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BELOGO MORYA

(Pelagic Larvae of Some Polychaeta in the
White Sea)

by

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ZOOLOGICHESKIY ZHURNAL

Vol. 39, No. 3

Pp. 343-355

MOSCOW 1960

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Editor : R. A. Hough
Typed by : B. Davis

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U. S. NAVAL OCEANOGRAPHIC OFFICE
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1968

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ABSTRACT

Pholoe minuta tecta Stimpson undergoes pelagic development in the White Sea. Its trochophora and metatrochophora possess a character typical of the pelagic larvae of all Aphroditidae, namely a bundle of long motionless cilia on the left side of the oral aperture. The larva has four larval segments on which only neuropodial sections of developing parapodia are well developed.

Nereis virens Sars in the White Sea also undergoes pelagic development. The larva is characterized by the presence of 3 paratrochs and 4 larval segments on which both the neuropodial and notopodial sections of developing parapodia are equally well developed.

Scoloplos armiger (O. F. Müller) in the White Sea lays single eggs into plankton where they undergo development up to the stage of metatrochophora. Characteristic features of the larvae belonging to this species are as follows: orange coloration, presence of several ciliar rings, paratrochs -- on each appearing segment, and leucitotrophous mode of feeding. Early stages of S. armiger were described by E. Smidt (1951) as the species Heteromastus filiformis Clap.

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PELAGIC LARVAE OF SOME POLYCHAETA IN THE WHITE SEA

The reproduction and development of Polychaeta in our seas has been little investigated. With the aid of a method described earlier (Sveshnikov, 1959), it was possible to raise under laboratory conditions some of the polychaetes whose development has not been known.

Family Aphroditidae, Subfamily Sigalioninae

The development of polychaetes belonging to subfamily Sigalioninae has been hardly investigated. G. Thorson (1946) did not observe the pelagic larvae of Pholoe minuta in the Ørezund (Sound). He described only a young sessile animal observed by him on a trunk placed in the sea. Since mature P. minuta are mass forms in the Ørezund, Thorson arrived at a faulty conclusion that this species develops without the stage of pelagic larva. However, there is no doubt that the pelagic larva described and pictured by Thorson as Nereis diversicolor belongs to species Pholoe minuta. Thus, also in the Danish waters Ph. minuta has a pelagic stage in development.

M. I. Kiseleva (1957) describes the development of Sthenelais boa (Johnston) for Sevastopol'skaya bukhta. His description, however, lacks data on the early stages of development of this species.

Pholoe minuta tecta Stimpson

We succeeded in investigating under laboratory conditions the development of Pholoe minuta tecta from the trochophore stage to the final metamorphoses of young animals. In order to substantiate that the development was normal under conditions, we observed at the same time the development of this species under natural conditions; the plankton samples were examined every day. Trochophores appear in plankton at the beginning of summer (end of June--beginning of July) when the water temperature is 7-9°C. These are very small transparent larvae, 190 μ in diameter (Fig. 1, 1). They have a spherical form, somewhat flattened on the poles, with episphere suspended over the mouth. The intestines are filled with transparent light-violet yolk. The prototroch is adorned with a cluster of long cilia hanging downward on the left side of the mouth. This cluster of cilia, which reaches 2/3 of the body length of the larva, does not participate in the action of the other cilia (whose length is normal) of the prototroch. When the larva moves, the cluster of long cilia becomes pressed to the body in a longitudinal direction. It can be assumed that this cluster

serves in steering or braking. D. Davenport (1954) notes the presence of such a cluster on the left side of the mouth in the prototroch of Acholoe astericola (Polynoinae) larvae, also E. Rasmussen (1956) describes similar clusters on both sides of the mouth in Harmothoe imbricata larvae. H. Korn (1959) finds the same characteristic in Harmothoe sarsi larvae (Polynoinae). /344 Evidently, the presence of long ciliary clusters at the mouth can be considered as a general characteristic of larvae (in trochophore and metatrochophore stages) which belong to the family Aphroditidae. There is a small apical cluster consisting of very short and weak cilia on the episphere of the trochophore Pholoe minuta tecta in the parietal lamella area. The episphere has one pair of small, black larval eyes. The ciliary field of the neurotroch is located along the ventral side of trochophore and near the growing stomodeum. The trochophore stage does not last longer than a day. Also the metatrochophore stage is very brief. The metatrochophore is characterized by a more elongated form of body (up to 200 μ long).

The episphere is not suspended over the hyposphere in the mouth /345 area as is observed in the trochophore stage. The cluster of cilia becomes wider and stronger on the left side of the mouth. Two more pairs of definitive eyes appear. The early stage of nectochaeta (Fig. 1, 2, 3) has an oval body somewhat exceeding 200 μ in length. The cluster of cilia reaches the maximum stage of development on the left side of the mouth. Three pairs of roundish sacs with still very little developed clusters of bristles appear on the sides of the body. Only complex bristles of very typical structure appear in the cluster (Fig. 1, 7). The distal end of the main part of bristle has one or two crenatures. The last part has an elongated form with small denticles on the inner edge. The mouth of the early stage of nectochaeta has a roundish-triangular form. Small cilia lie on its edge. A slight greenish pigment appears on the episphere around the mouth and in the anal area. Dorsal and ventral cirri appear on the parapodia. Well-developed bristle sacs can be glimpsed through the integument on the ventral side; they occupy a considerable part of the body. The sacs with bristles represent only the ventral part of the future parapodia. The dorsal parts with trichoid (hairy) bristles lag considerably in their development. The further development of nectochaeta is as follows: the parapodial papillae began to evaginate more and more, but the clusters of bristles reach far beyond their boundaries (Fig. 1, 4, 5). When the larva swims, the clusters of bristles project on the sides. The dorsal side of the larva becomes very convex and contains the main portion of the yolk. The ventral side becomes flat. Three pairs of large bristle-bearing sacs can be seen through the thin integument on the ventral side. These sacs touch the middle line of body. The prototroch begins to disappear gradually. First, the long cilia fall out of the cluster on the left side of mouth; then the remaining cilia

