Anadolu Doğa Bilimleri Dergisi 3(1): 23-36, 2012
(Journal of Anatolian Natural Sciences)

Research Article

Laophontidae Fauna (Crustacea: Copepoda: Harpacticoida) of the Turkish Black Sea Coast

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Abstract: Laophontid copepods inhabiting interstitial and phytal habitats in the mediolittoral zone of sandy beaches of the Black Sea Coast of Turkey were investigated. 66 different localities were sampled and 8 species/subspecies were determined. These taxa are: *Heterolaophonte uncinata, H. curvata, Klieonychocamptus ponticus, K. kliei adriaticus, Paralaophonte brevirostris, Laophonte setosa, L. elongata triarticulata, Asellopsis sarmatica*. Among the 3 subspecies of *L. elongata*, only *L. elongata triarticulata* has the 3-segmented P1 exopod in addition to the other differentiating characteristiscs, therefore this subspecies was raised to specific rank as *L. triarticulata* **stat. nov.** All taxa identified were recorded for the first time from the study area. Comparison with published marine harpacticoid records from Turkey also revealed that 4 species had not previously been reported from Turkish coastal waters.

Keywords: Black Sea, Copepoda, Harpacticoida, Laophontidae, Taxonomy

Türkiye Karadeniz Sahili Laophontidae (Crustacea: Copepoda: Harpacticoida) Faunası

Özet: Türkiye'nin Karadeniz kıyı şeridi kumluk sahilleri mediolittoral bölgedeki kumiçi ve fital habitatlarda yaşayan laophontid kopepodlar araştırıldı. Örneklenen 66 lökaliteden sekiz tür/alttür tanımlandı. Bu taksonlar: *Heterolaophonte uncinata, H. curvata, Klieonychocamptus ponticus, K. kliei adriaticus, Paralaophonte brevirostris, Laophonte setosa, L. elongata triarticulata, Asellopsis sarmatica*'dır. *L. elongata*'nın üç alttürü arasında sadece *L. elongata triarticulata* diğer farklı karakterlerine ek olarak P1 ekzopodunda 3 segment bulunması nedeniyle *L. triarticulata* **stat. nov.** olarak tür seviyesine yükseltilmiştir. Kaydedilen tüm taksonlar çalışma alanından ilk kez tanımlanmıştır. Türkiye'den harpaktikoid kopepodlarla ilgili daha önceki çalışmalarla karşılaştırıldığında dört tür aynı zamanda Türkiye kıyılarından ilk kez kaydedilmiştir.

Anahtar Kelimeler: Karadeniz, Copepoda, Harpacticoida, Laophontidae, Taksonomi

Introduction

The Black Sea is considered to be a residual basin of the Central European Tethys Sea, which existed from the end of the Paleozoic era to the Middle Tertiary period. At the end of the Tertiary period this basin separated from the Caspian Sea and shrank to the dimensions of the present Black Sea. A unique endemic biota formed in the Black Sea during millions years of its isolation from the Oceanic water. But the salt water of the Mediterranean Sea entered the Black Sea and filled its basin as a result of the formation of Strait of Bosporus about 5,300-13,000 years ago (Çağatay et al., 2000; Kerey et al., 2004; Shillington et al., 2008). Such event should have resulted in changing the freshwater faunal composition of the Black Sea, which came to be replaced by the saltwater fauna of the Mediterranean Sea.

The order Harpacticoida contains over 4,300 species belonging to 589 genera and 56 families (Wells, 2007). The marine harpacticoid fauna of the Turkey is poorly known despite the fact that the country has a vast coastline of about 8,300 kilometres (Alper etal., 2010). Noodt (1955) was the first to contribute to the marine Turkish harpacticoid fauna by reporting 52 species and subspecies from the Sea of Marmara. Later records added to the Turkish fauna between 1955-2010 were summarized by Alper et al., (2010). However,

harpacticoids of the majority of the Turkish coastline are still not known and the Black Sea coast has been studied very little. Here we contribute to the knowledge of the copepod biodiversity in Turkey by reporting interstitial and phytal Laophontidae of the Turkish Black Sea coast for the first time.

Material and Methods

Samples were collected from 66 different localities (Table 1). Interstitial samples were taken according to Karaman-Chauppuis method (Delamare Deboutteville, 1954). Phytal samples were taken from the supralittoral rocky shores by hand. All samples immediately preserved with 4% formalin solution. Copepods were extracted from detritus under OLYMPUS SZX-12 stereo microscope and stored 70% ethanol. Selected specimens were dissected in lactic acid and the parts mounted on slides in lactophenol mounting medium. Glass fibres were added to prevent the animal and appendages from being compressed by the coverslip and to facilitate rotation and manipulation, allowing observation from all angles.

Table 1. Localities and coordinates of the sampling stations (St: Stations).

