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EURYTEMORA CASPICA SP. NOV. FROM THE CASPIAN SEA – ONE MORE NEW SPECIES WITHIN THE *E. AFFINIS* COMPLEX (COPEPODA: CALANOIDA: TEMORIDAE)

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ABSTRACT

Eurytemora caspica **sp. nov.** (Crustacea: Temoridae) from the North part of the Caspian Sea and the delta of the Volga River is described. The new species belongs to the Asian clade of the *Eurytemora affinis* complex. This species is intermediate morphologically between the North-American and European species of the *E. affinis*- complex. *E. caspica* **sp. nov.** differs from nearest congeners by the shape of the mandible, absence of the seta segmentation on the caudal rami and on swimming legs, the shape of the genital double-somite and by the armament of the thoracic legs. *E. caspica* **sp. nov**. is possibly widely distributed along the North part of the Caspian Sea, as well as in the lower reaches of rivers flowing into this sea. The Japan fresh lakes are probably inhabited by undescribed species, very close morphologically to *E. caspica* **sp. nov.**

Key words: the Caspian Sea, copepod diversity, sibling species, taxonomy

EURYTEMORA CASPICA SP. NOV. КАСПИЙСКОГО МОРЯ – ЕЩЕ ОДИН НОВЫЙ ВИД КОМПЛЕКСА *E. AFFINIS* (COPEPODA: CALANOIDA: TEMORIDAE)

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РЕЗЮМЕ

Описан новый вид *Eurytemora caspica* **sp. nov.** (Crustacea: Temoridae), обитающий в северной части Каспийского моря и дельте реки Волга. Данный вид принадлежит к Азиатской кладе комплекса видов *Eurytemora affinis*. Морфологически особи *E. caspica* **sp. nov**. выглядят как промежуточная форма между Северо-Американским и Европейским видами комплекса *E. affinis* и отличаются друг от друга формой мандибул, сегментацией фуркальных щетинок и щетинок плавательных конечностей, формой генитального сегмента, а так же вооружением торакальных ног. Вид *E. caspica* **sp. nov**., вероятно, широко распространен в Северной части Каспийского моря, и нижней части рек его бассейна. Близкий, но не описанный вид предположительно встречается и в пресноводных озерах Японии.

Ключевые слова: Каспийское море, разнообразие копепод, виды-двойники, таксономия

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INTRODUCTION

Eurytemora affinis (Poppe, 1880) – was suspected as a complex of cryptic species (Lee 1999; Lee and Frost 2002), inhabiting fresh- and backishwater Holarctic basin, but this species does not tolerate of normal oceanic salinity (Rylov 1922).

This species complex is native to Ponto-Caspian Region (Kipp and Benson 2013), is reported from the North American Atlantic coast including the Gulf of Mexico, the North American Pacific coast, the western European coast, and parts of Asia (Mills et al. 1993; Torke 2001; Dussart and Defaye 2002; Lee and Frost 2002). In Europe and North American Atlantic areas, these copepods mainly known from coastal brackish water environments, but also from large continental lakes like Ladoga Lake in Europe and Great Lakes in North America (Rylov 1922; Engel 1962; Faber and Jermolajev 1966; Mills et al. 1993). However the suggested epicenter of diversity for the genus *Eurytemora* lies along coastal Alaska, where several species are endemic (Heron and Damkaer 1976; Dodson et al. 2010).

In the Baltic Sea, representatives of *E. affinis* complex are dominant copepods, both in littoral and pelagic ecosystems (Telesh and Hercloss 2004). In Asia, it is known from the Caspian Sea north part and from its inflows as well as from fresh water lakes in Japan (Lee 2000; Dussart and Defaye 2002). Due to its Holarctic distribution, euryhalinity and central position in food webs, *E. affinis* has been well studied using morphological (Lee and Frost 2002; Alekseev and Souissi 2011; Sukhikh et al. 2012), genetical tools (Lee 2000; Winkler et al. 2011; Sukhikh et al. 2012), with hybridization methods (Souissi, personal communication) and searches of physiological features (Beyrend-Dur et al. 2009).

Lee and Frost (2002) combined the molecular genetic results of Lee (2000) with a brief morphometric analysis of *Eurytemora cf. affinis* collected from 43 sites around the Holarctic. In their conclusion, they revealed morphological stasis in the *E. affinis* complex and came to a solution that due to the long-term reproductive isolation, the four major Asian, European, North Atlantic and Pacific clades became a complex of sibling species “where speciation was accompanied by lack of morphological differentiation” (P.:111). The Asian clade in accordance with the above-mentioned study included specimens from the Caspian Sea and from lakes of Japan. As a final conclusion of their study, Lee and Frost (2002) postulated an absence of species significant morphological features within the *E. affinis* complex that does not let specify new species them with the classical morphological description. Alekseev and Souissi (2011) meanwhile came to an opposite conclusion on the matter and described a new species *Eurytemora carolleeae* Alekseev et Souissi 2011 from Chesapeake Bay, USA within this *E. affinis* complex by using a new set of fine characters. This species was recently found in the Gulf of Finland and in the Gulf of Riga in the Baltic Sea (Alekseev et al. 2009; Sukhikh and Alekseev 2011; Sukhikh et al. 2012). In our study we used similar characters to delineate a new species from the Caspian Sea. The present study is a morphological description of the second cryptic species within this *E. affinis* complex.

MATERIAL AND METHODS

The type material for this new species was selected from a sample collected on 25 June 2011 by Federal State Unitary Enterprise Caspian Fisheries Research Institute (FSUE “CaspNIRKh”) in the North part of the Caspian Sea (Fig. 1).

For comparison we used specimens collected in the Elbe River, Germany (*terra typica* for *Eurytemora affinis* (Poppe, 1880)) in 2006 twice per season by Dr. Winkler and housing in the Field sample collection of Wimereux Marine Station, Lille University, France. Specimens from the Chesapeake Bay, Atlantic coastline of USA (*terra typica* for *Eurytemora carolleeae* Alekseev et Souissi, 2011) collected 16 on April 2008 by Dr. D. Kimmel (East Carolina University, USA) were used (Fig. 1).

The material from the Elbe River and from the Chesapeake Bay was preserved with a 70% ethanol, from the Caspian Sea – a 4% formalin solution. The samples were sorted under a dissection microscope (Olympus, SZX2). About 60 adult specimens from each population were selected for analyzes. Before dissection, copepod adults were measured with an ocular micrometer (5 μm resolution). The dissection was processed in glycerol. After dissection, the specimens were placed on slides in pure glycerol, covered with a cover slip and ringed with Canadian balsam. The slides were then examined at maximum resolution up to 1000× (Plan objective 100×, oil immersion) under a compound microscope (Zeiss IMAGER)

