Nematodes in meiofauna of the Large Aral Sea during the desiccation phase: taxonomic composition and redescription of common species

Vadim O. Mokievsky[1] and Maria A. Miljutina[2]

[1]P.P.Shirshov Institute of Oceanology RAS, Nachimovsky prosp. 36, Moscow, 117997, Russia
e-mail: vadim@ocean.ru
[2] Senckenberg Gesellschaft für Naturforschung , Senckenberg am Meer, DZMB, Südstrand 44, D-26382 Wilhelmshaven, Germany

Accepted for publication 12 November 2010

Summary. The taxonomic composition of meiobenthos with special reference to free-living nematodes is described for the Large Aral Sea at the intermediate stage of desiccation (year 2003). Water salinity at the time of sampling was about 89‰; meiobenthos was collected quantitatively at depths of 10 and 15 m. Twelve species of free-living nematodes were found, the dominating complex includes *Thalassomonhystera parva, Monhystera* sp. 2 and *Ethmolaimus multipapillatus.* The taxonomic composition on different taxonomic levels was tested in comparison with the Caspian Sea fauna and nematode fauna of inland brackish lakes of Central Asia (Issyk-Kul and Chany). It was concluded that the nematode fauna of Large Aral shows more similarities with Caspian fauna than with the faunistic composition of other inland lakes. Redescriptions of two common species *Thalassomonhystera parva* and *Ethmolaimus multipapillatus* are given.

Key words: Aral sea, *Ethmolaimus multipapillatus,* hyperhaline, meiobenthos, nematodes, Nematoda, salt lakes, *Thalassomonhystera parva*.

The Aral Sea, the former fourth large inland water body, is subjected to drastic changes in water input, sea level decrease and rapid increase of water salinity. These changes began in the 1960s when the surface water regime in the Middle Asia was altered by irrigation. In 1988-89 the sea became divided into two parts on the latitude of the Berg Strait: the northern the Small Aral and southern the Large Aral, which since then had developed separately.

The overall drop in level now approaches 23-24 metres with sea level now about 30 m above the ocean level. The maximum depth in the western part of the Large Aral sea decreased from 63 to 40 m. Since 2003-2004 the Large Aral Sea almost became split into a deep western basin and shallow eastern basin connected by a narrow channel on the north. Since 2009, due to further decrease of sea level of about 1 m, the channel has been closed and the eastern basin begun to shrink.

The sea water salinity increased continuously with the water loss. In 1960, salinity has a mean value of 10‰ and did not exceed 12 ‰. In 2003, the salinity of the Large Aral Sea approached 80-92‰ in the western basin and up to 110‰ in the eastern basin. A detailed description of hydrological changes of the Large Aral is given by Zavyalov and co-authors (Zavyalov, 2005; Zavyalov et al., 2009).

The drastic changes of salinity were followed by obvious alterations in the biota of the sea. Formerly inhabited by brackish water fauna, the Large Aral Sea lost most of the native species over recent decades. During the early stages of desiccation several macrobenthic species still occurred in the Large Aral Sea (Aladin & Plotnikov, 2008). The last macrobenthic species was *Sindosmya segmentum* Recluz, 1843 (Bivalvia), which had been reported from the Large Aral Sea until 2003 (Sapozhnikov et al., 2010). Since 2004 when salinity approached 90‰ no macrobenthic species had been found in the Large Aral Sea and metazoans in benthos are represented only by meiobenthic organisms.

Detailed oceanographic and biological observations have been conducted on the Large Aral Sea yearly since 2002. Meiobenthos abundance and distribution for 2003 and 2004 were described by Mokievsky (2009) for groups at a high taxonomic level. The present paper gives the first data on nematodes assemblages of Large Aral Sea and redescriptions of the two most abundant species.

MATERIAL AND METHODS

Benthic samples were collected in October 2003 from two stations in the West basin of the Large Aral Sea at depths of 10 and 15 m below actual sea level. Salinity there at the time of sampling was about 89‰ (Table 1, Fig. 1). Sediments were muddy sand, often covered by a sodium chloride crust several millimetres thick.

Table 1. Stations locality and environment.

Station №	Longitude	Depth, m	Water characters for near-bottom layer	
			Salinity, ‰	Temperature, C^o
11.2	58°13`55”E	10	88.88	13.55
11.3	58°13`53”E	15	89.73	13.65

Sediment samples were taken from a motorboat with hand-operated bottom grab of 1/80 m^2 inner size. On each cast five subsamples of 1 cm^2 were taken by tube sampler (a cut-off syringe of 10 cm^3) to a depth of 1-5 cm depending on the sediment conditions. The material was preserved in 4% neutralized formaldehyde, which had been made up using the Aral Sea surface water. In the laboratory samples were stained overnight with Rose Bengal and then sieved through a set of sieves of 32, 63, 125, 250 and 500 µm mesh size. All meiofauna groups were counted and then recovered for further identification. Nematodes were transferred into Seinhorst solution (Seinhorst 1959) and after 2-3 days were mounted in glycerol on permanent slides. The microscopic investigations were conducted using Olympus CX-41 and Leica DM2500 microscopes equipped with *camera lucida*.

Because of the large number of nematodes in the sample, subsets were picked from each sample for further microscopy study. The subsets comprised 167 individuals for station 11.2 and 163 specimens for station 11.3. All calculation were done in software packages PAST v. 2.0 (for diversity estimations; Hammer *et al*., 2001) and Primer v.6 (Clarke & Warwick, 1994) for calculation the taxonomic distinctness and related statistics. Statistical analysis include the routine diversity estimations, comparisons using similarity measures and biodiversity statistics for taxonomic distinctness analysis as described by Clarke and Warwick (1998a, 1998b) and Warwick *et al*.(2002). Schematic map on Fig. 1 was generated by PanMap.

In species descriptions the following abbreviations are used, and all dimensions are given in µm:

a – body length divided by maximum body diameter;

am.w., – amphid width;

am.w., % – amphid width as percentage of corresponding body diameter, %;

b – body length divided by pharyngeal length;

c – body length divided by tail length;

c.s. – length of cephalic sensilla;

diam.c.s. – body diameter at the level of cephalic sensilla;

diam.am. – body diameter at the level of amphids;

diam.n.r. – body diameter at the level of nerve ring;

diam.c. – body diameter at the level of cardia;

diam.midb. – mid-body diameter;

diam.an. – body diameter at anus level;

dis.am. – distance from cephalic apex to the anterior rim of amphid;

dis.e.p. – distance from cephalic apex to excretory-secretory pore;

dis.n.r. – distance from cephalic apex to nerve ring;

dist. tail part – absolute length of posterior cylindrical tail portion;

dist. tail part.%—length of posterior cylindrical tail portion as percentage of the entire tail length;

gub.ap. – length of apophysis of gubernaculum;

gub. l. – gubernaculum length;

L – body length;

o.l.s. – length of outer labial sensilla;

spic.arc – spicule length along the arch;

spic.chord – spicule length along the chord;

st.l. – total stoma length;

st.w. – maximal stoma width;

supl.h. – precloacal supplement height

supl.l. – precloacal supplement length;

supl.n. – number of precloacal supplements;

tail l., a.d. (%) – ratio of tail length to anal diameter;

V – distance to vulva from anterior end as percentage of body length, %.

