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INVERTEBRATE ZOOLOGY

New Species of Arrowworms (Chaetognatha) from Chazhma Bay (Peter the Great Bay, Sea of Japan)

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Abstract—Eighteen species of arrowworms have been found in Chazhma Bay (Peter the Great Bay, Sea of Japan) including 4 species (*Leptosagitta ocis* sp. n., *L. exigua* sp. n., *L. icis* sp. n., and *Oligosagitta entis* sp. n.) described here as new. Some specimens showed peculiar morphological abnormalities, which have never been registered in arrowworms from volcanic bays and geophysically active regions. This paper analyzes the ecological situation in Chazhma Bay and presents a list of arrowworms species found there with descriptions and drawings of the new species and a list of morphological deviations registered in all species of arrowworms.

Key words: arrowworms, Chaetognatha, plankton, morphological deviations, radioactive pollution.

The coastal waters of southern Primorye are subject to intensive anthropogenic and industrial effects, which have resulted in changes in the ecosystems and a decrease in their production. In this connection, studies on the condition of plankton ecosystems are one of the major goals in the investigations of biodiversity and productivity of marine bioresources in the Russian Far East.

This paper presents results of studies on species diversity of arrowworms (Chaetognatha) and morphological deviations in them in the plankton of Chazhma Bay, which is affected by common pollution characteristic of such types of bays and is contaminated by radionuclides due to an accidental release. Chazma Bay is also a source of pollution for the neighboring Strelok Bay (Razboinik Bight), which resulted in a decrease in the biomass and species diversity in the latter area [2].

MATERIALS AND METHODS

Plankton samples were collected by A.F. Sergeev in Chazhma Bay from 1999 to 2003 with a Juday net (with a ring diameter of 37 mm), throughout water column, from bottom (8–18 m) to surface. The samples were fixed with 10% formalin and then analyzed under a dissection microscope. The types and paratypes of the new species are deposited in the Pacific Institute of Oceanology, Far East Division, Russian Academy of Sciences (Vladivostok), the specimens with abnormalities were excluded from the type materials.

During the sampling period we also performed in Chazhma Bay radioecological investigations; some results of the latter, together with information from the available literature, have been used for the following brief description of the surveyed area.

Chazhma Bay is located in northwestern Peter the Great Bay. The bottom of the bay is constructed of homogeneous, in granulometric composition, sediments dominated by silt and sandy mixites [1], in some places with a smelt of hydrogen sulfide. In winter the bay is usually frozen. In summer the surface water layer warms up to 23°C and more. The values of the salinity characteristic of the water in the bay fall within the range of 32–34‰. In the innermost part of the bay the salinity of the water is lower due to the freshening effect of the Yuzhanka River entering the bay. In general, Chazhma Bay is characterized by weak water dynamics and shows a two-layer compensation structure of circulation. The currents in the surface water layer and at the bottom usually do not exceed 10–20 and 0–6 cm/s respectively [14].

The area of Chazhma Bay is part of a dockyard with floating piers and docks and anchorage grounds. It is characterized by a high pollution level, which is common for bays of such types. The concentrations of heavy metals in the water, bottom sediments, and suspended matter in Chazhma Bay are only somewhat smaller than in Zolotoi Rog and Nakhodka bays, which are the most heavily polluted water areas in Peter the Great Bay. The level of oil pollution in Chazhma Bay and the surrounding water area is also very high [8]. A unique ecological characteristic of this bay is radioactive pollution of the bottom sediments as a result of an accident in a submarine nuclear engine which happened in 1985. The most polluted was the southwestern part of the bay, where an asymmetrical radioactive trace appeared in the bottom sediments stretching from the

