

A New Species of *Enhydrosoma* Boeck, 1872 (Copepoda: Harpacticoida: Cletodidae) from the Black Sea Coast of Turkey with Some Remarks on the Taxonomic Status of *E. wellsi* Bodin, 1968

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Article History

Received 12 January 2018

Accepted 03 October 2018

Early View 11 October 2018

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Keywords

Taxonomy

New species

Meiofauna

Abstract

During a survey that was conducted at the South East Coast of Black Sea, Turkey on 10 March 2015, undefined *Enhydrosoma* specimens were encountered in the samples that were taken from 30 m depth of Çamburnu Harbour and described as new to science in detail. The new species differs from all of the known species of the genus by having 4 elements on the distal segment of Periopods(P)3 and P4 exopod (exp) except *E. wellsi* and *E. longifurcatum* but can easily be differentiated from *E. wellsi* by lacking an inner seta on P2-P4 exp-2; by having 2 setae instead of 3 on P1 endopod(enp)-1, 2 setae at antenna (A2) exp instead of one and having a mandibular palp with 3 setae instead of 5. The new species also differs from *E. longifurcatum* by having 4 elements on the distal segment of P3-P4 exp and with the form of female P5. On the other hand, it has been concluded that the report of *E. longifurcatum* from the Black Sea given by Apostolov and Marinov (1988) is conspecific with the new species and considered as a synonym of the new species.

Introduction

Family Cletodidae Scott T., 1904 of order Harpacticoida currently accommodates over hundred species that are classified in 26 genera (Chad & Huys, 2008). The members of the family have a global distribution and mostly inhabit shallow and sublittoral waters, also have a few exceptions that live in the deep sea and brackish waters (Boxshall & Halsey, 2004).

Genus *Enhydrosoma* Boeck, 1872 is the most specious group in the family consisting of 52 valid species (Chad & Huys, 2008) and considered as polyphyletic by various authors (Kim, Trebukhova, Lee, & Karanovic, 2014 and references therein). The genus established by Boeck (1872) with a rather insufficient diagnosis to accommodate two newly described species *E. curticauda* and *E. longicauda* and assigned *E. curticauda* as the type species of the genus. Sars (1909) was the one who first attempted to define the genus

with respect to the structure of the mouthparts and the fifth swimming leg and discriminated it from the *Cletodes* with these characters. Then Lang (1936) considered the distinguishing differences of *Enhydrosoma* and *Cletodes* as unreliable and instead he used the setation and form of the distal segments of the third and fourth swimming legs to differentiate the two genera. Gee (1994) redescribed the type species (*E. curticauda*) in his revision of the genus *Enhydrosoma* and rediagnosed it. Kim *et al.* (2014) redescribed formerly known *E. intermedia* and established a new genus, *Geehydrosoma*, to accommodate it together with *E. brevipedum* with the help of molecular data. Recently Karanovic, Kim, and Lee (2015) compared the molecular and morphology based phylogenies of the *Enhydrosoma* species that were collected from Korea and pointed out the need of an urgent revision of the genus.

During a survey that was conducted in South East

coast of Black Sea, Turkey on 10 March 2015, undefined *Enhydrosoma* specimens were encountered in the samples that were taken from 30 m depth of Çamburnu Harbour. The aim of present study is to describe the new species in details and discuss the affinities of the new species with the valid members of the genus.