RESULTS AND DISCUSSION

Abundance and taxonomic composition of meiobenthos. The quantitative data of meiobenthos are given in Table 2. Nematodes were the most abundant taxa followed by ostracods and harpacticoid copepods. Also, Chironomidae larvae were found in significant numbers and several Turbellarians were recognized in the material. The latter, however, are usually seriously damaged in fixation and their real

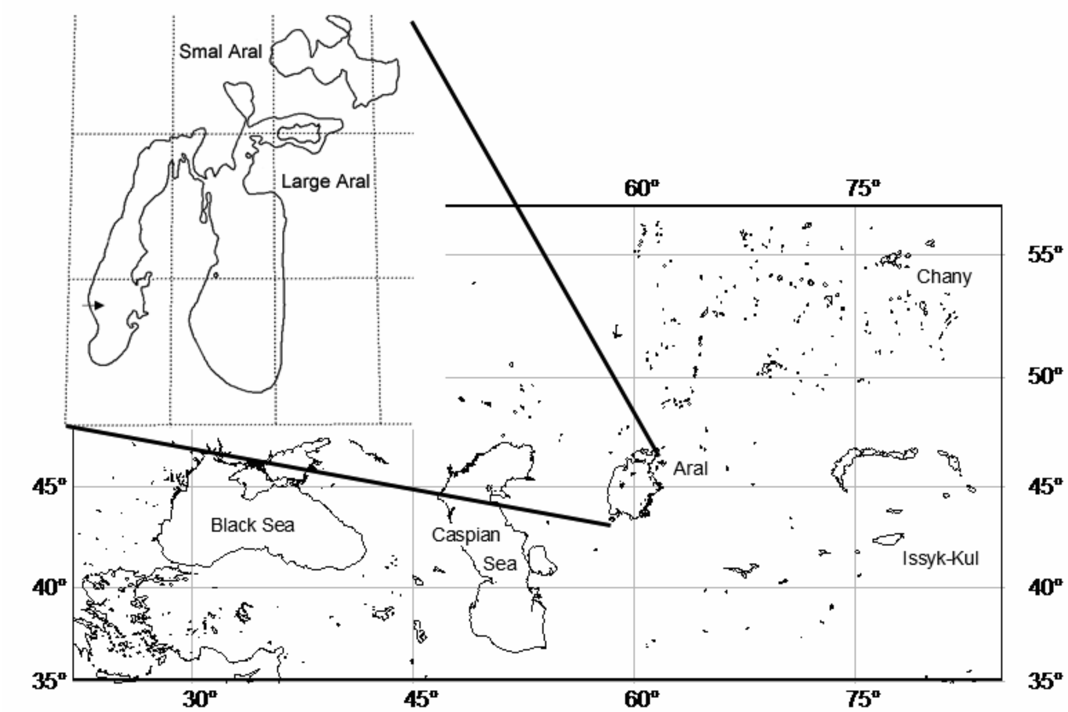

Fig. 1. Schematic map of South Europe and Central Asia with water bodies discussed in the text. The boundary of the Aral Sea on the base map is given as it was before desiccation; the configuration of the Large Aral Sea for year 2003 is shown in the upper left corner with the sampling area marked by arrow.

Table 2. Abundances of main meiofaunal taxa (ind./ 10 cm^2) at the investigated stations.

Station	Foraminifera	Nematoda	Harpacticoida	Ostracoda	Turbellaria	Chironomidae
11.2	72	1440	20	174	0	36
11.3	6	500	10	40	4	16

abundance could be much greater. The unicellular meiobenthos was represented by agglutinated foraminifera and unidentified ciliates.

Harpacticoid copepods were represented by a single species, *Cletocamptus retrogressus* Schmankevitch, 1875 (identified by D. Kondar). The single species of Chironomidae was identified as *Baeotendipes noctivaga* (Kieffer, 1911) (identification confirmed by N. Polukonova), and the foraminiferan was *Birsteiniolla macrostoma* (Yankovskaya & Mikhalevich, 1972). The harpacticoid copepod *C. retrogressus* is widely distributed Palearctic species, being known from Spain, Algeria, Iran, Turkey and Central Asia (Hammer, 1986). It was recorded from the Aral Sea before desiccation (Morduchai-Boltovskoi, 1974). The chironomid *B.noctivaga* is a very variable species which inhabits the Palearctic salines with mineralization of up to 247‰ (Belyanina & Polukonova, 2009). In the Large Aral Sea it was found in 2002-2008 and was regarded as a new invader of the desiccation stage of the sea (Sapozhnikov *et al.*, 2010). The agglutinated foram *B. macrostoma* was described by E. Mayer (1974) from the Aral Sea at its brackish stage.

Table 3. Nematode taxonomic composition - relative abundance (%%) on stations.

Species	11.2	11.3	Total
Thalassomonhystera parva	49.7	65.6	57.6
Monhystera sp.2	26.9	16.0	21.5
Ethmolaimus multipapillatus	13.8	6.1	10.0
Sphaerolaimus sp. 1	6.0	6.1	6.1
Sphaerolaimus sp. 2	1.2	0.0	0.6
Monhystera sp.3	0.6	0.6	0.6
Alaimella sp.	0.0	0.6	0.3
Chromadorina sp.	0.0	0.6	0.3
Dichromadora sp.	0.0	1.2	0.6
Enoplolaimus sp.	0.0	0.6	0.3
Hypodontolaimus sp.	0.0	0.6	0.3
Microlaimus sp.	0.0	0.6	0.3
Unknown	1.8	1.2	1.5

Nematodes were the most species diverse group among the meiobenthos, twelve species being found in the material (Table 3). Two species were sufficiently common and included adults of both sexes

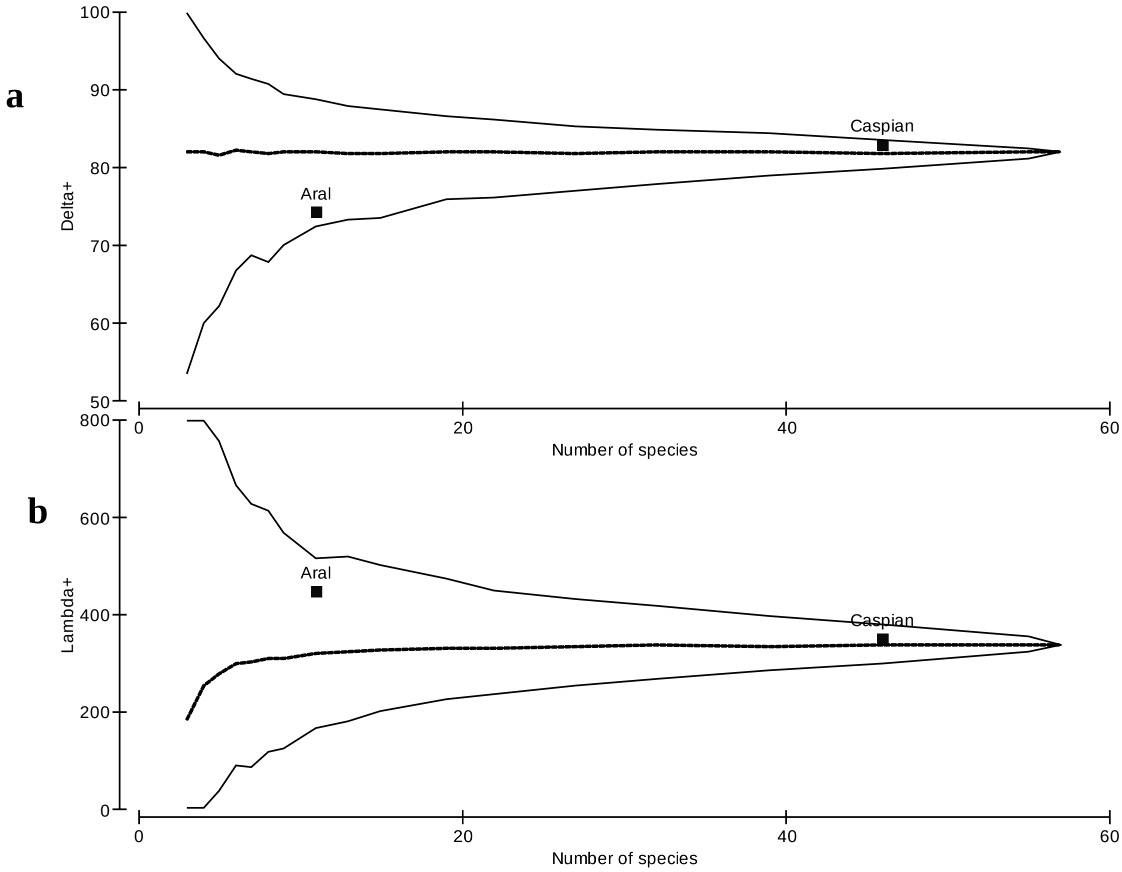

Fig.2. Taxonomic distinctness (a) and relative taxonomic distinctness (b) of Large Aral Sea nematode fauna in comparison with that of the Caspian Sea fauna. Mean values of Delta$^+$ and Lambda$^+$ (bold lines) are shown together with upper and lower 95% confidence limits (fine lines). The exact positions of Caspian and Aral faunas are marked by squares according to correspondent species number.

to make an accurate description possible. The second most abundant species from the genus *Monhystera s.l.* was represented by juveniles and adult females.