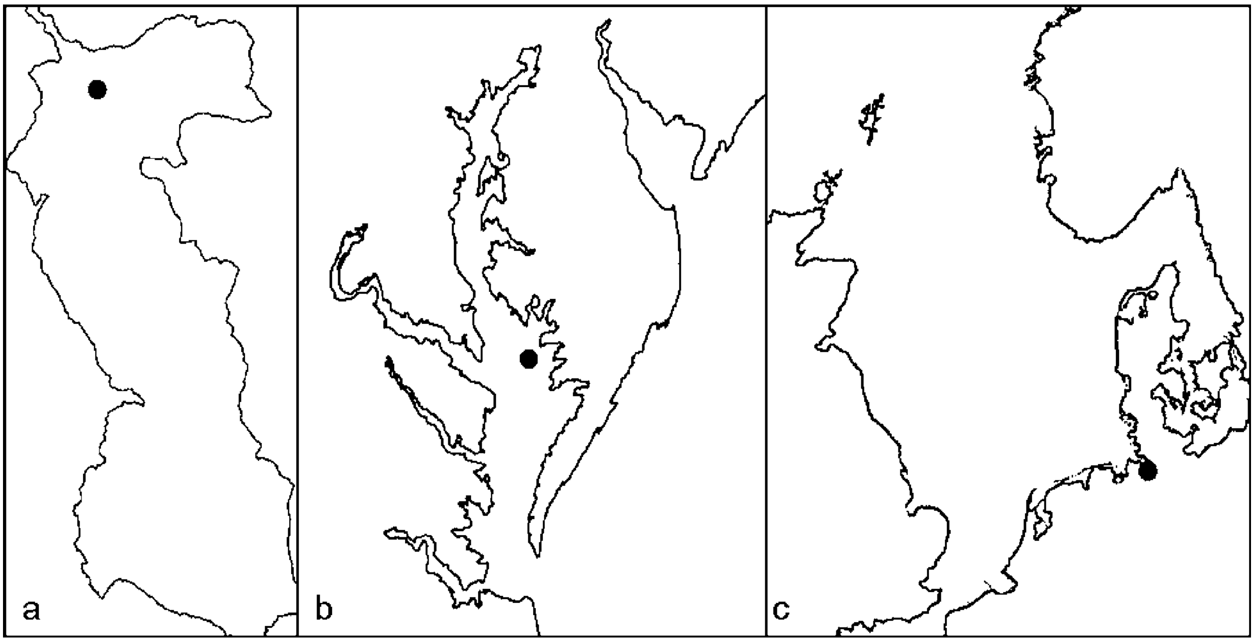

Fig. 1. Studied populations of *Eurytemora caspica* sp. nov. from theCaspian Sea(a), *Eurytemora carolleeae* Alekseev et Souissi, 2011 from the Chesapeake Bay (USA) (b) and *Eurytemora affinis* (Poppe, 1880) (c) from the Elbe Estuary (the North Sea).

equipped with Nomarski system for differential interference contrast microscopy and a drawing tube. All measurements are given in µm.

To define the species, both sexes were analyzed (Figs. 2a–f). Totally more than 20 different characters measurements were done. Secondary sexual dimorphic characters typically used in copepod taxonomy as well as mouth appendages, fine characters of the fifth legs, seta structure and body shape were observed. After some indexes calculation and their analysis the most indicative indexes were chosen (Tables 1, 2).

The next features were selected in both sexes: caudal rami length and width; the distal exopod segment as well as distal spine lengths in swimming legs 4.

In males we measured the distal exopod segment as well as distal spine lengths in the swimming legs 1. For males, we also measured length and maximal width of the first segment of the right exopod of leg 5, along with the maximal and minimal widths of the left exopod distal segment of the leg 5 (Fig. 10). In females, we measured leg 5 exopod spines lengths, and for the genital double-somite we determined length and width in the anterior (W1) and posterior (W2) sides of the somite (Figs. 3a, b, c; 4a, b).

The type slides for *E. caspica* **sp.n.** are deposited at the type collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia (ZIN) under reference numbers 55060–55063.

Table 1. Morphometric indexes in females *Eurytemora caspica* sp. nov., *Eurytemora carolleeae* and *Eurytemora affinis* from the type localities. Mean±error of the mean (Min–Max), not shown if less 0.0.

Species	Caudal rami, L/W	Genital somite, W1/W2	Leg 5, tiny spine/spine1	Leg 4, Long spine/ Distal Segment	Body size µm
E. affinis	6.1±0.6 (5.2–7.8)	1.2±0.1 (1–1.4)	0.3 (0.2– 0.4)	0.9±0.1 (0.8 –1.1)	1974.8±43.3 (1837–2137.6)
E. carolleeae	6.1±0.5 (5–7.4)	1.5±0.1 (1.4–1.7)	0.1 (0.1– 0.2)	0.9±0.1 (0.7– 1.0)	1502.1±31.4 (1352.7–1536.4)
E. caspica	7.7±0.1 (5.6–9.5)	1.3 (1.2–1.4)	0.1 (0.1–0.2)	0.9 (0.8–1.1)	921.4 ±14.4 (903–976.5)

Table 2. Morphometric indexes in males *Eurytemora caspica* sp. nov., *Eurytemora carolleeae* and *Eurytemora affinis* from the type localities. Mean±error of the mean (Min-Max) not shown if less 0.0.

Species/	Caudal rami, L/W	Leg 5Basipodit left, L/W	Leg 5 Basipodit right	Leg 4, Long spine/ Distal Segment	Leg 1, Long spine/ Distal Segment	Body size µm
E. affinis	7.8±1.0 (6–10.5)	1.0±0.1 (0.9–1.1)	5.0±0.1 (4–6.3)	1.1±0.1 (1.0–1.3)	1.2±0.1 (1.1–1.4)	1905.2±14.6 (1853.7–1953.9)
E. carolleeae	9.6±0.9 (8.1–11.1)	1.4±0.1 (1.3–1.6)	4.2±0.2 (2.8–5.8)	1.1±0.1 (1.0–1.1)	1.1±0.1 (1–1.4)	1336.5±19.3 (1285.9–1386.1)
E. caspica	10. ±0.3 (8.6–12.3)	1.2 (1.1–1.4)	2.9±0.1 (2.1–3.5)	1.1 (1.0–1.1)	1.2 (1.0–1.6)	905.3±25.1 (878.4–955.5)

For copepod body and appendage terminology we followed Huys and Boxshall (1991). Abbreviations used: END – endopod; EXP – exopod; BAS – basipod; P1–P4 – swimming legs 1–4; P5 – leg 5.

SYSTEMATICS

Class Copepoda H. Milne Edwards, 1840
Order Calanoida Sars, 1903
Superfamily Diaptomoidea Baird, 1850
Family Temoridae Giesbrecht, 1893
Genus *Eurytemora* Giesbrecht, 1881
***Eurytemora caspica* sp. nov.**
(Figs. 2a, b; 3–10)

Type material. Holotype, ZIN 55060, a female dissected on 1 slide; from the North part of the Caspian Sea, Russia (45°48´N, 49°38´E), collected by Federal State Unitary Enterprise Caspian Fisheries Research Institute – FSUE “CaspNIRKh”, 25 June 2011.

Paratypes, ZIN 55062, 55061/3–13, 15 females and 16 males, the same data as holotype, dissected on 11 slides (1 male 55062 on one slide, other – 3 individuals per slide)

Description. *Female* (Figs. 2b; 3–6). Body transparent, genital double-somite yellowish brown.

Length measurements:

Full body length without caudal setae 856, with caudal setae 961; cephalosome 283 and 4 free thoracic segments 1/2/3/4 = 67/64/50/42. Urosome 364, genital double-somite 72.

Cephalothorax 1,6 times as wide as long (Fig. 3 a), with maximum width close to middle, frontal part of cephalothorax oval.

Last thoracic somite with 1–2 small spines on wing-like outgrowths of lateral margin.

Genital double-somite symmetrical, 1.7 times as wide as long, due to wing-like outgrowths in anterior part of this somite, with 2 relatively long spines on both sides, with seminal receptacle as shown in Fig. 3b

Caudal rami (Figs. 3a, c) divergent, 8.1 times as long as wide, with long and strong hair-setae on both sides, as well as on last abdominal somite.

Length proportions of terminal setae, beginning from outermost caudal seta: 1/1.1/1.2/1.1. Length proportions of dorsal and lateral setae to outermost seta 0.4 and 0.9 times respectively.

Antennules (Fig. 4 c) of 25 segments, reaching end of fifth free thoracic somite, setation of segments beginning from first segment: 2/1/2/2/1/2/1/2/1/3 /2/2/1/3/3/1/3/1/2/2/0/2/1/3/7.

Antenna (Fig. 5 a) biramous, of 2-segmented protopod, 8-segmented exopod and 3-segmented endopod. First exopod segment with 4 setae, second segment with 1 setae, 3–6 segments with 1 seta each, 7–8 segments with 2 setae. First endopodal segment with 2 setae, second with 7 setae and third with 6 setae at distal end.

