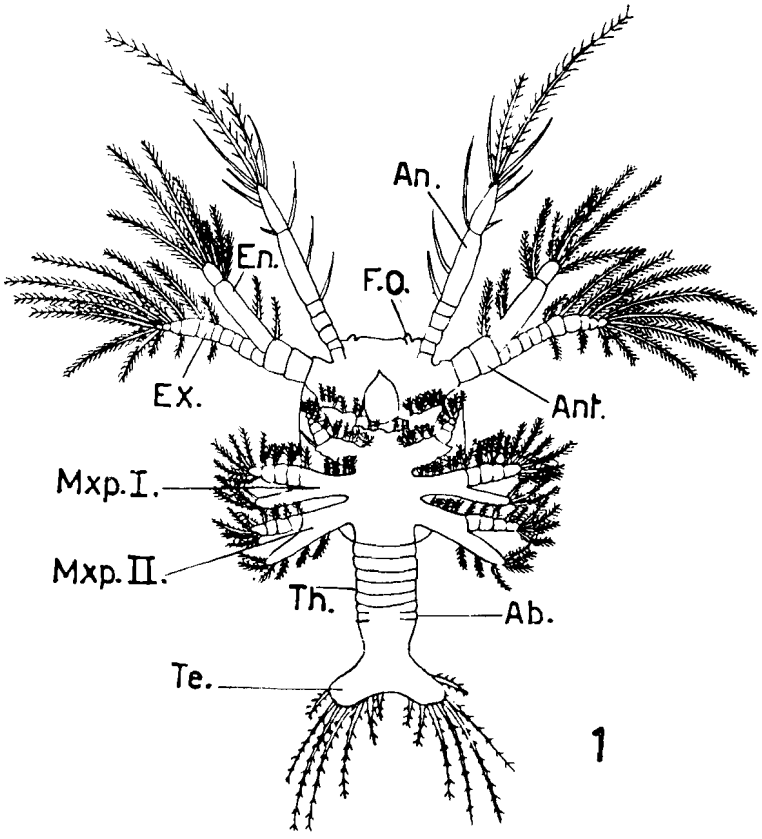
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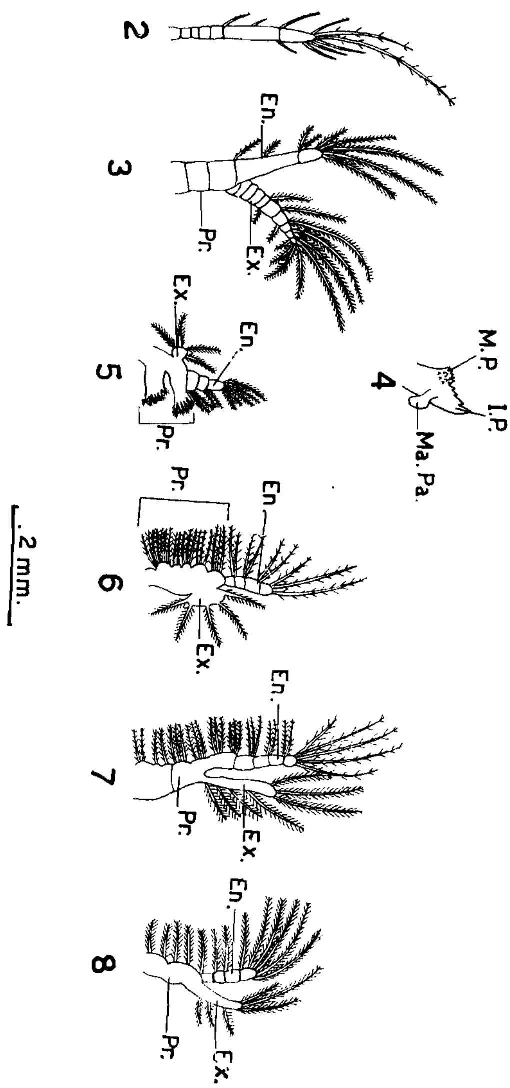
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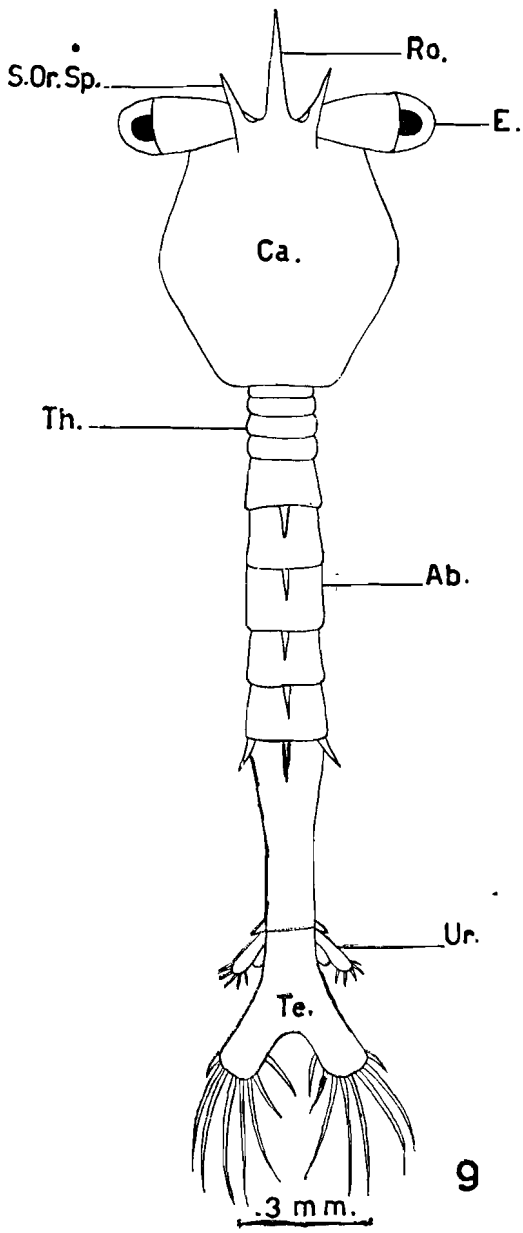