St.	Date	Locality (Coordinate)
1	16.09.2001; 10.08.2002	İğneada Beach / Kırklareli (N 41º 53. 366'; E 28º 00. 059')
2	16.09.2001; 10.08.2002	Kıyıköy Harbour / Kırklareli (N 41º 37. 581'; E 28º 06. 200')
3	29.04.2001; 10.08.2002	Kastro Beach / Kırklareli (N 41º 35. 142'; EO 28º 08. 734')
4	16.09.2001; 10.08.2002	Yalıköy Beach / İstanbul (N 41º 29.095'; E 28º 18.065')
5	30.04.2001; 11.09.2002	Karaburun Beach / Kırklareli (N 41º 20. 149'; E 28º 41. 943')
6	01.05.2001	Sahilköy Beach / İstanbul (N 41°12.395; E 29° 24.920')
7	14.07.2002	Kumbaba Beach / Şile/ İstanbul (N 41° 10.557'; E 29° 33.096')
8	01.05.2001; 17.09.2001	Şile Beach / İstanbul (N 41º 10.273'; E 29º 35.736')
9	17.09.2001; 14.07.2002	İmrenli Beach / İstanbul (N 41º 09.469'; E 29º 45.226')
10	17.09.2001; 14.07.2002	Ağva Beach / İstanbul (N 41º 08.331'; E 29º 50.904')
11	13.07.2002	Cebeci Beach / Sakarya (N 41° 11.323'; E 30° 14.995')
12	14.07.2002	Karasu Beach / Sakarya (N 41° 06.875' ;E 30° 41.060')
13	06.07.2001; 14.07.2002	Caferiye Village Beach / Sakarya (N 41° 04.365'; E 30° 56.329')
14	01.05.2001	Akçakoca Beach / Düzce (N 41º 05. 135'; E 31º 05. 513')
15	06.07.2001; 15.07.2002	A beach near Alaplı / Düzce (N 41° 07.115'; E 31° 18.053')
16	15.07.2002	Muslu Beach / Zonguldak (N 41° 31.223'; E 31° 54.394')
17	07.07.2001; 15.07.2002	Göbü Beach / Zonguldak (N 41° 32.116'; E 31° 57.032')
18	07.07.2001; 15.07.2002	Türkali Beach / Zonguldak (N 41° 32.694'; E 31° 59.149)'
19	07.07.2001; 15.07.2002	Filyos Beach / Zonguldak (N 41° 33.329'; E 32° 00.626')
20	07.07.2001; 14.09.2002	Amasra marina / Bartın (N 41° 44.850'; E 32° 23.066')
21	08.07.2001; 14.09.2002	Kurucaşile Beach / Bartın (N 41° 50.683'; E 32° 43.511)'
22	08.07.2001; 14.09.2002	Kapı suyu Beach / Bartın (N 41º 50. 847'; EO 32º 45. 177')
23	08.07.2001; 14.09.2002	Aydos Beach / Bartın (N 41° 56.371'; E 33° 05.204'
24	08.07.2001; 14.09.2002	Doğan yurt Beach / Kastamonu (N 42º 00. 481'; E 33º 27. 505')
25	08.07.2001; 14.09.2002	Özlüce Village Beach / Kastamonu (N 41° 59.209'; E 33° 36.660')
26	08.07.2001; 14.09.2002	İnebolu Beach / Kastamonu (N 41° 58.661'; E 33° 43.943')
27	08.07.2001; 13.09.2002	Abana Beach / Kastamonu (N 41° 58.838'; E 34° 00.454')
28	08.07.2001	Çatalzeytin Beach / Kastamonu (N 41° 57.271'; E 34º 12.902')
29	13.09.2002	Güzelkent Beach /Sinop (N 41° 57. 133'; EO 34° 23. 516')
30	09.07.2001; 13.09.2002	Aliköyü Beach / Sinop (N 41° 56. 499'; EO 34° 39. 437')
31	13.09.2002	Sarıkum Beach / Sinop (N 42° 01.129'; E 34° 54.032')
32	12.09.2002	Akliman Beach / Sinop (N 42° 01.614'; E 35° 04.711')
33	13.09.2002	Karakum Beach / Sinop (N 42° 00. 938'; EO 35° 11. 536')
34	09.09.2001; 12.09.2002	A beach near Gerze / Sinop (N 41° 45.242'; E 35° 13.739')
35	09.07.2001; 12.09.2002	A beach near Yakakent / Samsun (N 41° 37.916'; E 35° 33.461')
36	10.07.2001; 12.09.2002	Samsun Beach / Samsun (N 41° 22.844'; E 36° 13.182')
37	10.07.2001	A Beach near Yalı Village, Terme/ Samsun (N 41° 16.423'; E 37°00.820')
38	11.09.2002	Sivaslılar Village beach, Terme/ Samsun (N 41° 13.423'; E 37° 01.515')

St.	Date	Locality (Coordinate) (Table 1)
39	11.09.2002	Sakarlı Beach / Samsun (N 41° 08.928'; E 37° 08.776')
40	11.09.2002	Ünye Beach / Ordu (N 41° 08.684'; E 37° 16.376')
41	10.07.2001; 11.09.2002	Fatsa Beach / Ordu (N 41º 04. 601'; EO 37º 26. 448')
42	11.09.2002	Beyazkum Beach / Ordu (N 41º 06. 806'; EO 37º 43. 037')
43	10.07.2001; 11.09.2002	Perşembe Beach / Ordu (N 41° 01.689'; E 37° 48.256')
44	11.07.2001; 10.09.2002	Gülyalı Beach / Ordu (N 40° 58.363'; E 38° 01.999')
45	10.09.2002	Bulancak Beach / Giresun (N 40° 56.785'; E 38° 09.941')
46	11.07.2001	A Beach at west of Giresun (N 40° 56.193'; E 38° 17.745')
47	10.09.2002	Keşap Beach / Giresun (N 40º 56. 705'; EO 38º 35. 288')
48	11.07.2001	Espiye Beach / Giresun (N 40° 58.429'; E 38° 45.373')
49	11.07.2001; 10.09.2002	Tirebolu Beach / Giresun (N 41° 00.249'; E 38° 48.473')
50	10.09.2002	İsmail Beyli Village Beach / Giresun (N 41° 02.198'; E 38° 56.901')
51	11.07.2001; 10.09.2002	Beşikdüzü Beach / Giresun (N 41° 04.544'; E 39° 09.456')
52	10.09.2002	Yoroz Feneri Village Beach / Trabzon (N 41° 05.677'; E 39° 23.718')
53	10.09.2002	Salacık Village Beach / Trabzon (N 41° 03.152'; E 39° 32.227')
54	11.07.2001	Akçaabat Beach / Trabzon (N 41° 1.092'; E 39° 35.338')
55	09.09.2002	Sifla Beach / Trabzon (N 40° 57.242'; E 39° 53.952')
56	11.07.2001	Kuzguncuk Beach / Trabzon (N 40° 57.714'; E 39° 58.894')
57	09.09.2002	Araklı Beach / Trabzon (N 40° 55.483'; E 40° 04.653')
58	09.09.2002	Of Beach / Trabzon (N 40° 57.806'; E 40° 17.791')
59	11.07.2001	Kıyıcık Beach / Trabzon (N 40°58.096'; E40° 18.227')
60	09.09.2002	İyidere Beach / Rize (N 41° 01.039'; E 40° 22.165')
61	11.07.2001	Çayeli Beach / Rize (N 41° 6.087'; E40° 44.189')
62	09.09.2002	Fındıklı Beach / Rize (N 41° 15.403'; E 41° 07.506')
63	11.07.2001	Hopa Beach / Artvin (N 41° 24.231'; E 41° 25.652')
64	08.09.2002	Esenkıyı Village Beach / Artvin (N 41° 26.431'; E 41° 27.282')
65	08.09.2002	Kemalpaşa Beach / Artvin (N 41° 29.716'; E 41° 31.795')
66	08.09.2002	Sarp Beach / Artvin (N 41° 30.818'; E 41° 32.606')