In terms of relative abundance there were three species in the dominating complex – *Thalassomonhystera parva* (Bastian 1885) Jacobs 1987, *Monhystera* sp. 2 and *Ethmolaimus multipapillatus* Paramonov 1926. The pattern of dominance was similar at both stations. There were twice as many species at the deeper station and diversity measurements reflected this (Table 4). The structure of species assemblages was similar at the two stations in terms of species composition and their rank distribution. The first dominating species (*Thalassomonhystera parva)* made up about 50 to 65% of the total abundance, and the second species (*Monhystera* sp.2) comprised 16 to 30%; the relative abundance of the third species (*Ethmolaimus multipapillatus)* varied from 6 to 14%. One of two *Sphaerolaimus* species also approached this value (6%). The remaining species constituted about 1% of total abundance or less. This very simple structure of the assemblage, characterised by high level of dominance and low diversity, is regarded as a result of the hypersalinity of the basin.

Table 4. General characters of the nematodes community of the Large Aral.

Species	Stations		
	11.2	11.3	Total set
Number of Taxa (S)	7	13	14
Number of Individuals	167	163	330
Dominance (D)	0.3	0.5	0.4
Shannon (H)	1.3	1.2	1.3
Simpson (1-D)	0.7	0.5	0.6
Evenness ($e^{H/S}$)	0.52	0.26	0.26

Composition and geographic relations of nematodes fauna. Unfortunately, data is available neither for meiobenthos abundance nor for nematodes taxonomic composition for the period prior to desiccation. The only nematodes species previously reported from the Aral Sea is *Adoncholaimus*

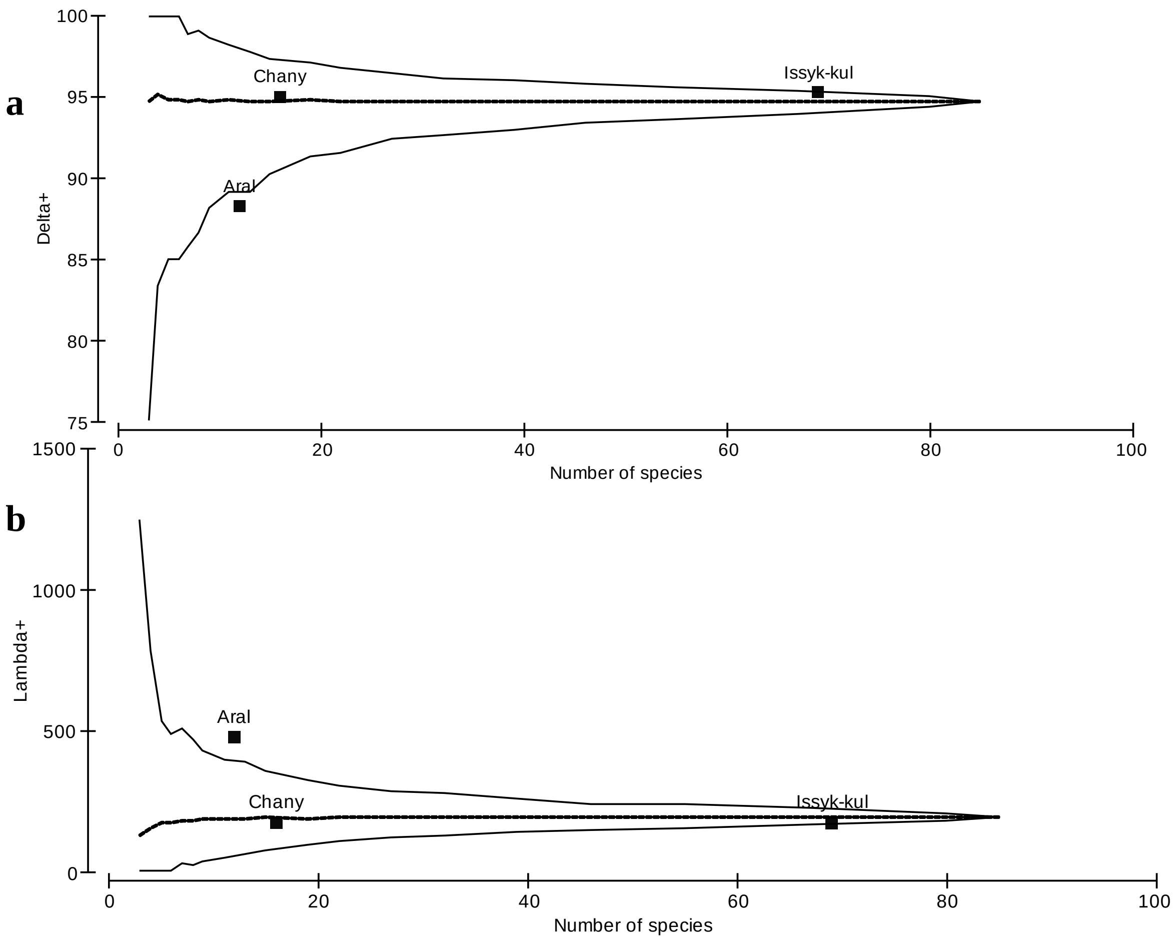

Fig. 3. Taxonomic distinctness (a) and relative taxonomic distinctness (b) of the Large Aral Sea nematode fauna in comparison with combined faunal lists for the Issyk-Kul and Chany lakes. Mean values of Delta$^+$ and Lambda$^+$ are shown together with 95% confidential funnel by the same way as on Fig. 2. The exact positions of local faunas are marked.

aralensis Filipjev, 1924 (Morduchai-Boltovskoi, 1974).

To understand the origin and possible relations of the nematode fauna of the Large Aral Sea we compared it with three sets of faunistic data from the Caspian Sea (Tchesunov, 1979 with further corrections by Tchesunov, pers. comm) and two lake systems in Central Asia – Issyk-Kul (Tokobaev & Lemzina, 1986) and Chany (Gagarin & Medvedev, 1987). The nematode taxonomy for these lists has been revised in accordance with Tchesunov (2006) and Gagarin (1993). For Issyk-Kul lake, the list includes 69 species whilst 16 species were reported from the Chany lake system (which includes three lakes with salinity from 1 to 7‰), and 50 species are known so far from the Caspian Sea.