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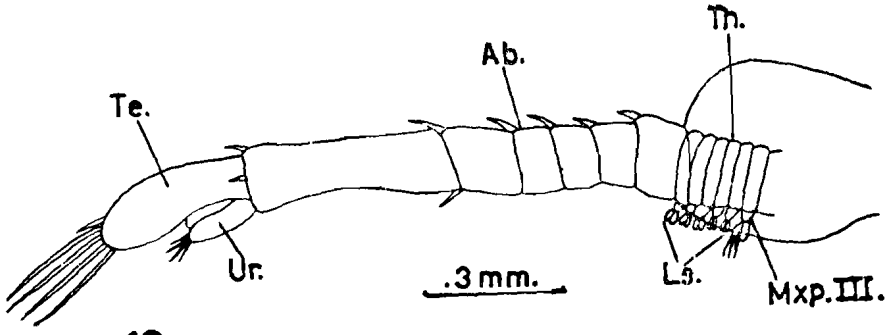

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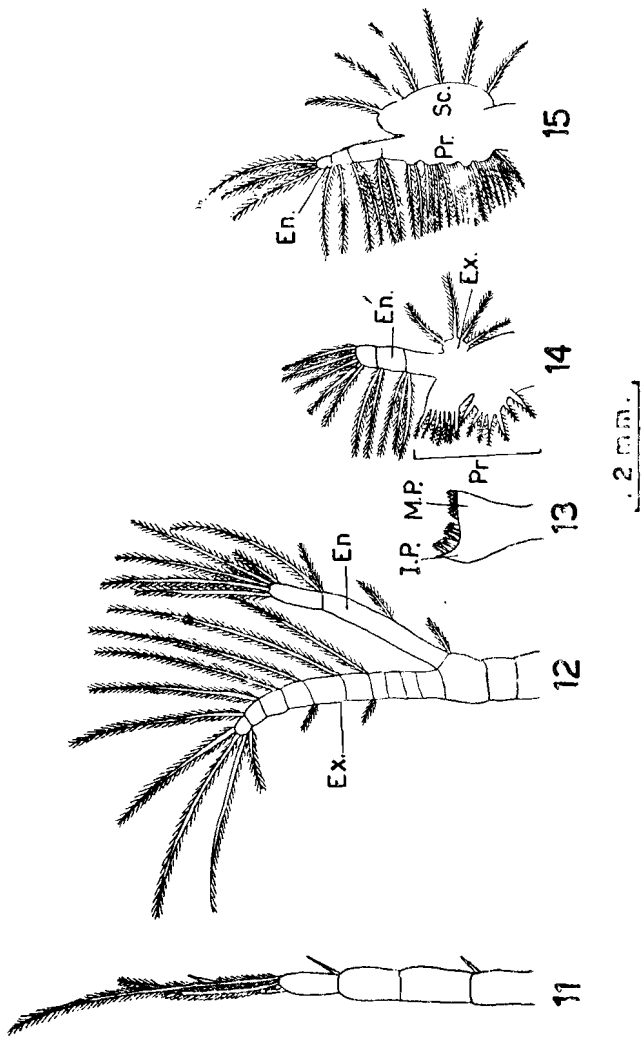
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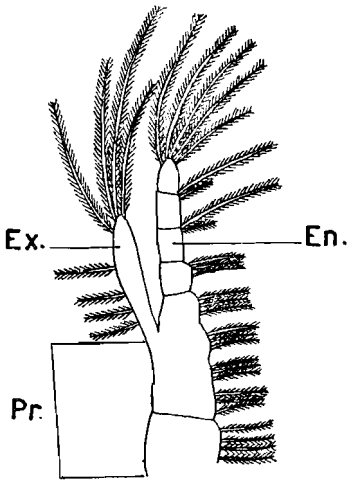