The material (*Laophonte setosa* ♀) was examined with a Zeiss Leo 1430 Scanning electron microscope. Specimens were prepared by dehydration through graded acetone, critical point dried, mounted on stubs and sputter-coated with gold and palladium.

Preparations were subsequently sealed with Entellan. Identifications were made under OLYMPUS BX-50 microscope equipped with differential interference contrast (DIC). Specimens were identified according to Wells (2007), Huys et al. (1996) and relevant literatures. The scale bars in the illustrations and SEM micrographs are in µm. The descriptive terminology is adopted from Huys *et al*. (1996). The descriptive terminology is adopted from Huys et al. (1996). Abbreviations used in the text are: ae, aesthetasc; P1-P6, first to sixth thoracopod; exp (enp)-l(2, 3) to denote the proximal (middle, distal) segment of a ramus. All materials are deposited in Mersin University Zoological museum (MUZM).

Results

Order: HARPACTICOIDA Sars, 1903

Suborder: POLYARTHRA Lang, 1944

Family: LAOPHONTIDAE Scott, 1905

Genus**:** *Heterolaophonte* Lang, 1944

Heterolaophonte uncinata (Czerniavski, 1868)

Material Examined

St.1 (5 ♀♀); St.12 (4♀♀, 2♂♂); St.13 (2 ♀♀, 2♂♂); St.15 (1♀); St.17 (6 ♀♀); St.20 (1♀, 2 ♂♂).

Distribution in Turkey

Datça (Alper et.al., 2010).

Heterolaophonte curvata (Douwe, 1929)

Material Examined

St.5 (5♀♀, 1♂); St.8 (3♀♀, 2 ♂♂); St.9 (6♀♀); St.22 (3♀♀, 5♂♂); St.23 (2 ♀♀); St.50 (3 ♀♀).

Distribution in Turkey

New record.

Remarks

The taxonomy of the genus *Heterolaophonte* rather problematic and almost all species are in need of revision. Therefore *H. uncinata* and *H. curvata* will be fully redescribed in a separate paper.

Genus: *Laophonte* Philippi, 1840

Laophonte triarticulata **stat. nov.** Monard, 1928 (Figure 1)

Synonym: *Laophonte elongata triarticulata* Monard, 1928

Material examined

St. 47 (2 ♂♂). In washings of the macroalgae.

Description, male

Anal somite (Figure 2E); anal operculum well developed, flanked by pair of sensilla; anal opening bordered by well-developed frill bearing long setular extensions. Caudal rami (Figure 1E); long, cylindrical, about 6 times longer than wide; each ramus with 7 setae: seta I subventral, bare and shortest; setae II and III bare; setae IV and V fused basally, and with fracture planes; seta VII tri-articulate at base. Each ramus with small spinules on dorsal surface; with spinular row along inner margin proximally; additional spinular ornamentation present around the setae I-VII as figured. Antenna 3-segmented, comprising coxa, allobasis and free 1-segmented endopod; allobasis elongate without spinular ornamentation, with 1 abexopodal plumose in distal half; exopod 1-segmented, with 4 well developed pinnate setae located along distal margin, inner margin with 2 spinules (Figure 1F). P1–P4 (Figures 1A–C) with wide intercoxal sclerites and well developed praecoxae; exopods 3-segmented, each segment with spinules along outer margin and along anterior surface as figured; endopods 2-segmented (P3 endopod 3-segmented). P1 (Figure 1A); coxa rectangular, with spinular rows near inner and outer distal margins; basis elongate with unipinnate seta on distal pedestal near insertion of endopod, with long setules along inner margin and 1 bipinnate spine and several spinules along outer margin; anterior tube-pore near articulation with coxa; exp-1 and exp-2 with 1 bare outer seta; exp-3 with 2 bare and 2 geniculate setae. Enp-1 2 times as long as exopod, with long and fine spinules along proximal half of inner and outer

margins, and with spinular row on anterior surface; enp-2 with 1 strong claw, and 1 small bare seta; several spinules along outer margin and around inner distal corner. P2 (Figure 1B); coxa with spinular rows along outer margin and on anterior surface; basis with spinules along inner margin and 3 spinules at the base of outer seta, tube-pore on anterior surface, with spinules along inner margin; enp-1 with spinules along outer and inner margins with tube pore on inner distal corner; enp-2 about 5.5 times as long as wide, with spinules along outer margin. P3 endopod 3-segmented; enp-1 and enp-2 with long spinules along inner and outer margins; enp-2 produced distally into spiniform apophysis (Figure 1G,H). P4 endopod 2-segmented; enp-1 small, bare and about twice shorter than enp-2; enp-2 with spinules along inner and outer margins. Armature of swimming legs as follows:

	Exopod	Endopod
P1	0.0.022	0.020
P2	0.1.132	0.220
P3	0.1.232	0.0.220
P4	0.1.232	0.111

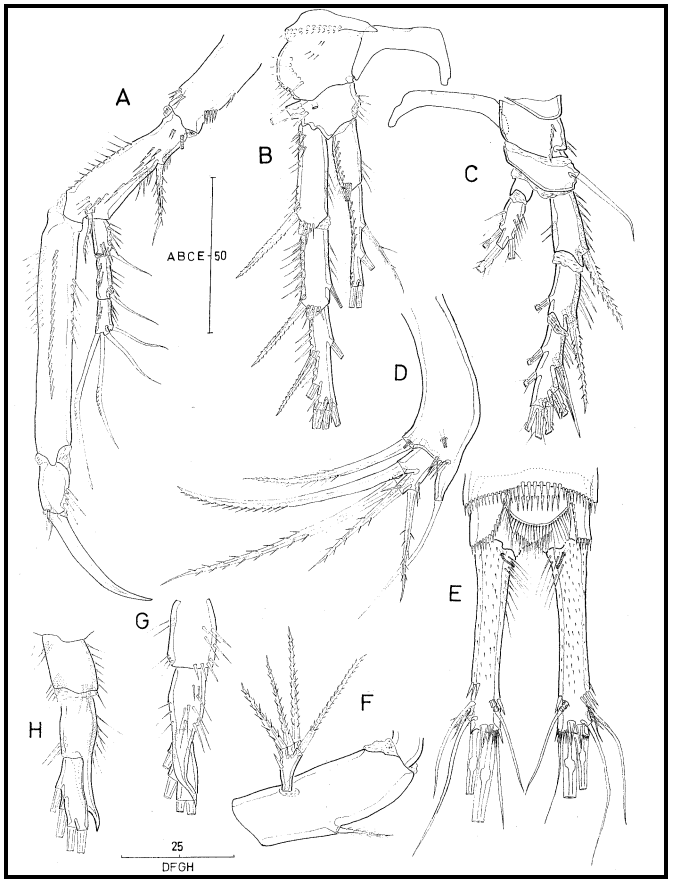

Figure 1. *Laophonte triarticulata* ♂. (A) P1, anterior; (B) P2, anterior; (C) P4, anterior; (D) P5, anterior; (E) anal somite and caudal rami, dorsal; (F) antenna exopod; (G,H) P3 endopod.

Fifth pair of legs (Figure 1D); baseoendopods fused medially; baseoendopod with large setophore bearing outer basal seta and with spinules near the articulation with exopod, with 2 tube-pores near articulation with exopod; with few coarse spinules at base of setophore; endopodal lobe with 1 long pinnate seta; exopod represented by small segment with 4 pinnate setae.

Distribution in Turkey

New record.

Remarks

L. elongata is represented by 3 subspecies namely *L. elongata elongata*, *L. elongata triarticulata* Monard, 1928 and *L. elongata barbata* Lang, 1934. Among these 3 subspecies the 3-segmented condition on the exopod of P1 as well as other characteristiscs found only in this subspecies therefore *L. elongata triarticulata* was upgraded to species level.

Laophonte setosa Boeck, 1865 (Figures 2-4)

Material examined

St.62 **(**1♀, 1♂); St.64 (2 ♀♀). In washings of the macroalgae.

Description, female

Body gradually tapering posteriorly (Figure 3A). Cephalothorax and entire body surface with small and hardly visible spinules (arrowed in Figure 3B). Anal somite (Figure 2G); covered with fine spinules; anal operculum well developed, flanked by pair of sensilla; anal opening with spinules as figured. Caudal rami (Figures 2G; 4D); cylindrical, slightly tapering posteriorly about 4 times longer than wide; each ramus with 7 setae: seta I subventral, bare and shortest; setae II and III bare; setae IV and V fused basally, and with fracture planes; seta VII tri-articulate at base. Each ramus covered with complex pattern of spinules on dorsal and ventral surfaces as figured, with tube-pore near ventral distal margin (arrowed in Figure 4D). Antennule (Figure 4A); 6-segmented; segment 2 and 3 longest; inner margins of segments 1–3 ornamented with tiny spinules (arrowed in Figure 4A). Antenna; 3-segmented, comprising coxa, allobasis and free 1-segmented endopod. Exopod 1-segmented, very small, with 4 naked setae (2 apically, 2 subapically); one row of coarse spinules present on anterior surface (Figure 2F). Endopod about as long as allobasis; lateral armature arising in distal half, consisting of one naked seta flanked by 2 strong pinnate spines (Figure 4B); apical armature consisting of 2 strong spines and 3 geniculate setae (one geniculate seta fused basally to short seta). Endopod with a row of long spinules ventrally and row of spinules subapically (Figure 4B). Maxilliped (Figure 3C); palmar margin of basis ornamented with fine spinules as figured; endopod drawn out into long (about as long as basis) distally pinnate claw. P1 (Figure 2C); praecoxa, coxa, basis, endopodal and exopodal segments covered with hardly visible spinules on anterior surface (arrowed in Figure 4C); intercoxal sclerite bare; praecoxa well developed with spinules along outer margin; coxa rectangular, with spinular row along outer margin and 2 spinular rows on anterior surface; basis elongate with bare seta (with subapical flagellate extension) near insertion of endopod, with spinular row along inner margin and 1 bipinnate spine with subapical flagellate extension; exp-1 and exp-2 with spinular rows as figured. Endopod 2-segmented (Figure 4C); enp-1 about 2.5 times as long as exopod, with long and fine spinules along proximal half of inner margin; enp-2 with 1 strong claw, and 1 bare seta; several spinules along outer margin and around inner distal corner. Armature of swimming legs as follows:

	Exopod	Endopod
P1	0.032	0.020
P2	0.1.132	0.220 [0.120 ♂]
P3	0.1.232	0.321 [0.0.220 ♂]
P4	0.1.232	0.111

P5 (Figure 2E); covered with hardly visible small spinules; endopodal lobe nearly reaching exopod; baseoendopodal seta bare; endopodal lobe with a tube pore located terminally, with 2 lateral and 2 terminal pinnate setae; exopod with 1 bare and 4 pinnate setae. ***Male*****:** P3 (Figure 2A) with 3-segmented endopod and exopod; enp-2 with sigmoid apophysis exceeding the enp-3, with spinules on anterior surface. P5 (Figure 2B); with highly reduced endopod carrying 1 unipinnate seta and complex spinular ornamentation as figured;

baseoendopodal seta long and bare; exopod with 4 well-developed pinnate setae, and with spinular rows near proximal base and along outer margin.

Distribution in Turkey

Reported from the Sea of Marmara (Noodt, 1955).

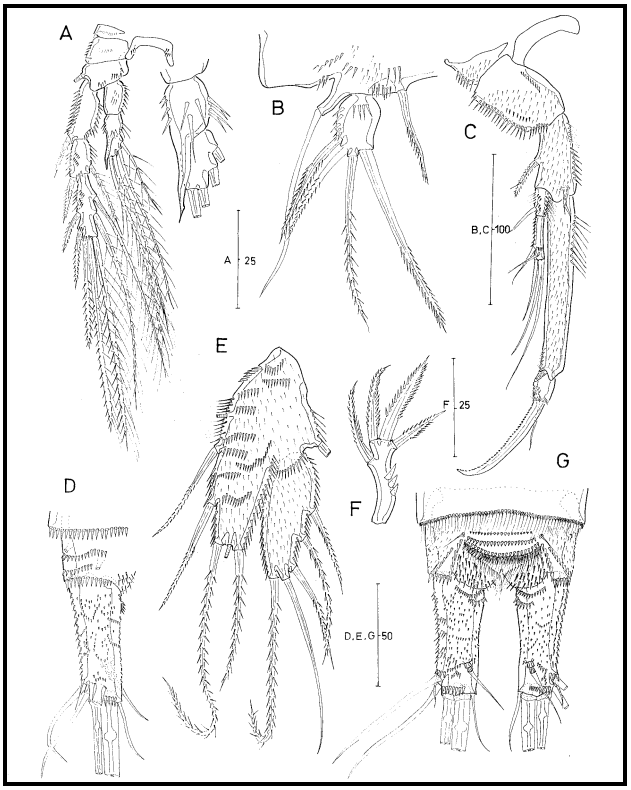

Figure 2. *Laophonte setosa*. (A) P3 ♂, anterior; (B) P5 ♂, anterior; (C) P1 ♀, anterior; (D) left caudal ramus ♀, ventral; (E) P5 ♀; (F) antenna exopod ♀; (G) anal somite and caudal rami ♀, dorsal.

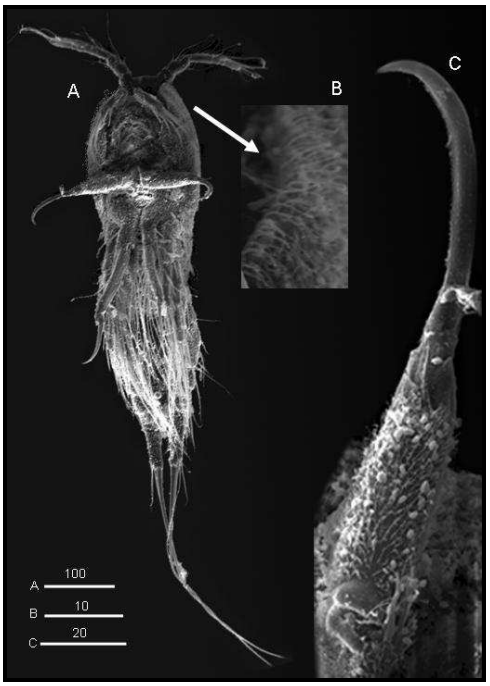

Figure 3. *Laophonte setosa* ♀. (A) habitus, ventral; (B) surface spinules on pleural area of cephalotorax (C) maxilliped.