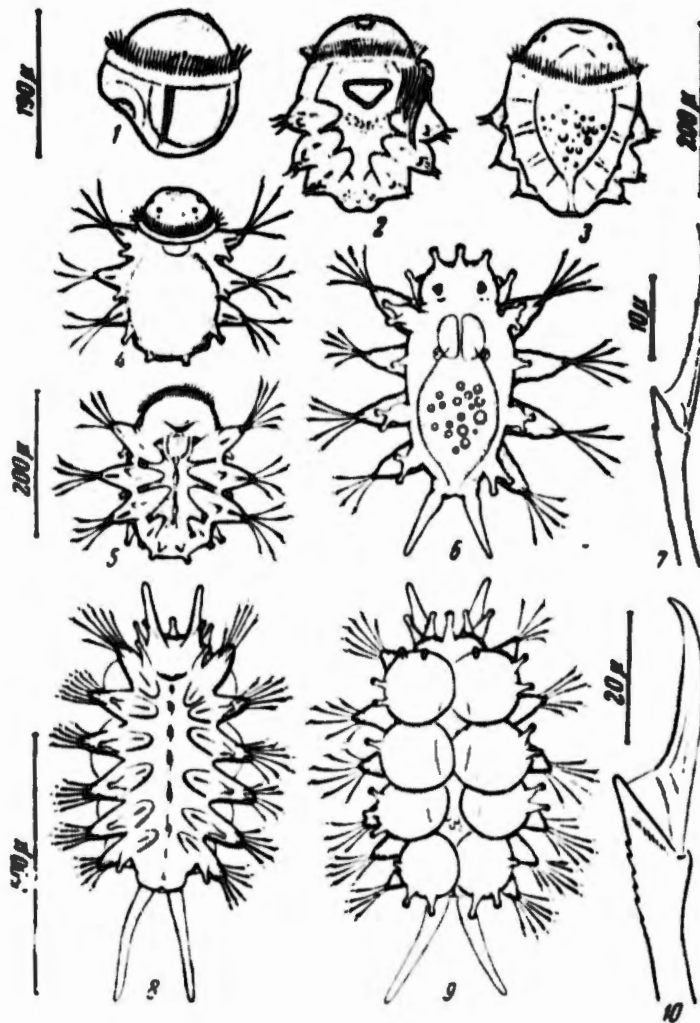


FIG. 1. The development of Pholoe minuta tecta (Stimpson).

1--trochophore from the left; 2--early nectochaeta from ventral side; 3--the same from dorsal side; 4--nectochaeta ready for settlement from dorsal side; 5--the same ventral side; 6--settled 4-segment nectochaeta from dorsal side; 7--complex bristle (chaeta) of a 3-4 segment nectochaeta (phase contrast); 8--young benthic stage with a developed elytron from ventral side; 9--the same from dorsal side; 10--bristle of a mature polychaete (phase contrast).

of the prototroch fall out. During this time, three original bristle bearing segments are preserved in the larva (i.e., there is a pause after the creation of first segments). In Ph. minuta tecta the metastoma, which composes part of the body segments, does not bear bristles. Thus, the general number of larval segments is 4 in this species. M. I. Kiseleva (1957) observed in Sthenelais boa larval of the Black Sea, a simultaneous growth of four bristle-bearing segments. Adding one body segment--the metastoma, which is also devoid of bristles in S. boa, we have 5 larval segments in this species. It is possible that in the species of subfamily Sigalioninae we have to deal with the same inconstancy of the number of larval segments, which is also observed in other groups of polychaetes.

According to our observations, P. minuta tecta settles on the bottom when reaching the stage of three bristle-bearing segments. At that time the prototroch is lost and the animal moves slowly among the particles of muddy bottom. The animal camouflages itself with particles of sand and detritus which stick to its back. Therefore, it is difficult to find the larva on the muddy bottom.

In the larva of benthos one can observe the appearance of post-larval segments. Three antennae of the same length, palps and two pairs of palp-like tentacles of the peristomial segment appear on the head of the five-segment nectochaeta (Fig. 1, 6). At this stage, the bases of second, fourth and fifth dorsal tentacles begin to grow thicker. The lowered end of the dorsal tentacle appears to be resting on an inflated base. Soon new tentacles appear on the base; they become papillae, but their bases grow into elytrons. In stage 4 of the bristle-bearing segments, one can observe the formation of pharynx. Its form is spherical and it occupies the central part of the volume of the I bristle-bearing /346 segment. The central duodenum is filled with yellow-green vitellus.

During the six-segment stage the growth of paired antennae lags considerably behind that of the middle antenna. Two to three more papillae appear on the inflated elytrons. The anal antennae reach half the length of body. Jaws are formed within the pharynx.

The semisegmented young animal (Fig. 1, 8, 9) has the basic characteristics of the mature organism. The body length reaches 500-600 μ . The head has a bilobate form. The middle antenna becomes large while the paired antennae disappear. Palps project noticeably forward, exceeding in length all the other additions to the head. Elytrons become flat and large, touching the middle line of the back. On the segments where the elytrons are absent, the dorsal antennae disappear. The clusters of bristles project far beyond the boundaries of the body.

In line with the first two denticles, three to four more denticles appear on the handle of bristle (Fig. 1, 10). The distal member is fixed to the handle. The denticles become numerous on the distal member. Hair-like bristles, indented from one side, are formed in dorsal clusters. The pharynx assumes an elongated form, occupying a space of three frontal segments.

Thus, Pholoe minuta tecta has a rather lengthy pelagic larval stage in the White Sea. It seems that also in Danish Straits this species may have a pelagic development.

FAMILY NEREIDAE

The larvae that belong to this family have been described by many authors. The genus Nereis is of considerable interest to investigators.