Mandible (Fig. 5 b) composed of coxa with gnatobasis, one of its tooth (outermost) significantly larger than others. Coxa in middle with biramous mandibular palp, basis with 4 setae, 8-segmented exopod and 5-segmented endopod. Distal segment of exopod with 2 sub-equal setae, other segments bearing single long seta each. Distal segment of endopod with 2 long setae, 2 and 4 segments with 1 long setae each, 3 and 5 – with 2 long setae each.

Maxillula (Fig. 5 c) biramous and composed of precoxa with medial arthrite bearing 8 strong claw-like spines, 7 relatively long setae; coxa with elongated endite bearing 6 long setae and outer outgrowth with 9 very strong sub-equal in length setae and 1 thin setae. Basis composed of basal endite, 1-segmented endopod with 9 long subequal setae and 4-segmented exopod bearing 5–5–4–7 (distally) long setae.

Maxilla (Fig. 5 d) uniramous, composed of precoxa with 2 endites; distal endite bearing 3 long setae, first segment with 4 setae, coxa with two endites bearing 2 long and 1 short setae each and 5-segmented endopod including basal endite with 2 long, 1 short setae and 4 short segments bearing 1 or 2 long distal setae.

Maxilliped (Fig. 5 e) uniramous and 9-segmented, composed of short precoxa with 1 seta and long coxa with 3 hill-shaped endites bearing 2–3–3 setae; basis more wide in middle part with 3 long setae and with complex of long hairs; endite with 2 long setae followed by 5-segmented endopod armed with 2–2–2–2–4(distally) setae.

Swimming legs P1–4 (Figs. 6a–d) consist of coxa and basis bearing 3-segmented exopod and 1 (P1) or 2-segmented endopod (P2–4). Coxa connected with smooth coxal membrane. First and second exopodal segments in each leg with 1 spine outside and 1 seta inside. Tiny spines between apical and short lateral spines on the distal exopodal segments of P2–P4. In P1 endopod with 5 setae, in P2–P3 first segment with 3, distal segment with 6 setae, in P4 first segment with 3, distal segment with 5 setae. Formula for spine (Arabic) and seta (Roman) for distal exopodal segments in P1–4 as follows: 3IV–3V–3V–3V. Some setae in swimming legs with segment-like divisions (Fig. 6 c, indicated with arrow). Both sides of P1–P4 covered with very short hair-setae.

Rudimentary P5 (Figs. 4a, b) uniramous and 4-segmented, narrow coxal plate bearing 1-segmented basis. Exopod 2-segmented, first segment with inner outgrowth oriented about 45° to segment axis and 2 lateral spines, distal segment with long apical seta and short lateral spine about half of apical seta. Tiny spine inserted between these 2 appendages about 10% or less of short spine length and shorter than distal seta width in insertion place.

Eggs are packed in sac. (Fig. 2 b).

Male (Figs. 2a; 7). Body length 881, with caudal setae 1016, in alive and freshly conserved specimens blue-grey in colour or colorless.

Cephalothorax slightly longer than wide, with maximum width close to caudal end, anterior part of cephalothorax round shaped.

Last thoracic somite without wings and spine on lateral margin (Fig. 7)

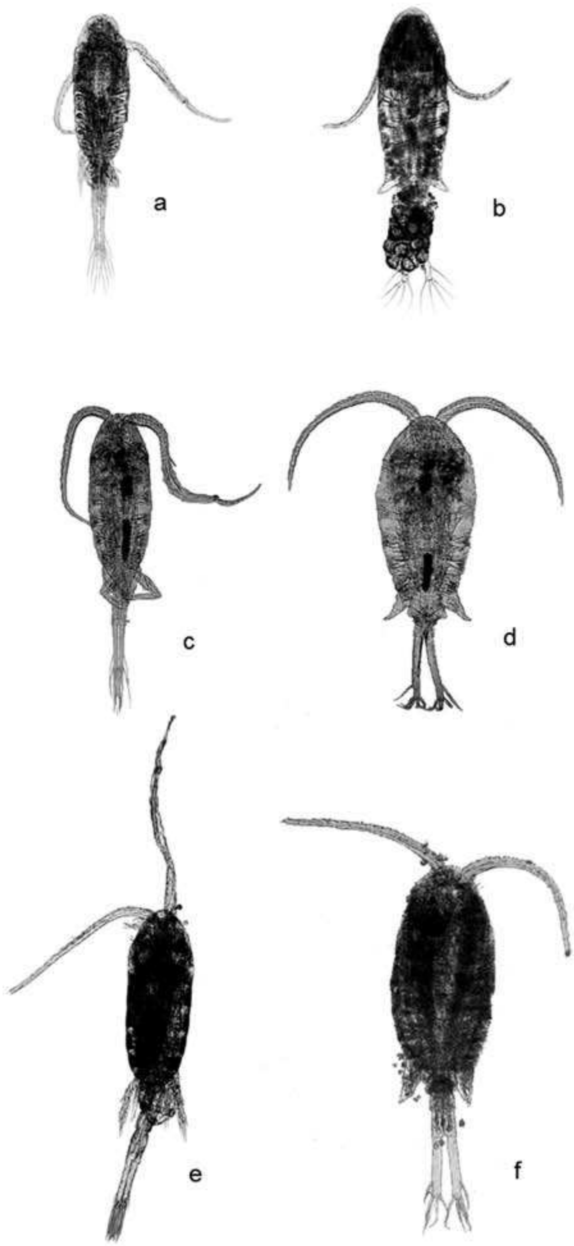

Fig. 2. Common viev of males and females *Eurytemora caspica* sp. nov. (a, b), *Eurytemora carolleeae* Alekseev et Souissi, 2011 (c, d) и *Eurytemora affinis* (Poppe, 1880) (e, f) from the type localities.

Abdomen 5-segmented.

Caudal rami: 10.3 times as long as wide without setules or hair-like seta on dorsal and ventral sides but with long hair-seta on inner part of cauda. Terminal setae ratio beginning from outermost caudal seta: 1/1.14/1.15/1.1. Lateral seta about 0.9 times longer