Material and Methods

The samples were collected from Çamburnu Harbour (40° 55' 44.1" N; 40° 12' 22"E) in South East coast of Black Sea at 10.03.2015 from 30 m depth. Sediments samples were collected by using Van Veen Grab with a surface area of 2500 cm². R/V KTU DENAR 1 were used during the sampling. In the beginning, the sediment samples were sieved by means of 500 µm mesh size sieve to retain the coarse particles. Then the remaining part of the samples were passed through a 63 µm sieve. The particles above the 63 µm sieve which contain the organisms were washed and transferred to the plastic bottles. Washing material was fixed with 4% borax buffered formaldehyde. Harpacticoid species in the sediment were selected under Nikon SMZ 745 steroid microscope and transferred to 50 ml falcon tubes until examination. The method described by Karaytuğ and Sak (2006) used for the preparation of the specimens for identification. Olympus SZX-12 stereo microscope was used for dissecting of the specimens. Olympus BX-53 binocular microscope equipped with a drawing tube was used to observe and draw the specimens. The hand driven sketches of the figures transferred to the computer with the help of Wacom Intuos Pro graphics tablet with Adobe Photoshop CC graphics software. The holotype and paratypes were stored in lactophenol at slides that were sealed with Entellan® (Merck) and deposited in the collection of ZMADYU. Huys *et al.* (1996) was followed for the terminology. The following abbreviations used in the text: A1 for antennule, A2 for antenna, ae, aesthetasc; exp, exopod; enp, endopod; P1-P6, first to sixth periopods; exp (enp)-1 (2, 3) to denote the proximal (middle, distal) segment of a ramus.

Results

Systematics

Subclass Copepoda Milne Edwards, 1840
Order Harpacticoida Sars, 1903
Family Cletodidae Scott T., 1904
Enhydrosoma *erdarsakisp.* n.

Synonym

E. longifurcatum Sars, 1090 *sensu* Apostolov and Marinov, 1988

Holotype

1 ♀ (ZMADYU 2015/138) dissected in 8 slides.

Paratypes

1 ♀, dissected in 8 slides (ZMADYU 2015/139), 1 ♂, dissected in 8 slides (ZMADYU 2015/140)

Type locality

Çamburnu harbour in the South East coast of Black Sea. Coordinates: 40° 55' 44.1" N; 40° 12' 22"E. Depth: 30 m. 10.03. 2015. Leg: Dr. İlnur YILDIZ

Description

Female

Body cylindrical, without clear demarcation between urosome and prosome, 610 µm from tip of rostrum to the posterior margin of caudal rami (measured from dorsal view), slightly curved ventrally in lateral view. Posterior margin of somites with numerous papillary socles (each bearing sensillum) as figured (Figures 1a, b). Rostrum convex, fused to cephalic shield, ventrally recurved in lateral view, bearing two sensilla on dorsal surface. Genital double-somite (Figures 1a, b, 2a) completely fused ventrally and dorsally, subcuticular ridge indicating line of fusion clear at lateral view, as long as wide in dorsal view. Genital opening located midventrally at anterior half of the genital double somite; covered by vestigial P6, ornamented with a setular row near genital opening (Figure 2a). Anal somite (Figures 1a, b, 2a) with spinules arising from a short cuticle projection on each side of lateral surface, a convex operculum that bears two sensillae arising from a papillary socle at each side, ornamented with very minute spinules along posterior margin;

Caudal rami (Figures 2a-c) about 4.5 times longer than wide, bears seven bare setae. Setae I and II located at proximal part of dorsolateral surface; seta I smaller than seta II; seta III located at proximal half of dorsolateral surface, naked and longer than seta II; seta IV located at outer distal corner; seta V located terminally, about 2.5 times longer than caudal rami; seta VI located at inner distal corner, short; seta VII located at the middorsal surface of caudal rami, bi-articulated at base and arising from a small pedestal.

A1 (Figure 3a) slender, 5- segmented, segment surfaces naked except segment I; segment I bears two spinular rows at dorsal surface, segment III bears an aesthetasc fused to a long naked seta, arising from a pedestal; segment IV with a small apical acrothek consisting of a small aesthetasc fused basally to one naked and one pinnate setae. Armature formula: 1-[1], 2-[4+3 spinulose], 3-[4+3 spinulose+ (1+ae)], 4-[1 spinulose], 5-[6+ 3 spinulose+ acrothek].