To trace the relations of nematode fauna of the Large Aral Sea with those of the Caspian Sea and with nematode fauna of inland Central Asia salt lakes we use the taxonomic distinctness (Delta$^+$) and relative taxonomic distinctness (Lamda$^+$) indices as they are realised in Primer v.6 (see Platt & Warwick, 1994, 1998, 1998a for formulas and the details of the method and Warwick et al., 2002 for realisation of the method for a similar task). The first test shows the probability of given set of species to be a random selection from a certain faunistic complex. In our case, the list of the Large Aral Sea nematode fauna was compared with Caspian fauna and then with the joint list of nematodes from Issyk-Kul and Chany. The second test (Lamba$^+$) was used to check whether any of higher taxa are either over- or under-represented in the Large Aral Sea in comparison with faunas of the nearest known salt basins. The results are shown in Figures 2 and 3. When compared with Caspian fauna, the Large Aral Sea nematodes fit within 95% confidence limits of both parameters. On the taxonomic distinctness plot (Fig. 2a) the value for the Large Aral Sea fell within 95% confidence limits for Caspian fauna. Thus, the

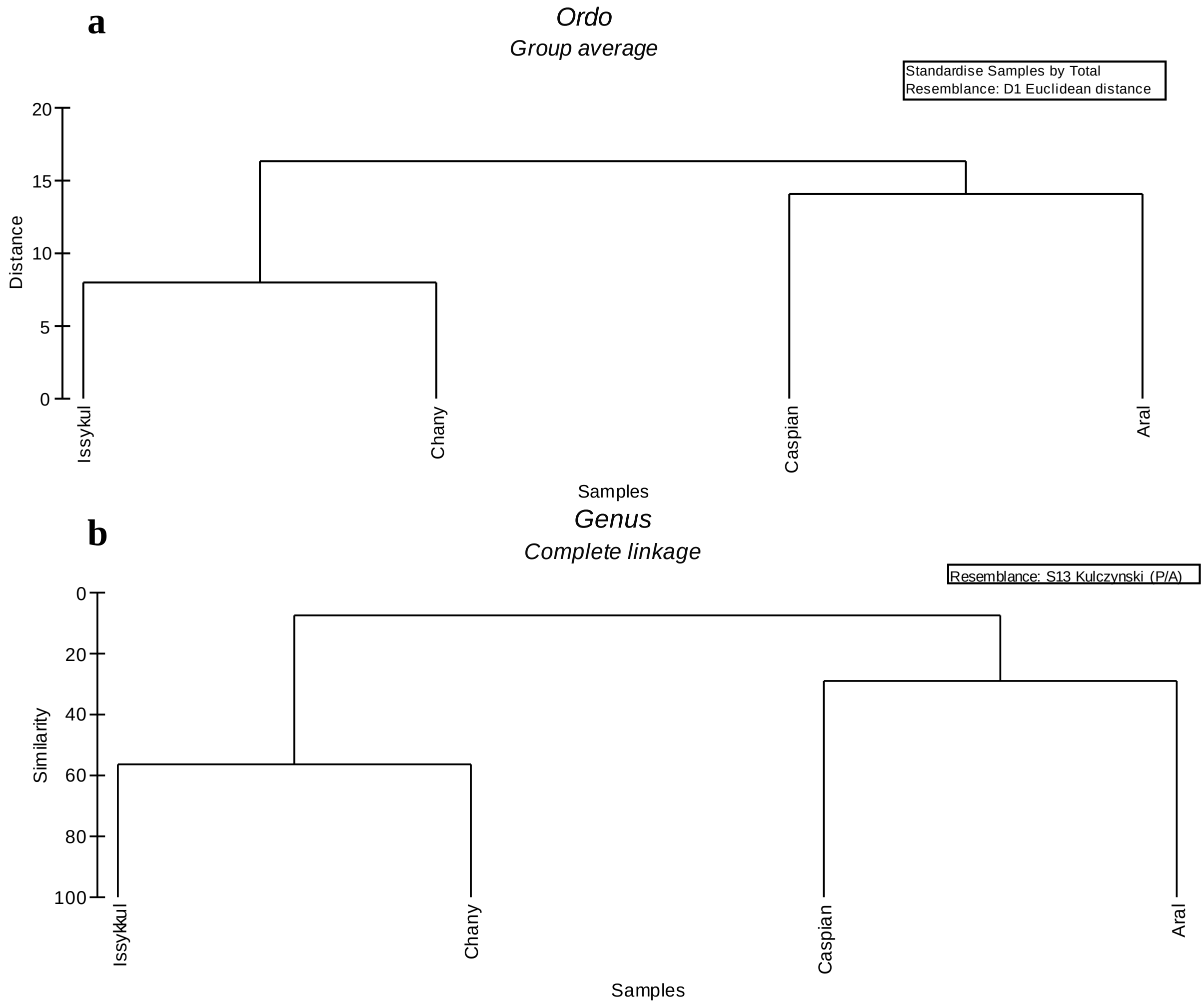

Fig. 4. Similarity in taxonomic composition on two levels: genera (a) and ordo (b) within local faunistic complexes of Issyk-Kul, Chany, Caspian and Aral. The similarity measure for (a) is Kulczynski index for presence-absence data, complete linkage clustering. On fig. b Euclidean distance calculated for each region using species richness of each ordo in percent of total number of species.

observed faunal composition in the Large Aral Sea does not differ significantly from the set of twelve nematodes randomly selected from the list of the Caspian Sea. The relative taxonomic distinctness test (Fig. 2b) confirms that there is no over- or underrepresented high taxa within Lager Aral Sea taxa, when compared with Caspian fauna – that is, the relative representation of taxa is similar in Large Aral and Caspian Seas.

The comparison of the Large Aral Sea fauna with the combined list from Issyk-Kul and Chany lakes shows less similarity in taxonomic composition (Fig. 3). The Large Aral Sea fauna is taxonomically distinct from both Issyk-Kul and Chany lists. The latter two faunas look similar when the four-fold difference in total species number is ignored. In terms of average taxonomic distinctness and relative taxonomic distinctness the set of Large Aral Sea nematodes differ greatly from inland lakes' fauna. In both cases it fell outside the 95% confidence range. The composition of the fauna that we found in the Large Aral Sea could not be found in any random replicate from Chany and Issyk-Kul lake systems (Fig. 3a). Also, some of higher taxa are overrepresented in the Large Aral Sea (Fig. 3b). So, the set of species that had been found in Large Aral Sea in 2003 could be interpreted as a remnant of former, more diverse fauna closely related to that in the Caspian Sea.

The direct comparison of different levels of taxa gives the same but less distinct results. At the generic level using Kulczynsky similarity index for present/absent data ($C = (M/(M+N_1) + M/(M+N_2))/2$, where M is the number of species common for two data sets, and N is the number of unique species in each set) the regions are linked in two clusters, one

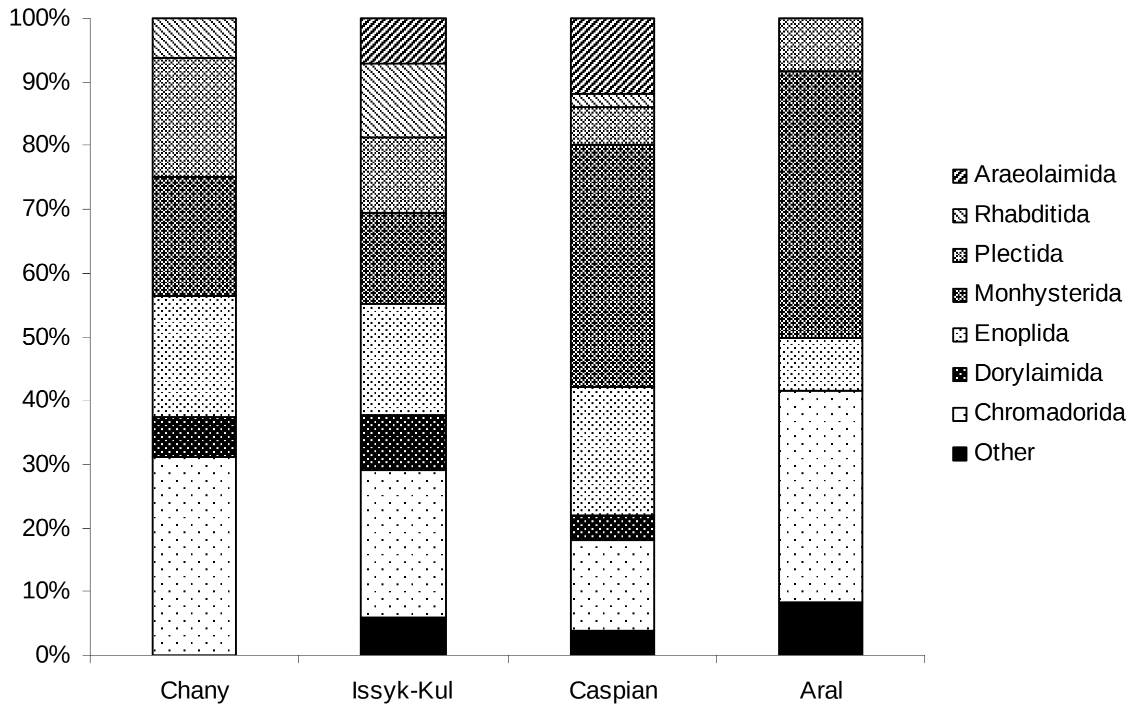

Fig. 5. Taxonomic composition on the level of orders as a percentage of total species diversity for each region.

includes Issuk-Kul and Chany at a high level of similarity and the second combines the Large Aral Sea and Caspian faunas at the low level of similarity (Fig. 4a). The composition of families varied greatly from site to site and is unique for each area (Table 5). In each area combination of families is different and the set of most diverse families is also variable. The clustering does not provide any stable combinations. The composition at the high taxonomic levels again highlights more similarity between the Large Aral and Caspian Seas faunas, which is different from the Asian inland lakes (Fig 4b, 5).