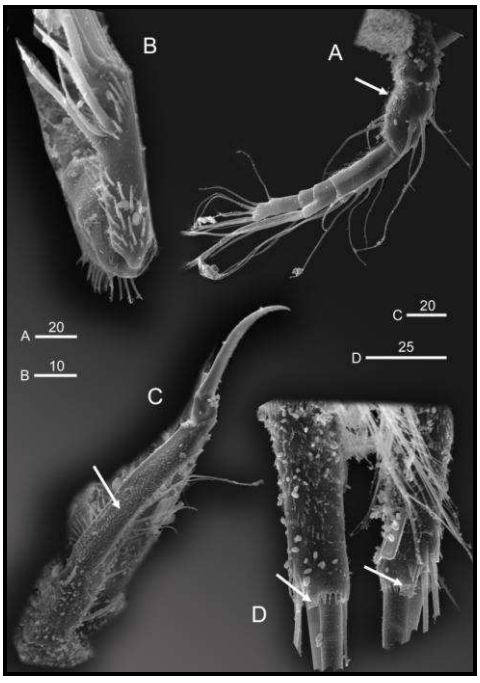

Figure 4. *Laophonte setosa* ♀.(A) antennule; (B) antenna; (C) P1, anterior; (D) caudal rami, dorsal.

Paralaophonte Lang, 1944

Paralaophonte brevirostris (Claus,1863) (Figure 5)

Material examined

St.3 (2♀♀, 1♂); St.5 (2 ♀♀); St.29 (4♀♀; 2♂♂); St.41 (1♀, 1♂). In washings of the macroalgae.

Description, female

Antennule 6-segmented. Antenna 3-segmented, comprising coxa, allobasis and free 1-segmented endopod; exopod 1-segmented, with 4 well developed pinnate setae located distally, inner margin with spinular row (Figure 5C). P1 (Figure 5A); intercoxal sclerite thin, long and bare; praecoxa well developed with spinules along outer margin as figured; coxa rectangular with a tube pore located proximally on anterior surface, with spinular row along outer margin and 4 spinular rows on anterior surface as figured; basis elongate with a pinnate seta near insertion of endopod, with spinular row along inner margin, with 2 spinular rows on anterior surface, with a bipinnate spine and spinular rows along outer margin; exp-1with spinular rows on anterior surface, exp-2,3 with spinules along outer margin. Enp-1 about 2.4 times as long as exopod, and 6 times as long as maximum width, with long and fine spinules along proximal half of inner margin; enp-2 with 1 strong claw, and 1 bare seta; several spinules along outer margin and 2 spinules around inner distal corner. Armature of swimming legs as follows:

	Exopod	Endopod
P1	0.0.031	0.020
P2	0.1.123	0.220
P3	0.1.223	0.321 [0.0.220 ♂]
P4	0.1.223	0.121

P5 (Figure 5E); covered with hardly visible small spinules and complex row of spinules on anterior surface as figured; endopodal lobe reaching halfway of exopod; baseoendopodal seta broken; endopodal lobe with a long tube pore located between the terminal setae, with 2 lateral unipinnate and 2 terminal plumose setae; exopod covered with hardly visible small spinules on anterior surface, with spinules along inner margin, with well-developed posterior spinules near the base of terminal pinnate setae, with 2 bare setae on inner later margin and 3 terminal pinnate setae.

Description, Male

P2 (Figure 5D) endopod 2 segmented; enp-1 with a tube pore located terminally on anterior surface and with spinules along outer margin, terminalmost spinule well developed; enp-2 with spinules along outer margin, with 2 lateral and 2 terminal setae; proximal half of the innerodistal seta pinnate, distal half plumose. P5 (Figure 5B); with highly reduced endopod carrying 1 long plumose seta; baseoendopodal lobe with spinular row along outer margin and another spinular row near the insertion of exopod, with a long tube pore near the insertion exopod; exopod with 4 normal and 1 modified pinnate setae, with long spinules inner and outer margins and on anterior surface.

Distribution in Turkey

Sea of Marmara (Karaytug and Sak, 2006); Datça (Alper et.al., 2010).

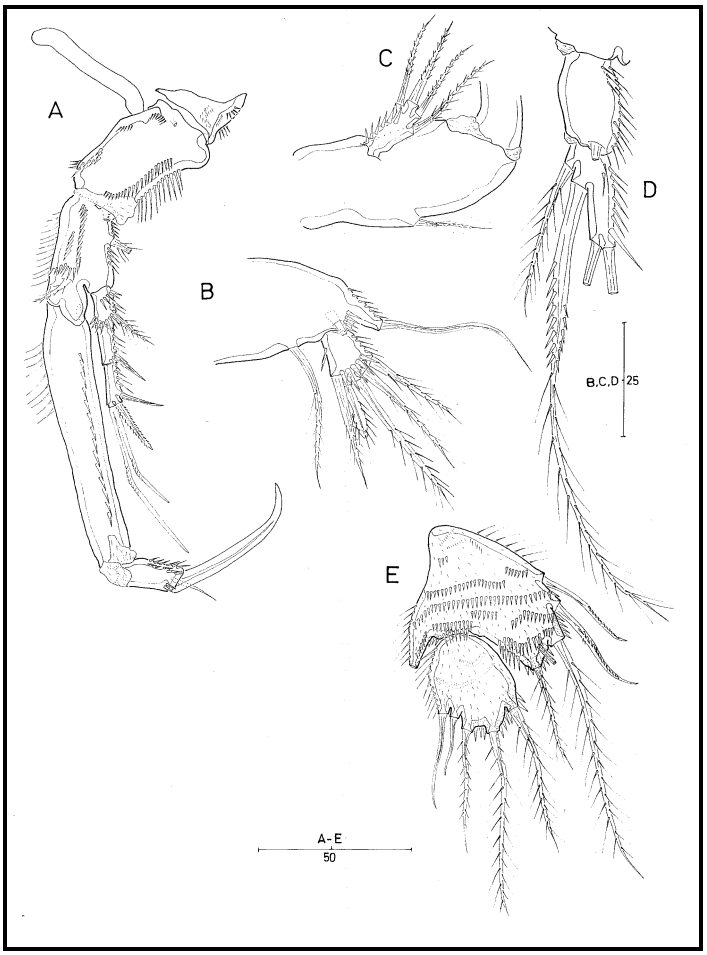

Figure 5. *Paralaophonte brevirostris*. (A) P1 ♀, anterior; (B) P5 ♂, anterior; (C) antenna exopod ♀, ventral; (D) P2 endopod ♂, anterior; (E) P5 ♀, anterior.