According to Reish (1957), out of 20 species of nereids, 10 species are characterized by a free pelagic development with a clearly pronounced epitoke in the mature animals. The latter group includes Nereis succinea (Frey and Leuckart) whose development is described by Banse (1954) and Kinne (1954). G. M. Belyayev (1953) expressed an opinion that, after becoming acclimatized to living in the Caspian Sea, this species lost its ability for free pelagic development. Pelagic development is also observed in N. Grubei (Kinberg), according to Reish (1954) in N. irrorata (Malmgren), Perinereis marione (Audouin and Milne-Edwards) and P. cultrifera (Grube), according to data by Herpin (1925). However, according to Zалenskiy (1882) and Peres and Rancurel (1948), P. cultrifera is also characterized by direct development without the pelagic stage. In addition, the pelagic stage is also observed in Nereis pelagica (Linneus), according to Wilson (1932), N. procera Ehlers and Platynereis bicanaliculata (Baird), according to Guberlet (1934 and 1934a), as well as in P. dumerilli (Audouin and Milne-Edwards) according to Hauenschild (1951). Nereis vexillosa (Grube) is characterized by a pronounced epitoke development, but, according to Johnson (1943), the development of eggs takes place within the mucous clutches.

According to Izuka (1908, 1912), Nereis japonica (Izuka) spawns without the epitoke.

According to E. Berkeley and C. Berkeley (1953) Micronereis nanaimoensis Berkeley and Berkeley spawns without the epitoke, but

the eggs develop within the mucous clutches. According to F. Rullier (1954), N. variegata Claperede behave similarly. The males of the two latter species take care of the young.

According to M. Durchon (1956), Ceratonereis costae (Grube) multiply without the epitoke and swarming by laying eggs into the mucous matter; the parents care for the young. Reisch (1952) has observed the same behavior in Neanthes caudata (delle Chiaje).

M. Bogucki (1954) and R. Ph. Dales (1950) have observed a straight development in Nereis diversicolor (Muller). However, Thorson (1946) points out that under the influence of brackish water N. diversicolor may become viviparous.

Viviparity has been observed by I. Smith (1950) in Neanthes lighti (Hartman). In this species a complete development of eggs and larvae to the 30-segment stage occurs in 3-4 weeks within the coelom of the parent.

Hermaphroditism is observed in 3 species: in Namanereis reneuensis (Feuerborn), according to Feuerborn (1932), in N. indica (Southern), according to Aiyar (1935), and in Platynereis massiliensis (Moquin-Tandon) according to Hauenschild (1951); in the two latter species one can speak of protandrous hermaphroditism. /347

Thus, in the representatives of the family Nereidae the methods of reproduction and development are very diverse. A considerable quantity of nereids are characterized by a free pelagic development and a clearly pronounced epitoke in the mature animals.

In addition, in a number of cases one can observe changes in the methods of reproduction and development in the same species. The development of nereids is evidently rather elastic, affected by external conditions more so than are other polychaets. This circumstance affected, to a degree, the selection of genus Nereis as the object for acclimatizational measures and studies in the Caspian Sea (Zenkevich, 1952).

NEREIS VIRENS SARS

Though the development of some nereids has been studied in detail, the development of others has been entirely neglected. In fact, the data on the reproduction and development of Nereis virens are very scant. McIntosh (1910) observed the species off the coast of England in May. They emitted egg-cells of greenish color, their diameter being 20 μ . In October McIntosh observed trochophores in plankton, their diameter being 228 μ ; he assigned the animals to the species N. virens. Thorson (1946), however, doubts that the egg-cells and trochophores described by McIntosh belong to the same species. Thorson himself has not observed the reproduction of N. virens off the coast of Denmark, but he cites oral data given by Gustafsson who had observed the nonpelagic development of this species off the coast of Sweden.

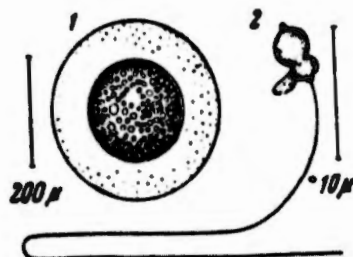


FIG. 2. Fertilized egg-shell (1), and spermatozoa of Nereis virens Sars (2)

We investigated the multiplication and development of this species in the plankton of the White Sea and under laboratory conditions. The descriptions listed here are much more accurate, detailed and verified on the basis of additional data than the original descriptions (Sveshnikov, 1955).

In guba Ruzozerskaya the reproduction of N. virens always occurs when the water temperature is 9°C (Sveshnikov, 1959) and continues 2-3 days. Especially large numbers of heteronereid individuals appear in the surface layer when the optimum temperature for reproduction coincides with the new or full moon. The epitokous pelagic males and females, 30-45cm long, appear on the surface

in calm nights and swim with their heads above water and bodies curved. In the laboratory, during spawning, the males and females of *N. Virens* swim out into the enameled basins where the sexual products are emitted. After a while, small portions of fertilized eggs were transferred to crystalizers where the further development took place. Spermatozoa (Fig. 2, 2) have a spherical head, a small conic perforatorium, an inflated neck and a very long tail fiber, reaching 50 μ in length, whereas the diameter of the head is about 5 μ . The general habitus of the spermatozoan of *N. virens* is somewhat reminiscent of that of *Micronereis variegata*, which was described by Rullier (1954), though there are certain differences between them.

