

The mandible has a clear distinction between molar and incisor part. The molar part is small, but well developed for this stage, the incisor part is furnished with a long line of pointed teeth. A second line of teeth has started to develop behind the teeth at the cutting edge of the mandible. This, and more so the shape of the basi-endite of the first maxilla, shows that the larva is strongly carnivorous, as also the larva of *S. sp. larva danae*. The carnivorous habit seems more strongly developed in these two species than in any of the other species. On the dorso-lateral side of the mandibular body is, as usual in this stage, a small, unjointed, naked, and sausage-shaped palp.

The labium or lower lip is split practically to the bottom with hardly any communicating basal part between the two lobes. This causes less movability of the labrum as it, lacking the proximal stalk, can not be pushed forward as a spoon for small food particles. Also this indicates larger prey and a carnivorous living.

The first maxilla is a powerful limb with a coxa and a basis in the protopod, both with a medial endite. The basi-endite is very strong with its marginal setae developed as strong tearing teeth with a line of stiff setae behind them. The coxa-endite is furnished with stiff, plumose setae. The exopod is only a small bud on the lateral side of basis and is furnished with three densely plumose setae. The endopod is three-jointed with two setae on each of the first two joints and four setae tipping the third joint.

The second maxilla has also the protopod divided into two joints, each with two strong, densely setose endites. The endopod has five clearly separated joints. The exopod forms a large leaf, turned in an angle to the protopod; its most posterior seta is very long.

The first maxillipede has two very stout protopodial joints, a small, still unjointed exopod, and a stout four-jointed endopod. A large mastigobranchia is present on the coxa.

The second maxillipede is a little longer than the first but has a less stout, although also two-jointed protopod with a much smaller mastigobranchia on coxa. The exopod is longer than in the first maxillipede, and so is also the endopod although it has only three joints.

The third maxillipede is more slender and limb-like and much longer than the two preceding ones. The protopod is two-jointed with one mastigobranchia on coxa, the exopod is long with many swimming setae. The endopod is five-jointed with a short basal joint.

The anterior three pereopods have a two-jointed protopod with both a mastigobranchia and a podobranchia. The fixed finger of the chela has started to develop, but is still only a short process. The fourth pereopod has a two-jointed protopod with an only bud-like mastigobranchia, but no podobranchia, a two-jointed exopod and a five-jointed endopod. The fifth pereopod is a little shorter than the fourth and has no branchiae, otherwise it is like number four.

The pleopods are only present as very small limb-buds on the first five abdominal segments.

The uropods are well-developed for the stage, reaching the hind margin of the telson branches.

#### *Dimensions.*

Total length 6 mm; length of carapace 2 mm; width of carapace 2 mm; rostrum 1 mm; abdomen 2.5 mm.

### **Mysis II.**

Figs. 124-136.

This stage is still a stout form, but more slender and shrimp-shaped than the previous stage.

#### *Carapace.*

Formula: 2 3. (4). (5). 7. 8. 9. 10. 11. 12. 13. 15. 17. 19. 20. 24. 25. 26. 27. 28. (29). 30.

The rostrum which in the previous stage was soft and ventrally curved as in the embryo, has now become nearly straight as in the adult, only slightly curved with the distal part pointing in a dorsal direction and reaching forward nearly to the tip of the longest flagellum of the first antenna. A second epigastric-rostral tooth has been added so that the rostrum in this stage is armed with three teeth, one rostral tooth and two

epigastric-rostral teeth. Caused by this enlargement of the rostrum itself, the rostral plate has diminished or has practically disappeared. The two dorsal organs are nearly unchanged, the posterior organ has a small, thinner process and is more elevated from the carapace than in the previous stage. The cervical groove is present, but only as a hardly visible impression on the carapace, and the branchio-cardiac groove remains as a thin curved line much the same as in the first *Mysis*. The supra-orbital spine at the side of the rostrum is like this slimmer than in the previous stage and reaches forwards to about the middle of the eyeglobe forming a long, pointed and a little downwards curved spine. The antennal spine is still a small, pointed spine, but it has developed a curvature with the tip pointing dorsally.

Along the margin of the carapace, a little behind the antennal spine, the filament of the supra-antennal teeth starts and continues unbroken into the line of branchiostegal teeth. Where this line of teeth ends posteriorly the carapace is divided, by a transverse impression, into an anterior and a posterior section each continuing as a shallow lateral lobe. The margin of the lobe on the posterior half of the carapace is naked for the anterior two-thirds of its length, but the posterior third is trimmed with a line of branchio-lateral teeth which extends into the postero-marginal and postero-branchial teeth. The postero-branchial teeth fringe the postero-branchial spine which is short and broad partly fused with the carapace, only its tip is free and points straight backwards from the carapace. Of the medio-posterior filamental teeth only a few vestigial ones are left at the posterior end of the medio-longitudinal line of the carapace.