Table 5. Leading families in taxonomic spectra of Aral, Caspian, Issyk-Kul and Chany water bodies. The figures show the percent of each family from total number of species. Two most divers families from each area are marked by bold.

	Issyk-Kul	Chany	Caspian	Aral
Chromadoridae	**15.9**	6.2	**10**	**25**
Monhysteridae	**8.7**	0	8	**41.7**
Xyalidae	5.8	**18.8**	**20**	0
Leptolaimidae	4.3	**12.5**	4	8.3

The nematode fauna of the Large Aral Sea in 2003 can been regarded as a remnant of more diverse set of species related to the Caspian Sea fauna. The only species formerly known from the Aral Sea was not found there in the limited sampling of 2003. The observed species richness (12 species) found in 2003 when the salinity was 89‰ is similar to those found in another hypersaline water body – the Salton Sea with 49‰ (Warwick *et al.*, 2002). Faunistic similarity between the Large Aral Sea and the Caspian Sea nematode assemblages leads to the conclusion that prior to the desiccation phase the Aral nematodes fauna was more diverse and resembled that of the Caspian Sea. With the increase in salinity the number of species declines more or less proportionally within the decline at the higher taxonomic levels; no one family or order was more successful in adaptation. Also, apart from one probable candidate (*Ethmolaimus multipapillatus*), no other hyperhaline invaders were found in the Large Aral Sea. The continuing desiccation and mineralisation will apparently lead to further loss of diversity in nematodes which, however, are the group of meiobenthos most resistant to hypersaline conditions (Jensen, 1986; Warwick *et al.*, 2002).

REDESCRIPTIONS

Ethmolaimus multipapillatus Paramonov 1926
(Figs. 6 -7; Table 6)

Literature: Paramonov 1926: 50-53, 56, Figures 3-3e; Gerlach 1951: 8-10, Figure 5 a-c; Caspers

1952: 244; Gerlach 1957: 141, Figures 3 a-c; Kunz & Kunz 1973: 54-55; Decraemer & Coomans 1978: 504; Platt 1985: 139-141, Figure 1; Jensen 1994: 7, Figures 2,6.

Material: 8 males, 6 females and 9 juveniles.

Locality: Aral Sea, 44º84′14″N, 58º23′14″E, depth 10-15m, silt covered by salt crust. October, 2003.

Body elongate, cylindrical, very slightly narrowed to the anterior end and posterior to anus. Cuticle ornamented with transverse rows of dots without lateral differentiation, but the rows anastomose laterally in midbody region. Inner, outer labial and cephalic sense organs papilloid. Somatic setae few in number, anteriormost ones situated sublaterally on dorsal body side. Amphideal fovea spiral with 2 turns.

Mouth opening surrounded by twelve rugae. Buccal cavity consists of two portions: 3-4 µm long cup-shaped cheilostom with weakly sclerotized walls and 16-19 µm long cylindrical oesophagostom with strongly sclerotized walls. Three teeth at the junction between two portions: one large dorsal tooth and two slender and less sclerotized subventral teeth. Pharyngeal musculature surrounding buccal cavity, posteriorly pharynx enlarged into oval bulb. Cardia big, triangular. Nerve ring situated at the level of posterior half of the pharynx. In specimen on the figure ventral gland and ventral pore not observed though in other specimens ventral pore located posterior to nerve ring. Tail conical.

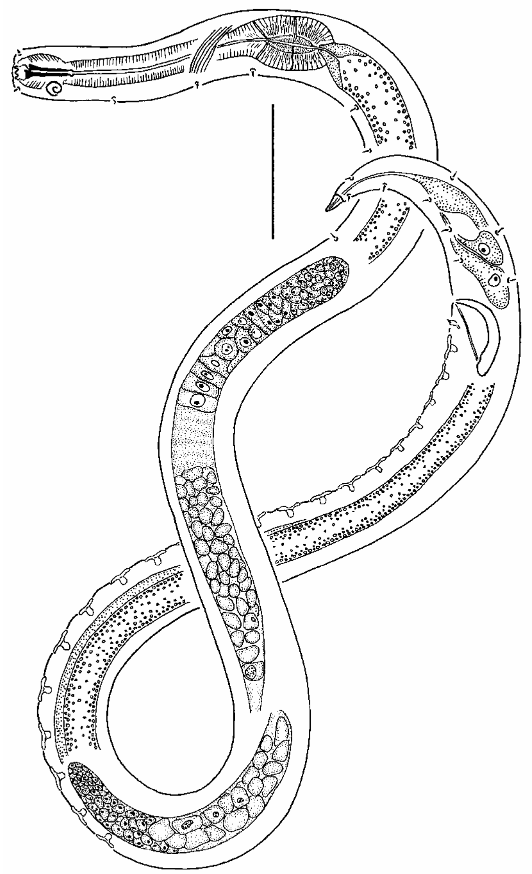

Fig. 6. *Ethmolaimus multipapillatus* Total view, male. Scale bar: 50 µm.

Table 6. Morphometrics of *Ethmolaimus multipapillatus* specimens. (All measurements are in µm unless otherwise stated, except a, b, c and c').

	1♂	2♂	3♂	4♂	5♂	1♀	2♀	3♀	4♀	5♀
L	902	872	979	887	850	865	977,5	910	793	827
a	29	21.8	19.6	17.7	18.9	25	19.6	16.2	17.6	16.5
b	7	7.1	8.2	7.6	7.1	7.4	8.0	7.2	7.5	7.0
c	9.4	9.9	11.1	10.1	9.4	11.1	10.1	9.3	9.6	8.0
V %	-	-	-	-	-	47	51	52	51	49
diam.c.s.	15	14	15	15	14	12	13	16	12	13
diam.am.	17	17.5	20	18	20	16	20	21	19	18
diam.n.r.	21	24	31	28.5	29	24	28	34	29	29
diam.c.	24	26.5	35	33	35	26.5	34	41	35.5	39
diam.midb.	31	40	50	50	45	35	50	56	455	50
diam.an.	23	25	28	28	28	22	26.5	32	25	28
c.s.	1	1.5	1	1	1	1	1	1	1	1
am.w.	5	5	6	5.5	5.5	4	4.5	5	4.5	4.5
am.w. %	29	29	30	30.5	30	25	22.5	24	24	25
dis.am.	11.5	12	15	10.5	11.5	10	13	10	11.5	10.5
st.w.	11	11	14	14	11	10	13	14	12	12
st.l.	22	22	21	20	22	21.5	22	21	21	21
spic.chord	30.5	27.5	29.9	31.7	31.1	–	–	–	-	-
spic.arc	37.1	37.4	39	37.7	40	–	–	–	-	-
supl. l.	9	10	10.5	11	9	–	–	–	-	-
supl. h.	3	3	3	3	3	–	–	–	-	-
supl.n.	21	19	21	19	19	–	–	–	-	-
tail l., a.d.	4.2	3.5	3.1	3.1	3.2	3.5	3.7	3.1	3.3	3.7