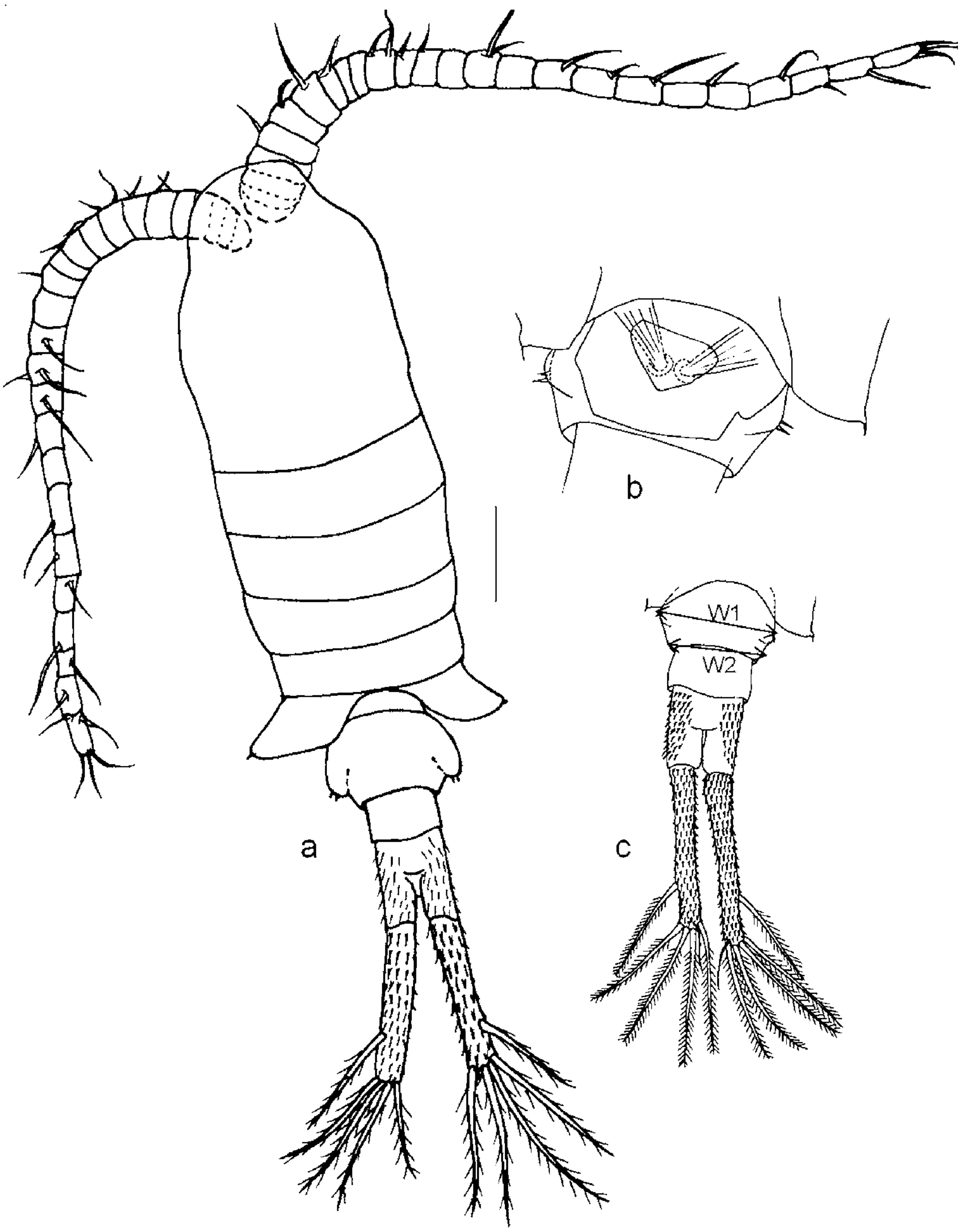

Fig. 3. *Eurytemora caspica* sp. nov., female, ZIN 55060 (holotype): a – habitus, dorsal view; b – genital double-somite, ventral view; c – urosome, ventral view. Scale bar: a, b – 200 μm; c – 100 μm.

than outermost seta, dorsal seta very short, located near innermost seta insertion place (Fig. 7).

Right antennule (Figs. 8a, b) 21-segmented, 8–12 segments with strong spines, strongest spine (twice as long as any other spine) at segment 12 (Fig. 8 b); 19 segment with denticulate plates at outer edges, distal segment with several small setae (Fig. 8 a, indicated with arrow). Other segments with regular setae as in Fig. 8a. Left antennule 25 segmented armed as in female (see Fig. 4 c).

Antenna biramous (not shown) with 2-segmented protopod, 3-segmented endopod and 8-segmented exopod. Setation as in female (see Fig. 5 a).

Mandible of the same construction as in female, gnatobasis with outermost tooth–like processor significantly larger than other. (Fig. 8 c).

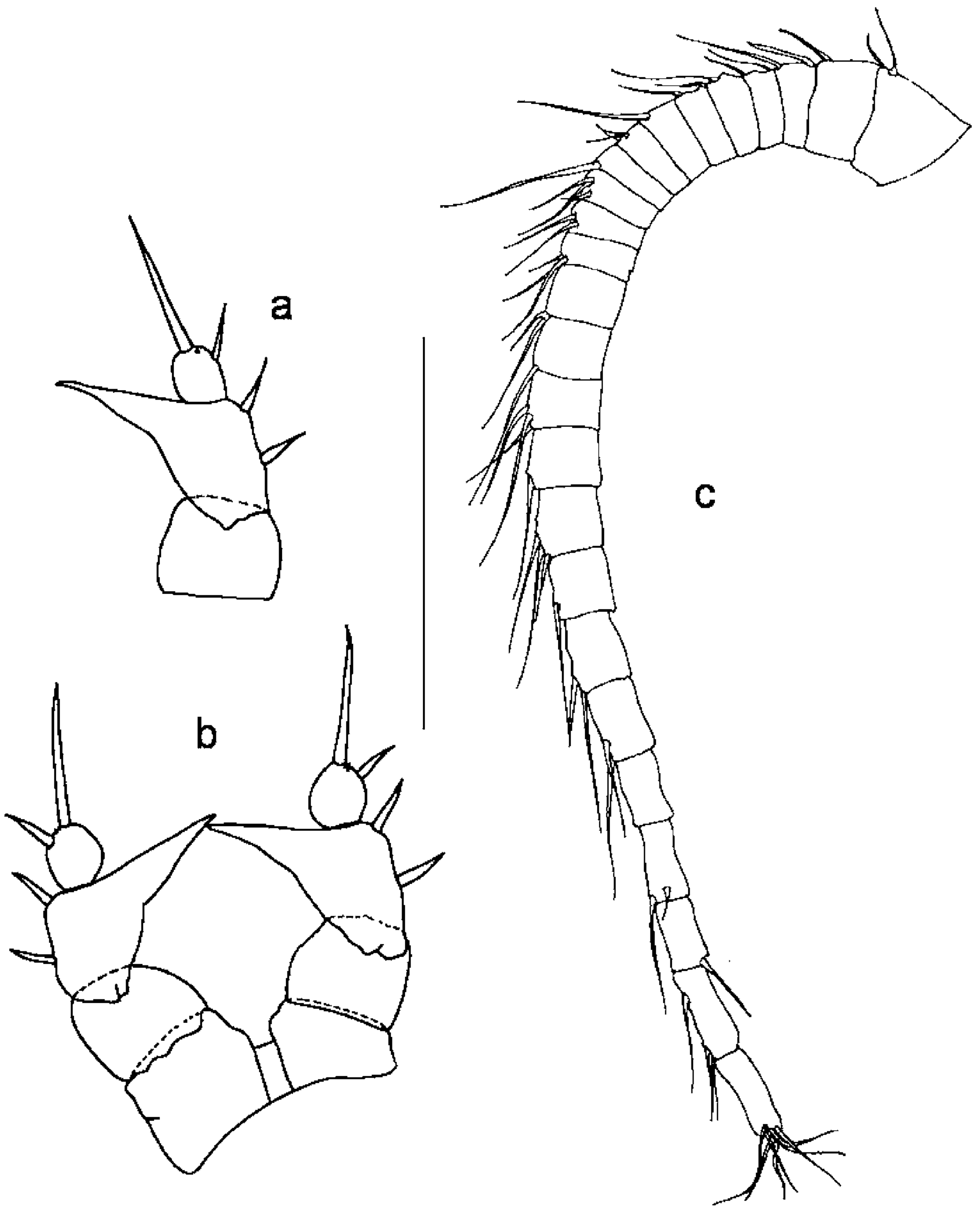

Fig. 4. *Eurytemora caspica* sp. nov., female, ZIN 55060 (holotype): a – P5; b – P5; ZIN 55061 (paratype); c – female left antennula. Scale bar: a, b – 100μm; c – 200 μm.

Maxillula, maxilla, maxilliped, basically like the same in female but not shown in figures.

Swimming legs P1–4 (Figs. 9a–d) constructed basically like in female. Formula for spine (Arabic) and seta (Roman) for distal exopod segments in P1–4 as follows: 3IV–3V–3V–3V. Some setae in swimming legs with segment-like divisions. Distal spines in exopod P1–4 slightly shorter than nearest setae and longer than distal segment length (Figs. 9a–d). Lateral edge of coxa in P3–4 with complex of long hair-setae. Both sides of P4 covered with very short hair-setae.

