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On the harpacticoid fauna of the Caspian Sea, including the description of *Schizopera rybnikovi* sp.n. (Copepoda: Harpacticoida: Diosaccidae)

К описанию фауны гарпактикоидных ракообразных Каспийского моря: описание нового вида *Schizopera rybnikovi* sp.n. (Copepoda: Harpacticoida: Diosaccidae)

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KEY WORDS: Caspian Sea, Copepoda, *Harpacticus*, taxonomy, *Schizopera rybnikovi* sp.n.
КЛЮЧЕВЫЕ СЛОВА: Каспийское море, Copepoda, *Harpacticus*, таксономия, *Schizopera rybnikovi* sp.n.

ABSTRACT. Harpacticoid copepods of the Caspian Sea are poorly known; only 16 valid species have been recorded to date. In this paper, three species from the sandflat of the south Caspian Sea are added to the fauna: *Harpacticus compsonyx* Monard, 1926, *Nitokra lacutris* (Schmankevitsch, 1875) and *Schizopera rybnikovi* sp.n., the last as a new species. *S. rybnikovi* sp.n. differs from its congeners by the confluent basoendopod and exopod of leg 5 in female, armed with short robust spines and by sexually dimorphic caudal rami. The abundance and the species diversity are clearly different on different sediments. *S. rybnikovi* sp.n. was in great abundance on the fine sand, with overall harpacticoids density 11 specimens per cm^2; *S. neglecta* Akatova, 1935 was in great abundance on the shell sand (overall density 23 specimens per cm^2).

РЕЗЮМЕ. Гарпактикоидные копеподы Каспийского моря к настоящему времени изучены слабо — отмечено только 16 валидных видов. В данной статье приводится описание еще трех новых для региона представителей, найденных на песчаном участке побережья южного Каспия: *Harpacticus compsonyx* Monard, 1926, *Nitokra lacutris* (Schmankevitsch, 1875) и *Schizopera rybnikovi* sp.n., последний вид является новым для науки. *S. rybnikovi* отличается от других видов рода срастанием базиэндоподита и экзоподита пятой пары ног самки, вооружением пятой пары ног и половым диморфизмом ветвей фурки.

Показано, что обилие гарпактикоид и видовая структура сообщества резко меняются в зависимости от типа грунта. На мелкозернистых песках плотность копепод равна всего 11 экз/см^2, доминирует *S. rybnikovi* sp.n., а на ракуше численность — 23 экз/см^2 и преобладает *S. neglecta* Akatova, 1935.

Introduction

The isolation of the Caspian Sea, along with its geological history has led to the formation of a remarkable fauna, including some Tethyan remnants, freshwater species and recent invaders from the Black Sea. The bulk of the fauna is composed by marine species, which have adapted to the brackish-water conditions and became endemic species of the recent Caspian groups. Other components of the fauna are arctic and pontic species, which colonized the basin after the glacial epoch. The most recent invaders are species from the Black Sea, possibly introduced by man. Nevertheless, the Caspian fauna is poor and includes only about 725 species [Kasymov, 1987], but nearly 46 % of the species are local endemics, what demonstrating the very high degree of endemism [Zenkevich, 1963].

Unlike the well studied macrobenthic fauna, meiobenthos of the Caspian Sea is almost unknown. There are just a few publications on harpacticoids, the paper of G. Sars [1927] being one of the most significant ones. He listed 32 species of harpacticoids (fourteen of them as new ones), but did not describe any of them in later papers.

New data on the species composition and ecology with detailed description of Schizopera rybnikovi sp.n. from the south Caspian Sea are presented in the current paper.

Materials and methods

Samples were taken along the coast zone of Gyzylagadgskiy Bay in the vicinity of Narimanobad (38°51’N, 48°50’E), Caspian Sea, Azerbaijan (Fig. 1). The area studied was a slightly sloping sandflat about 2 km in

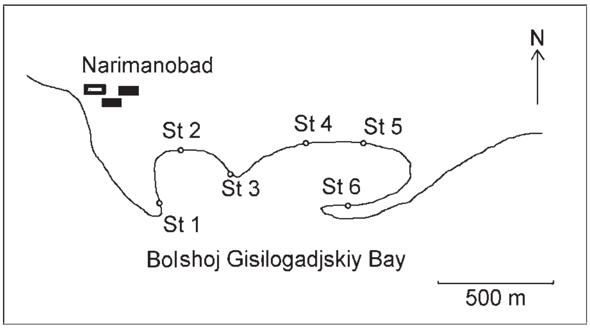

Fig. 1. Map of sampling area.
Рис. 1. Карта района взятия проб.

length, without large stones or seaweed. The sediments were heterogeneous, with sites of fine sand and shell sand. Salinity in the examined part of the bay was quite low, near 10 ‰, as a result of the freshwater inflow from the reservoir.

Twenty-four quantitative samples of meiobenthos on six sampling sites were taken. Three sites (St 1, St 3, St 6) had a fine sand with modal particle size (M_0) 0.3 mm whereas the others (St 2, St 4, St 5) were located in small bays containing a sediment with modal particle size 1.0 mm. Distances between different sites ranged from several hundreds of meters to 1.5 km.