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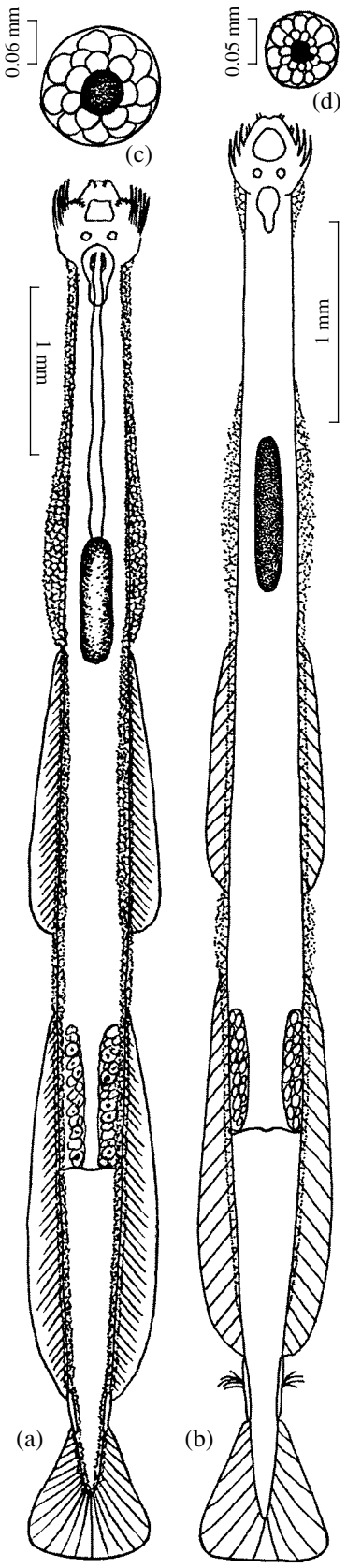

Fig. 1. Holotypes. (a, d) *Leptosagitta icis* sp. n. (a—general aspect; d—an eye); (b, c) *L. exigua* sp. n. (b—general aspect; c—an eye).

epicenter of the accident along the shoreline. The major components of the radioactive pollution were corrosive Co-60 (>99%) and, to some extent, also Cs-137, a product of nuclear disintegration. Such a composition of nuclear pollutants was due to the fact that the accident happened in a nuclear reactor that had been refilled with fresh fuel [9]. At present, the maximum specific activities of Co-60 and Cs-137 in the bottom sediments across the water area of the bay are still high exceeding the levels of 10^7 and 10^3 Bq/kg respectively. Thus, the bottom water layer is evidently exposed to radiation. Radiometric surveys showed that the intensity of gamma radiation in some areas affected by the accident falls down to the background level in the water column only at a distance of 2 m from the bottom surface. Thus, in the area affected by the accident, marine organisms in the bottom water layer and on the bottom (as well as in the column of sediments) are prone to excess radioactive irradiation exceeding the background (natural) level.

RESULTS AND DISCUSSION

Over 10 000 specimens of arrowworms were collected from plankton samples and observed. Altogether 18 species of arrowworms were identified including 13 known ones [3, 5–7]. The genus *Leptosagitta* comprised five known species (*L. nudata* Kassatkina, 1973; *L. collariata* Kassatkina, 1973; *L. schakovi* Kassatkina, 1973; *L. eris* Kassatkina et Selivanova, 2003; and *L. alba* Kassatkina et Selivanova, 2003) and three new species (*L. icis* sp. n.; *L. exigua* sp. n. and *L. ocis* sp. n.). The genus *Aidanosagitta* included seven known species (*A. scarlatoi* Kassatkina, 1971; *A. macilenta* Kassatkina, 1971; *A. acus* Kassatkina et Selivanova, 2003; *A. pilum* Kassatkina et Selivanova, 2003; *A. murex* Kassatkina et Selivanova, 2003; *A. bella* Kassatkina et Selivanova, 2003; and *A. venusta* Kassatkina et Selivanova, 2003), and the genus *Parasagitta* was represented by one known species (*P. septicoela* Kassatkina, 1971). We also found one new species of the genus *Oligoradiata* (*O. entis* sp. n.) and one species of a new genus, whose description is not provided here, as the specimen was at the 2nd stage of maturity.

It is pertinent to note that only specimens showing no morphological deviations were used to describe the new species.

Leptosagitta icis sp. n.

(Figs. 1a, 1d)

Diagnosis. Anterior end of the fins of the 1st pair is located in front of the level of the posterior margin of subenteric ganglion; this part of the fin, located at the level of the ganglion, is one-ninth as long as the ganglion itself. The rays are incomplete only in lateral fins, along the edges of the latter there are zones devoid of rays. Seminal vesicles touch both lateral fins and tail fin.

