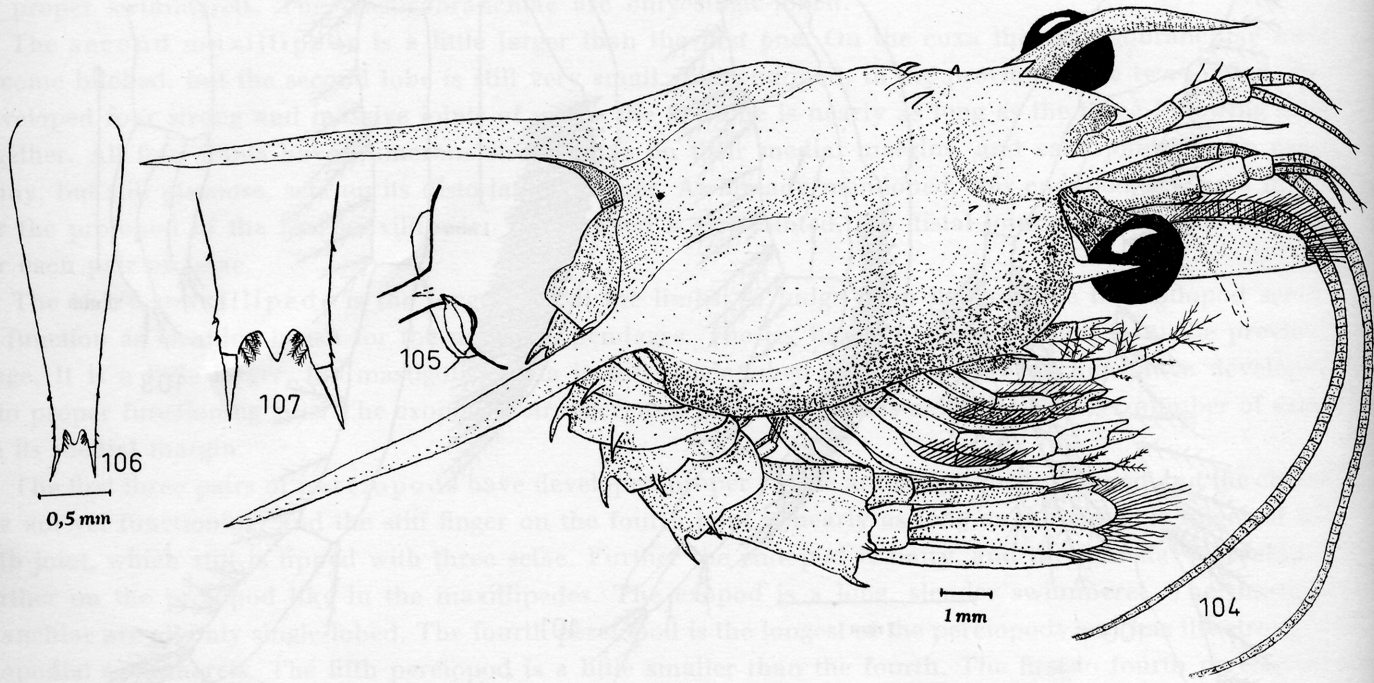
cells can be seen as a dark spot under the cuticle. The cervical groove is not very distinct. The supra-orbital spines are still large, strongly forward curved horns, and the antennal spines have enlarged a little from the previous stage. The branchiostegal spine remains a small marginal tooth on the carapace. Both the post-antennal spines and the latero-hepatic spines are still present, but very small and so vestigial that they are difficult to discern. Only the pro-hepatic spines are clear and distinct in this region of the carapace. The last part of the branchio-lateral teeth have disappeared, but the postero-branchial spines have grown larger and look as a pair of stabilisators extending right backwards from the carapace.

Abdomen.

Formula, segments I–VI: 1. 2.