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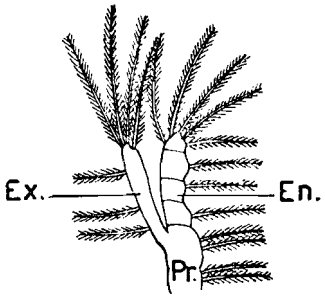

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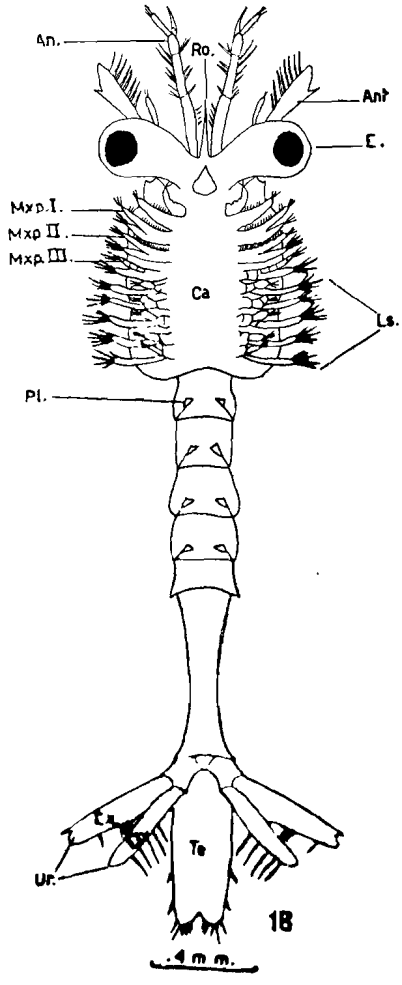
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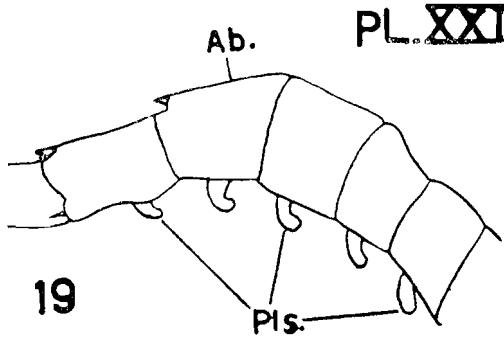
PL. XXIX