Materials. The holotype. The reference number is LP-9/1. It was found in Chazhma Bay, Peter the Great

Bay, Sea of Japan; on March 6, 2003; at a negative water temperature.

Paratypes. Four specimens were found in the same sample as the holotype. The reference numbers are LP-9/2, LP-9/3, LP-9/3, and LP-9/4.

Description of the holotype. Body is rigid and muscular. Head is somewhat wider than trunk; on genital septum there is no constriction. The specimen is at the 3rd stage of maturity. Body is 7.8 mm long. Tail region and subenteric ganglion are 24% and 7.3% as long as the body. No digestive diverticula are present on midgut (trunk gut). The midgut is not vacuolated, but flattened dorsoventrally. Ciliary loop is short, arises behind the level of eyes somewhat above the neck; no one pair of medial lacunae is present. The anterior margin of the fins of the 1st pair is located in front of the posterior margin of the subenteric ganglion; the part of the fin located at the level of the ganglion is one-ninth as long as the ganglion itself. The fins of the 1st pair are shorter than the lateral fins of the 2nd pair; they are 21.7% as long as the body. The distance between the anterior margin of the fins of the 2nd pair and the posterior margin of the fins of the 1st pair is about 6% of the entire body length. The tail part of the fins of the 2nd pair is 1.4 times longer than their trunk part. Tail fin is rounded, its length on the trunk is 5% of the total body length and 21% of the length of tail region. The rays are incomplete only in lateral fins, along the edges of the latter there are zones devoid of rays. A thin layer of vesicular tissue covers the entire body being somewhat thicker on the ventral side, at the level of subenteric ganglion. There are 9–10 spines, 8–10 anterior teeth, and 16–18 posterior teeth in each row, on each side of the body. Each eye has in the central part a dark rectangular pigment spot. The pigment occupies 1/5 of the entire volume of the eye. Seminal vesicles are elongated, about 3% as long as the entire body and about 14% as long as tail region, overlying the lateral and tail fins. Ovaries somewhat do not reach the level of the anterior margin of the fins of the 2nd pair.

Variability. The length of adult specimens ranges from 7 to 8.5 mm, while the length of tail region may reach 23–25% of the entire body length.

Differential diagnosis. The species is well distinguished from all other species of this genus in the position of the fins of the 2nd pair (in all other species the latter are located at or behind the level of the posterior margin of subenteric ganglion).

Remarks on biology. The condition of gonads allowed us to judge about the reproduction schedule in this species; reproduction seems to happen at negative water temperature, in December. No adult specimens have been registered in spring.

Etymology. "Icis" means a needlelike structure (Latin).

Leptosagitta exigua sp. n.

(Figs. 1b, 1c)

Diagnosis. Anterior end of the fins of the 1st pair is located behind the level of the posterior margin of subenteric ganglion. Rays in fins are complete; no zones devoid of rays are present in all fins. Seminal vesicles touch both lateral fins and tail fin. The distance between the fins of the 1st and 2nd pairs is shorter than that between subenteric ganglion and the fins of the 1st pair. Subenteric ganglion is shorter than the trunk part of the fin of the 2nd pair.

Materials. The holotype. The reference number is LP-7/1. It was found in Chazhma Bay, Peter the Great Bay, Sea of Japan; on December 16, 1999; at a negative water temperature.

Paratypes. Three specimens were found in the same sample as the holotype. The reference numbers are LP-7/2, LP-7/3, and LP-7/4.