The egg-cells of *N. virens* deposited in the water have a diameter of 200 μ (Fig. 2, 1). A large concentration of eggs has a rosy color. After fertilization, the membrane of the egg becomes inflated and its diameter increases to 500 μ . The nucleus lies in the center of the egg and is enveloped by adipose ingredients. The content of the egg has a yellowish-green color. The inflated membrane is transparent so that it is almost unnoticeable. Twenty-four hours after fertilization, a spheric trochophore is formed, its diameter being about 200 μ (Fig. 3, 1). The prototroch runs along the equator of the larva under which there is a pink pigmentation characteristic of many larva of the *Nereis* genus. In *N. virens* this pigmentation is especially noticeable from the ventral side of the larva. Vitellus, in the form of large greenish-blue spheres, is concentrated on the dorsal side of the trochophore. In this stage, the larva still lacks the mouth of anus. /348

Metatrochophore I (Fig. 3, 2) has almost the same dimensions, only its form is more reminiscent of egg. A pair of small red eyes is formed on the episphere. Three more ciliary rings of paratrochs appear on the body of the metatrochophore. No signs of muscular nodes can be detected. All of the three paratrochs lie nearer to the lower pole. The same pink pigment as is observed beneath the prototroch is noticeable beneath the paratrochs. Six pairs of chaetal sacs--3 dorsal and 3 ventral--appear on the sides of the gut. The frontal pairs of the chaetal sacs lie on the level of the prototroch (beneath), while the rear pairs lie on the level of the frontal paratroch.

Thus, there is no coincidence in the position of ciliary rings and chaetal sacs in this stage of development. The ciliary rings of paratrochs and the chaetal sacs lie at different levels. In later stages of development, as we shall later see, this relationship appears gradually, leading to the regulation of the above- /349

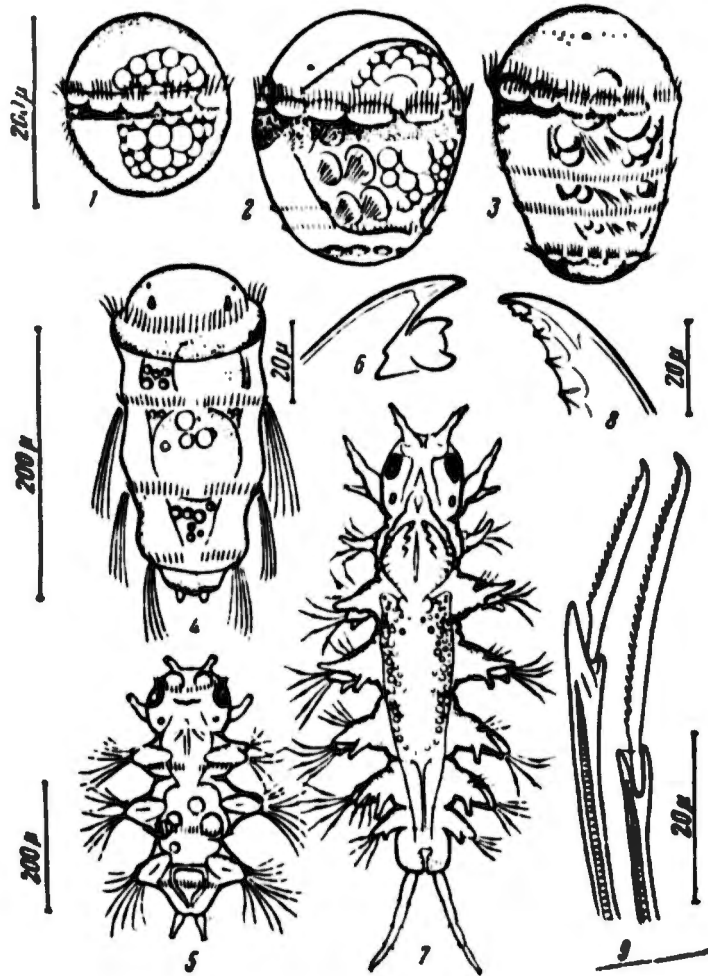


FIG. 3. Development of *N. virens* Sars

1--trochophore from left; 2--metatrochophore I from left; 3--metatrochophore II from left; 4--early nectochaeta when swimming (from dorsal side); 5--nectochaeta with head from ventral side; 6--jaw of this nectochaeta; 7--young benthic stage from dorsal side; 8--jaw of this stage; 9--homogomphic and heterogomphic bristle in this stage.

Figures 2, 3, 4, 5, 7 are on the same scale.

mentioned markings. It can be noted that at the beginning the signs of segmentation in N. virens larvae are noticeable on the body surface in the form of developing paratrochs; only later does internal segmentation of the body take place. These data do not contradict the opinion expressed by P. P. Ivanov (1944) concerning the segmentation of the coelom of polychaetes.

Metatrochophore II (Fig. 3, 3) continues to stretch and assume an egg-shaped form. The pigment beneath the prototroch somewhat brightens, but in the area of anal lobe the pigment becomes more intense. At this stage one can observe a noticeable cavity with bristles in the forebody which will develop into mouth. The paratrochs appear to lie at an equal distance from the prototroch and from one another. At the same time, the chaetal sacs seem to be displaced toward the rear, due to which the first two pairs appear to lie between the prototroch and the first paratroch, the second two pairs between the first and second paratrochs and, lastly, the third two pairs, between the second and third paratrochs. Thus, an impression is created that the mouth segment carries bristles. However, a further displacement of chaetal sacs toward the rear changes the picture, as will be seen later.

The body length of an early nectochaeta (Fig. 3, 4) is 250 μ . Two more pairs of larger eyes appear on the episphere. The muscular node beneath the prototroch becomes more convex. At the beginning, the sides of each segment are smooth; later, the convexities of the parapodia begin to smooth. The tracts of the complex bristles extend far beyond the boundaries of the body, but, in contrast to Pholoe minuta, the bristles are tightly pressed to the body when the animal swims; the body can be slightly curved. Each segment bearing bristles has a paratroch. The anal membrane has a pink color and a pair of small anal bristles. The bristles can be folded into the sacs beginning with the distal end of the last member; then the member appears and the distal end of the handle is formed, and lastly the main portion of the bristle.