Samples of the upper 3 cm of sand were collected using plastic tube corers (2 cm^2 cross-section) and fixed in 4 % formaldehyde solution. In the laboratory samples were washed by flotation and sieved through 70 µm mesh.

Selected copepods were placed in a mixture of alcohol and glycerin, then transferred in pure glycerin for dissection. All figures were made using a *camera lucida* on a BIOLAM microscope at a ? 1500 magnification.

For every species, the number of individuals (*N*) and biomass (*B*) were estimated. Individual biomass was calculated using Chislenko"s nomograms [Chislenko, 1968]. Pair-wise similarity between samples was estimated by the percentage similarity (Czekanowski) index [Legandre & Legandre, 1998]:

$$D_{XY} = \sum_{i=1} \min(X_i, Y_i)$$

where X_i,Y_i are percentages of *i*-th species in samples *X* and *Y*.

The computations were implemented using the ECOS 1.3 [A.I. Azovsky, MSU, 1995] software.

Descriptive part

Six species of harpacticoids were found, including 1 new species and 2 species first recorded for the Caspian Sea: *Nitokra lacustris* (Schmankevitsch, 1875) and *Harpacticus compsonyx* Monard, 1926.

Family Harpacticidae

Harpacticus compsonyx Monard, 1926

Fig. 2.

Only single ♀ of this species was found. This species is first species of Harpacticidae, reported for the Caspian Sea.

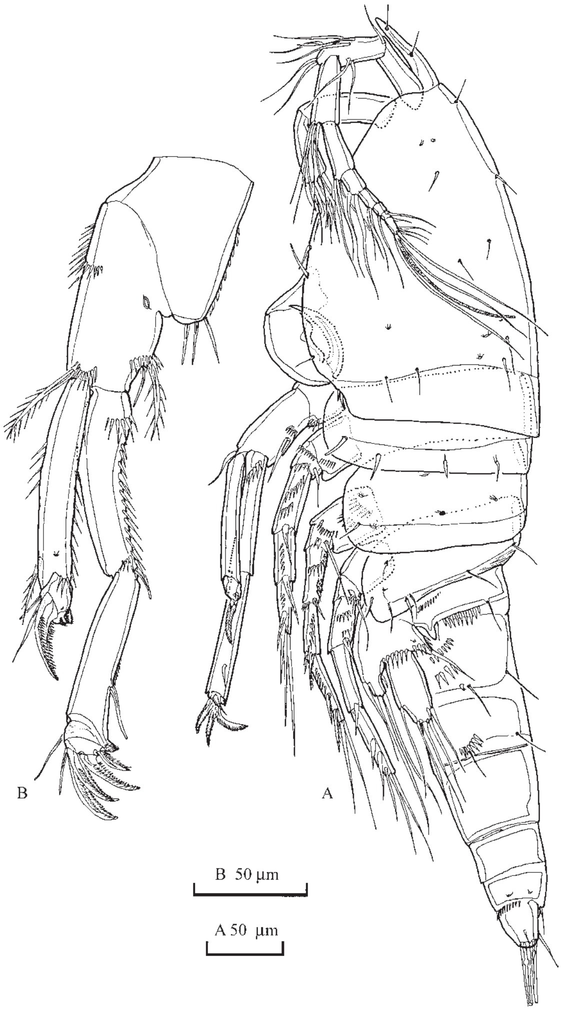

Fig. 2. *Harpacticus compsonyx* Monard, 1926: a — ♀, habitus lateral; b — ♀, leg 1.

Рис. 2. *Harpacticus compsonyx* Monard, 1926: a — ♀, внешний вид латерально; b — ♀, первая плавательная нога.

Family Diosaccidae

Schizopera rybnikovi **sp.n.**

Figs 3–6.

MATERIAL. Holotype ♀, Azerbaijan, Caspian Sea, Gyzylagadgskiy Bay (38°51' N, 48?50' E), supralittoral; dissected on 4 slides (labelled as 1. *Schizopera rybnikovi*, holotype +, antennula, antenna, 2. *Schizopera rybnikovi*, holotype ♀, Md, Mxl, Mx, Mxp, 3. *Schizopera rybnikovi*, holotype ♀, P1, P2, P3, P4, 4. *Schizopera rybnikovi*, holotype ♀, urosoma). Paratypes: 1 ♀, dissected on 3 slides (labelled as 1. *Schizopera rybnikovi*, paratype ♀, A1, A2, Md, Mxl, Mx, Mxp, 3. *Schizopera rybnikovi*, paratype +, P1, P2, P3, P4, 4. *Schizopera rybnikovi*, paratype +, urosoma), 2 undissected ♀♀, 1 dissected ♂, mounted on 4 slides (labelled as 1. *Schizopera rybnikovi*, ♂, antennula, antenna, 2. *Schizopera rybnikovi*, ♂, Md, Mxl, Mx, Mxp, 3. *Schizopera rybnikovi*, ♂, P1, P2, P3, P4, 4. *Schizopera rybnikovi*, ♂, urosoma) and 1 undissected ♂. All material preserved in the Museum of the P.P. Shirshov Institute of Oceanology, Moscow.