Description of the holotype. Body is rigid and muscular. Head is somewhat wider than trunk; on genital septum there is no constriction. The specimen is at the 3rd stage of maturity. Body is 7 mm long. The length of the tail region is 27.7%, and the subenteric ganglion, about 11% of the body length. No digestive diverticula are present on midgut (trunk gut). The midgut is neither vacuolated, nor flattened dorsoventrally. Ciliary loop is short, arises behind the level of eyes somewhat above the neck; it has one pair of weakly pronounced medial protuberances. The anterior margin of the fins of the 1st pair is located behind the posterior margin of subenteric ganglion; the distance between the former and the latter is one-third as long as the ganglion itself. The fins of the 2nd pair are about 1.4 times longer than the fins of the 1st pair, which are approximately 18% as long as the body. The distance between the anterior margin of the fins of the 2nd pair and the posterior margin of the fins of the 1st pair is about 5.4% of the entire body length and 1.5 times longer than the distance between subenteric ganglion and the fins of the 1st pair. The fins of the 2nd pair are approximately 25% as long as the body; their tail part is 1.8 times longer than the trunk part. The length of tail fin on the trunk is about 7% of the total body length and 24.7% of the length of tail region. Rays are complete in all fins; no zones devoid of rays are present. Vesicular tissue covers the body only around neck, on the dorsal side at the level of subenteric ganglion and backward up to the middle of tail region. On the head there is one pair of setal rows and two pairs of dental rows. There are 8 spines, 6 anterior teeth, and 9 posterior teeth in each row. Each eye has in the central part a dark rectangular pigment spot. Seminal vesicles are elongated, simple, without diverticula (the holotype was fixed at the moment of the release of spermatozoa). The length of the vesicles is about 5% of the body length and 18% of the length of tail region; they touch both lateral fins and tail fin. Ovaries somewhat do not reach the level of the anterior margin of the fins of the 2nd pair.

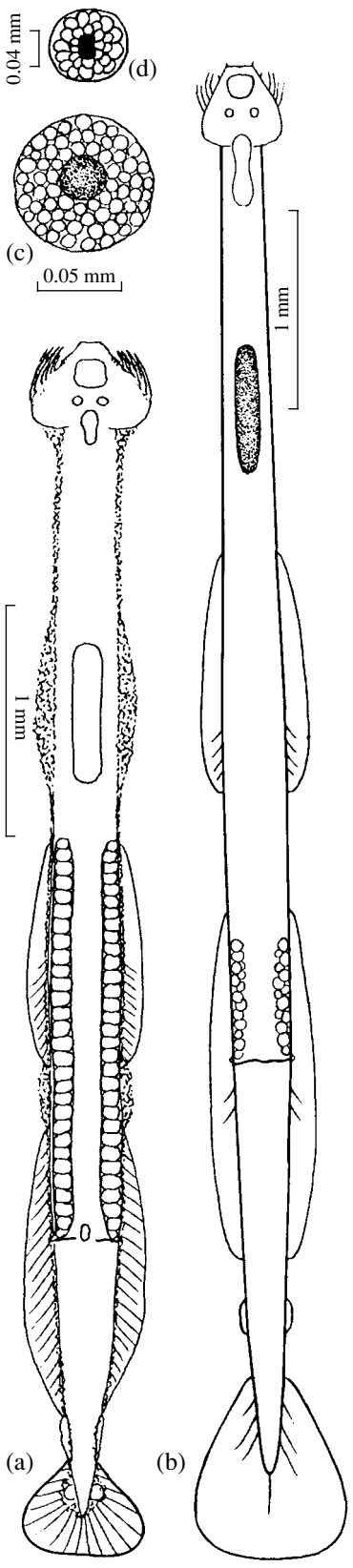

Fig. 2. Holotypes. (a, d) *Leptosagitta ocis* sp. n. (a—general aspect; d—an eye); (b, c) *Oligoradiata entis* sp. n. (b—general aspect; c—an eye).

Variability. The length of adult specimens ranges from 6.7 to 7.5 mm, while the length of tail region may reach 27–29% of the entire body length.

Differential diagnosis. This species is similar to *L. acicula* Kassatkina et Panteleeva, 2001, but differs in several characteristics. The most pronounced among the latter are as follows: (1) vesicular tissue in *L. acicula* is present only around the neck, there are no thickenings at the dorsal side of trunk region; and (2) seminal vesicles touch neither tail fin nor lateral fins.

Remarks on biology. The condition of gonads provide indirect information about the reproduction schedule, which seems to happen in December, at a negative water temperature. No adult specimens have been registered in spring.

Etymology. "*Exigua* means "small" (Latin)

Leptosagitta ocis sp. n.

(Figs. 2a, 2d).

Diagnosis. Anterior end of the fins of the 1st pair is located behind the level of the posterior margin of subenteric ganglion. Lateral fins in the anterior parts are lacking rays; the zones devoid of rays are present only in the lateral fins. The distance between the fins of the 1st and 2nd pairs is equal to that between subenteric ganglion and the fins of the 1st pair. Subsenteric ganglion is longer than the trunk part of the fins of the 2nd pair.