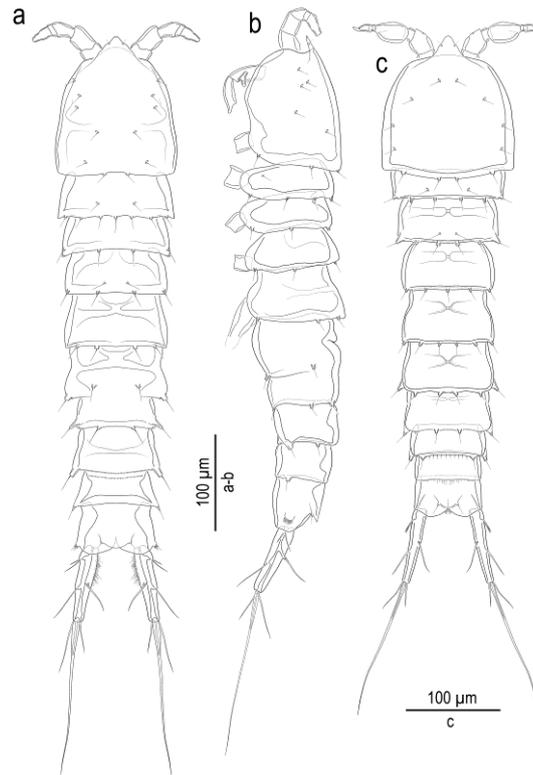


Figure 1. *E. serdarsaki* sp. n., habitus; a) ♀, dorsal, b) ♀, lateral, c) ♂, dorsal.

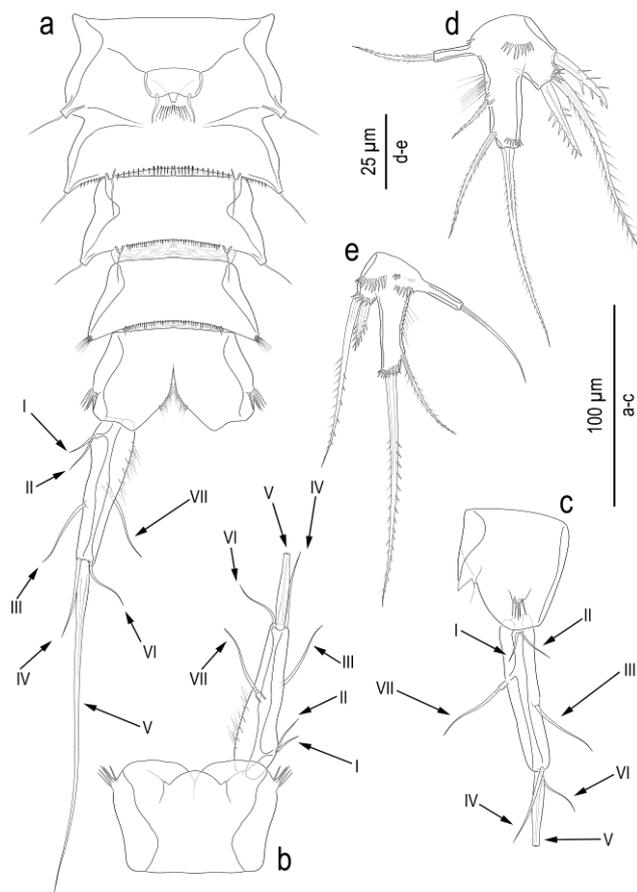


Figure 2. *E. serdarsaki* sp. n.; a) ♀, urosome, ventral, b) ♀, anal somite and caudal rami, dorsal, c) ♀, anal somite and caudal rami, lateral, d) ♀, P5, e) ♂, P5.