DESCRIPTION. Female. Body length 585 μm (caudal rami included). Body (Fig. 3a) slender, with poorly pronounced prosome-urosome geniculation. Pleural folds on ventral edges of somites small, transparent, without ornamentation. Anal somite with spinular rows at the bases of caudal rami. Sensillae pattern (from cephalothorax to anal somite): 16 pairs, 6, 4, 3, 2, 4, 2, 0, 1. Rostrum large, triangular, slightly curved, well defined at base, with a pair of sensillae in the middle part (Fig. 4a). Genital double somite with inner chitinous rib on the dorsal side in the place of subdivision. Genital field (Fig. 5F) with broad copulatory pore near the middle of ventral side of somite, on the end of copulatory tube. Outer end of copulatory tube bears greatly chitinized copulatory bulb, with attached spermatophore; proximal end of copulatory tube with a pair of inner chitinized sacs.

Caudal rami (Fig. 3b) conical, with length/width ratio 2.3; armed by small spinular row on the inner side. First seta [terminology by Huys, 1988 and Huys & Boxshall, 1991] not observed, second seta represented by robust spinulose spine, third sixth and seventh setae small, without modification; fourth seta stout, spinulose; fifth seta long, armed by 3 spinular rows.

Antennule (Fig. 4a) 8-segmented, slender. Aesthetascs on 4 and 8 segments. Armature formula: [1]; [9]; [6]; [2 + (1+aesthetasc)]; [2]; [4]; [4]; [5 + (2+aesthetasc)].

Antenna (Fig. 4b). Coxa small, square. Allobasis armed by 1 inner seta and 2 spinular rows, without trace of subdivision, length/width ratio 2.2. Exopod 2-segmented, first segment with 1 seta, second with 2 terminal setae. Endopod with 2 outer spines, 3 terminal geniculate seta, 1 terminal spine and 1 subterminal powerful spinulose geniculate seta, fused to small seta at base.

Mandible (Fig. 4c). Coxa strongly chitinized, gnathobase with 1 large bifid tooth, four smaller pectinate teeth, and 2 setae in dorsal corner. Basis with 3 plumose setae in distal corner. Exopod unisegmented, with 1 seta. Endopod unisegmented, with 2 inner setae and 5 terminal setae in 2 groups.

Maxillule (Fig. 4d). Praecoxal arthrite with 9 spines and 2 juxtaposed setae. Coxal endite small, cylindrical, with 2 setae, one of them spinulose. Basis with 2 groups of setae comprising 3 small setae and 3 long setae, one spinulose. Exopod and endopod 1-segmented, each with 2 setae.

Maxilla (Fig. 4e). Syncoxa with 3 endites armed by 2, 2 and 3 setae, from proximal to distal, respectively. Allobasis with 1 strong claw and 2 small spines. Endopod 1-segmented, with 5 setae.

Maxilliped (Fig. 4f). Syncoxa elongate, with several outer spinular rows and 3 inner setae near the distal corner. Basis ovoid, with 2 spinular rows and 1 seta. Endopod modified in a claw, with 2 setae at base.

Leg 1 (Fig. 5a). Praecoxa well developed, with a spinular row; coxa with several spinular rows. Basis with several spinular rows, inner and outer pinnate spines. Exopod 3-segmented, first segment with outer spine and spinular row, second segment with outer and inner spinular rows and outer spine, third segment with outer and inner spinular rows, 2 outer spines and 2 terminal geniculate setae. Endopod 3-segmented, first segment 1.16 times shorter than whole exopod, length/width ratio = 4, armed by inner seta and inner and outer spinular rows; second segment 6 times shorter than first, with a row of outer spinules; third segment 5 times shorter than first, with outer spinular row, 1 long geniculate terminal setae, 1 spinulose spine and 1 small subterminal seta.

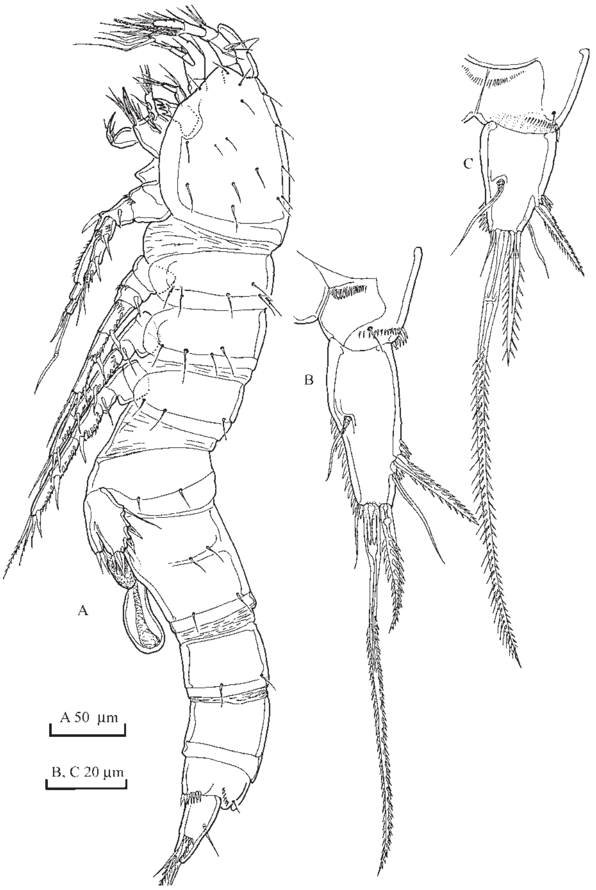

Fig. 3. *Schizopera rybnikovi* sp.n.: a — ♀, habitus lateral; b — ♀, caudal ramus; c — ♂, caudal ramus.

