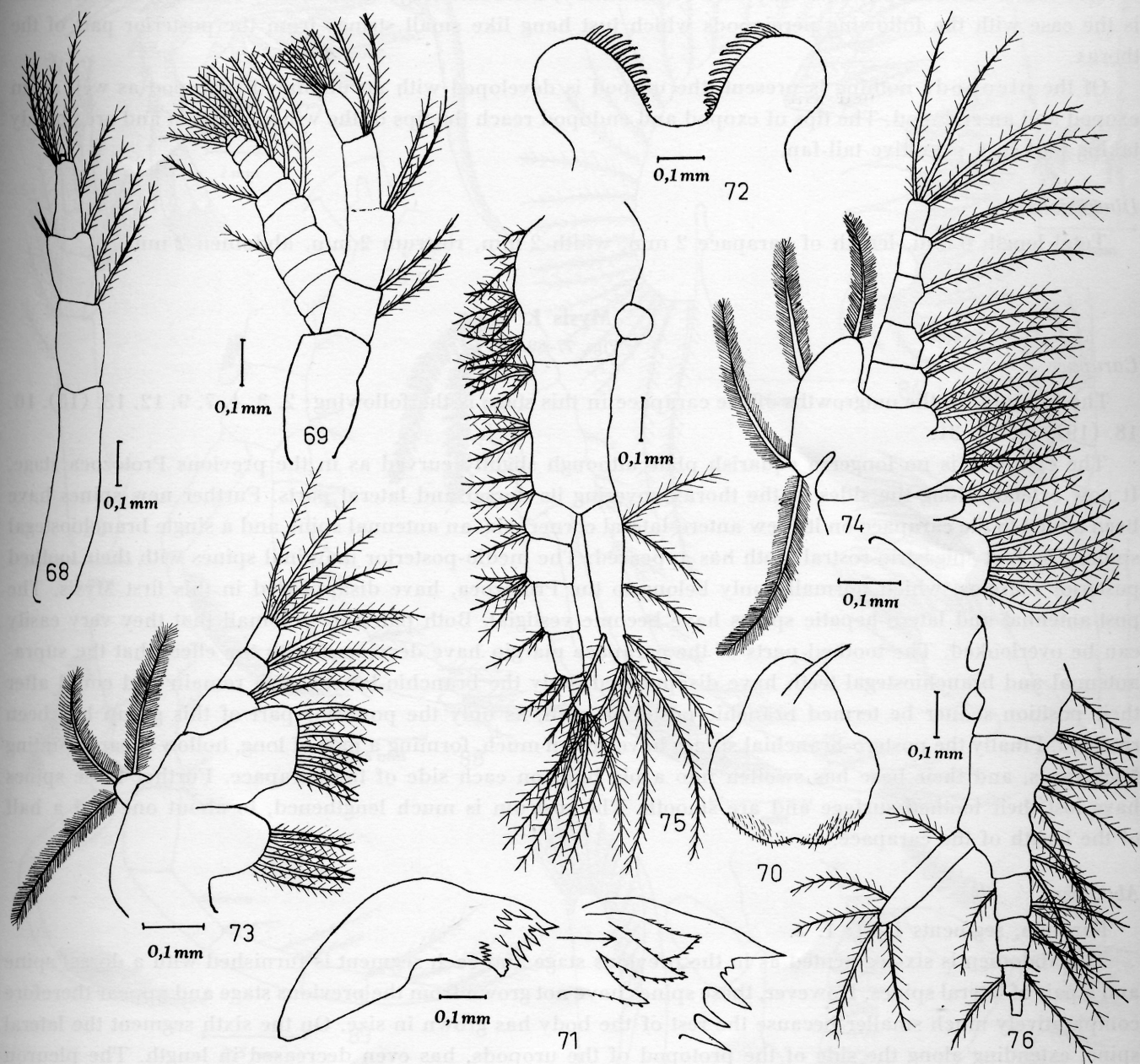


is in this stage a small vestigial bulb with only three strong, plumose setae. The usual number of setae on such an exopod is four.