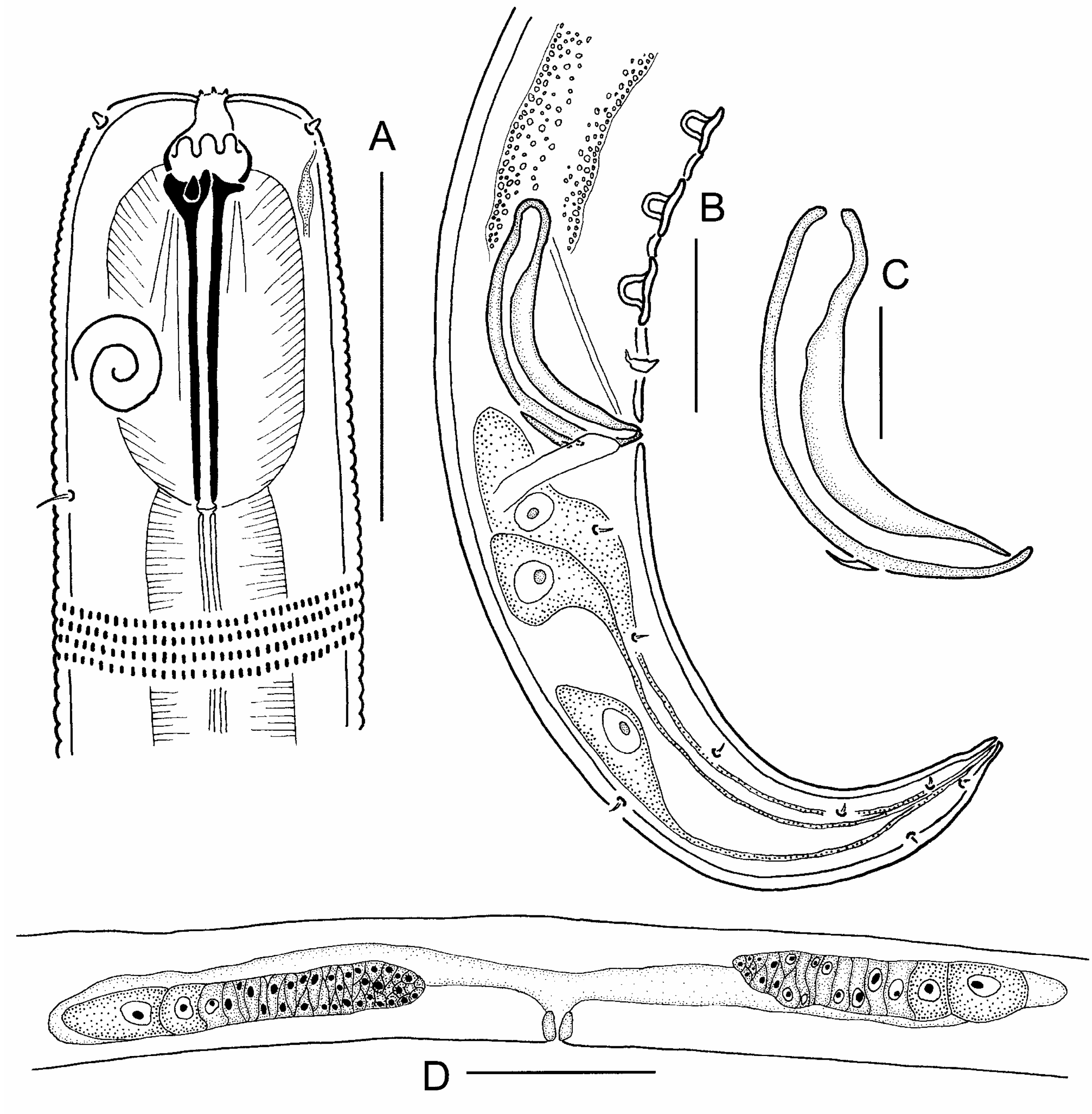

Fig. 7. *Ethmolaimus multipapillatus* A, anterior end, male; B, tail, male; C, spicule, male; D, female reproductive system. Scale bars: A, B – 20 μm; C – 10 μm; D – 50 μm.

Ovaries paired, reflected. Vulva situated in the body middle. Testes opposite and outstretched; anterior branch to the left (or below) of the intestine, posterior branch to the right. Spicules slender and curved. Gubernaculum small, rod-shaped. Nineteen to 21 preanal cup-shaped supplements. Single minute seta in front of cloaca. Three caudal glands.

Discussion. Morphology of present specimens from the Large Aral Sea corresponds well with the original description by Paramonov (1926) made on material from the salines of the Kinburnskaja Spit (the Black Sea), except for some details as a presence of few short somatic setae and a gubernaculum in our specimens which were not observed by Paramonov. Platt (1985) in the redescription of *E. multipapillatus* also mentioned the presence of a gubernaculum. All differences could be explained by the improved quality of modern optical instruments.

Geography. This species is adapted to hypersaline basins and was previously found mainly in hypersaline lakes and lagoons. *Ethmolaimus multipapillatus* is known from the salines of the Kinburnskaja Spit (Black Sea) (Paramonov, 1926), the evaporation pond of a saltworks on the Black Sea coast (Caspers, 1952), a hypersaline lake in Malaga (Spain) (Jensen, 1994); a sandy shore of hypersaline lagoon (270‰ S) of Namibia (Kunz & Kunz, 1973; Platt, 1985; Jensen, 1994), mangrove swamps of Brazil (as *E. cf. multipapillatus*; Gerlach, 1957) and from Australia (Decraemer & Coomans, 1978).

Table 7. Morphometrics of *Thalassomonhystera parva* specimens. (All measurements are in μm unless otherwise stated, except a, b, c and c').

	1♂	2♂	3♂	4♂	5♂	1♀	2♀	3♀	4♀	5♀
L	567	537	555	587	591	546	596	588	501	593
a	24.6	30	20.5	23.5	26.9	24	27.1	24.5	25	23
b	6.2	6.0	5.5	5.7	5.8	5.7	5.8	5.8	5.3	5.7
c	6.1	6.0	5.9	6.05	6.4	5.1	5.5	5.3	5.6	5.3
V	–	–	–	–	–	54	61	56	60	58
diam.c.s.	8	9	8	8	8.5	8	9	9	9	9
diam.am.	10	10	10,5	10	11	10.5	11	11	10	13
diam.n.r.	14.5	14	17	16	14	15.5	15	15	14	18.5
diam.c.	17	15	20	20	17.5	18	17	17.5	14.5	21
diam.midb.	23	18	27	25	22	23	22	24	20	25.5
diam.an.	16	15.5	17.5	15.5	16	16	14.5	15	13.5	17
o.l.s.	4	3	3.5	3.5	3	3	3	3	2.5	2.5
c.s.	4	3	3.5	3.5	3	3	3	3	2.5	2.5
am.w.	3	4	3.5	3.5	3.5	4	3	3	3	3.2
am.w. %	35	40	33	35	32	38	27	27	30	25
dis.am.	10	10	10	10	10.5	8.5	11	8.5	8.5	12
dis.e.p.	?	?	28	35	36.5	?	?	62	35	35
dis.n.r.	59	52.4	63.5	63	62	59	60	71	59	65
st.w.	4	4	4	4	4	3	3.5	3.5	4	4.5
st.l.	3.5	3.5	4	4.5	3.5	3	4	4	3	5
spic.chord	20.1	21.6	21.6	21.2	21.9	–	–	–	-	-
spic.arc	23.6	25	25	25.5	24.5	–	–	–	-	-
gub.l.	?	5	7.5	6	?	–	–	–	-	-
gub.ap.	?	6.5	8.5	8	?	–	–	–	-	-
tail l., a.d.	5.8	5.8	5.4	6.25	5.75	6.7	7.4	7.4	6.6	6.5
dist. tail part	39	31	37	41	39.5	43	44	53	37	68
dist. tail part%	42	34	39	42	43	40	41	48	42	61

Thalassomonhystera parva (Bastian 1885) Jacobs 1987 (Fig. 8; Table 7)

Literature: for reference see Gerlach & Riemann, 1973-1974; Jacobs, 1987; Fonseka & Decraemer, 2008.