The mature nectochaeta is 420 μ long (Fig. 3, 5). Its head is roundish, standing out of the first chaetal segment. Large pigmented spots appear on the sides of the head, which are typical of this stage, covering a considerable part of the head. These spots appear immediately after death. The prostomial part of the head has a pair of antennae and a pair of spheric palps. The prototroch has considerably decreased by that time; it lies in the back of the palps and on the upper boundary of the large eye spots, separating the prostomium and metastomium. The mouth lies on the ventral side of this boundary, somewhat below the prototroch. A pair of tentacles appears on the sides of

metastomium, which is later followed by other tentacles. Only at this time does it become clear that the metastomium is formed on the sectors lying between the prototroch of the larva and the first chaetal sac, and that the metastomium itself does not have any bristles. Boundaries of the body segments become very clear due to the chaetal sacs which are unusually well developed in this stage. Thus, in the process of development, the first two pairs of chaetal sacs develop at the level of the prototroch and are gradually displaced toward the rear, so that, finally, they lie behind the metastomium. The remaining--second and third-- /350 pairs lie behind the first pair of chaetal sacs. Assuming metastomium I is a segment of the body, the *Nereis* has not three, but four larval segments. In a developed nectochaeta the tentacles of the I segment that bears bristles are much less developed than on the other two segments. Also, the parapodial convexities of this segment are much less developed. The tracts of bristles of the II and III segments rest on the pink acicula. The intestines consist of 3 parts. In the pharynx, which occupies the volume of the I chaetal segment, lie the jaws. Initially, the jaws consist of two segments: the large denticle and the small additional rounded section, equipped with two denticles (Fig. 3, 6). The additional section is later lost, so that it can be considered as a larval remain. In the middle section the intestines still contain remains of a yellowish vitellus and several large and transparent tannin sacs. The rear section of the intestines has a ciliated coating. The anal membrane has a pair of anal bristles with sensitive tentacles at the end. At this stage the larvae settle on the bottom and for a time no new segments are created; i.e., after the first four segments have developed in *N. virens*, there is a pause during which new segments are not formed. In benthic larvae, after a while, postlarval segments appear. When the larva has 7 segments (Fig. 3, 7), its form is roundish and the head is clearly pronounced. The frontal part of the prostomium has a pair of antennae equipped with ciliae, while the lower part has a pair of short, almost spherical, palps. On the sides of the head there still are large reddish-pink spots--melanophores. Two pairs of distinct eyes can be distinguished in the rear part of the head. The metastomium has two pairs of tentacles, the dorsal pair being twice as large as the ventral pair, which lags behind in development since it appears much later than its dorsal counterpart. Parapodia of the I segment with bristles are completely underdeveloped. Only one pair of dorsal bristles are on this segment, while the ventral bristles are just beginning to develop. The tracts of bristles are still poorly developed on this segment. The bristles often fall out. The parapodia of other segments are normally developed. Notopodial and neuropodial branches with developed ventral and dorsal bristles begin to appear. In the notopodial tracts, which appear belatedly, one can usually observe homogomorphic bristles. In the neuropodial tracts the homo- and

heterogomphic bristles can be equally distributed (Fig. 3, 9). The anal cirri lengthen noticeably. The pharynx becomes larger and one can clearly notice jaws with teeth in it. A transparent membrane lies between the denticles of the jaws (Fig. 3, 8). A small stomach lies in the rear of the pharynx. The pharynx and stomach accepts the first two segments of the body. Farther back one can notice the mid-intestine which is filled with greenish grains of vitellus. The rear section of the intestines occupies the two last segments and opens by the anus on the dorsal side.

This stage of 8 segments is characterized by the following changes in the structure of the young polychaete. The fingers have two parts and can be clearly distinguished when viewed from above. The I chaetal segment loses all of its bristles and moves toward the head. A ventral cirrum now appears on it; the dorsal cirrum of this segment is longer than both of the tentacles of the metastomium taken together. Losing all of the bristles and moving toward the forebody, this segment forms the peristomium of Nereis after joining with the metastomium. The peristomium becomes part of the head.

Thus, in addition to the prostomium, the metastomium (mouth segment) and I bristle-bearing segment constitute part of the Nereis head, i.e., only two of the four larval segments, but not all of the larval segments, as it is assumed by V. N. Beklemishev (1952).

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FAMILY ARICIIDAE

Scoloplos armiger (O. F. Müller)

According to data by Thorson (1946), S. armiger deposits large mucous mass of eggs fastened to the particles of sand. We never found such oviposition in S. armiger inhabiting the White Sea. On the contrary, the females of the species emit single eggs into the water, and the entire development takes place in the surface water. The eggs are spherical, 230 μ in diameter. Their color is orange or pink; they are richly supplied with vitellus and are quite buoyant. In the first stages of division one can readily identify the animal pole from the vegetal pole because micromeres are concentrated on the animal pole, while the macromeres occupy the vegetal pole (Fig. 4). This difference in the arrangement of blastomeres is not lost prior to the appearance of a prototroch which begins to be formed only on the flanks of the larval body