The second maxilla is furnished with four endites: two coxa-endites and two basi-endites; further with a long, slender five-jointed endopod with the following numbers of setae: 2-2-1-2-4. Possibly the only



Figs. 68-76. *Solenocera* sp. larva *danae*. Third Protozoa. Fig. 68, first antenna. — Fig. 69, second antenna. — Fig. 70, labrum. — Fig. 71, mandible. — Fig. 72, labium. — Fig. 73, first maxilla. — Fig. 74, second maxilla. — Figs. 75-76, first and second maxillipeds.

single seta on the third joint is caused by an accidental loss of the other. The exopod is still bulbous and provided with the normal four stout, plumose setae, but it has become more elongate both in the proximal and the distal direction.

The first maxillipede is the largest in this stage. The protopod is two-jointed consisting of coxa and basis. On coxa a beginning gill-exite or mastigobranchia shows as a bud. The exopod is un-jointed, rather weak and has a few swimming setae at the lateral margin and on the tip. The endopod consists of five joints and is the largest. Along the medial margins of the protopod and the endopod is a row of trapping setae.

The second maxillipede is shorter than the first. The protopod is two-jointed and more distinctly jointed than the first maxillipede, on coxa are placed two exite buds for beginning gills (mastigobranchia and podobranchia). The endopod is five-jointed, but short and much compressed which shows that it was not properly developed and jointed in the previous stage. The exopod is short, unjointed and has a few setae.

The third maxillipede is only in a rudimentary, bifurcate stage without any function, and the same is the case with the following pereopods which just hang like small strings from the posterior part of the thorax.

Of the pleopods nothing is present, the uropod is developed with an unjointed protopod as well as an exopod and an endopod. The tips of exopod and endopod reach the tips of the wings of telson and are already taking part in a primitive tail-fan.

Dimensions:

Total length 6 mm, length of carapace 2 mm, width 2 mm, rostrum 2 mm, abdomen 2 mm.

Mysis I.

Figs. 77-89.

Carapace.