Materials. The holotype. The reference number is LP-8/1. It was found in Chazhma Bay, Peter the Great Bay, Sea of Japan; on February 29, 2000; in the surface water layer, at a negative water temperature.

Paratypes. Three specimens were found in the same sample as the holotype. The reference numbers are LP-8/2, LP-8/3, and LP-8/4.

Description of the holotype. Body is rigid and muscular. Head is wider than trunk; on genital septum there is no constriction. The specimen is at the 4th stage of maturity. Body is 5.2 mm long. Tail region and subenteric ganglion are 23.3 and about 12% as long as the entire body respectively. No digestive diverticula are present on midgut (trunk gut). The midgut is neither vacuolated, nor flattened dorsoventrally, however it is not straight, like that in all other species of the genus, but rather tortuous. Ciliary loop is short, arises immediately behind the level of eyes somewhat above the neck and is located equally on head and trunk. It has one pair of weakly pronounced medial protuberances. The anterior margin of the fins of the 1st pair is located behind the posterior margin of subenteric ganglion; the distance between the former and the latter is 2/5 as long as the ganglion itself. The fins of the 2nd pair are approximately 1.3 times longer than the fins of the 1st pair, which are about 19% as long as the body. The distance between the anterior margin of the fins of the 2nd pair and the posterior margin of the fins of the 1st pair is about 5% of the entire body length and equals the distance between subenteric ganglion and the fins of the

1st pair. The fins of the 2nd pair are more than 24.3% as long as the body; their tail part is 1.5 times longer than the trunk part. Tail fin is rounded, its length on the trunk is 5% of the total body length and approximately 21% of the length of tail region. The rays are incomplete only in lateral fins, whose anterior parts are entirely lacking rays. Vesicular tissue covers the entire body, from neck to caudal extremity, thickening on the dorsal side, at the level of subenteric ganglion and on the trunk, between the fins of the 1st and 2nd pairs. On the head there is one pair of setal rows and two pairs of dental rows. There are 8 spines, 6 anterior teeth, and 9 posterior teeth in each row. Each eye has in the central part a dark rectangular pigment spot. Seminal vesicles are elongated, about 4% as long as the body and 17% as long as tail region; they touch both lateral fins and tail fin. Ovaries reach the level of the anterior margin of the fins of the 1st pair.

Variability. The length of adult specimens ranges from 4.7 to 5.5 mm, while the relative length of tail region and subenteric ganglion may equal 22.5–24% and 11.5–13% of the entire body length, respectively.

Differential diagnosis. This species is similar to *L. exigua* sp. n., but differs in several characteristics. The most pronounced among the latter are the following: (1) the presence of zones devoid of rays in *L. ocis* sp. n.; (2) the arrangement of fins: in *L. ocis* sp. n. the distance between the fins of the 1st and 2nd pairs equals that between subenteric ganglion and the fins of the 1st pair, whereas in *L. exigua* sp. n. the former distance is longer; and (3) the subenteric ganglion in *L. exigua* sp. n. is shorter than the trunk part of the fins of the 2nd pair, whereas in *L. ocis* sp. n. the former is longer than the latter.

Remarks on biology. The condition of the gonads provides indirect information about the reproduction schedule, which seems to happen in December, at a negative water temperature. No adult specimens have been registered in the spring.

Etymology. "Ocis" means "quick" (Latin)

Oligoradiata entis sp. n.

(Figs. 2b, 2c)

Diagnosis. The distance between seminal vesicles and lateral fins is equal to that between the former and tail fin. Tail part of the fins of the 2nd pair is significantly longer (approximately 1.3 times) than their trunk part.

Materials. The holotype. The reference number is OLR-1/1. It was found in Chazhma Bay, Peter the Great Bay, Sea of Japan; on February 29, 2000.

Paratypes. Two specimens were found in the same sample as the holotype. The reference numbers are OLR-1/2 and OLR-1/14.

Description of the holotype. The body is rather flabby, longitudinal muscle bands are wide and clearly visible through the integument. Head is wider than trunk; on genital septum there is no constriction. The specimen is at the 3rd stage of maturity.