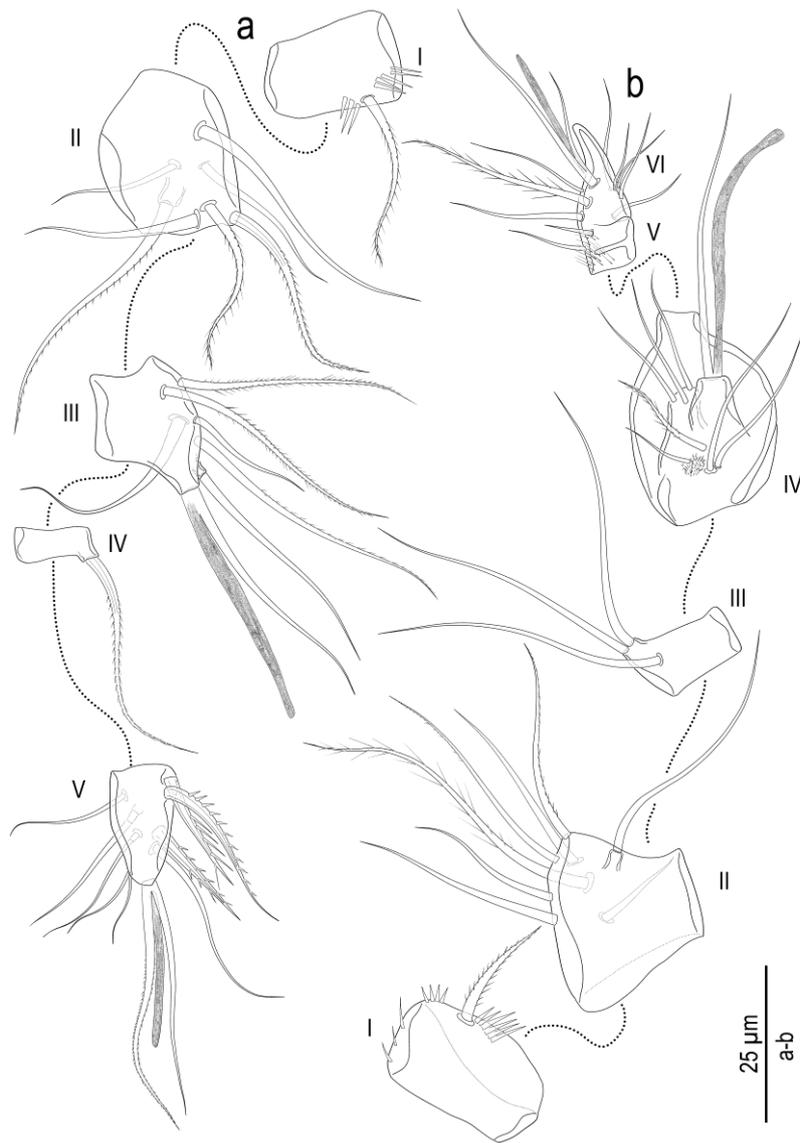


Figure 3. *E. serdarsaki* sp. n., A1; a) ♀, b) ♂.

A2 (Figure 4a) with coxa, allobasis, uni-segmented exopod and endopod. Coxa squarish and naked; allobasis elongated, about 1.6 times longer than wide, bears a short row of spinules near outer distal corner, without abexopodal seta. Exopod uni-segmented, slightly elongated, furnished with short spinules near distal margin, armed with two bipinnate setae. Endopod elongated, about 3.4 times longer than wide, ornamented with a spinular row at outer margin and stout spinular rows at inner margin, bears two naked setae laterally, one naked, one bipinnate, two long geniculate setae and one stout pectinate spine apically.

Mandible (Figure 4b). Gnathobase with several teeth as figured; palp uni-segmented, slightly elongated, armed with one lateral and two terminal spinulose setae.

Maxillule (Figure 4c). Praecoxa well developed, bears a short spinular row at distal margin. Arthrite bears 3 bare seta and three spines which of two fused to the arthrite at base. Coxa and basis fused,

armed with one naked and four spinulose setae.

Maxilla (Figure 4d). Syncoxa slightly longer than wide, with row of spinules as figured, bears a squarish syncoxal endite armed with one strong bipinnate spine and two bare setae. Distal and basal endite and endopod fused. Distal endite armed with two modified spines fused at base; basal endite bears two surface seta and one strong spine fused to endite at base. Endopod reduced and fused to basal endite, bears two short spinulose setae.

Maxilliped (Figure 4e). Syncoxa about 2 times longer than wide with spinular rows on posterior and anterior surfaces; without seta at inner distal corner. Basis elongate, about 2.2 times longer than wide and bears one spinular row on ventral surface. Endopod with curved slender claw fused to endopod and naked accessory seta distinct from endopodal segment.