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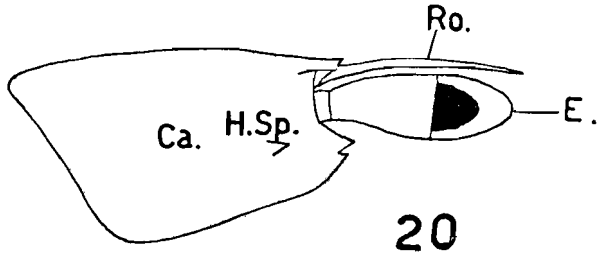
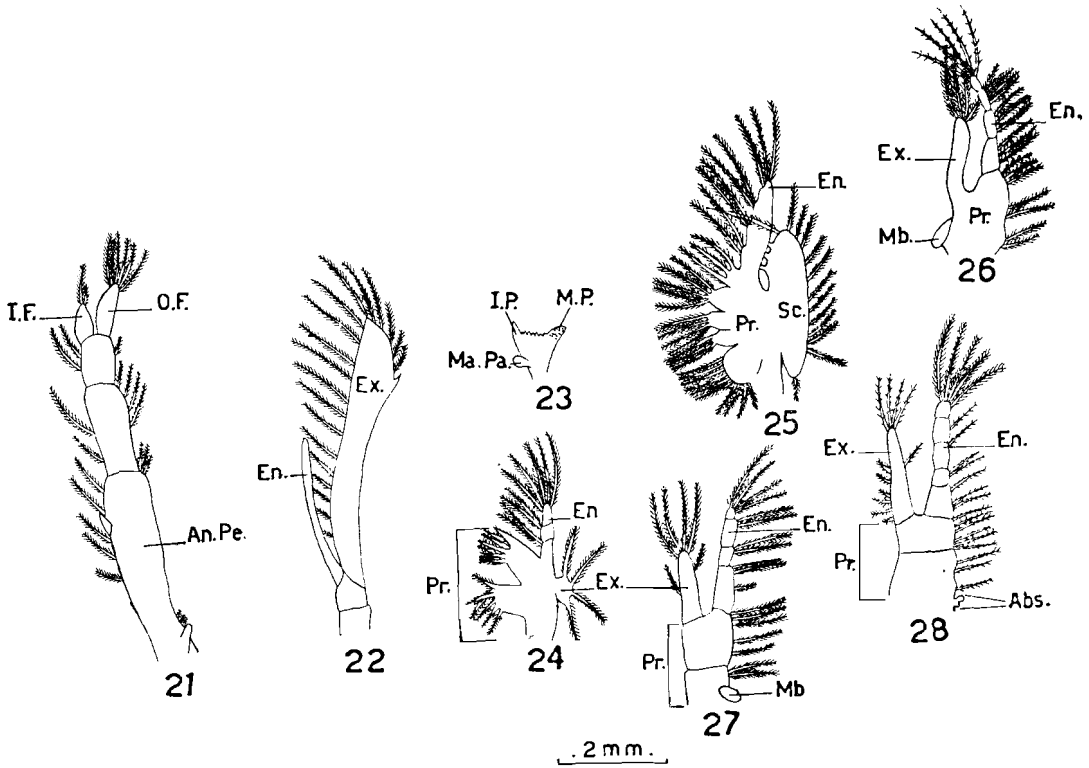
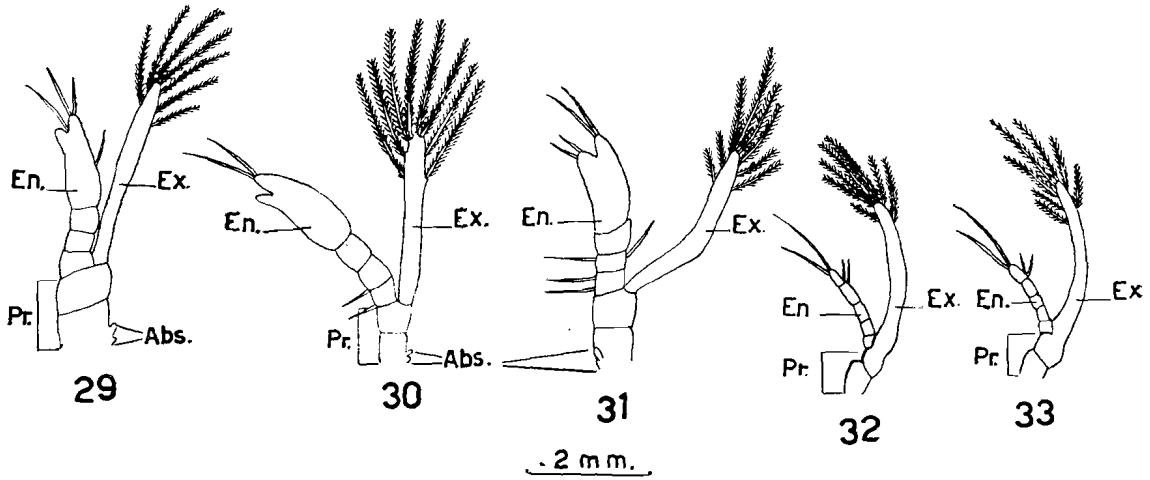
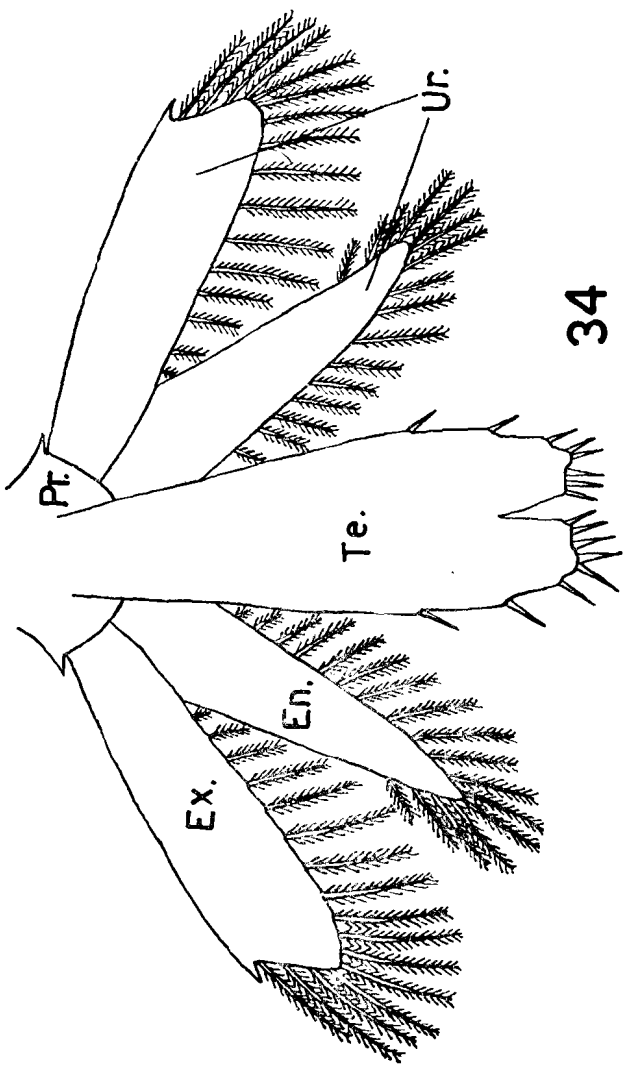