Body is 7 mm long. Tail region and subenteric ganglion are 24.4% and about 8.9% as long as the entire body respectively. Digestive diverticula on midgut are small, closely applied against the surface of the gut. The midgut is not vacuolated. Ciliary loop is short, arises behind the level of eyes and is rounded on head. It has only one pair of weakly pronounced medial protuberances. The anterior margin of the fins of the 1st pair is located behind the posterior margin of the subenteric ganglion; the distance between the former and the latter is 62.5% as long as the ganglion itself, which equals 5.7% of the entire body length. The fins of the 2nd pair are approximately 1.5 times longer than the fins of the 1st pair, which are about 17% as long as the body. The distance between the anterior margin of the fins of the 2nd pair, and the posterior margin of the fins of the 1st pair is about 8.5% of the entire body length and 1.5 times longer than the distance between subenteric ganglion and the fins of the 1st pair. The fins of the 2nd pair are more than 24.9% as long as the body; their tail part is approximately 1.3 times longer than the trunk part. Tail fin is rounded, its length on the trunk is 6.8% of the total body length and about 23% of the length of the tail region. Rays are absent not only in lateral fins, but also in tail fin; some cilia appear only in adult animals. No vesicular tissue is present. On the head there is one pair of setal rows and two pairs of dental rows. There are 7 spines, 6–7 anterior teeth, and 10–11 posterior teeth in each row. Each eye has in the central part a dark rectangular pigment spot. Seminal vesicles are elongated, about 2.5% as long as the body and approximately 8.5% as long as the tail region. The distance between seminal vesicles and lateral fins is equal to that between the former and tail fin and reaches 2.8% of the entire body length and about 10% of the length of the tail region. Ovaries are 4.3% as long as the body, they do not reach the level of the anterior margin of the fins of the 1st pair.

Variability. The number of rays in the fins of the 2nd pair and in tail fin can vary from 0 to 6.

Differential diagnosis. This species differs from *O. mitis* Kassatkina, 1971 in several characteristics. The most pronounced among the latter are as follows: (1) in *O. mitis* the trunk part of the fins of the 2nd pair is almost equally long (or somewhat shorter) than their tail part, whereas in *O. entis* sp. n. the latter is significantly longer (approximately 1.3 times) than the latter and (2) *O. mitis* has vesicular tissue and seminal vesicles in this species are located close to the tail fin. *O. entis* sp. n. shows similarities to *O. pellucida* Kassatkina et Selivanova, 2003, but differs from this species in several characteristics. The most pronounced among the latter are as follows: (1) in *O. pellucida* seminal vesicles touch the lateral fins, but are remote from the tail fin and (2) the anterior margin of the fins of the 1st pair in *O. pellucida* is located behind the level of the poste-