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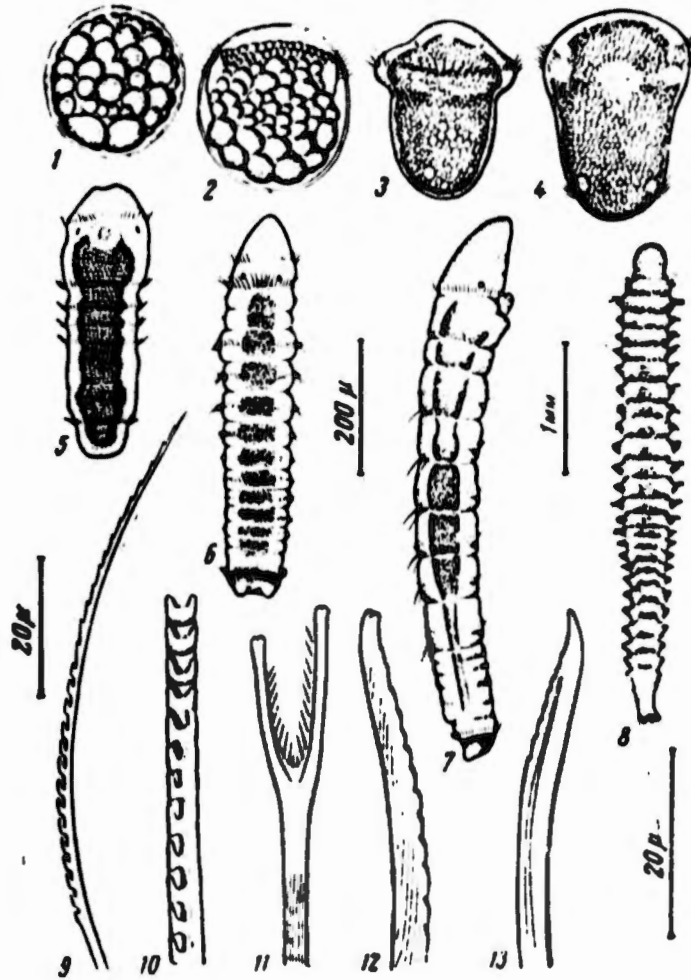


FIG. 4. Development of Scoloplos armiger

1--the crushing egg; 2--trochophore under the membrane of the egg; 3--trochophore with prototroch; 4--trochophore with prototroch and telotroch from ventral side; 5--metatrochophore; 6--larva settled on the bottom; 7--benthic larva with developed definitive intestines; 8--young animal; 9--serrate bristle; 10--its central part greatly magnified; 11--forked bristle; 12--acicular bristle with one denticle at the end (10-13-- phase contrasts).

where the membrane of the egg is disrupted. At this stage the larva becomes capable of limited locomotion (Fig. 4, 2). Later, the prototroch becomes ring-shaped, tearing gradually apart the membrane of the egg so that in the end the larva is freed of it altogether. Being freed of the membrane, the larva swims for a very brief while with one prototroch, under which a muscular *purca* is formed (Fig. 4, 3). At this stage, a pair of red eyes appears in the larva. In a few seconds, a telotroch develops in the rear part of the larva, and a rhomboid opening for a mouth is formed (Fig. 4, 4). Vitellus occupies almost all of the larval body.

The metatrochophore (Fig. 4, 5) has an elongated body 400 μ long. Four paratrochs appear in the central part of the body. Intestines continue to be stuffed with vitellus, and no anal opening exists at that stage. Thus, it can be concluded that during its entire pelagic life, the larva does not feed actively and can be assigned to the lecithotrophic type.

E. Smidt (1951) describes and illustrates the larvae that coincide with our data on this species, but he assigns them to the species Heteromastus filiformis (Claparede). Rasmussen (1956) expressed doubts about the visual identification made by Smidt. The former raised the H. filiformis larvae in the laboratory and, naturally, noticed the difference. Now there is no doubt that the larvae described by Smidt belongs to the species Scoloplos armiger.

In special crystallizing basins we succeeded in observing the settlement of metatrochophores on the bottom. At the beginning, the larva begins to move on the surface of the bottom and sometimes penetrates the mud particles. In a certain time, the boundaries of segments become established. We did not succeed in observing a pause in the formation of segments and, therefore, we cannot express our opinion on the presence of larval or postlarval parts of the body in S. armiger.

The 12-segment larva has a body 600 μ long (Fig. 4, 6). The conic prostomium is clearly pronounced, on which a supplementary wreath of ciliae is formed--namely, arotroch lying on the boundary and lying in two intermittent sectors above the eyes. The Prototroch bounds on the prostomium. The first two segments that follow the head have weakly developed paratrochs which are devoid of bristles. The remaining segments, beginning with the III, bear more developed paratrochs and are equipped with bristle tracts. At this stage there are no signs of parapodia. At the beginning, only hair-like bristles appear on the larva (Fig. 4, 9). They are rather curved, having indentations on the outer edge.

Initially, the indentations at the base of bristles have a complex form of obtuse patterns, and at the end the bristle is acutely serrated. Only in later stages is the indentation of the hair-like bristles reminiscent of that of S. armiger (Fig. 4, 10). In the 12-segment stage the larva has an anal opening between two papillae formed at the end of pygidium. At this stage the telotroch is still weakly developed. Sometimes the larva may leave the bottom and swim in the bottom layer. Soon the arotroch disappears and with it the paratrochs on the first two segments. The pharynx is formed and can be projected outside (Fig. 4, 7). The frontal, central and rear sections of intestines are formed. The larva becomes completely adapted to the hemthic way of life, permanently entering the bottom. Its body length is 3-4mm (Fig. 4, 8). The head becomes rounded, losing entirely the ciliar cover (as the entire body). Eyes sink deeply under the integument and can be noticed only with difficulty. Noto- and neuro-podial papillae appear on the segments of the body. The notopodia of the II segment have only hair-like bristles with the typical graduated indentation. In addition to the hair-like bristles, the neuro-podia of this segment have thick and short bristles (Fig. 4, 12) which are slightly curved and roundishly indented on the convex side. At the end these bristles have two obtuse denticles. Exactly similar bristles are on the neuropodia of III, IV and V segments. One forked bristle adorns each tract of hair-like bristles on the notopodia of these segments (Fig. 4, 11). One forked end is longer than the other one. Each end is slightly forked. On the inner edge of the fork are bristles whose ends point toward the central line of the bifurcation. Beginning with the VI segment, brief deicular bristles with one denticle at the end appear in the neuropodia (Fig. 4, 13). Also beginning with the VI segment, small papillae of the future gills appear on the dorsal side of each segment. The pygidium ends with four appendages between which lies the anal opening. /353

Thus, the reviewed cycles of development of the three representatives of various groups enable us to conclude the following: in the White Sea the sub-species Pholoe minuta tecta (Stimpson) has a typical pelagic larva. True, the same pelagic development of the species occurs in other sectors of the European coast. The larva of Ph minuta tecta, when undergoing the trochophore and metatrochophore stages, has a tract of long immobile cilia on the prototroch, notably on the left-hand side of the mouth. This characteristic is typical of all the pelagic larval belonging to the family of Aphroditidae and can be considered as an intrinsic feature of larva of this family. The larva has 4 larval segments, on which only ventral tracts of bristles are developed at the beginning.