P1-P4 (Figure 5a-d). Coxa broad; ornamented with a row of long spinules at outer distal corner and a row of short spinules at anterior surface. Basis ornamented with rows of spinules as figured; armed with one

naked (P1) or one bipinnate (P2-P4) outer seta; bears a strong plumose inner seta (P1) or inner margin naked (P2-P4); with 3 segmented exopod and two segmented endopod. Exp-1 and exp-2 ornamented with a row of long spinules at outer margin, armatured with a strong bipinnate spine at outer distal corner, inner margin without any armature. Exp-3 ornamented with rows of spinules as figured, armatured with one bipinnate outer spine, one unipinnate (P1) or bipinnate (P2-P4) spine at outer distal corner and two long distal setae with penicillate tips (P1) or two long plumose setae (P2-P4). Enp-1 very short and squarish, ornamented with spinules as figured, without any armature. Enp-2 elongated, about 3.5 (P1, P4) or 4 (P2, P3) times longer than wide, ornamented with long spinules at inner margin and relatively weak and short spinules at outer margin. P1 enp-2 bears one strong unipinnate spine and one long plumose seta distally. P2 enp-2 with two long plumose setae distally. P3 and P4 enp-2

armatured with a strong bipinnate spine at outer distal corner, bears two long plumose distal setae. Setal formula of the swimming legs:

	Enp	Exp
P1	0.020	0.0.022
P2	0.020	0.0.022
P3	0.021	0.0.022
P4	0.021	0.0.022

P5 (Figure 2d). Baseoendopod and exopod fused. Baseoendopod ornamented with a row of spinules on anterior surface near the base of endopodal lobe; outer basal seta bipinnate, arising from a long peduncle. Exopod about twice as long as endopodal lobe; proximal part of outer margin ornamented with long setules; armatured with one bipinnate seta arising from a short peduncle located at midline of outer margin, bears a bipinnate seta near outer distal corner and one