Рис. 3. *Schizopera rybnikovi* sp.n.: a — ♀, внешний вид латерально; b — фуркальная ветвь ♀; c — фуркальная ветвь ♂.

Leg 2–4 (Fig. 5b–d). Praecoxae short, with spinular row, coxae with several spinular rows, intercoxal sclerites with small ventral spiniform projections. Armature formula:

	Exopod	Endopod
Leg 1	0.0.022	1.0.120
Leg 2	0.1.022	0.1.121
Leg 3	0.1.022	1.1.021
Leg 4	0.1.022	1.1.021

Baseoendopod and exopod of leg 5 (Fig. 5e) confluent, exopodal lobe with 4 broad spinulose spines and 1 seta; endopodal lobe with 4 spinulose spines. Sixth pair of legs is included in genital field (Fig. 5f), each member of pair represented by small plate with 3 setae, outermost spinulose.

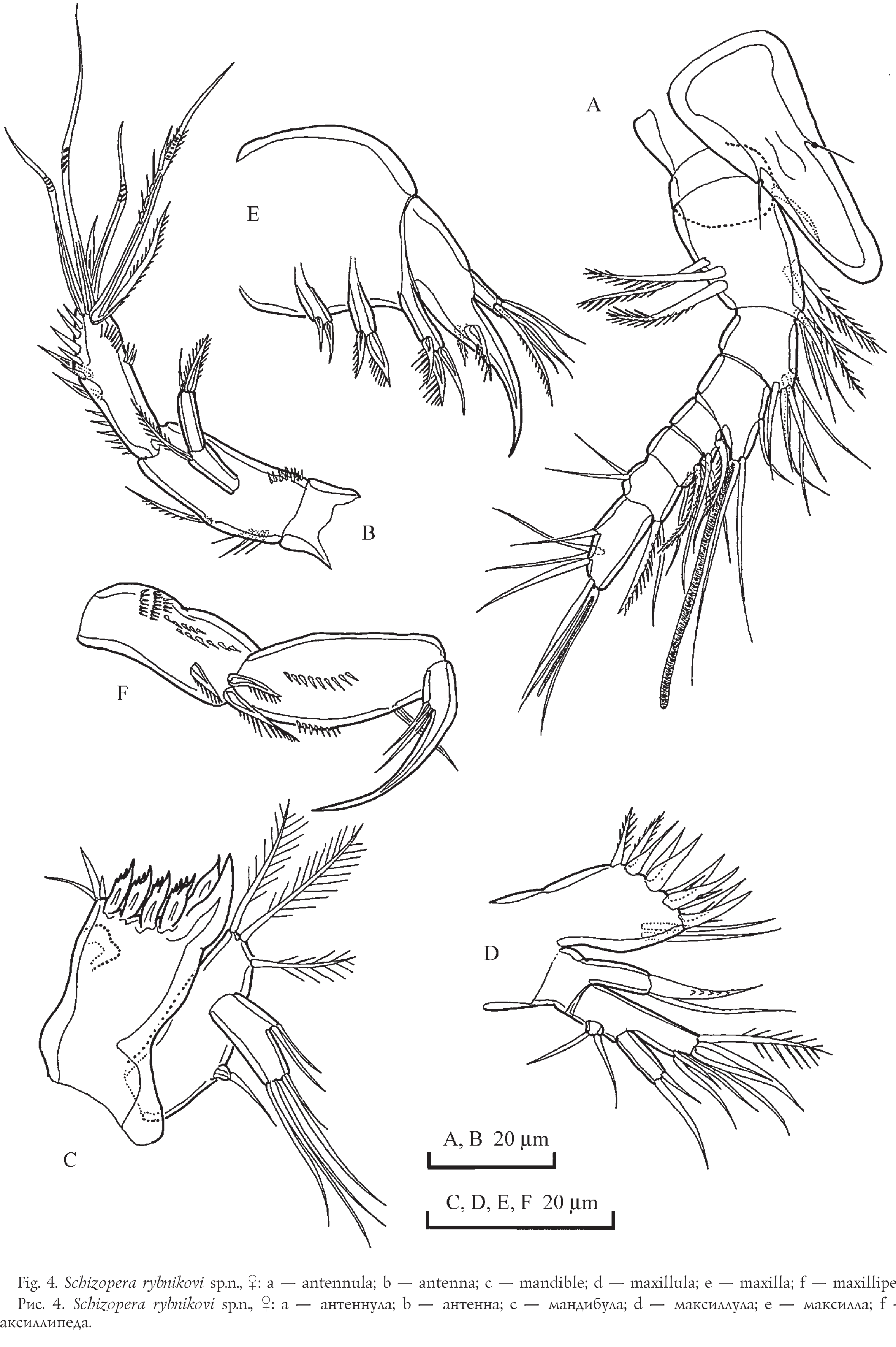

Fig. 4. *Schizopera rybnikovi* sp.n., ♀: a — antennula; b — antenna; c — mandible; d — maxillula; e — maxilla; f — maxilliped.