Klieonychocamptus Noodt, 1958

Klieonychocamptus ponticus (Serban and Plesa, 1957) (Figure 6)

Material examined

St.22 (3♀♀,1♂); St.41 (1♀); St.44 (2♀♀, 1♂); St.49 (2♀♀); St.57 (1♀). Found among intersititial water.

Description, female

Rostrum (Figure 6A) bell-shaped with 2 apical sensillae. Anal somite (Figure 6B); covered minute spinules; anal operculum well developed, flanked by pair of sensilla; anal opening with spinules as figured. Caudal rami (Figure 6B); cylindrical, inner margin with protuberances; each ramus with 6 setae: seta I absent; setae II and III bare; setae IV and V fused basally, and with fracture planes; seta VII bare and tri-articulate at base. Each ramus covered with complex pattern of spinules on dorsal surface as figured. Antennule 6-segmented; segment 1–3 dorsally with spinules as figured, ventrally smooth; segment 4–6 smooth; segment 2 with large thorn on midway along outer margin; segment 3 longest; armature formula 1-[1], 2-[6 + 2 plumose], 3-[7], 4-[1+(1 + ae)], 5-[1], 6-[9 + acrothek]. Antennary exopod 1-segmented, with 3 sub-equal pinnate setae distally and 1 short and bare seta subdistally, inner margin with spinular row (Figure 6E). P1 (Figure 6C); coxa squarish without ornamentation; basis with bare seta near insertion of endopod; enp-1 about 2 times as long as exopod and about 7 times as long as maximum width, with long and fine spinules along half of inner margin; enp-2 with 1 strong claw, and 1 bare seta; few spinules along outer margin. Armature of swimming legs as follows:

	Exopod	Endopod
P1	0.0.031	0.020
P2	0.0.022	0.120
P3	0.0.022	0.121
P4	0.022	0.120

P5 (Figure 6D) with separate exopod and baseoendopod; baseoendopodal seta plumose; endopodal lobe with a tube pore near the proximalmost spine, with 2 proximal semispinulose spines and 2 distal plumose setae, with spinules along outer margin as figured; exopod with 2 bare and 1 plumose setae, inner margin with spinules.

Distribution in Turkey

New record.

Remarks

Klieonychocamptus ponticus was originally described from Romania as *Onychocamptus ponticus* (Serban and Plesa, 1957) and transferred to the genus *Klieonychocamptus* by Vervoort (1964). The report from Andaman and Nicobar Islands clearly is not conspecific with *K. ponticus* (cf. Wells and Rao, 1987). Apostolov and Marinov's (1988) description mainly differs from the present material by the 1-segmented P4 endopod of female. Examination of the literature revealed wide range of distribution and morphological variations among different populations identified as *K. ponticus*. Such findings indicate that more than 1 species is involved under the name of *K. ponticus*.

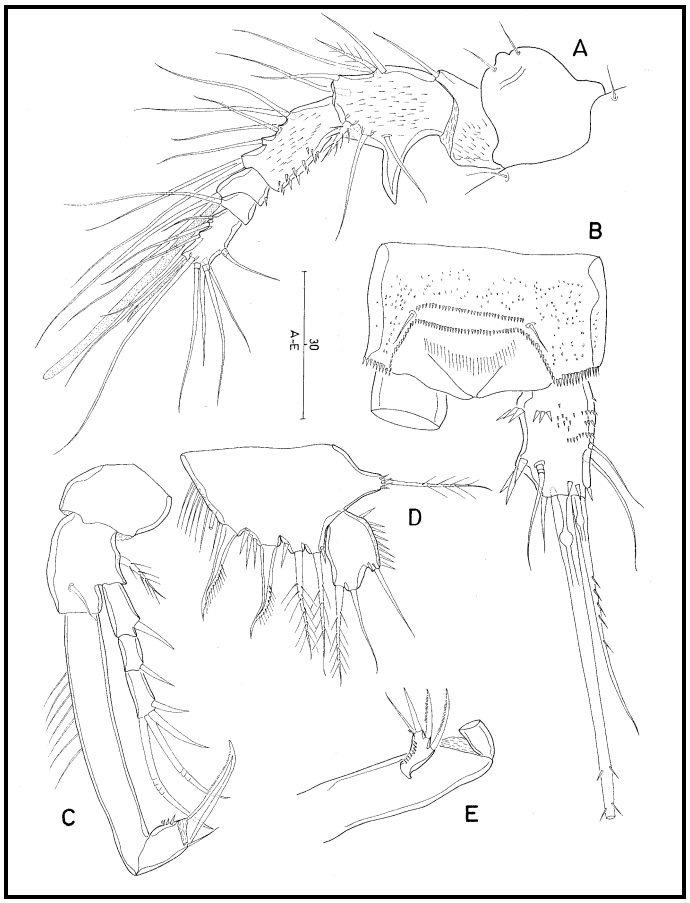

Figure 6. *Klieonychocamptus ponticus* ♀. (A) antennule; (B) anal somite and right caudal ramus, dorsal; (C) P1, anterior; (D) P5, anterior; (E) antenna exopod.