Because of the carapace reaching further backwards in the dorsal line, covering the dorsal part of the first abdominal segment when the abdomen is stretched in line with the thorax, the dorsal spine is lost on



Figs. 104–107. *Solenocera* sp. larva *danae*. Third Mysis. Fig. 104, total view, from lateral. — Fig. 105, posterior part of carapace and first abdominal segment showing lateral process. — Fig. 106, telson. — Fig. 107, distal part of telson.

the first abdominal segment, but remains on the following five segments. The last abdominal segment begins to enlarge especially in length more than the other segments of the abdomen, as is characteristic for the adult of the Penaeids. The lateral spine is present in all the segments. The lateral process of the first abdominal segment, has moved a little forward and is placed in front of the lateral spine with a clear interval between them (Fig. 105). Further it is now a swollen, leaf-shaped organ fastened to the segment only at its ventro-anterior part, and it fits well into the curve between the free basis of the postero-branchial spine and the latero-posterior margin of the carapace, keeping the latter in a fixed position. No musculature of the segment has yet moved into the process.

Telson.

Telson has grown perhaps a little more conical posteriorly, and the median process inside the telson furca has enlarged to become nearly larger than the side wings of the furca, finally the two large spines on each wing are now in a terminal position to the wing.

Appendages.

The appendages have all developed further. The flagella of both the first and second antennae have lengthened, the endopodial flagellum of the second antenna is now longer than the carapace, still more setae have developed on the mouth appendages so that they now function as a trap basket for detritus, small organisms or torn-off parts of prey animals. The endopods of the thoracopods are excellent for grabbing the food, although the chelae on the three first pairs not yet are in full shape; they seem to be able to start functioning for more tiny objects, but their musculature is not yet much developed. The abdominal appendages are still rudimentary, unfunctioning organs a little larger than in the previous stage but with the same shape. The uropods are large and form the main part of the telson fan.

Dimensions:

Total length excluding rostrum 20 mm. Carapace 9 mm long, 7 mm wide. Free ends of posterior branchial spines 8 mm, including bulbs 11 mm. Abdomen 8 mm.

Approximate dimensions of stages in mm.

	Protozoea III	Mysis I	Mysis II	Mysis III
Total length	6	12.5	22	30?
Carapace	2 × 2	3 × 3	6 × 6	9 × 7
Rostrum	2	6	9	?
Abdomen	2	3	6	8
Postero-branchial spines	0,75	2,5	6	8

Distribution and Remarks.

Fig. 108.

This larva is known from "Dana" in 1929 when it was taken on three different positions in the Indian Ocean, around the Seychelle Islands and northwest and west of Sumatra. Its very long rostrum and postero-