The Nereis virens (Sars) which inhabits the White Sea undergoes pelagic development. The metatrochophores and nectochaetas are characterized by the presence of three paratrochs. In metatrochophores, the arrangement of paratrochs does not coincide with the future segments of body; only in a completed nectochaeta do the paratrochs lie on each chaetal segment; this is caused by a gradual arrangement of the parts. The metastomium does not have bristles. In addition to the I body segment there are three chaetal segments. Thus, the larva of Nereis has not three, as it is assumed, but four larval segments. Since its earliest stages, the larva has equally well-developed dorsal and ventral chaetal sacs.

Scoloplos armiger (O. F. Müller) lets out single eggs in the White Sea where they pass through pelagic stage. The body of the larva is stuffed with vitellus, and during the entire pelagic life the larva feeds by the lecithotrophic method. Typical features of the larva are the telotroch on the anal membrane, paratrochs on all the segments, without the two former, and a brilliant orange color of the body. The supersaturation of the body with vitellus supports the usual course of development. Thus, during the entire pelagic life the larva is devoid of bristles. Therefore, the Scoloplos armiger does not have the pelagic stages of nectochaeta. The bristles appear only after the final transition to the pelagic way of life.

BIBLIOGRAPHY

1. BEKEMISHEV, V. N. OSNOVY SRAVNITEL'NOY ANATOMII BESPOZVONOCHNYKH (Fundamentals of the Comparative Anatomy of Invertebrates). IZD-VO SOV. NAUKA, 1952 M.
2. BELYAYEV, G. M. (On the Development of Some of the Black Sea Invertebrates in Caspian Waters.) ZOOL. ZH., Vol. XVIII, No. 2, 1953.
3. ZENKEVICH, L. A. AKKLIMATIZATSIYA NEREIS V RASPIYSKOM MORE (Acclimatization of Nereis in the Caspian Sea). SB. RABOT MOSK. O-VA ISPYT. PRIRODY, 1952.
4. ZALENSKIY, V. ETUDES SUR LE DEVELOPPMENT DES ANNELIDES (A Study of the Development of Annelida). EXTRAIT DES ARCHIVES DER BIOL., vol. III, 1882.
5. IVANOV, P. P. (Primary and Secondary Metamerism of the Body.) ZH. OBSCHCH. BIOLOGII, Vol. 5, No. 2, 1944.
6. KISELEVA, M. I. (Pelagic larvae of the Polychaeta Worms of the Black Sea.) TRUDY SEVASTOP. BIOL. ST., Vol. 9, 1957.
7. SVESHNIKOV, V. A. RAZMNOZHENIYE I RAZOVITIYE NERFIS VIRENS SARS (New Polychaeta Species in the Black Sea). DOKL. AN SSSR, Vol. 103, No. 1, 1955.
8. AIYAR, R. G. (Hermaphroditism in *Lycastis Indica* [Southern].) CURRENT SCI. (INDIA), No. 3.
9. BANSE, K. ÜBER MORPHOLOGIE UND LARVALENTWICKLUNG VON NEREIS (NEANTHES) SUCCINEA (LEUCKART), 1847. (Morphology and Larval Development of Nereis succinea.) ZOOL. JAHRB. ABT. 2, 74 (I), 1954.
10. BERKELEY E., BERKELEY C. (*Micronereis Nanaimoensis* N. Sp. with Some Notes on Its Life-history.) CANADIAN FISHERIES RES. BD., JOURN. 10(2), 1953.
11. BOGUCKI, M. ROZROD I ROZWOJ WIELSZCZETA NEREIS DIVERSICOLOR (O. F. MÜLLER) (Origin and Development of Nereis diversicolor in the Baltic Sea). POLSKIE ARCH. Hydrobiol., No. 1, 1954.

12. DALES, R. Ph. (The Reproduction and Larval Development of Nereis Diversicolor [O. F. Muller].) J. MARINE BIOL. ASSOC., Vol. 29, 1950.
13. DAVENPORT, D. (Notes on the Early Stages of the Commensal. Polynoid Acholoe Astericola.) J. MARINE BIOL. ASSOC. U. K., Vol. 33, 1954.
14. DURCHON, M. MODE DE REPRODUCTION ET DEVELOPEMENT DE NEREIS COSTAE GRUBE (Reproduction and Development of the Nereis costae Grube). ARCH. ZOOL. EXPTL. ET GEN., 93, 1956.
15. FEUERBORN, H., J. EINE RHIZOCEPHALE UND ZWEI POLYCHAETEN AUS DEM SUSSWASSER VON JAVA UND SUMATRA (A Rhizocephale and Two Polychaetae from Pure Water of Java and Sumatra). INTERN. VER. THEORET. LIMNOL. STUTTGART, VERHANDL. 5, 1932.
16. GUBERLET, J. E. Observations on the Spawning and Development of Some Pacific Annelids. Fifth Pacific Sci. Cong. Canada, Proc. 5.--1934 a. Life History Studies on Some Pacific Annelids, Anat. Rec., 60, 1934.
17. HAUENSCHILD, C. NACHWEIS DER SOGENANTEN ATOKEN GAESCHLECHSFORM DES POLYCHAETEN PLATYNEREIS DUMERILII AUD. ET M.--EDW. ALS EIGENE ART AUF GRUND VON ZUCHTVERSUCHEN (Report on the So-Called Atokous Seaforms of Polychaeta Platynereis dumerilii (Aud. et M.--Edw.) as a Species on the Basis of Breeding Studies). ZOOL. JAHRBUCH, Abt. 1, No. 63, 1951.
18. HERPIN, R. RECHERCHES BIOLOGIQUES SUR LA REPRODUCTION ET LE DEVELOPEMENT DE QUELQUES ANNELIDES POLYCHETES (Biological Research on the Reproduction and Development of Polychaete Annelids). SOC. DES SCI. NAT. DE L'OUEST FRANCE. BULL., SER. 4, 5, 1925.
19. IZUKA, A. (On the Breeding Habit and Development of Nereis Japonica N. Sp., Annot. Zool. Jap., 6--1912. The Errantiate Polychaeta of Japan, Tokyo Imp. Univ., Col. Sci. Journ., 30 (2), 1908.
20. JOHNSON, M. W. (Studies on the Life History of the Marine Annelid Nereis Vexillosa.) BIOL. BUL. 84, 1943.