Of the spines inside the margin of the carapace the epi-cardiac or dorsal spine is unchanged from the previous stage in placement and relative size. The post-antennal, however, has grown and is farther back followed by the latero-hepatic spine and still farther back and a little towards the median line by the supra-hepatic spine. Laterally, close to the anterior dorsal organ is the medio-gastric spine which has diminished much from the previous stage, being now very small and delicate, hardly visible. All these spines, except the dorsal spine, are paired, with a duplicate on the other lateral half of the carapace. The rostrum and the dorsal organs are the only other unpaired processes on the carapace.

Along the branchio-cardiac groove, which is only a line, is a line of small spines and lobes, the latter with two or three spines. This line extends forwards beyond the groove nearly reaching the anterior margin of the carapace near the antennal spine. The number and exact placement of these spines vary even on the two sides of the same specimen.

#### *Abdomen.*

Spine formula for segments I-V: 1. 2. 3. and for segment VI: 1. 2. 3. 4.

On the abdominal segments the spines have become more pointed and slimmer. The dorsal spine has now a small accessory basal spine, at its base. The sixth segment has developed a dorso-lateral spine like the other segments, and the ventro-lateral spines of the segment have remained, but are very small. On the first five segments the ventral spine has disappeared, but instead the cuticle has developed a free lateral pleuron on each side of the segments. The lateral process of the first segment has grown. It is more pointed and has a larger, freely extruding lobe in its dorsal half and has also extended towards the ventral part of the segment.

#### *Telson.* (Fig. 126).

The form is more quadratic than in the previous stage, with the two lateral margins of the telson being practically parallel and with the cleft more closed, its inner lines forming an angle of about  $60^\circ$ . The arched lobe at the bottom of the cleft still remains. The three pairs of lateral spines on the telson are the same, but the two most distal ones have moved a little more away from one another so that the most distal one is placed only a little behind the tip in line with the most distal seta in the inner cleft of the telson. The second spine is placed farther back near the bottom of the cleft and in line with the third inner seta counted from the tip towards the bottom of the cleft. The third and most proximal lateral spine is placed nearly, but not quite, half way up on the telson.

### Appendages.

The first antenna has only changed little from the previous stage. The statocyst groove has become deeper, the lateral process at its base is enlarged and the numbers of setae along its three joints have increased. Also the two flagella have grown in length, but they have not yet become annulated. The missing annulation is characteristic for *Solenocera* larvae with more than two Mysis stages. In the species with only two Mysis stages these flagella are often divided into a few rings in the second Mysis.

The second antenna is much like in the first Mysis, only the antennal scale has developed further with setae on its lateral margin and a well developed hook-shaped spine at the disto-lateral corner. The endopod has lost its terminal seta and instead grown to twice its former length as an approach to the later flagellum-like form, but it is still unjointed.

The upper lip is a globular cup which together with the lobes of the lower lip forms a basket around the mouth-opening. The lips are, as in most larval forms, very large with movable parts, well fitted for carrying the food into the mouth-opening after it has been ground into pieces by the mandibles and the first maxillae.