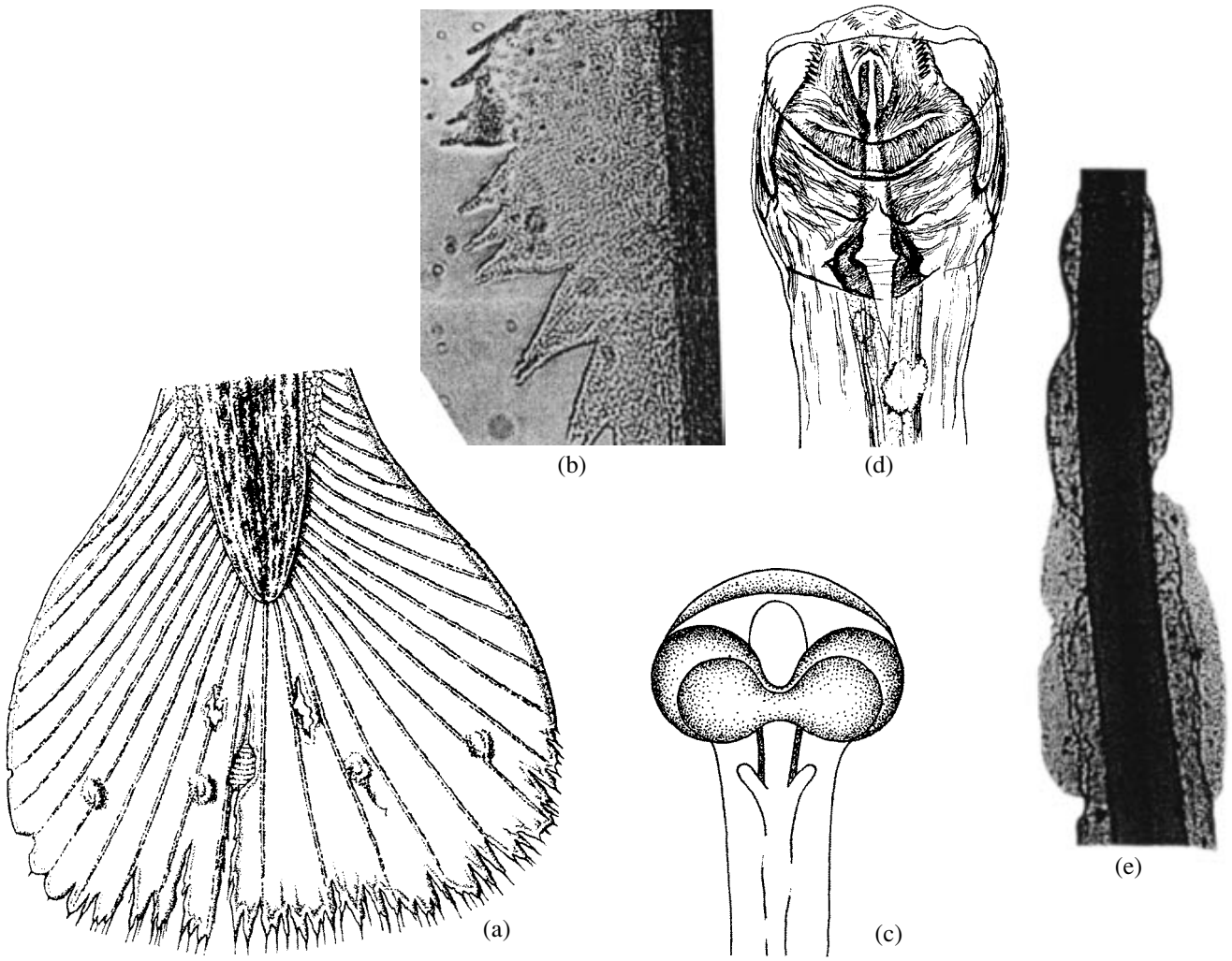

Fig. 3. Morphological abnormalities in arrowworms. (a) Tail fin (*L. exigua* sp. n.); (b) a part of lateral fin with damaged basal membrane (*L. icis* sp. n.); (c) head and a part of trunk, dental armament on the head is entirely lacking and intestine is partially damaged (*P. septicoela*); (d) Head and part of trunk, dental armament on the head is entirely retained, while the intestine is partially damaged (*L. exigua* sp. n.); (e) part of trunk region with abnormal area of vesicular tissue (*L. icis* sp. n.).

rior margin of the subenteric ganglion; the distance between the former and the latter is 1/4 as great as the ganglion itself.

Remarks on biology. The condition of the gonads provides indirect information about the reproduction schedule, which seems to happen in December, at a negative water temperature. No adult specimens have been registered in spring.

Etymology. "Entis" means "translucent" (Latin).

Description of Morphological Deviations in Arrowworms from Chazhma Bay

It is pertinent to note that the morphological deviations listed below are not mechanical injuries. The long-term practical experience of the authors of this paper clearly demonstrates that mechanical injuries could appear in arrowworms as a result of sample treatment by inexperienced technicians, who use forceps with straight tips and strongly squeeze an animal across the body. We treated the samples using either forceps with hooked tips or a pipette. It is particularly remarkable that in both the abnormal specimens collected from Chazhma Bay and specimens from geophysically active areas the most delicate and vulnerable organ of arrowworms, the ciliary loop, remained intact. This organ could easily be lost in the course of a careless mechanical transportation of the animals.

We treated many thousands of samples (collected in different areas, from the Atlantic to the East China Sea) and indeed nowhere have we registered such morphological deviations as those observed in the arrowworms from Chazhma Bay. On the other hand, in the arrowworms from Chazhma Bay we have never found the morphological abnormalities characteristic of animals inhabiting the waters of volcanic bays and seismically

active areas, such as changes in the pigment nuclear core (sometimes even the total reduction of eyes) and the lysis of muscles [4, 13].