Material. 22 males, 32 females, 71 juveniles.

Locality. Aral Sea, 44º84′14″N, 58º23′14″E, depth 10-15m, silt covered by salt crust. October, 2003.

Body slender, slightly spindle-shaped. Cuticle smooth. Somatic setae short, few in number. Labial papillae not discernible. Outer labial setae and cephalic setae located in one circle of ten equal tiny setae approximately 2.5-4 μm long. Amphideal fovea circular with distinct cuticular edging. Buccal cavity cup-shaped, weakly sclerotized. Pharynx with radial muscular striation, plainly widening to the posterior end. Cardia cordate. Renette cell big, prominent, visible. Renette ampulla anterior to nerve ring and renette cell body posterior to cardia, ventrally to intestine. Nerve ring slightly posterior to mid-pharynx.

Female gonad single, outstretched and situated to the right of mid-gut. Vulva not sclerotised. Few cells with light cytoplasm and small dense nuclei (spermatozoa or spermatides?) present in the posterior prevaginal portion of the gonad. No postvulvar sac present.

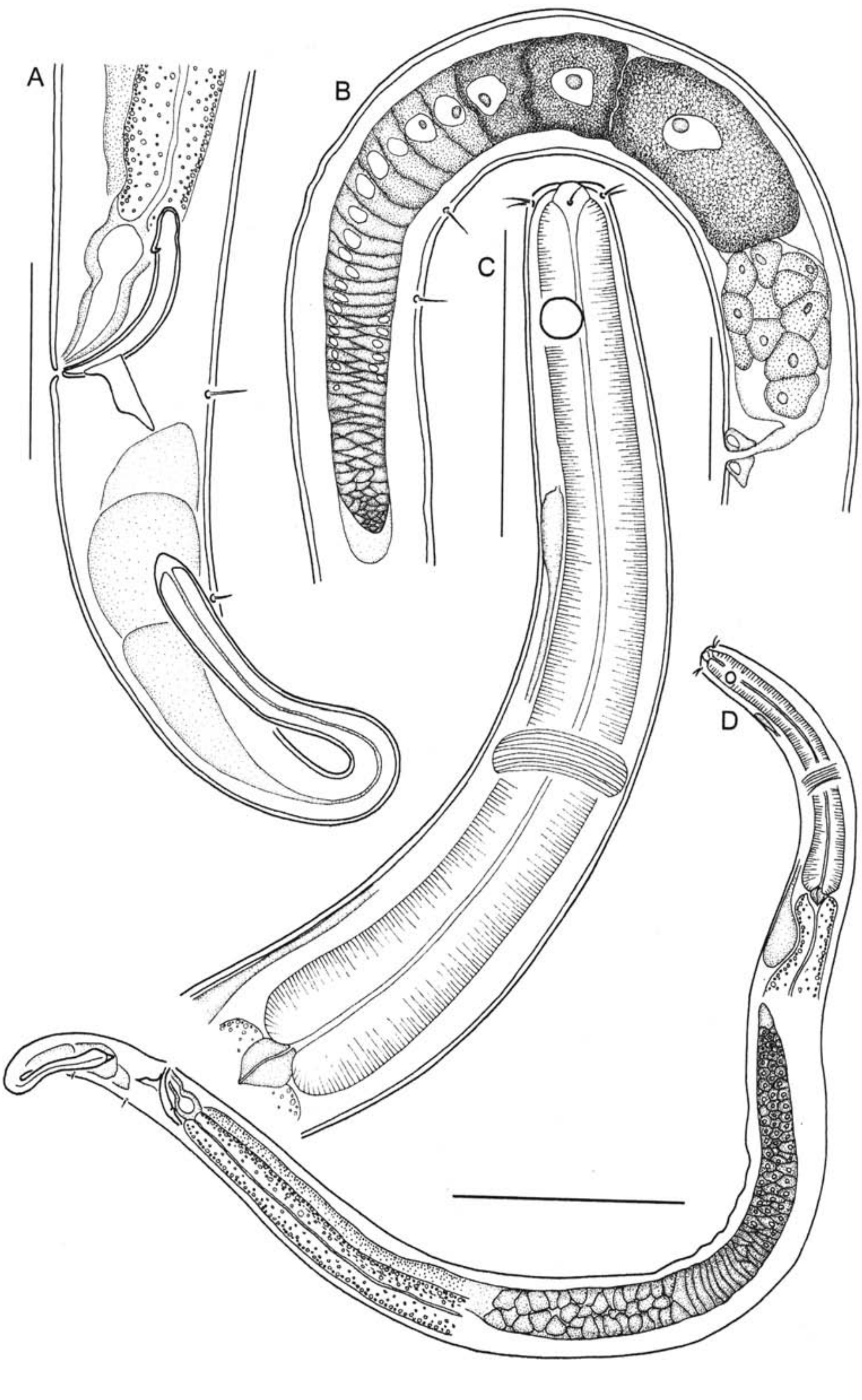

Fig. 8. *Thalassomonhystera parva* A, tail, male; B, female gonad; C, anterior end, male; D, total view, male. Scale bars: A – 20 µm; B – 25 µm; C, D – 30 µm.

Male gonad single, outstretched and situated to the right of mid-gut, starts just posterior to renette cell body. Spermatocytes relatively large. Spicules slightly curved, distally pointed and proximally slightly cephalated, with ventral denticle on knob. Gubernaculum with solid dorso-caudal apophysis. No supplementary organs present.

Tail from anterior conical and posterior cylindrical portions, the latter terminally slightly enlarged in clavate-like fashion. No pre- or postanal setae visible. Three caudal gland cell bodies visible within anterior portion of tail in some specimens.

Discussion. Large Aral Sea individuals agree well with the original description and with redescriptions of De Coninck and Schuurmans Stekhoven (1933) and Hopper and Meyers (1967). They differ from individuals from Biscayne Bay (Hoppers & Meyers, 1967) in having shorter spicules (20-22 µm *vs* 27 µm, on chord) and gubernacular apophysis (6.5-8.5 µm *vs* 12 µm), longer and thinner female body (420-490 µm and a=19 *vs* 500-596 µm and a=23-27).

Geography. *Thalassomonhystera parva* was found previously in Atlantic Ocean, English Channel, North Sea, Baltic Sea, Sargasso Sea, Mediterranean, Red Sea, Black Sea; Bay of Bengal; USA (New England, Texas, Massachusetts, Maryland, Florida); Chile and Antarctica.

CONCLUSIONS

Two species described from the Large Aral Sea represent different life strategies: *T. parva* is distributed widely in the oceanic and inland waters within wide range of salinity from brackish to hyperhaline; it was found in the Caspian Sea and (with question mark) in hypersaline Salton Sea. The second species, *E. multipapillatus,* is restricted in its distribution to hyperhaline lakes. It is not clear, however, whether the two species remain in the Large Aral Sea from the time of brackish water conditions of the greater Aral Sea, or they both (or the second one) came in during the desiccation phase. However, as a whole, the observed fauna of Large Aral Sea is more similar to that of the Caspian Sea than to faunas of the inland Asian lakes in terms of the composition of higher taxa. In the other meiobenthic groups, from three adequately identified species of three taxonomic groups, two still remain in the Large Aral Sea from its brackish-water stage and the third one could be the newcomer for the hypersaline phase.

ACKNOWLEDGEMENT

Authors would like to thank the leader of the Aral Sea expedition Dr P. Zavyalov, and his team. Special thanks to D. Kondar for identification of harpacticoid copepod and to Natalia Polukonova for identification of chironomids. The material was collected during the Aral Sea expedition of P.P.Shirshov Institute of Oceanology RAS. We appreciate the input of the anonymous reviewer for improving the text. The study was supported by grant of Russian Foundation for Basic Researches, 08-05-00201.

REFERENCES

ALADIN, N.V. & PLOTNIKOV, I.S. 2008. [Modern fauna of residual water bodies formed on the place of the former Aral Sea]. *Trudy Zoologicheskogo Instituta* 312: 145-154.