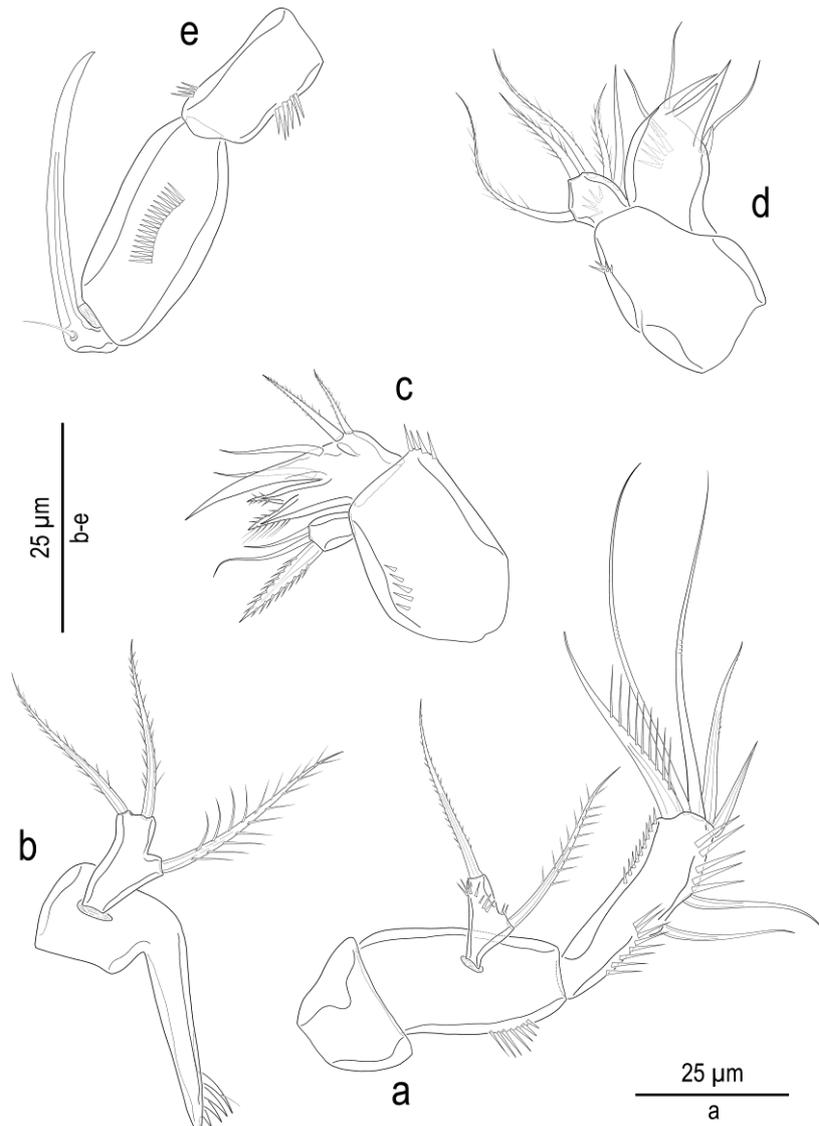


Figure 4. *E. serdarsaki* sp. n., ♀, a) A2, b) mandible, c) maxillule, d) maxilla, e) maxilliped.

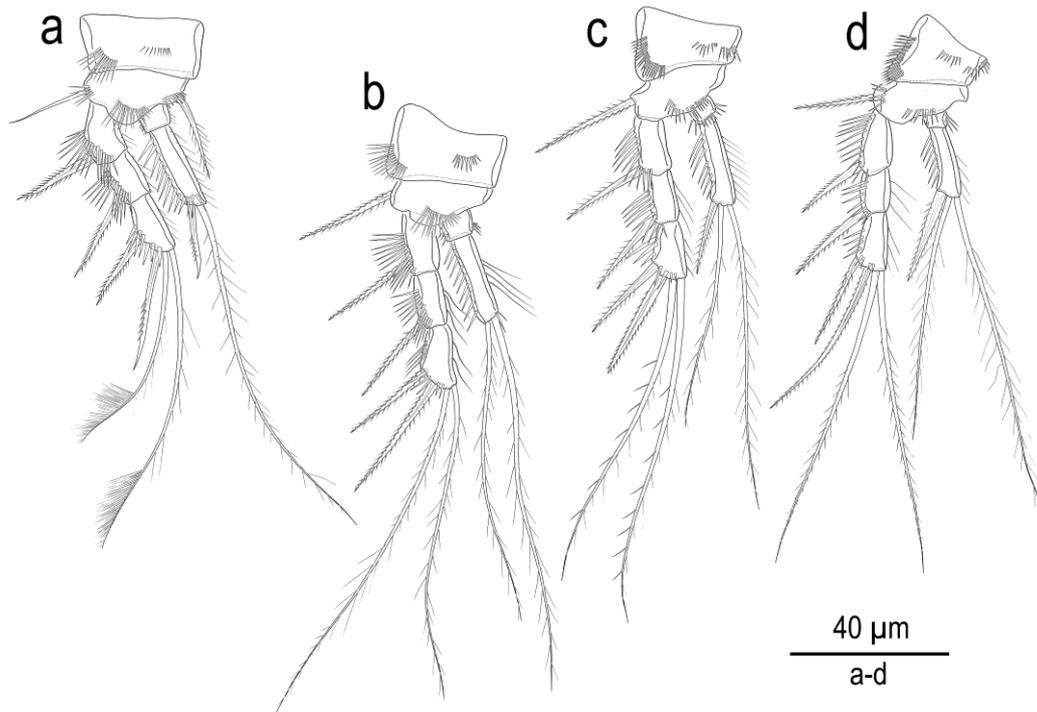


Figure 5. *E. serdarsaki* sp. n., ♀; a) P1, b) P2, c) P3, d) P4.

very strong bipinnatespiniform seta distally, inner margin naked. Endopodal lobe armed with two short and strong bipinnate spines and one long bipinnate seta.

P6 (figure 2a) pairs fused and reduced to a symmetric plate, located on the genital opening, armed with one short bare seta on each side.