Рис. 4. *Schizopera rybnikovi* sp.n., ♀: a — антеннула; b — антенна; c — мандибула; d — максиллула; e — максилла; f — максиллипеда.

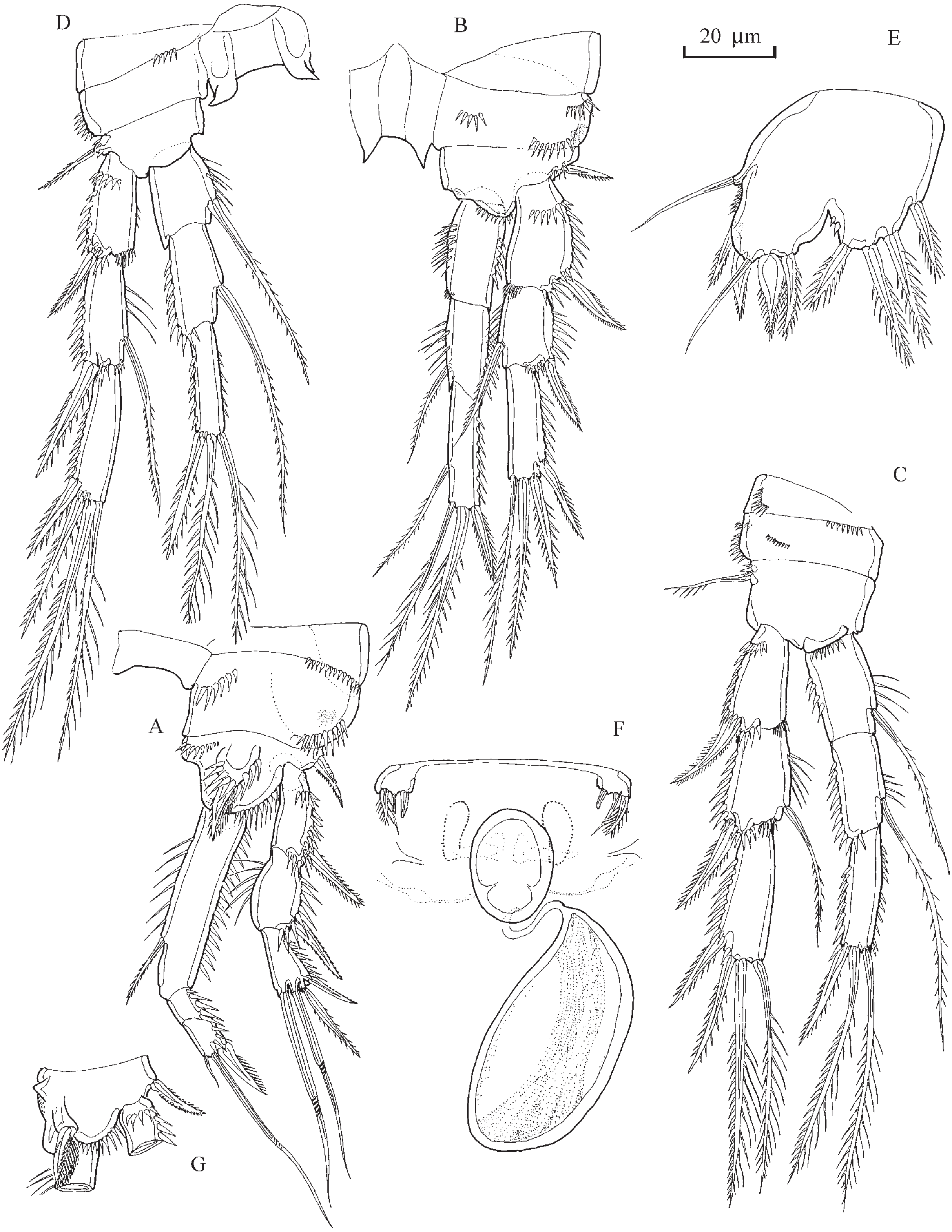

Fig. 5. *Schizopera rybnikovi* sp.n., ♀ (a–f) and ♂ (g): a — leg 1; b — leg 2; c — leg 3; d — leg 4; e — leg 5; f — genital field; g — basis of leg1.

Рис. 5. *Schizopera rybnikovi* sp.n., ♀ (a–f) and ♂ (g): a–e — первая–пятая плавательные ноги; f — генитальное поле; g — базиподит первой плавательной ноги.