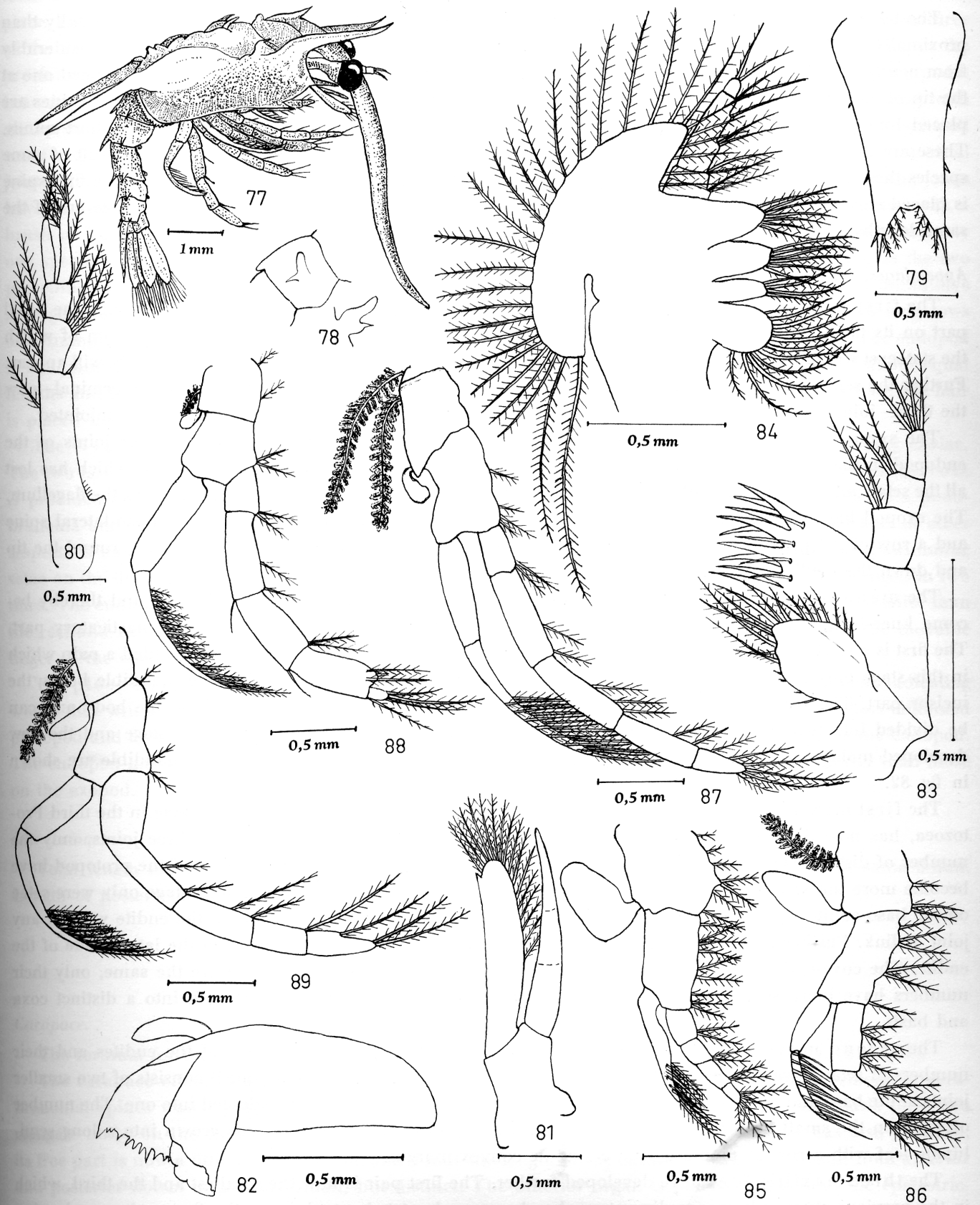
The formula for the outgrowths of the carapace in this stage is the following: 2. 3. 4. 7. 9. 12. 13. (15). 16. 18. (19). 24. 27. 31.

The carapace is no longer a squarish plate although slightly curved as in the previous Protozoa stage. It now extends along the sides of the thorax covering its dorsal and lateral parts. Further new spines have been added to the carapace on its new antero-lateral corner, viz. an antennal spine and a single branchiostegal spine. The first epigastrio-rostral tooth has appeared. The medio-posterior marginal spines with their toothed posterior margins, which normally only belong to the Protozoa, have disappeared in this first Mysis. The post-antennal and latero-hepatic spines have become vestigial. Both pairs are so small that they very easily can be overlooked. The toothed parts of the carapace margin have decreased with the effect that the supra-antennal and branchiostegal teeth have disappeared, only the branchio-lateral teeth remain and could after their position sooner be termed branchio-posterior teeth, as only the posterior part of this group has been retained. Finally the postero-branchial spines have grown much, forming a pair of long, hollow spears pointing backwards, and their base has swollen into a big bulb on each side of the carapace. Further these spines have lost their toothed surface and are smooth. The rostrum is much lengthened, to about one and a half of the length of the carapace.

Abdomen.

Formula, segments I-VI: 1. 2.

The abdomen is six-segmented as in the previous stage and each segment is furnished with a dorsal spine and a pair of lateral spines. However, these spines have not grown from the previous stage and appear therefore comparatively much smaller because the rest of the body has grown in size. On the sixth segment the lateral spine, extending along the side of the protopod of the uropods, has even decreased in length. The pleuron on each side of each abdominal segment has started to develop as a free lobe. This was not visible on the Protozoa III, neither was the lateral process on the first abdominal segment present. The further development of this small process is already described in general on p. 15. However, it can be pointed out that in this species the process in its early stage is fused with the lateral spine of the same segment (Fig. 78) so that the process is placed dorso-anteriorly to the spine. In this early stage of the development the process seems to keep the carapace in place in a way similar to that of ladies' hatpins in the beginning of this century, in so far as the process fits in between two of the branchio-lateral teeth at the margin of the carapace and through this grip keeps the carapace from sliding backwards over the abdomen or to one of the sides which could have a disastrous result for the gills, which just have started to develop along the sides of the thorax and on the exterior side of the pereopods where they only are protected by the covering sides of the carapace.