Rudimentary legs P5 (Fig. 10): right leg with basipodal segment cylindrical in shape and with small hill on inner side pointed with long spine, distal bent segment with 2 short spines in middle part. Ratio

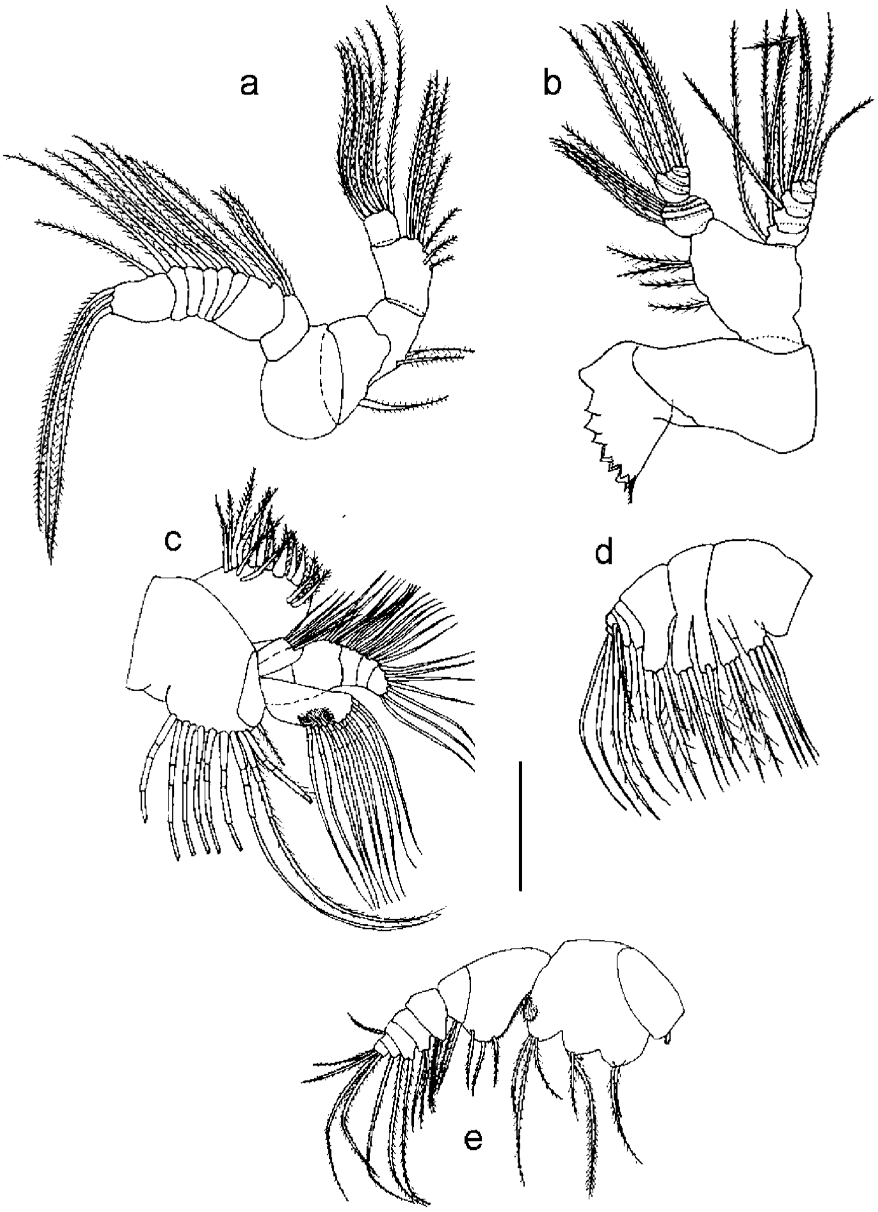

Fig. 5. *Eurytemora caspica* sp. nov., female, ZIN 55060 (holotype): a – antenna; b – mandible; c – maxillula ventral view, d – maxilla, e – maxilliped. Scale bar: 50 μm.

W1 (widest part of last segment of right leg P5)/W2 (width of this segment end near outgrowth) of this bent segment maximal for *E. caspica* sp. nov. compared to *E. affinis* and *E. carolleeae* (Fig. 10 indicated with arrow). Left leg basipod triangular shape about 1.2 times as long as wide, segment with 2 spines on outer edge, next exopodal segment with 2 long spines on middle part of inner edge and 2 spines on outer edge, distal segment with 2 spines in central part of inner edge, 2 spines on outer edge and hook at end of segment, similar to *E. affinis*.

Etymology. The new species is named after its type locality.

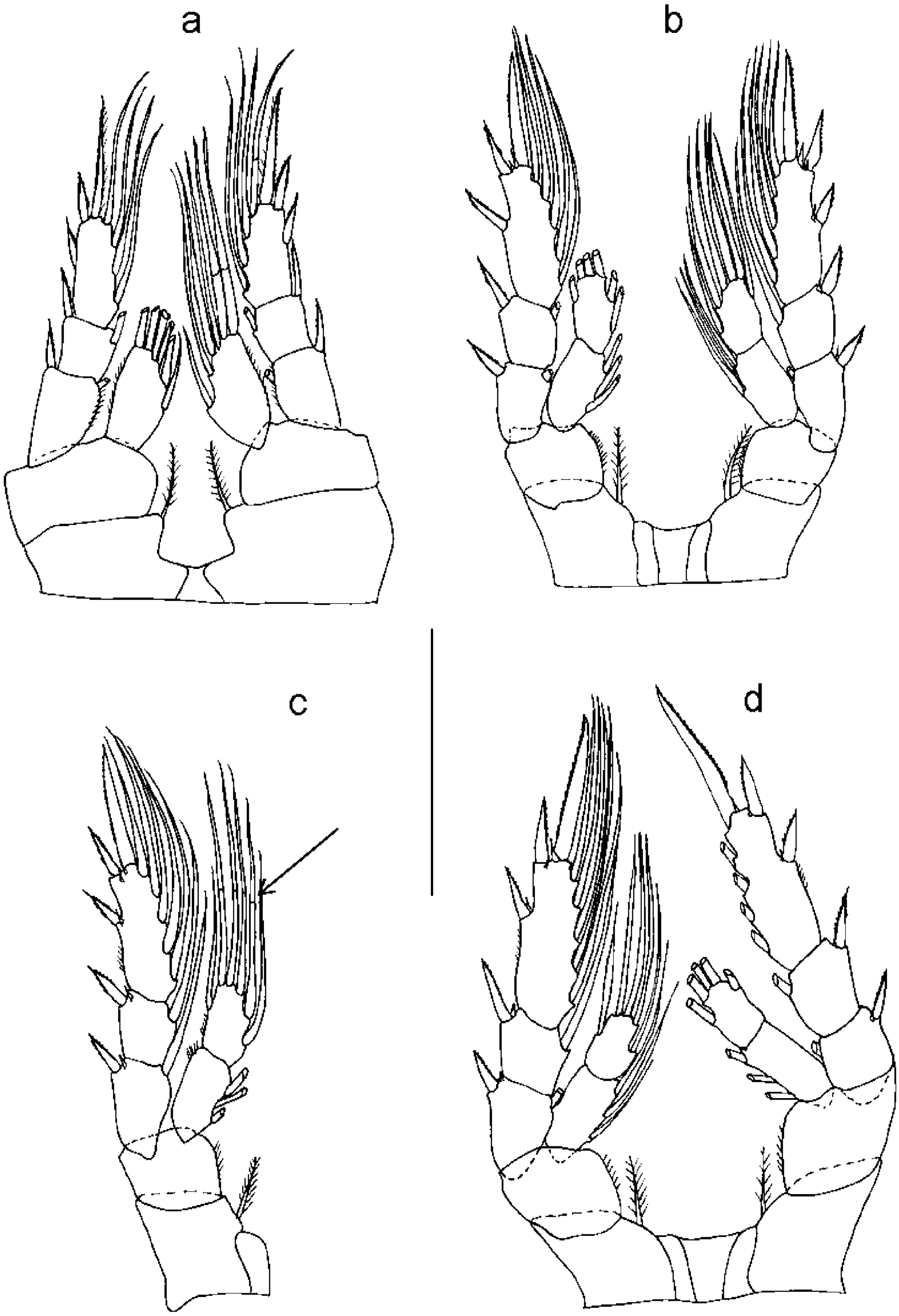

Fig. 6. *Eurytemora caspica* sp. nov., female, ZIN 55060 (holotype): a – left swimming leg 1, anterior view; b– swimming legs 2, anterior view; c – swimming legs 3, anterior view; d – swimming leg 4, anterior view. Scale bar: 100 μm. Arrow indicates seta segmentation.