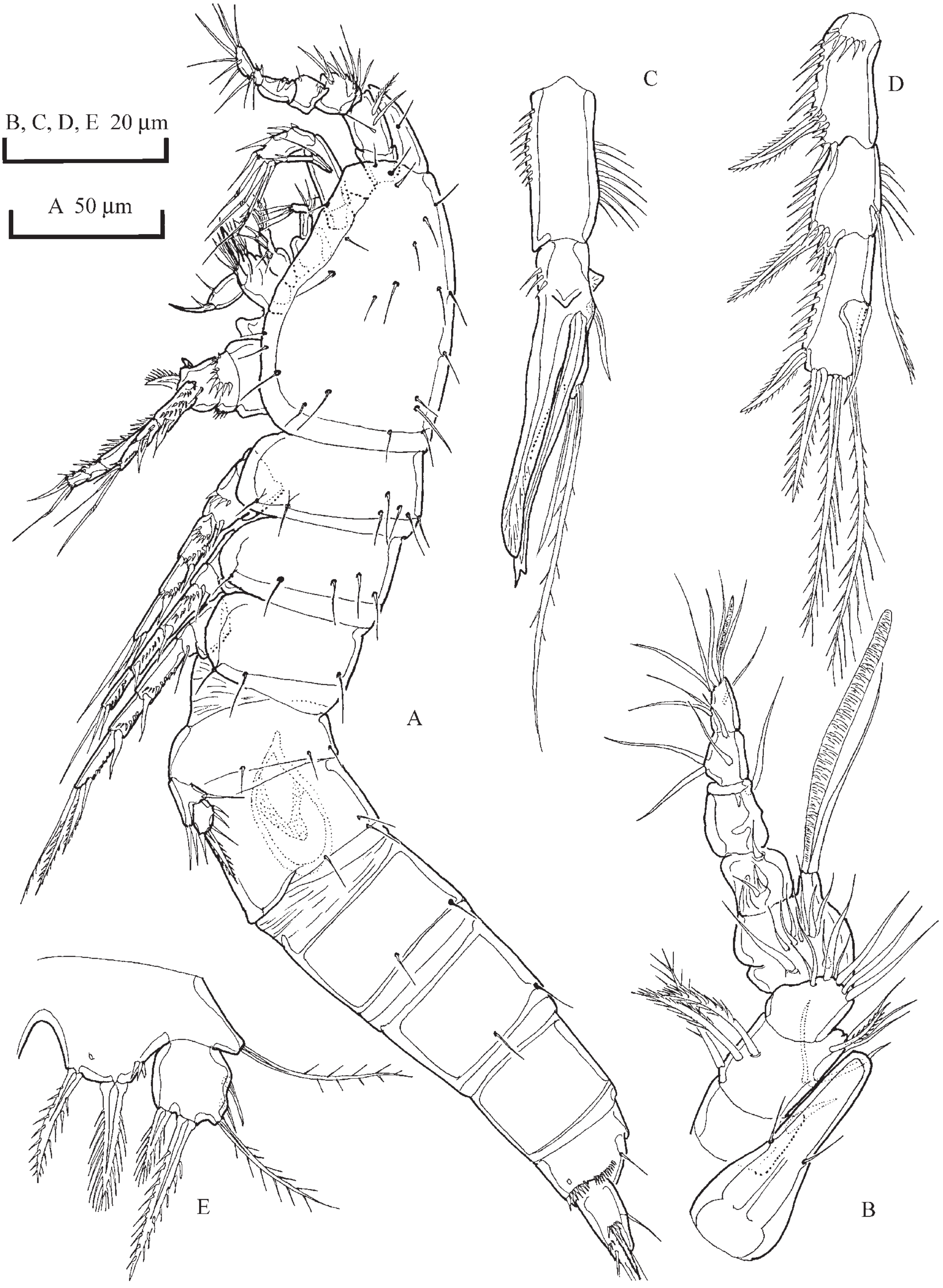

Fig. 6. *Schizopera rybnikovi* sp.n., ♂: a — habitus lateral; b — antennula; c — endopod of leg 2; d — exopod of leg 3; e — leg 5.

Рис. 6. *Schizopera rybnikovi* sp.n., ♂: a — внешний вид латерально; b — антеннула; c — эндоподит второй пары ног; d — экзоподит третьей пары ног; e — пятая пара ног.

Male (Fig. 6a). Sexual dimorphism in antennule; basis of leg 1; endopod of leg 2; exopod of leg 3; leg 5; leg 6; caudal rami and genital segmentation.

Antennule (Fig. 6b) 8-segmented. Fourth segment swollen. Geniculation between fifth and sixth segments. Aesthetascs on fourth and eighth segments. Armature formula: [1]; [9]; [7]; [10 + aesthetasc]; [3]; [1]; [4]; [8+ aesthetasc].

Basis of leg 1 (Fig. 5g) with inner knob in middle part of the segment and conical-shaped process in inner distal corner, at the base of slightly modified inner spine.

Endopod of leg 2 (Fig. 6c) 2-segmented, first segment unmodified, second segment with 1 inner seta in middle half, 2 closely situated inner setae in distal half, 2 long processes, one of them bifid and 2 knobs. Integument of processes punctated in the middle part.

Exopod-3 of leg 3 (Fig. 6d) armed by a large tube-pore.

Basoendopods of fifth legs (Fig. 6e) pair medially fused, each endopodal lobe with 2 robust spines. Exopod are not fused with basoendopod, armed by 5 setae.

Caudal rami (Fig. 3c). Length:width ratio of the male caudal rami 1.5, in armature male caudal rami are similar with female.