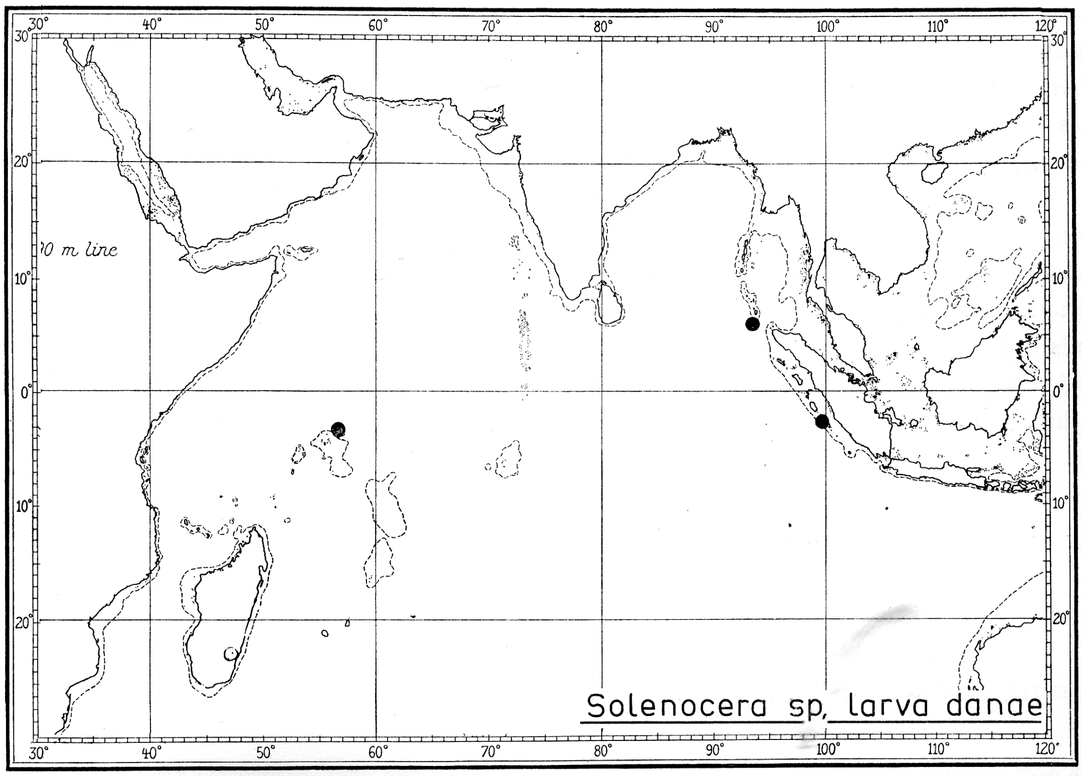


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Fig. 108. Map of distribution.

branchial spines make it likely that the species is a strictly tropical species of *Solenocera*. It may be restricted to the Indian Ocean or it may be distributed from around the Indonesian Islands and New Guinea into the Pacific Ocean. It is not likely to round the Cape into the Atlantic. But at the present time no records are known except the three from the Indian Ocean. It has been taken at depths between 25 and 250 m, but very likely it may reach further down. It is worth to note that all the localities are not from the open ocean but relatively near an island-coast, which indicates that the adult *Solenocera* as expected spawn in shallower water, 500–600 m or less. Although the depth at the stations where the larvae were taken range from 1400–1500 m they are not far from an island shelf. Further the youngest larva, a Protozoea III, which means larval stage no. 6, was taken only rather few miles north of the shelf around the Seychelle Islands. Here the current during the middle and last half of the year runs in a northern direction (date of capture 12.12.1929). This can easily result in the transport from the shelf to the position of capture,—smaller local currents between the islands may play their part.

The species is a true tropical, oceanic *Solenocera* furnished with the big spines so often found in true oceanic forms, especially in the Tropics. The only known fully developed *Solenocera* is *Solenocera membranacea* studied by HELDT (1938, 1955) from first Protozoea to Postlarva, the Nauplius stages are not found. She concludes that only two Mysis stages exist. This is the case for this species, at least at the coast of Tunis. Here can briefly be reminded of the papers of PROVENZANO (1962) on variable numbers of instars in the same species of decapod larvae and of RASMUSSEN (1953) on the change of sex from male to female in *Pandalus borealis* at Spitzbergen at an age of five years, whereas in Skagerrak it changes already in the second year. This does not include that there is the same number of ecdyces in the two years period in Skagerrak and the five years period at Spitzbergen because time is also a factor although not the only one for the duration of a cuticle. Further we know that in the ocean two factors can retard growth: low temperature, and scarcity of food. As *Solenocera* is a tropical or subtropical genus only the scarcity of food can be involved, and in the tropical ocean food is far more scarce in the open ocean, than along the continental coasts and in subtropical waters where *Solenocera membranacea* is found. It is therefore understandable that in the two cases from the present material with a true oceanic tropical species of *Solenocera*, where enough material is available, viz.: *S.* sp. larva *danae* and *S.* sp. larva *sumatransis*, we find at least three or four Mysis stages. The same is the case for the other genera dealt with in this paper *Cerataspis* and *Cerataspides* of which all three species have at least five Mysis stages each.

For *Solenocera* sp. larva *danae* the following points may indicate the likeliness of more, still unknown, Mysis stages to follow the here described third Mysis stage before the first postlarval stage is reached: the rostrum although partly broken off is in the third Mysis still as in the young larva bent downwards and not stiff and more straight, forward pointing as in an adult *Solenocera*. The rostrum has only one dorsal tooth and no carina. The very long posteriorly directed postero-branchial groove spines are still present and without any indication of decrease in size. These spines can not be expected to remain in the first postlarva, but their loss may occur in a single moult. The pereiopods as well as the pleopods have a decidedly larval shape. The uropods only reach slightly beyond the telson plate and the shape of the tip of the telson plate is still furcate, and a strong spine is still present at the tip of each furcal branch. These characters are all larval indicating the likelihood of more Mysis stages to follow this third Mysis stage, before the first postlarval stage is reached.