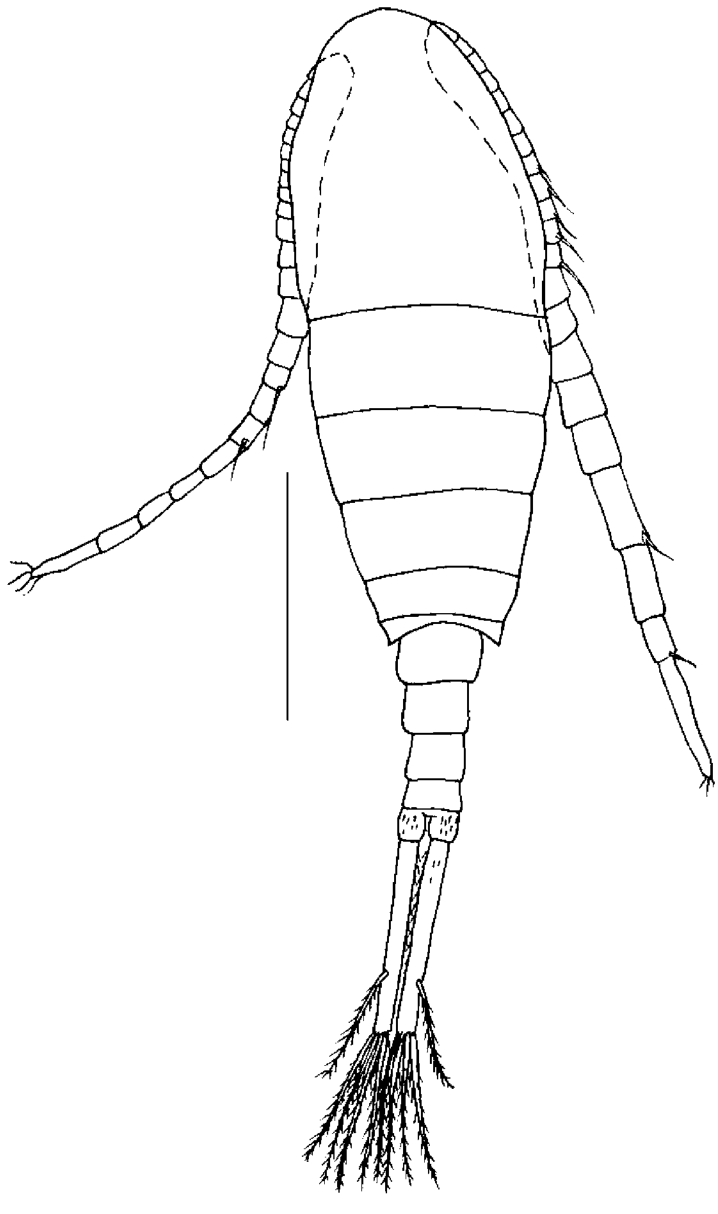

Fig. 7. *Eurytemora caspica* sp. nov., male – habitus, dorsal view, ZIN 55062. Scale bar: 200 μm.

Remarks. As for intraspecific variability within the type population we did not observe significant differences among 60 analyzed individuals. This low variability is reflected in the small errors of the mean shown in Tables 1 and 2. In general, the variation among individuals is rather small especially for females – not more than 2% for the mean values. Only for leg 5 the index of error/mean reached 7%, but to our mind it was rather a result of some unavoidable inaccuracies in the measurements, because P5 structures are smallest of all measured characters. Relative errors of mean for males are two times more than for females and only for leg 1 the index is 1.8%. To our mind the low variability among the tested individuals of the new species from the Caspian Sea, possibly indicates stability in environmental conditions for this population.

Differential diagnosis. Most of *E. caspica* sp. nov. features such as the shape of mandible, absence of clear segment division on swimming legs setae and on caudal setae for both species (Figs. 12a–o) are close to *E. affinis*. *E. affinis* females from the type locality as well as from others localities in Europe in contrast to the newly described species have genital somite with only small upper outgrowths (if present) which do not look like wings (Figs. 12a, k).

In *E. affinis* males, the caudal rami always have the sets of spines on the dorsal surface (sometimes only a few). The left rudimentary P5 of *E. caspica* sp. nov. males have the exopod of triangular shape similar to *E. affinis*, and length/ width proportion is not less than 1.2 times (Table 2, Fig. 10). The right rudimentary P5 of *E. caspica* sp. nov. male with distal segment of the characteristic shape and W1/ W2 proportion 2.9 that differs it from *E. affinis* (Table 2).

At the same time *E. caspica* sp. nov. females similarly to *E. carolleeae* are equipped with wing-like outgrowths of the genital double-somite, but the outgrowths are less than in *E. carolleeae* (Figs. 12f, k).

In *E. caspica* sp. nov. females like in *E. carolleeae* a small tiny spine P5 in the second exopodal segment placed between two distal spines (Alekseev, Souissi 2011) (Figs. 12g, m). The length of this tiny spine is less than the width of the nearest spines, or about 10% of the short distal spine length that definitely separates both species from *E. affinis* (Table 1).

In males of *E. caspica* sp. nov. like in *E. carolleeae* the caudal rami are naked on both dorsal and ventral sides. We did not find any others similarities within

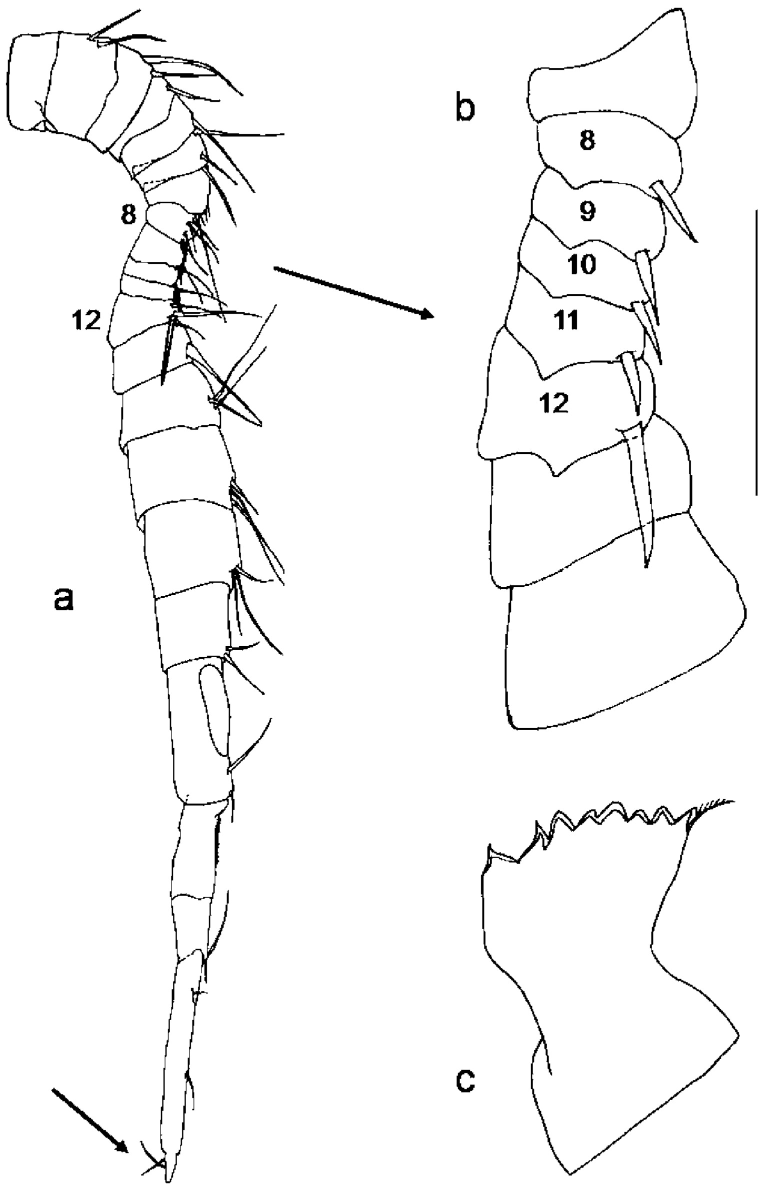

Fig. 8. *Eurytemora caspica* sp. nov., male, ZIN 55062: a – male antennula; b – 8–12 segments of male right antennule; c – mandible. Scale bar: a – 150 μm; b, c – 50 μm.

taxonomically significant characters for males of *E. caspica* sp. nov. and *E. carolleeae*.