REMARKS. This species clearly belongs to the genus *Schizopera* on the basis of reduced exopod armature of swimming legs and characteristic sexual dimorphism in exopod of leg 3, but differs significantly from the other *Schizopera* species. The distinctive form of the female fifth legs, with fused exopod and basoendopod, is thus far unique within the genus. The armature of the exopod lobe of leg 5 with short broad spines is also a distinctive feature of this species. Another specific character is the sexual dimorphism in caudal rami, which is unusual for Diosaccidae. Sexual dimorphism in caudal rami is occurs in several families of Harpacticoida: Tetragonicipitidae, Paramesochridae, Parastenocarididae, Canthocamptidae and Cletodidae [Veit-Kohler, 2000], rary occured in Diosaccidae [Mielke, 1989], and as a rule only slightly affect in shape of caudal rami, as it observed in a new *Schizopera* species.

ETYMOLOGY. The species is named in a honour of Pavel V. Rybnikov, who has studied harpacticoid fauna of the Black, Barents and White Seas for many years.

Schizopera neglecta Akatova, 1935

All specimens examined do not show any significant differences with the original description. This species, initially described from the Caspian Sea [Akatova, 1935], has subsequently been recorded from the Black Sea [Apostolov & Marinov, 1988].

Family Ameiridae

Nitokra lacustris (Schmankevitch, 1875)

The only difference noted between the Caspian specimens and those examined in previous descriptions [Gurney, 1920; Borutzky, 1952] concerns the leg 1 endopod which is slightly longer in the former.

Family Cletodidae

Limnocletodes behningi Borutzky, 1926

Specimens examined agree well with the type description.

Family Laophontidae

Onychocamptus mohammed (Blanchard & Richard, 1891)

Only a single specimen of this species was found, no significant differences from the typical description were observed.

Ecology

The overall diversity on the sites examined is low, the mean number of species per sample being 1.6. Total abundance of copepods is about 17 individuals per 1 cm^2. Some species are clearly more abundant than others. Both species of Schizopera are the most abundant, with adults being more numerous than copepodid stages which are mostly represented by fifth copepodids. This relative importance of the latter stages was observed at each site. *S. neglecta* and *S. rybnykovi* sp.n. together comprise more than 90 % of total harpacticoid abundance. Differences between samples are mainly determined by differences in the population density of these two species. The abundance of the other species is low to very low, with *Onychocamptus mohammed* and *Harpacticus compsonyx* being represented by single specimens only. Data on the relative abundance of adult stages of Harpacticoida are summarized in Table 1.

Table 1. Abundance (N) and biomass (B) of the adult harpacticoids.

Таблица 1. Обилие (N) и биомасса взрослых гарпактикоид.

Species	Sediment				Total	
	Fine sand (Mo=0,3)		Shell sand (Mo=1,0)			
	N	B	N	B	N	B
Onychocamptus mohammed	0	0	0,41	1,05	0,3	0,79
Schisopera neglecta	6,82	7,42	94,24	93,52	71	72,15
S. rybnikovi sp.n.	86,36	80,57	2,47	2,1	24,77	21,58
Nitokra lacustris	0	0	1,65	1,4	1,21	1,05
Limnocletodes behningi	5,68	9,72	1,23	1,93	2,42	3,86
Harpacticus compsonyx	1,14	2,30	0	0	0,3	0,57
All species	4		5		6	

Species diversity between sites with different sediment type is similar (four species in fine sand, five in shell sand). However, the structure of harpacticoid communities is quite different. Abundance and total biomass of harpacticoids were twice lower in fine sandy sediments (11 specimens per cm^2, 0.2 mg per cm^2) than in shell sandy sites (23 specimens per cm^2, 0.7 mg per cm^2). The distribution of individual species shows some marked differences. For example, *S. neglecta* is restricted to the shell sand of small bays and *S. rybnykovi* sp.n. predominates on the fine sand. Copepodid stages of both species also inhabit the same sediment type as their respective adults. This heterogeneity is possibly conditioned by interspecific competition. Distribution patterns of the other species are not so clear because of their low density. Similarity in species composition is highest between replicate samples of the same site, and between sites with similar sediment type; resemblance between sites on the different types of sediment is very low (Table 2).

Therefore, in the harpacticoids community on the examined sandflat is observed middle-scale (hundreds of meters) heterogeneity, which corresponds to the character of sediment and relief of the coastline.

Table 2. Similarity between structure of species composition in the different space scale.
Таблица 2. Сходство между структурой видового состава в зависимости от масштаба.

Sediment	Similarity (D)		
	Between plots of one set	Between sets with one type of sediment	Between sets with different types of sediment
Fine sand (Mo=0,3)	0,84	0,79	0,08
Shell sand (Mo=1,0)	0,92	0,92	

Discussion

Based on literature data and the present study the updated list of the Caspian Sea harpacticoid species is presented (species, cited originally as *nomina nuda*, are not included):

Family ECTINOSOMATIDAE
Halectinosoma abrau (Kritschagin, 1877)
H. concinnum (Akatova, 1935)
H. curticorne (Boeck, 1873)
Pseudobradya barroisi (Richard, 1893)

Family HARPACTICIDAE
Harpacticus compsonyx Monard, 1926

Family DIOSACCIDAE
Schizopera neglecta Akatova, 1935
S. akatovae Borutzky, 1953
Schizopera rybnikovi sp.n.