20

.3mm.

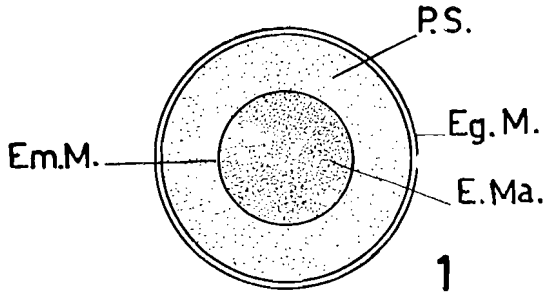

I.F.
O.F.
An.Pe.
21
Ex.
En.
22
I.P.
M.P.
Ma.Pa.
23
En
Pr.
Ex.
24
En.
Pr.
Sc.
25
En.
Ex.
Pr.
Mb.
26
En.
Pr.
Mb
27
Ex.
En.
Pr.
Abs.
28
.2 mm.


En.
Ex.
Pr.
Abs.
29
En.
Ex.
Pr.
Abs.
30
En.
Ex.
31
En
Ex.
Pr.
32
En.
Ex
Pr.
33
2 m m.

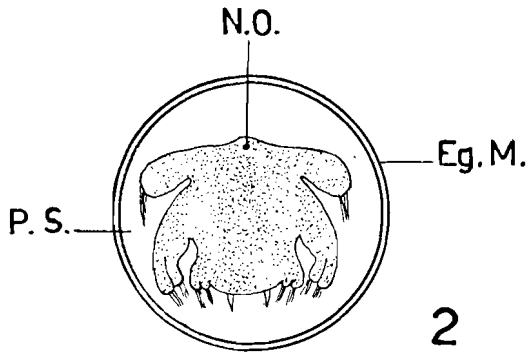


34

.2 mm.