According to our morphological survey, the Caspian species takes an intermediate position between *E. affinis* and *E. carolleeae* (Figs. 11a, b), but can be separated by above mentioned combination of the characters.

From other congeners female of *E. caspica* sp. nov. can be separated by the following combination of characters: inner edge of swimming legs 1–4 coxa covered with a plumose seta; endopod 1st swimming leg bears six setae; distal segment of rudimental leg 5 has two short spines on lateral edge, the first segment of leg 5 includes outgrowth directed at 45° angle to

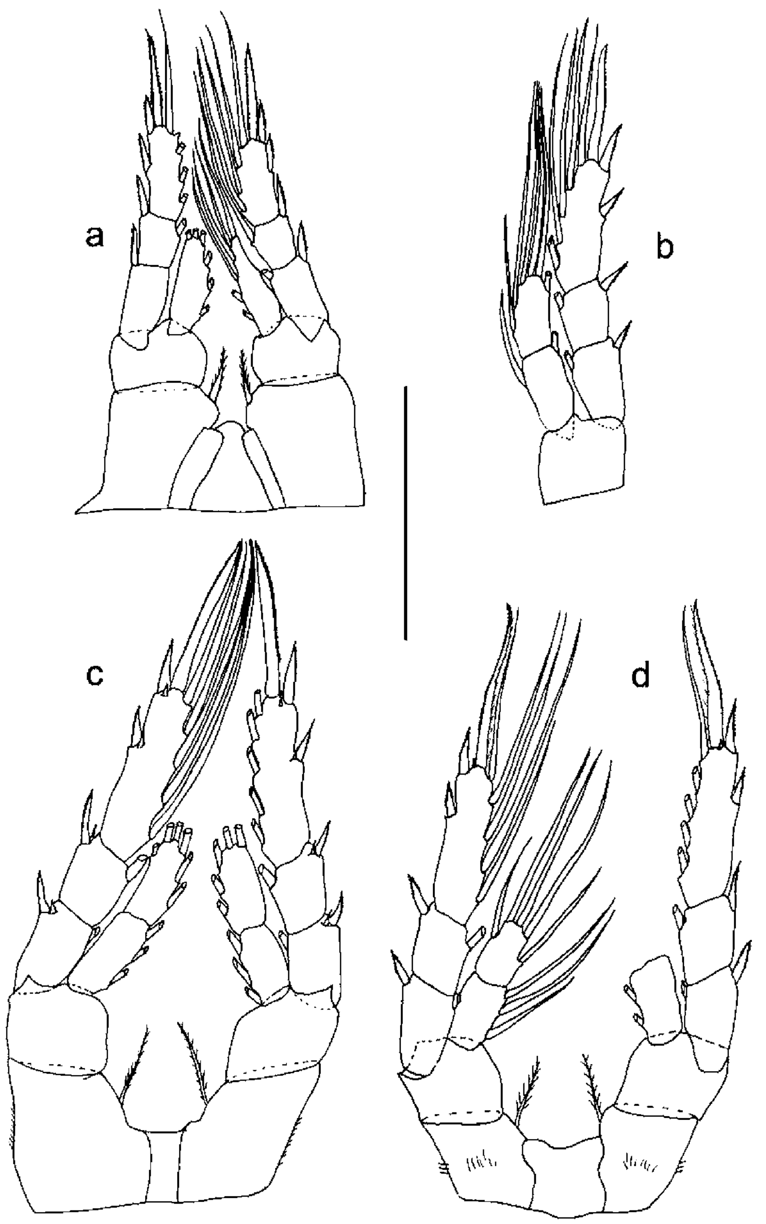

Fig. 9. *Eurytemora caspica* sp. nov., male, ZIN 55062: a – swimming leg 1, anterior view; b – swimming leg 2, anterior view; c – swimming leg 3, anterior view; d – swimming leg 4, anterior view. Scale bar: 100 μm.

the leg axes; abdomen is basically symmetrical; anal segment and caudal seta covered with spines

Compared to the other 17 congeners, *E. caspica* sp. nov. differs by a combination of characters that in females include: genital double-somite with lateral "wings" of sub equal sizes, tiny spine of P5; mandible with more or less equal teeth; coxae of legs 1–4 with long setae at inner side; symmetrical abdomen; caudal rami and last abdominal segment covered with dense spines. Males in *E. caspica* sp. nov. differ from other congeners by: a long seta at inner side coxa in legs 1–4; 4-segmented right leg in P5; caudal rami without setules or hair–like seta on dorsal and ventral side but with long hair-seta on inner part; last abdominal segment covered with rather strong dents; 8–12 segments of the first antenna armed with spines, the spine at 12th segment at least two times as long as other spines; in P5 left basis is triangular in shape, provided with

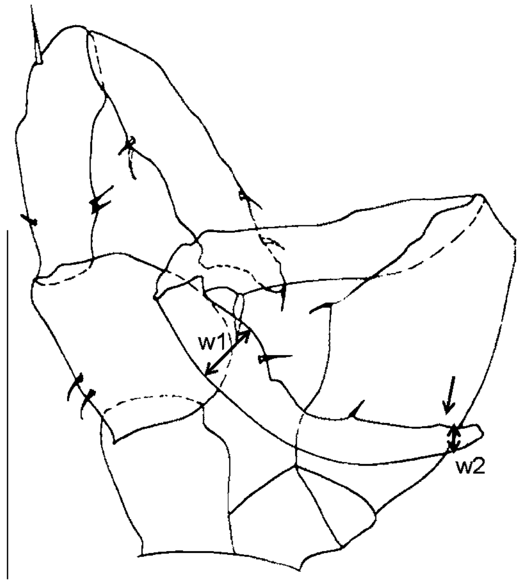

Fig. 10. *Eurytemora caspica* sp. nov., male, ZIN 55062: P5; arrow indicating W1 and W2, W1 is more wide part of P5 right leg last segment, W2 is width of this segment end near the outgrowth (arrow indicating). Scale bar: 100 μm.