Family AMEIRIDAE
Nitokra typica Boek, 1865
N. lacustris (Schmankevitsch, 1875)
N. divaricata Chappuis caspica Behning, 1936
N. hibernica (Brady, 1880)

Family CANTHOCAMPTIDAE
Mesohra lilljeborghi Boeck, 1865

Family LEPTASTACIDAE
Paraleptastacus caspicus Sterba, 1973

Family CLETODIDAE
Limnocletodes behningi Borutzky, 1926
Cletocamptus retrogressus Schmankevitsch, 1875
C. confluens (Schmeil, 1894)

Family HUNTEMANNIIDAE
Nannopus palustris Brady, 1880

Family LAOPHONTIDAE
Onychocamptus mohammed (Blanchard & Richard, 1891)

These are mostly euryhaline species belonging to euryhaline genera (*Nitokra*, *Schizopera*, *Mesochra*, *Cletocamptus*, *Nannopus*). Most of them are widely distributed in the European marine intertidals, estuaries or rivers. Exceptions are *Halectinosoma curticorne*, *Harpacticus compsonyx*, *Pseudobradya barroisi* and *Paraleptastacus caspicus* which are representatives of marine genera, or typical marine species encountered in brackish water only in Caspian Sea. A typical marine form is *Harpacticus compsonyx*, which was reported from the Mediterranean Sea, Black Sea and Pacific [Song & Chang, 1993]. Such distribution pattern may suggest that *H. compsonyx* is possibly a Tethyan relict. Other harpacticoids belonging to typically marine groups, such as *Tegastes inopinatus* Sars, 1927 and various representatives of the Tisbidae, were reported by Sars [1927] and are also potential Tethyan relicts. The presence in the Caspian Sea of the species occurring in both the Pacific and Mediterranean, such as *H. compsonyx,* is not usual for the non-copepod groups of Caspian fauna, as demonstrated by the Cumacea which underwent substantial speciation during Caspian isolation. It appears that the isolation of the Caspian basin was sufficiently long for the endemic speciation and radiation of macrobenthic groups but not so for the harpacticoid copepods. This discrepancy may be due to the possibly slower evolutionary rate in meiobenthic groups which would explain why only four of the species recorded thus far (*Ectinosoma concinnum*, *Schisopera akatovae*, *S. rybnikovi* sp.n. and *Paraleptastacus caspicus*) are endemics of the Caspian Sea. Possibly some species listed by Sars [1927] are also endemics.

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References

Akatova N. 1935. Drei neue Copepoden-Arten aus dem Kaspi-See // Zool. Anz. Vol.111. P.319–326.

Apostolov A., Marinov T. 1988. Copepoda, Harpacticoida // Fauna Bulgarica. T.18. Sofia: Aedibus Acad. Scient. 384 pp.

Borutzky E.V. 1952. [Fresh-water Harpacticoida] // Fauna SSSR. Rakoobraznye. T.3. No.4. Moscow-Leningrad: AN SSSR Publ. 424 pp. [in Russian].

Chislenko L.L. 1968. [Nomogram for estimation of water organisms weight by their body size and form] // Leningrad: Nauka Publ. 195 pp. [in Russian].

Gurney R. 1920. The British species of the copepod genus *Nitocra* Boeck // Ann. Mag. Nature History. Vol.9. No.6. P.214–220.

Huys R. 1988. A redescription of the presumed associated *Caligopsyllus primus* Kunz, 1975 (Harpacticoida, Paramesochridae) with emphasis on its phylogenetic affinity with *Apodopsyllus* Kunz, 1962 // Hydrobiologia. Vol.162. P.3–19.

Huys R., Boxshall G.A. 1991. Copepod evolution // London: Ray Society. 468 pp.

Kasymov A.G. 1987. [Caspian Sea] // Leningrad: Gidrometeoizdat. 152 pp. [in Russian].

Legendre P., Legendre L. 1998. Numerical Ecology // New York: Elsevier. 853 pp.

Mielke W. 1989. *Amphiascus discrepans* sp. n., a new benthic copepod (Crustacea) from Iquique (Chile) // Zool. Scripta. Vol.18. No.4. P.501–508.

Sars G.O. 1927. [Notes on the crustacean fauna of the Caspian Sea] // Sbornik v chest professora Nikolaya Mikhailovicha Knipovicha. P.315–329 [in Russian].

Song S.J., Chang C.Y. 1993. Eight harpacticoid species of Harpacticidae (Copepoda, Harpacticoida) from Korea // Kor. J. syst. Zool. Vol.9. No.2. P.203–220.

Veit-Kohler G. 2000. Habitat preference and sexual dimorphism in species of *Scottopsyllus* (Copepoda, Harpacticoida) with the description of *Scottopsyllus* (*S.*) *praecipuus* sp.n. from the Antarctic // Vie Milieu. Vol.50. No.1. P.1–17.

Zenkevich L.A. 1963. Biology of the seas of the USSR // London: 427 pp.