Figs. 77-89. *Solenocera* sp. larva *danae*. First Mysis. Fig. 77, in total, from lateral. — Fig. 78, first abdominal segment, above from lateral, below from ventral. — Fig. 79, telson. — Fig. 80, first antenna. — Fig. 81, second antenna. — Fig. 82, mandible. — Fig. 83, first maxilla. — Fig. 84, second maxilla. — Figs. 85-87, first, second and third maxillipedes. — Fig. 88, first pereopod. — Fig. 89, fourth pereopod.

Telson.

The telson has changed considerably towards its final shape. In the Protozoa it was wider distally than proximally due to the distal split being so open that it was forming a T. This split has now closed considerably from nearly 180° to only about 50° , thus widening the base of the telson. The setae which are placed one at the tip of each wing forming the telson cleft have changed into spines, and in the cleft inside the spines are placed four plumose setae on each side. On both lateral margins of the telson plate are three short spines. These are the characteristic spines for the Penaeid telson, which now have appeared. On the adult of some species these spines, however, move from the margin onto the dorsal side of the telson plate. The first spine is placed close to the larger distal spine on the telson. The two intervals between the three spines are of the same lengths, thus dividing the telson into three equally long sectors.

Appendages.

The first antenna. The first and the second joints have coalesced into a single joint of which the basal part on its lateral side has developed the—for most decapods characteristic—arch at the bottom of which the statocyst will be formed. Already a few short hairs indicate where the opening to the concavity will appear. Further the setae on the lateral sides of the antenna have increased in number and from the terminal—now the third—joint the two flagella have started to develop. In this stage they are only short and unjointed.

The second antenna has also changed. The protopod remains unjointed, but the four joints of the endopod in the Protozoa have in the first Mysis coalesced into a single baton-shaped joint which has lost all the setae, and which in the following stage develops into the basal joint and growing centre for the flagellum. The exopod has also been reduced to a single, flattened joint, the antennal scale, with a disto-lateral spine and a row of stiff plumose setae reaching from this spine along the rest of the lateral margin, round the tip and down the medial margin.

The mandible has now developed a distinct molar part, not present in the last stage, and thereby become knee-bent, divided into two major parts: the corpus mandibulae proper and the masticatory part. The first is a sausage-shaped body to which all the muscles fasten and to which has been added a palp which in this stage only is a small bulbous one-jointed sausage placed latero-dorsally on the mandible below the incisor part. The second part of the mandible—the masticatory part—forms an angle to the body and can be divided into two sub-parts, the insisor part which also was present in the previous stage and the new developed molar part, which is relatively large in this species. These four parts of the mandible are shown in fig. 82.

The first maxilla has only changed a little. The exopod which had lost one of its setae in the third Protozoa, has now disappeared completely. The endopod remains unchanged with its three joints, only the number of distal setae on the third joint is reduced from five to four. The two endites of the protopod have become more massive both in shape and thickness of the chitin. What in the previous stage only were setae on the baso-endite have now grown into direct claws or teeth-like excrescences from the endite without any joint or link. Further another row of hair-like setae has developed inside of them on the lateral side of the endite. The coxa-endite has grown and acquired a rhomboid shape, but the setae are the same, only their numbers have increased. Finally a clear marginal line on the protopod is dividing it into a distinct coxa and basis.

The second maxilla has also approached the shape of the adult. The sizes of the endites and their numbers of setae have increased. The endopod has undergone a smaller reduction. It consists of two smaller joints at the base and a small terminal joint, but the joints in the middle have coalesced into one. The number of setae on the small terminal joint is reduced from four to two. The exopod has grown into a long semi-lunate leaf with a row of plumose setae along its convex margin.