The abnormalities that were registered most often in the arrowworms were as follows:

(1) Damage to the fin membrane along the edge, between rays. In this case the rays themselves usually remain intact and their tips usually protrude beyond the edge of the fin membrane (Fig. 3a). Sometimes, due to the damage to the membrane, the fin edges do not have the fringe of free rays (as shown on Fig. 3a), but rather look like a cock's comb (Fig. 3b). It is pertinent to note that in the case of mechanical damages not only the edge membrane is destroyed (sometimes involving the entire fin membrane), but the fin rays are also damaged, therefore such a picture could never be observed in mechanically damaged specimens. For the abnormal specimens from Chazhma Bay, the "cock's comb" is their most characteristic feature. It is particularly remarkable that in the damaged specimens of all species having regular dense fin rays the latter are retained in all fins, therefore we consider the pattern of fin rays as a taxonomic characteristic and their absence cannot be interpreted as an abnormality. This is evidently due to the fact that the rays consist of a denser substance compared with the membrane of the fin [10]. Such deviations occur in species having dense numerous rays in the fins, like *Leptosagitta ocis* sp. n.; *L. exigua* sp. n.; *L. icis* sp. n.; *L. nudata* Kassatkina, 1973; *L. collariata* Kassatkina, 1973; *L. ushakovi* Kassatkina, 1973; *L. eris* Kassatkina et Selivanova, 2003; *Aidanosagitta scarlatoi* Kassatkina, 1971; *A. macilenta* Kassatkina, 1971; *A. acus* Kassatkina et Selivanova, 2003; *A. pilum* Kassatkina et Selivanova, 2003; *A. murex* Kassatkina et Selivanova, 2003; *A. bella* Kassatkina et Selivanova, 2003; *A. venusta* Kassatkina et Selivanova, 2003; and *Parasagitta septicoela* Kassatkina, 1971. The destruction of the edge membrane in species that do not have dense rays in the fins causes the wide fin to look like a narrow stripe or even disappear entirely. This happened in species of the genus *Oligoradiata* and also in *L. alba* Kassatkina et Selivanova, 2003.

(2) Destruction (thinning) of the basal membrane. In this case the setae and teeth break away, out of the head. Sometimes they are entirely lost and a picture that is strange for the members of the phylum Chaetognatha might be observed, a "bald" head lacking dental armament (Fig. 3c). It is remarkable that the head musculature is retained in this case (unlike, for example, the specimens from a geophysically active area of Kraternaya Bay). Such abnormal specimens were found in species of the genus *Leptosagitta* (*L. exigua* sp. n. and *L. icis* sp. n.) and *Parasagitta* (*P. septicoela*).

(3) Disintegration of the intestinal epithelium (Figs. 3c, 3d). It is known that in arrowworms from the areas of high geophysical activity the tissues of intestinal and skin epithelia are retained entirely [4]. The disintegration of the intestinal epithelium in arrowworms has never been observed in any of the ecologically unfavorable regions. Mechanical damage to the intestine is possible during the treatment of samples even if the animal is squeezed strongly with forceps; however, in the latter case the tissues of the body wall would also be damaged. In Chazhma Bay we registered specimens that had absolutely intact tissues of the body wall, but the intestine was damaged (*P. septicoela* and *L. exigua* sp. n.).

(4) Disintegration of vesicular tissue; some cells of the latter fall away, so that the edges of the vesicular sheath become not smooth, but rather "corroded" (Fig. 3e). Such deviations occur in species having well-developed vesicular tissue, like *Leptosagitta ocis* sp. n.; *L. exigua* sp. n.; *L. icis* sp. n.; *L. nudata* Kassatkina, 1973; *L. collariata* Kassatkina, 1973; *L. ushakovi* Kassatkina, 1973; *L. eris* Kassatkina et Selivanova, 2003; *Aidanosagitta scarlatoi* Kassatkina, 1971; *A. macilenta* Kassatkina, 1971; *A. acus* Kassatkina et Selivanova, 2003; *A. pilum* Kassatkina et Selivanova, 2003; *A. murex* Kassatkina et Selivanova, 2003; *A. bella* Kassatkina et Selivanova, 2003; and *A. venusta* Kassatkina et Selivanova, 2003.

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