Male

Urosome, genital area, anal somite, antennule and P5 sexually dimorphic. Body length 600 μm from tip of rostrum to posterior margin of caudal rami (measured from dorsal view); Second and third urosomites not fused (Figure 1c). P6 reduced without any armature. Anal somite generally as in female but without lateral spinular rows.

Antennule (Figure 3b). 6-segmented, subchirocer; segment I with stout pinnate spine and spinular rows as figured; segment IV swollen, with a short aesthetasc fused basally to a naked seta. Segment V and VI partially fused at outer margin; segment VI with a small apical acrothek consisting of a small aesthetasc fused basally to one short and one relatively long naked setae. Armature formula: 1-[1 spinulose], 2-[5+3 spinulose], 3-[3], 4-[6+ 1 spinulose + (1+ ae)], 5 -[2], 6-[7+1 spinulose+ acrothek].

P5 (Figure 2e) Baseoendopod and exopod fused. Baseoendopod ornamented with row of spinules on anterior surface; outer basal seta naked, arising from a long peduncle. Exopod much longer than endopodal lobe; outer margin ornamented with short setules; armed with one bipinnate seta near outer distal

corner and one very strong bipinnatespiniform seta distally, inner margin naked. Endopodal lobe very short ornamented with spinular rows as figured; armed with one short and strong spine and one long seta.

Etymology

The new species is named after Prof. Dr. Serdar SAK for his contributions to the harpacticoid taxonomy.

Discussion

Genus *Enhydrosoma* has been a taxonomic debate since its erection by Boeck (1873). Various attempts (Sars, 1909; Lang, 1936; 1948; 1965; Thistle, 1980; Gee, 1994; Kim *et al.*, 2014; Karanovic *et al.*, 2015) had been taken to construct a monophyletic group but this task still could not be accomplished because of the insufficient descriptions and figures that lack important characters such as the form and setation of the mouthparts, and even pereopods on some occasions.

The most up to date diagnosis of the genus was the one provided by Gee (1994) who reviewed the morphological traits among the species of the genus that are known at the time. Although the new species described herein generally in concordance with the diagnosis of the genus differs from all of the known species of the genus by having 4 elements at the distal segment of P3 and P4 exopod. Lang (1936) first used the armature of P3-P4 and the length of the distal segment of the exopods to distinguish the two closely related genera *Enhydrosoma* which has five elements

in the exp-3 of P3 and P4 and relatively short exopodal segments, and *Cletodes* which has five elements at the above-mentioned segments and elongated exopodal ramus at the P1-P4. Thistle (1980) and Gee (1994) followed Lang (1936) for this trait but could not be able to discuss *E. wellsii* Bodin 1968 which also has 4 elements at P3-P4 exp-3, as this species was considered as a synonym of *Cletodeslatirostris* by Drzycimski (1969) until Bodin (1997) placed the species again in *Enhydrosoma*. Although the new species described here is similar to *E. wellsii* with the armature formula of P3 and P4 exp-3, can easily be differentiated by lacking an inner seta at P2-P4 exp-2; by having 2 setae instead of 3 at P1 exp-1, 2 setae at A2 exopod instead of one and having a mandibular palp with 3 setae instead of five. Although these characters of *E. wellsii* mentioned above also deviates from the diagnosis of the genus, we believe that transferring it to another genus or erecting a genus to accommodate without properly inspecting the type species (which is not in the scope of this study) will lead another taxonomic problem.

Besides the armature formula of P3 and P4 exp-3, the new species described herein is very similar to *E. longifurcatum* Sars, 1909 sensu Apostolov and Marinov, 1988 who reported the species from Black Sea without giving any information on the armature of swimming legs but with the drawings of P5 which differs Sars's (1909) original description by having an exopod completely fused to the baseoendopod, and also resembles the new species described herein with this character. Therefore, the population reported as *E. longifurcatum* by Apostolov and Marinov (1988) from the Black Sea should be considered as a synonym of *E. serdarsaki* sp. n.

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