The three maxillipedes have developed further. The first pair is now the smallest and the third, which in the previous stage only was rudimentary, has become about twice as long as the first and second pairs. The first maxillipede has a protopod consisting of two joints of about equal lengths, although the coxa is more stoutly built and provided with a mastigobranchia. The exopod has diminished its number of joints

from five to four. Because of the loss of the intermediate setae it is not clear how the reduction has taken place, but it looks as if joints three and four in Protozoa III have coalesced into a single joint, number three of the endopod in Mysis I. The second maxillipede is only a little larger than the first, and like in the previous stage the protopod is divided into coxa and basis. Coxa bears both a mastigobranchia and a podobranchia, both were present as small buds in the Protozoa III. The exopod is two-jointed, but short with all the swimming setae placed on the second joint. The endopod is two-jointed. In Protozoa III the endopod was five-jointed, but with only indistinct sutures between some of the joints, especially the three most distal joints. Here in Mysis I these three joints have coalesced into one joint, and also the first and the second joints have coalesced resulting in a total of only two joints in the endopod. The distal joint is now tipped with a brush of five setae, whereas no setae were observed in the third Protozoa, this may be accidental, as only one specimen of this stage was available. The third maxillipede is slender and twice as long as the two preceding ones. The protopod is now divided into coxa and basis. The coxa is furnished with a very diminutive mastigobranchia and two podobranchia. The exopod is long, slender and two-jointed with two long rows of swimming setae on the distal joint. The exopod reaches to the tip of the third endopodial joint. The endopod is five-jointed, joints number one and five are the shortest, the intermediate three joints are of about equal lengths and twice as long as number one or five. The fifth joint is tipped with three setae and a hair, the hair is placed most laterally.

The five pereopods are now fully functional limbs of which the three first are developing chelae. The two last pereopods are never chelate. The pereopods have all a two-jointed protopod of which the coxa is provided with both a mastigobranchia and a podobranchia; only the fifth pereopod lacks both podobranchia and mastigobranchia, although its protopod is divided into both coxa and basis and also in other respects is built like that of number four. The exopod is in all pereopods two-jointed with strong swimming setae on the distal half or for most of the length of the second exopodial joint. The setae are arranged in two lines. The endopod is in all pereopods five-jointed, and in the three first pairs the distal joint is smaller than the rest and has a narrow base to the preceding joint, as preparation for its development into the movable finger of the chela.

The pleopods have started to develop, but only as very tiny buds on the abdominal segments indicating where they will appear. The uropods have developed into a proper part of the tail-fan, with a short unjointed protopod and an exopod with long plumose setae at its tip and along its medial margin towards the endopod. The endopod has also a brim of setae around the whole of its margin, but these setae are shorter than those on the exopod.

Dimensions:

Total length including rostrum and telson 12.5 mm. Length of carapace 3 mm. Width of same 3 mm. Length of postero-branchial spines 2–2.5 mm. Rostrum 6 mm. Abdomen 3 mm.

Mysis II.

Figs. 90–103.

Carapace.

The formula for the carapace in this stage is: 2. 3. 4. 7. 9. 12. 13. (15). 16. 18. (19). 24. (27). (31).

The carapace changed a little more from the first Mysis. Most characteristic are the enormous postero-branchial spines which posteriorly reach beyond the basis of the telson plate and at their basis form two elongate bulbs on the carapace, one on each side. The third large "spine", the rostrum has also enlarged, its free part is now a little more than one and a half the length of the carapace without rostrum. Both anterior and posterior dorsal organs are small, but distinct. The anterior organ is placed just behind the epigastric-rostral tooth. The antennal spine and the single branchiostegal spine have become larger. The pair of latero-hepatic spines which in the previous stages were vestigial remain very small and are difficult to distinguish and so are also the post-antennal spines. The prehepatic spines are the only remaining pairs of spines of