BELYANINA, S.I & POLUKONOVA, N.V. 2009. [On the taxonomic status of *Baeotendipes* Kieffer (Chironomidae, Diptera)] *Materialy Konferencii Ecologia, Systematica I Evolucia zhivotnych November, 17-19, 2009.* pp. 302-304. Ryazan.

CASPERS, H. 1952. Untersuchungen über die Tierwelt von Meeressalinen an der bulgarischen Küste des Schwarzen Meeres. *Zoologischer Anzeiger* 148: 243-259.

CLARKE, K. R. & WARWICK, R. M. 1994. *Change in Marine Communities: An Approach to Statistical Analysis and Interpretation*. 167 pp. Plymouth Marine Laboratory, U.K

CLARKE, K. R. & WARWICK, R. M. 1998A. A taxonomic distinctness index and its statistical properties. *Journal of Applied Ecology* 35: 523–531.

CLARKE, K. R. & WARWICK, R. M. 1998B. Taxonomic distinctness and environmental assessment. *Journal of Applied Ecology* 35: 532-543.

CLARKE, K. R. & WARWICK, R. M. 1999. The taxonomic distinctness measure of biodiversity: weighting of step lengths between hierarchical levels. *Marine Ecology Progressive Series* 184: 21–29.

DE CONINCK, L.A. & SCHUURMANS STEKHOVEN, J.H. 1933. Freeliving marine nemas of the Belgian Coast. II. With general remarks on the structure and the system of nemas. *Koninklijk Natuurhistorisch Museum Van België. Verhandeling* 58: 1- 163.

DECRAEMER, W. & COOMANS, A.1978. Scientific report on the Belgian Expedition to the Great Barrier Reef in 1967. Nematodes XII. Ecological notes on the nematode fauna in and around mangroves on Lizard Island. *Australian Journal of Marine and Freshwater Researches* 29: 497-508.

FILIPJEV, I. 1924. Revision der Gattung *Adoncholaimus*. *Zoologischer Anzeiger* 58: 268-277.

FONSECA, G. & DECRAEMER, W. 2008. State of the art of the free-living marine Monhysteridae (Nematoda). *Journal of the Marine Biological Association of the United Kingdom* 88: 1371-1390.

GAGARIN, V.G. 1993. [*Free-living nematodes of fresh water of Russia and surrounding countries*.] 351 pp. Saint Petersburg, Gydrometizdat.

GAGARIN, V.G. & MEDVEDEV, F.S. 1987. [To the fauna of free-living nematodes of Chany lake system.] *Biologia Vnutrennych Vod* 73: 27-31

GERLACH, S. 1957. Marine Nematoden aus dem Mangrove-Gebiet von Cananeia. *Abhandlung der Mathematisch-naturwissenschaftlichen Klasse* 5: 130-176.

GERLACH, S.A. & RIEMANN, F. 1973-1974. *The Bremerhaven checklist of aquatic nematodes.* Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven, Suppl. 4 (1-2): 1-404, 405-736.

HAMMER, Ø., HARPER, D.A.T. & RYAN, P.D. 2001. PAST: paleontological statistics software package for education and data analysis. *Palaeontologia Electronic.* 4:1-9.

HAMMER, U.T. 1986. *Saline lake ecosystems of the World*. 632 pp. Dr. W. Junk Publishers.

HOPPER, B.E. & MEYERS, S.P. 1967. Foliicolous marine nematodes on turtle grass, *Thalassia testudinum* König, in Biscayne Bay, Florida. *Bulletin of Marine Sciences* 17 (2): 471- 517.

JACOBS, L.J. 1987. *A checklist of the Monhysteridae (Nematoda, Monhysterida).* 125 pp. Johanesburg, South Africa: Rand Afrikaans University.

JENSEN P. 1986. Nematode fauna in the sulphide-rich brine seep and adjacent bottoms of the East Flower Garden, NW Gulf of Mexico. 4. Ecological aspects. *Marine Biology* 92: 489-503.

JENSEN, P. 1994. Revision of Ethmolaiminae Filipjev & Stekhoven, 1941 (Nematoda,Chromadorida), with descriptions of one new genus and three new species. *Hydrobiologia* 286: 1-15.

KUNZ, H. & KUNZ, G. 1973. Ökologische Untersuchungen am Strandgewässern Südwestafrikas. *Namib und Meer* 4: 41-64.

MAYER, E.D. 1974. [Foraminifera. In: *Atlas bespozvonochnych Aral'skogo morya*.] (Morduchai-Boltovskoy, F.D. Ed.). 272 pp. Moscow, Pishchevaya Promyshlennost.

MORDUCHAI-BOLTOVSKOY, F.D. (ED.). 1974. [*Atlas bespozvonochnych Aral'skogo morya*.] 272 pp. Moscow, Pishchevaya Promyshlennost.

MOKIEVSKY, V.O. 2009. Quantitative distribution of the meiobenthos in the Large Aral Sea in 2003 and 2004. *Journal of Marine Systems* 76: 336–342

PARAMONOV, A.A. 1926. [Anatomische und systematische Beiträge zur Kenntniss der freilebenden Nematoden.] *Russkij zooogicheskij Zhurnal* 6: 44-56.

PLATT, H.M. 1982. Revision of the Ethmolaimidae (Nematoda: Chromadorida). *Bulletin of the British Museum (Natural History), Zoology series* 43 (4): 185-252.

SAPOZHNIKOV, P.V., ARASHKEVICH, E.G. & IVANISHCHEVA, P.S. 2010. *Biodiversity*. *The Aral Sea environment*. *The Handbook of Environmental Chemistry, 7*. Eds.A.N.Kostianoy, A.G.Kosarev. pp. 235-282. Springer.

SEINHORST, J.W. 1959. A rapid method for the transfer of nematodes from fixative to anhydrous glycerin. *Nematologica* 4: 67-69.

TCHESUNOV, A.V. 1979. [*Free-living nematodes of the Caspian Sea*.] Ph.D.Thesis. Abstract. 24 pp. Moscow, Moscow State University Press.

TCHESUNOV, A.V. 2006. [*Biology of Marine Nematodes*]. 367 pp. Moscow, KMK Scientific Press Ltd.

TOKOBAEV, M.M. & LEMZINA, L.V. 1986. [Structure of fauna and peculiarities of distribution of free-living nematodes in Issyk-Kul lake]. Svobodnozhivushchie i parazitičheskie *Scolecida* fauny Kirgizii. pp. 3–15. Frunze.

WARWICK, R. M., DEXTER, D.M. & KUPERMAN, B. 2002. Freeliving nematodes from the Salton Sea. *Hydrobiologia* 473: 121–128.

ZAVIALOV, P. O. 2005. *Physical Oceanography of the Dying Aral Sea*. 154 pp. Springer-Verlag / Praxis, Chichester, UK.

ZAVIALOV, P.O., NI, A.A., KUDYSHKIN, T.V., KURBANIYAZOV, A.K. & DIKAREV, S.N. 2009. Five years of field hydrographic research in the Large Aral Sea (2002–2006). *Journal of Marine Systems* 76: 263-271.

В. О. Мокиевский, М. А. Милютина. Нематоды в мейофауне Большого Арала в фазе его высыхания: видовой состав и переописание наиболее обычных видов.

Резюме. Описан видовой состав нематод, как составной части мейобентоса Большого Арала на промежуточной стадии его высыхания (2003). Показатели солености составляли в тот момент около 89‰. Количественные учеты мейобентоса проводили на глубинах 10 и 15 м. Обнаружено 12 видов нематод: комплекс доминирующих видов включал *Thalassomonhystera parva, Monhystera* sp. 2 и *Ethmolaimus multipapillatus.* Проведено сравнение видового состава различных таксонов в сравнении с Каспийским морем и нематодами внутренних водоемов Центральной Азии (оз. Иссык-Куль, оз. Чаны). Делается вывод о большем сходстве нематофауны Большого Арала с каспийской фауной, нежели с внутренними озерами Азии. Предложено переописание видов *Thalassomonhystera parva* и *Ethmolaimus multipapillatus*.