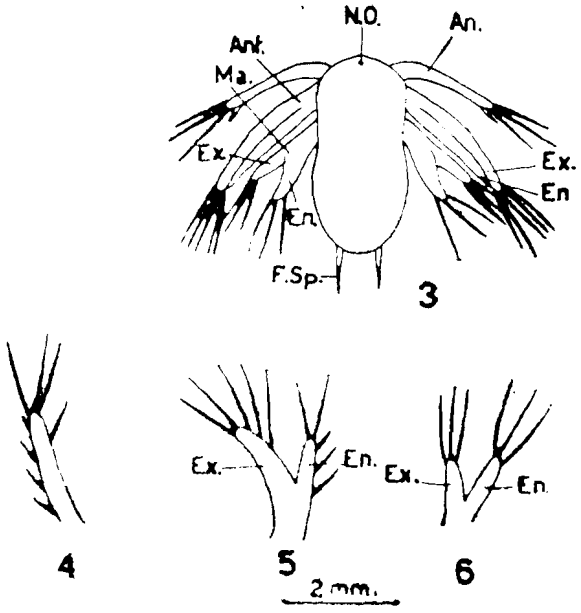


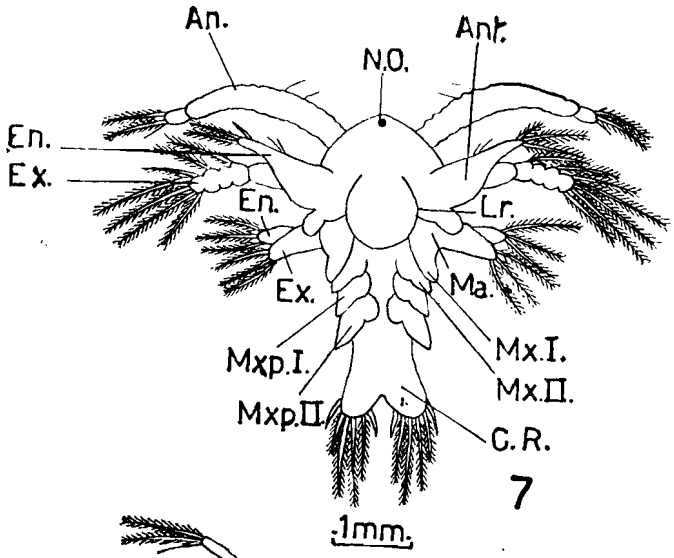
1

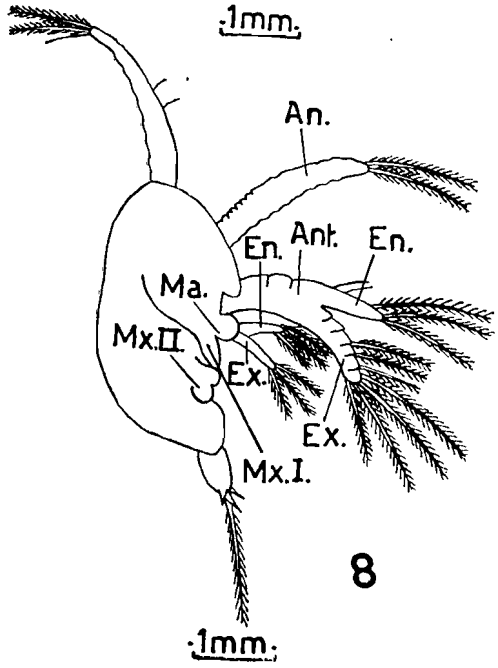


2

.3 mm.


N.O.
An.
Ant.
Ma.
Ex.
Ex.
En
En.
F.Sp.
3
4
Ex.
En.
Ex.
En.
5
6
2 mm.


An.
Ant.
N.O.
En.
Ex.
En.
Lr.
Ex.
Ma.
Mxp.I.
Mx.I.
Mx.II.
Mxp.II.
C.R.
7
·1mm.


An.
En.
Ant.
En.
Ma.
Mx.II.
Ex.
Ex.
Mx.I.
8
·1mm.