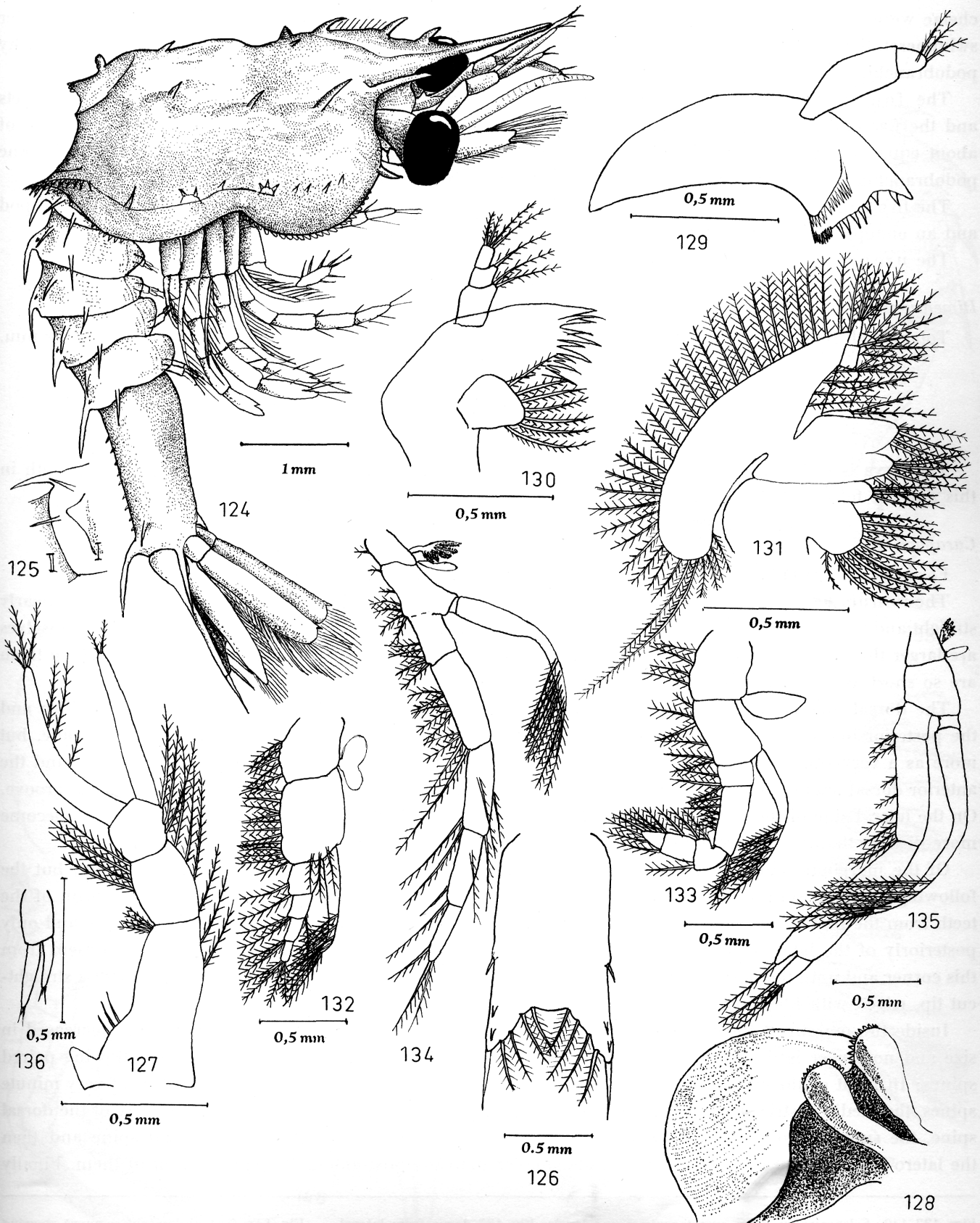
The mandible has developed a second distinct line of incisor teeth behind the marginal line showing the carnivorous habits of this larva. The mandibular palp is two-jointed as always in the second Mysis and has a few setae on the distal joint.

The first maxilla has not changed much from the previous stage. The basi-endite is extraordinarily strong and almost mandible-like; it definitely takes part in the tearing up of the prey. In order not to obstruct this function the coxa-endite is much smaller than in most other species, but furnished with a brush of stiff, plumose setae, which can function as a grate behind the basi-endite and the mandible, preventing the prey from escaping backwards. The palp of the maxilla has decreased a little in size, but is still three-jointed.

The second maxilla. The protopod has not changed much since the first Mysis stage, and the endopod is still five-jointed, but shorter than the frontal lobe of the exopod; in the first Mysis it was longer. This is mostly because the exopod itself has grown, with both the anterior and posterior lobes becoming very long. In the first Mysis the most posterior seta was very long about twice the length of the other seta on the exopod. In the second Mysis the posterior seta remains very long, and the first seta laterally of it has also grown in size being nearly as long. Further the long seta is no longer the last one, four more short setae have been added on the posterior lobe towards the coxa. The function of the one very long seta in the first Mysis and the two long setae in the second Mysis is unknown, but as they are more stiff than the rest they possibly serve as organs for cleaning the mouth-appendages, especially the many trapping setae on the median edge of the flat and very broad protopod of the first maxillipede. This protopod of the first maxillipede is the dominating part of the limb and seems to function as a shovel or a barrier preventing the food in escaping backwards. The exopod and the endopod are only short, the latter with four joints and the former with few swimming setae on the tip. On the lateral side of coxa is only one mastigobranchia.

The second maxillipede is also furnished with a two-jointed protopod with setae on the medial margin and one mastigobranchia on the coxa, no other gills, but it is not so flat and broad as the protopod of the first maxillipede. The exopod is still short with a few swimming setae at its distal end. The endopod is five-jointed with a geniculation between joints number two and three so that the three distal joints are bent like a hook towards the proximal part of the limb; this geniculation can be useful both for cleaning the limbs in front of it and for holding the prey and pushing it under the cutting and tearing organs of the mandibles and the first maxillae. Also the second maxillipede has only one mastigobranchia on the coxa, and no other gill filaments.