Solenocera sp. larva *sumatransis*

Figs. 109–153.

Localities.

Mysis I:

Dana St. 3903 III, 5°30′ W–93°28′ E. 300 mW., 17.11.1929. 1 spec.

Mysis II:

Dana St. 3903 III, 5°30′ W–93°29′ E. 300 mW. 17.11.1929. 2 spec.

Mysis III:

Dana St. 3903 III, 5°30′ W–93°28′ E. 300 mW. 17.11.1929. 1 spec.
— — 3903 V, 5°30′ W–93°28′ E. 50 mW. 17.11.1929. 1 spec.

Mysis IV:

Dana St. 3903 III, 5°30′ W–93°28′ E. 300 mW. 17.11.1929. 1 spec.

Description.

Mysis I.

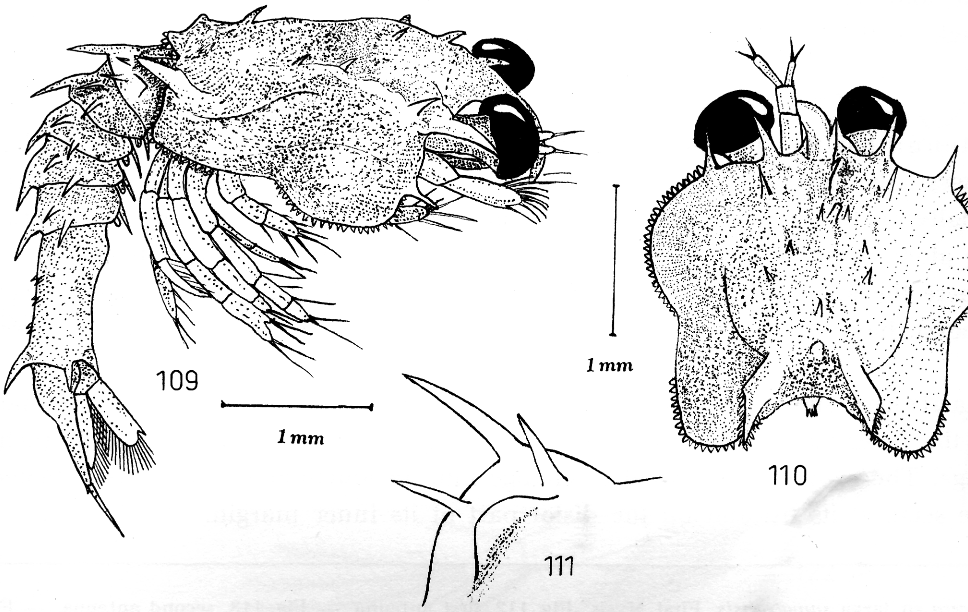
Figs. 109–123.

This is a small, clumsy larva with a short rostrum, a wide carapace with very many filamental teeth along its margin, and a short abdomen.

Carapace.

Formula: (1). 2. 3. (5). 7. 8. 9. 10. 11. 12. 13. 15. 17. 19. 20. 24. 25. 26. 27. 28. 29. 30.

The carapace is squarish, a little wider than long. The rostrum is of medium size and has at each side of its base a very small, triangular, rostral plate, shaped as a short, narrow lobe from the carapace (Fig. 109). The rostrum is provided with two dorsal teeth, the distal is placed on the rostral plate, the other on the ridge of the posterior prolongation of the rostrum on the carapace. This latter tooth is here named the epigastric-rostral tooth. Between these two teeth is a row of stiff hairs. A little further back in the median line of the carapace follows the small, conical anterior dorsal organ. Near the posterior end of the carapace is the still smaller posterior dorsal organ. Between these organs, in the median line, is the dorsal or epi-cardiac spine. The distance between this spine and the posterior dorsal organ is less than one third of the interval between the two dorsal organs. On the posterior dorsal organ is a single medio-posterior marginal spine which, however, is not an actual spine, but only a small, conical process with a brim of four teeth at its tip. The rest of the spines are paired and are the following: at the side of rostrum is the supra-orbital spine which, although the largest spine on the carapace, is smaller than in most other species. Farther laterally on the margin follows the antennal spine at the base of the second antenna. Posteriorly on the carapace, still reaching beyond the margin, is the posterior branchial groove spine, which in this species is shaped like a rectangular