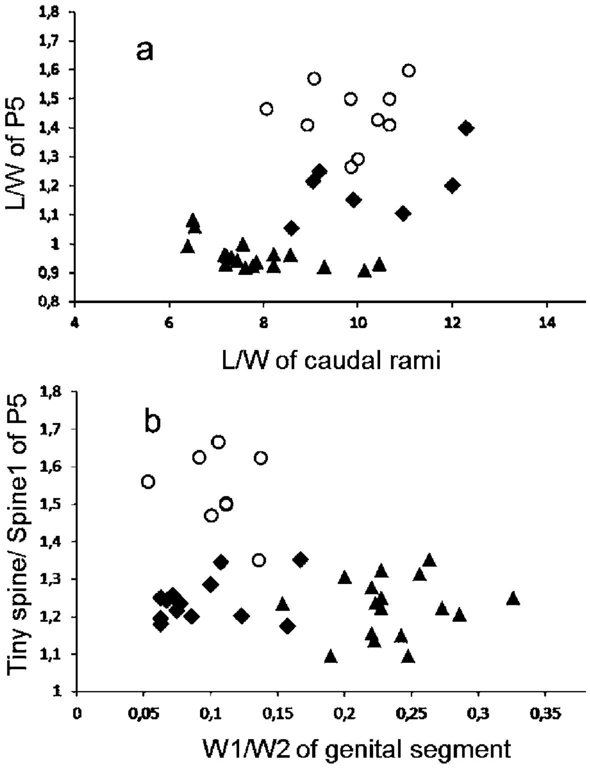

Fig. 11. Morphological indexes in *Eurytemora caspica* sp. nov. from theCaspian Sea (squares), *Eurytemora affinis* (Poppe, 1880) from the Elbe Estuary (the North Sea) (triangles) and *Eurytemora carolleeae* sp. nov. from the Chesapeake Bay, USA (rings). a – males, b – females. For more explanation see text and Tables 1, 2.

two small round shape outgrowth, the first segment of the left exopod is without very long spine distally and the second (distal) segment with 2 lobes at the end; mandible with more or less equal teeth.

DISCUSSION

Concerning other possible members of the *E. affinis* complex, previous studies of mitochondrial genes, such as CO1 and 16S rRNA have shown some differences between the Caspian and the Japanese specimens (Lee 2000), however morphological data on *E. affinis* from Japan are still lacking. Specimens from Japan might also show morphologically differences from *E. affinis* form the type locality in the Elbe estuary, and may therefore represent a further species in the complex.

In Russia and adjacent countries practically all *Eurytemora* species can be found, and identified using existing identification keys (Boruzky et al. 1991; Stepanova 1995). The only exceptions are the two recently described sibling species from the *E. affinis* complex (Alekseev et al. 2009; Alekseev and Souissi 2011; this paper). Hereafter we provide an identification key to *E. affinis* complex separately for male and female.

Key to *Eurytemora* species of the *E. affinis* complex

Despite of the fact that our measurements showed relatively small body size in *E. caspica* sp. nov., we did not include this information in our identification key. Probably this significantly smaller size compare to both other species is a result of a seasonal body length variation that is not studied yet. On the other hand it may be also an artifact, caused by the formalin preservation of the Caspian material. It is known that formalin causes a greater reduction in the body size than ethanol when used for preservation (S.Ya. Tsalolikhin, pers. communication).

Females

1. In leg 5, tiny spine about 10% or less of length of nearest lateral spine, shorter than width of nearest distal spine in insertion place 2
– In leg 5, tiny spine about 15–30% of length of nearest lateral spine, equal to width of nearest distal spine in insertion place .... *E. affinis*

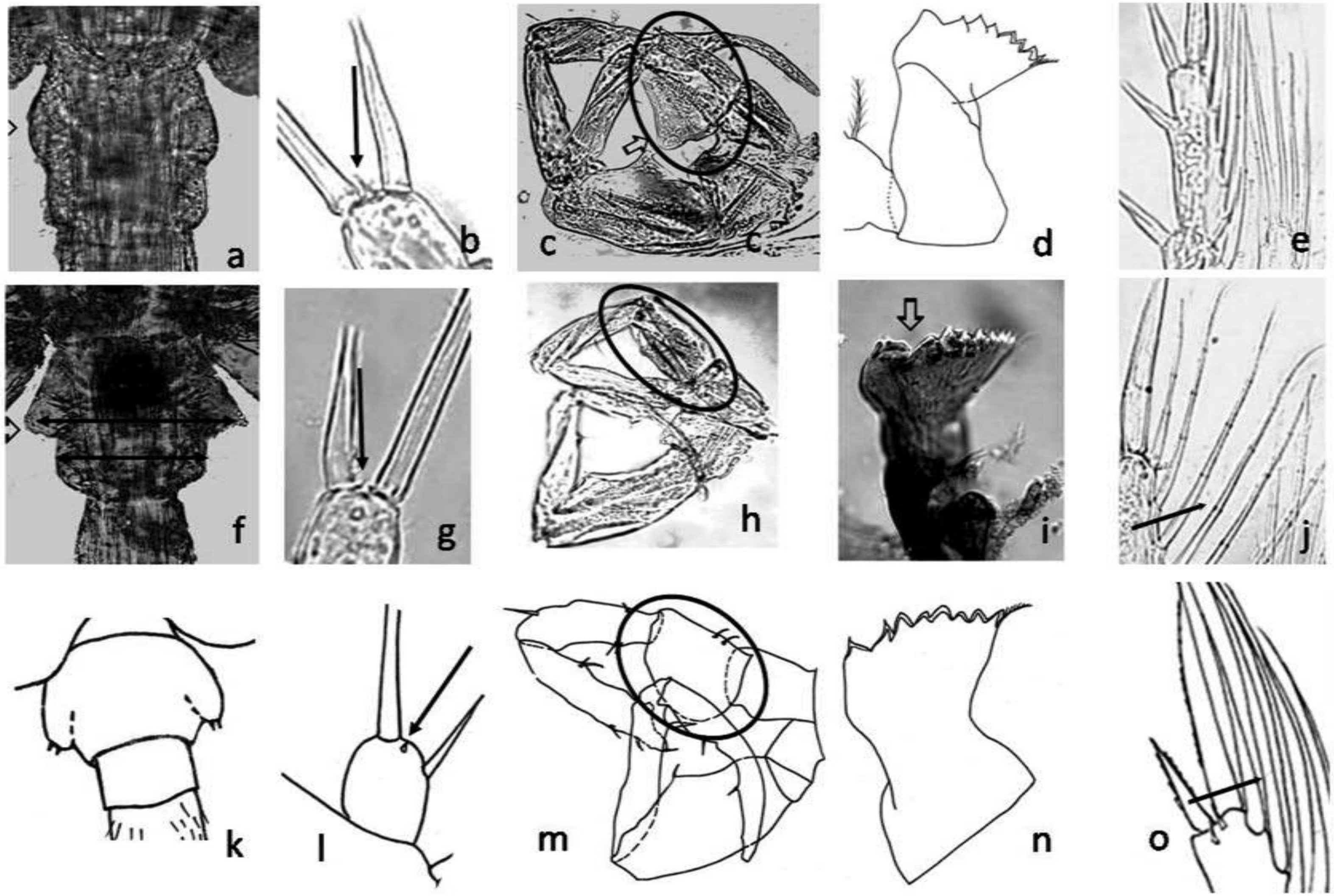

Fig. 12. Main differences between *Eurytemora affinis* (Poppe, 1880) (a–e), *Eurytemora carolleeae* (f–j) and *Eurytemora caspica* sp. nov. (k–o). a, f, k – female genital somite; b, g l – distal segment of female p5 and tiny spine (arrow indicating); c, h, m – male leg 5 with ellips indicating left basipod; d, I, n – male mandible, arrow indicating a gap; e, j, o – setae of swimming legs with arrow indicating segmentation. See text for more explanations.

2. Mandible with more or less equal teeth; outside tooth not separated from neighboring teeth by gap, caudal setae without clearly seen segment-like divisions .... *E. caspica* sp. nov.
– Mandible with outside tooth clearly separated from neighboring teeth by gap, caudal setae with clearly seen segment-like division .... *E. carolleeae*

Males

1. Caudal rami always with spines on dorsal surface (sometimes few). In left P5 basipodite with maximal width in anterior part of lateral outgrowth and with length/width ratio usually less than 1 .... *E. affinis*
– Caudal rami always naked on both dorsal and ventral sides. Left P5 basipodite with maximal width in the middle part, with length/width ratio usually more than 1 (Table 2, Fig. 10) 2
2. Mandible with more or less equal teeth; outside tooth not separated from neighboring teeth by gap, caudal setae without clear seen segment-like separation .... *E. caspica* sp. nov.
– Mandible with outside tooth clear separated from neighboring teeth by gap, caudal setae with distinct segment-like separation .... *E. carolleeae*

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