The third maxillipede is slender and long, a little longer than the following pereipods. It has a two-jointed protopod of which the coxa bears both a small mastigobranchia and a bushy podobranchia behind it. The endopod has five long and slender joints with a normal number of plumose setae. The exopod is also a well developed swimmeret. The three first pereipods have all chelae, which now are shaped as proper chelae, but still not functioning, partly because of their muscles not being fully developed, partly because the branches of the chelae are tipped with long, plumose setae, which certainly will be in their way if the



Figs. 124–136. *Solenocera* sp. larva sumatransis. Second Mysis. Fig. 124, larva in total, from lateral. — Fig. 125, first abdominal segment showing lateral process. — Fig. 126, telson. — Fig. 127, first antenna. — Fig. 128, labrum and labium, mandibles removed. — Fig. 129, mandible. — Fig. 130, first maxilla. — Fig. 131, second maxilla. — Figs. 132–134, first, second and third maxillipedes. — Fig. 135, first pereopod. — Fig. 136, one of the pleopods.

chelae were to clasp any object. The endopod, of course, is five-jointed and the exopod is a long, slender swimmeret, the protopod is two-jointed, and its coxa is furnished with a small mastigobranchia and a bushy podobranchia.

The fourth and fifth pereopods are ambulatory with the exopods forming strong swimmerets and the five-jointed endopods shaped as walking limbs and as organs for catching the prey. They are of about equal size with a two-jointed protopod. But the fourth has only a very small mastigobranchia, one podobranchia and one arthrobranchia, and the fifth limb has no branchiae.

The five pairs of pleopods have all an unjointed protopod, a short, unjointed and unfunctional exopod and an endopod (see figure 136).

The uropods are well-developed parts of the tail-fan.

#### *Dimensions:*

Total length 10 mm; length of carapace 3.5 mm; width of same 3 mm; rostrum 1.8 mm; abdomen 3.7 mm.

### **Mysis III.**

Figs. 137-149.

The larva is in this stage more shrimp-like in shape, although it remains a definite Mysis larva both in this and the following stages.

#### *Carapace.*

Formula: 2. 3. (4). 5. 7. 8. 9. 10. (11). 12. 13. 15. 17. 18. 19. 20. 21. 24. 26. 28. (29). 30.

The rostrum has developed further with a strong rostral ridge on the carapace and with its free part nearly straight and provided with one rostral tooth and two epigastric-rostral teeth. Because these teeth in themselves are larger than in the previous stage they appear as being placed closer together, the intervals between them are so short as to appear only as incisions in the dorsal ridge of the rostrum.

The dorsal organs are both small, the anterior one is placed immediately behind the rostral ridge and the posterior one close to the posterior marginal spine, which still is present, not so much as a spine, but more as a very short, spiny lobe with three small filamental teeth. The cervical groove directly behind the anterior dorsal organ is present, but only as an indistinct impression on the carapace, not as a line or groove. On the lateral side of the carapace the line for the posterior part of the branchio-cardiac groove has become more distinct than in the previous stage.

Of the marginal spines of the carapace the supra-orbital spines are well-developed as usually, but the following antennal spines are smaller than in the previous stage. A little behind these spines a brim of the teeth from the branchiostegal filament is breaking the smooth carapace margin for a short distance and only posteriorly of the latero-posterior corner of the carapace the next series of filamental teeth is present from this corner and until the postero-branchial groove spine. This latter is short, wide and lamellar with a straight-cut tip, edged with filamental teeth.

Inside the margin of the carapace are the unpaired dorsal or epicardiac spine, which has decreased in size and no longer is the largest of the spines inside the margin of the carapace, and the following paired spines: In front of the cervical groove a little to the side of the anterior dorsal organ is a pair of very minute spines, the medio-gastric spines; behind these are first the prehepatic spines and then, anteriorly of the dorsal spine, the supra-hepatic spines; and behind the antennal spine are first the post-antennal spine and then the latero-hepatic spines, the latter are a little smaller than the post-antennal spine in front of them. Finally

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Figs. 137-149. *Solenocera* sp. larva *sumatransis*. Third Mysis. Fig. 137, larva from lateral. — Fig. 138, first abdominal segment showing lateral process. — Fig. 139, telson. — Fig. 140, first antenna from ventral, showing beginning of statocyst development. — Fig. 141, position of right side of labrum, right mandible, and right side of labium with bent lobe. — Fig. 142, mandible. — Fig. 143, first maxilla. — Fig. 144, second maxilla. — Figs. 145-146, first and second maxillipedes. — Fig. 147, first pereopod. — Fig. 148, fourth pereopod. — Fig. 149, one of the pleopods.