Figs. 109–111. *Solenocera* sp. larva *sumatransis*. Third Protozoea. Fig. 109, in total, from lateral. — Fig. 110, carapace from dorsal including eyes and left first antenna. — Fig. 111, dorsal part of first abdominal segment showing lateral process and three spines.

wing. It starts on the carapace a little from the margin as a high ridge and reaches backwards past the margin, at its distal end it is lined with filamental teeth. The ridge of this spine extends anteriorly into the branchiocardiac groove, which is present in this stage, but very weak, hardly visible. Inside the margin of the carapace are the following spines: Between the antennal spine and the supra-orbital spine, but behind them the post-antennal spine; on each side of the anterior dorsal organ the rather small medio-gastric spine; farther back a little more laterally the latero-hepatic spine; and finally latero-posteriorly of this the supra-hepatic spine.

The filamental teeth still form a whole brim along the lateral margins of the carapace, only broken for a short interval at its middle. Anteriorly come first the supra-antennal and the branchiostegal teeth in one continuous line, then after a short interval without teeth follows the second unbroken line of teeth consisting of the branchio-lateral and the postero-marginal teeth, and in continuation of the latter are the teeth on the postero-branchial spine.

Abdomen.

Formula for segments I–V: 1. 2. 3. 5 and for segment VI: 1. 2. 4.

Of the six segments the last one is very long, about four times as long as any of the preceding segments. This is characteristic for the larvae of *sumatransis*, which is one of the species of *Solenocera* with the longest sixth abdominal segment in the larvae. Each of the first five segments is provided with a relatively short, but stout dorsal spine and a more delicate ventral spine. Laterally, close to the dorsal spine, are a pair of lateral and a pair of dorso-lateral spines, both with spines much smaller than the dorsal spine. The sixth segment has neither these last pairs nor the ventral spine, but instead a pair of ventro-lateral spines ventrally of the base of the uropods. Dorsally of the base are the lateral spines. The lateral process (Fig. 111) is placed laterally on the first abdominal segment in very close connection with the dorso-lateral spine. The cuticle-pad starts a little anteriorly of the base of this spine, almost, but not quite, touching it, and curves down to midway on the lateral side, with the lateral spine almost in line with the apex of the curve. The process itself is only a thin, membranous lobe.

Telson.

The telson-plate is short and wide, with a furca of only a little above 90° opening between its branches. The two sides of the cleft do not meet, but are seperated from one another by a short convex lobe. Along the medial margin of each furcal branch are the usual four plumose setae. Each branch is tipped with a long, straight spine, and has at its base, but on the lateral margin, two small, short spines placed close together, a little farther back on the lateral margin is the third, a little larger spine.

Appendages.

The first antenna has the, for the first Mysis stage usual, three joints in the peduncle. The two first joints are the longest; the third is tipped with the rudiments of its two flagella. The setae are already well developed, especially on the medial side. Both flagella are tipped with setae, and the lateral one has also a few short setae along its side. The basal joint of the first antenna is coalesced from the several joints in the Protozoea where the appendage was an ambulatory organ. The usual process and curve on this joint for the later statocyst, have started to develop, and a few stiff hairs are found along the margin of the later statocyst groove.

The second antenna shows also a retarded development. It has a two-jointed protopod and an unjointed endopod, the latter has a single, plumose, terminal seta; in other species both branches are usually naked in this stage. The exopod has started to change into an antennal scale, it has flattened and bears a series of plumose setae at its tip and on the distal part of its inner margin.

Figs. 112–123. *Solenocera* sp. larva *sumatransis*. First Mysis. Fig. 112, first antenna. — Fig. 113, second antenna. — Fig. 114, mandible. — Fig. 115, labium. — Fig. 116, first maxilla. — Fig. 117, second maxilla. — Figs. 118–120, first, second and third maxillipedes. — Fig. 121, first pereiopod. — Fig. 122, fourth pereiopod. — Fig. 123, telson.