21. KINNE, O. ÜBER DAS SCHWÄMEN UND DIE LARVALENTWICKLUNG VON NEREIS SUCCINEA LEUCKART (On Swarming and Larval Development of Nereis succinea Leuckart). ZOOL. AUF., Vol. 153, No. 5-6, 1954.
22. KORN, H. VERGLEICHEND-EMBRYOLOGISCHE UNTERSUCHUNGEN AN HARMOTHOE KINBERG, 1857, ORGANOGENESE UND NEUROSEKRETION (Comparative Embryological Investigations of Harmothoe Kinberg 1857). Z. WISS. ZOOL., Vol. 161, No. 3-4, 1959.
23. McINTOSH, W. C. A Monograph of the British Annelids, Pt. II. Polychaete, 1910.
24. PERES, J. M., RANCUREL, P. OBSERVATIONS SUR LA PONTE DE PERINEREIS CULTRIFERA GRUBE DANS LE GOLFE DE MARSEILLE (Observations of Marine Perinereis cultrifera Grube in the Gulf of Marseille). BULL. SOC. ZOOL. FRANCE, LXXIII, No. 2, 1948.
25. RASMUSSEN, E. Faunistic and Biological Notes on Marine Invertebrates, III, BIOL. MEDD. DAN. VID. SELSK., 23, No. 1, 1956.
26. REISH, D. J. The Life History and Ecology of the Polychaetous annelid Nereis Grubei (Kinberg) Allan Hancock Fond. Occas. Paper, No. 14--1957. The Life History of the Polychaetous Annelid Neanthes Caudata (dell Chiaje), including a Summary of Development in the Family Nereidae. PACIF. SCI., II, No. 2, 1954.
27. RULLIER, F. RECHERCHES SUR LA MORPHOLOGIE ET LA REPRODUCTION DU NEREIDEN MICONEREIS VARIEGATA CLAPAREDE (Research of Morphology and Reproduction of Micronereis variegata Claparede. ARCH. ZOOL. EXPTL. ET GEN. 91, 1954.
28. SMIDT, E. Animal Production in the Danish Waddensea, Medd. Danm. Fisk. Havunders. ser. Fiskeri., Vol. II, No. 6, 1951.
29. SMITH, R. L. Embryonic Development in the Viviparous Polychaeta Neanthes Lighti, J. Morphol., 87, 1950.
30. THORSON, G. Reproduction and Larval Development of Danish Marine Bottom Invertebrates, Medd. Komm. Danm. Fiskeri-og Havunders, ser. Plankton, Vol. IV, No. 1, 1946.
31. WILSON, D. P. The Development of Nereis Pelagica Linnaeus, T. MAR. BIOL. ASSOC., 18, 1932.

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DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)		2a. REPORT SECURITY CLASSIFICATION	
U. S. Naval Oceanographic Office		UNCLASSIFIED	
		2b. GROUP	
3. REPORT TITLE			
"Pelagic Larvae of Some Polychaeta in the White Sea" PELAGICHESKIYE LICHINKI NEKOTORYKH POLIKHET BELOGO MORYA .			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)			
Translation			
5. AUTHOR(S) (First name, middle initial, last name)			
V. A. SVESHNIKOV		M. Slessers, Translator	
6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS	
	21	31	
8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)		
b. PROJECT NO.	TRANS 389		
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)		
d.			
10. DISTRIBUTION STATEMENT			
Distrubition of this document is unlimited.			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY	
ZOOLOGICHESKIY ZHURNAL, VOL. 39, No. 3. Pp. 343-355. MOSCOW 1960.		U. S. Naval Oceanographic Office	
13. ABSTRACT			
<p><u>Pholoe minuta tecta</u> Stimpson undergoes pelagic development in the White Sea. Its trochophora and metatrochophora possess a character typical of the pelagic larvae of all Aphroditidae, namely a bundle of long motionless cilia on the left side of the oral aperture. The larva has four larval segments on which only neuropodial sections of developing parapodia are well developed.</p> <p><u>Nereis virens</u> Sars in the White Sea also undergoes pelagic development. The larva is characterized by the presence of 3 paratrochs and 4 larval segments on which both the neuropodial and notopodial sections of developing parapodia are equally well developed.</p> <p><u>Scoloplos armiger</u> (O. F. Müller) in the White Sea lays single eggs into plankton where they undergo development up to the stage of metatrochophora. Characteristic features of the larvae belonging to this species are as follows: orange coloration, presence of several ciliar rings, paratrochs -- on each appearing segment, and leucitotrophous mode of feeding. Early stages of <u>S. armiger</u> were described by E. Smidt (1951) as the species <u>Heteromastus filiformis</u> Clap.</p>			

KEY WORDS

LINK A

LINK B

LINK C

ROLE

WT

ROLE

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ROLE

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Morphology (Biology)
 Larvae
 Plankton
 Seawater