Klieonychocamptus kliei adriaticus (Petkovski, 1954) (Figure 7)

Material Examined

St.2 (3♀♀, 2♂♂); St.4 (6♀♀, 2♂♂); St.5 (14♀♀, 6♂♂); St.13 (8♀♀, 2♂♂); St.33 (7♀♀, 5♂♂); St.60 (15 ♀♀). Found among intersititial samples.

Description, female

Anal somite (Figure 7A,B); covered with fine spinules; anal operculum well developed, flanked by pair of sensilla; anal opening with spinules as figured; ventral surface 2 pair of pores (a pair of which is tube-like). Caudal rami (Figure 7A,B); cylindrical, slightly tapering posteriorly about 2 times longer than wide; each ramus with 7 setae: seta I bare and shortest; setae II and III bare; setae IV and V fused basally, and with fracture planes; seta VII tri-articulate at base. Each ramus covered with pattern of spinules on dorsal surface as figured. Antenna 3-segmented, comprising coxa, allobasis and free 1-segmented endopod; basis with outer pinnate seta located medially; exopod 1-segmented, with 2 pinnate and 2 bare setae located distally, inner margin covered with spinules (Figure 7D). P1 (Figure 7C); intercoxal sclerite rectangular and bare; praecoxa well developed with spinules along outer margin; coxa with spinular rows along outer margin and on anterior surface; basis with 1 pinnate seta near insertion of endopod and with 1 pinnate seta at outer margin located medially, with spinular rows along inner and outer margins as figured; exp-1 and exp-3 with spinules along outer margin, exp-2 with spinular rows along inner and outer margins. Enp-1 very long, about 2 times as long as exopod and about 10 times as long as maximum width, with long and fine spinules along proximal half of inner margin; enp-2 with 1 strong claw, and 1 bare seta; 4 spinules along outer margin and a group of spinules around inner distal corner. Armature of swimming legs as follows:

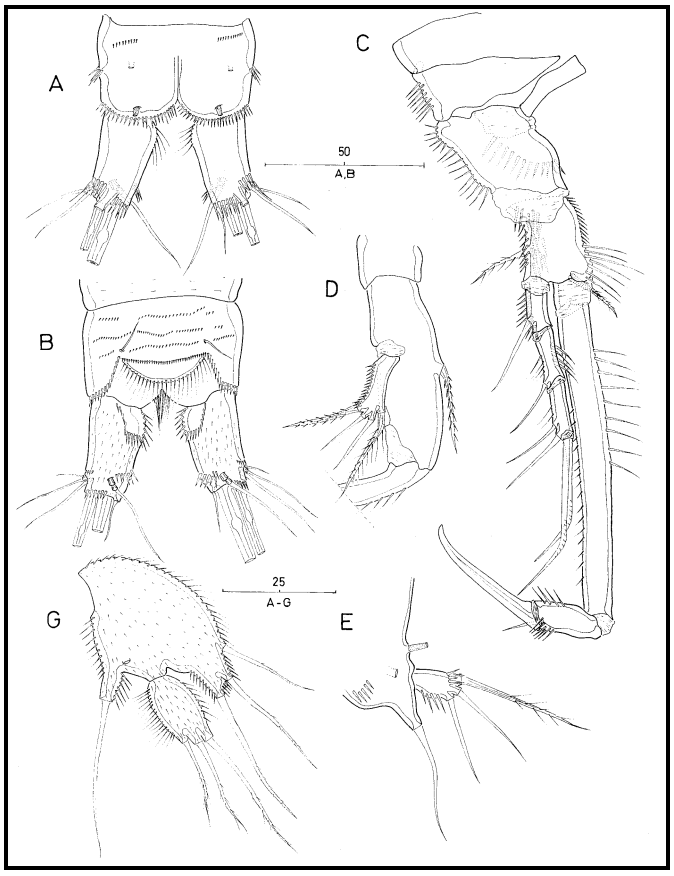

Figure 7. *Klieonychocamptus kliei adriaticus*. (A ventral, B dorsal) anal somite and caudal rami ♀,; (C) P1 ♀, posterior; (D) antenna exopod ♀; (E) P5 ♂, anterior; (G), P5 ♀, anterior.

	Exopod	Endopod
P1	0. 0. 022	0. 020
P2	0. 0. 023	0. 120
P3	0. 0. 023 [0. 0. 122 ♂]	0. 121
P4	0. 0. 023	0. 130 [0. 121 ♂]

P5 (Figure 7G); covered with hardly visible small spinules; endopodal lobe reaching halfway along exopod; baseoendopodal seta bare; endopodal lobe with a tube pore located near the base of baseoendopodal seta, with 2 lateral and 1 terminal setae; exopod with 1 subterminal and 2 terminal plumose setae. ***Male*****:** P5 (Figure 7E); endopod reduced carrying only 2 tube pores, with spinular row on anterior surface; baseoendopodal seta long and bare; exopod with 3 setae, and with anterior spinular rows distally and along outer margin.

Distribution in Turkey

Datça (Alper et al., 2010).

Asellopsis Brady & Robertson, 1873

Asellopsis sarmatica Jakubisiak, 1938 (Figure 8)

Material Examined

St.62 (1♀). Found among intersititial sample.

Description, female

Anal somite (Figure 8D); covered with tiny spinules; anal operculum well developed; anal opening with spinules as figured. Caudal rami (Figure 8D); cylindrical, about 2.3 times longer than wide; each ramus with 7 setae: all setae bare; each ramus covered tiny spinules on dorsal surface. Antennary exopod 1-segmented, with 2 pinnate setae located distally (Figure 8C).

P1 (Figure 8A); intercoxal sclerite bare; coxa with complex spinular rows as figured; basis elongate with plumose seta near insertion of endopod, with 2 transverse spinular rows on anterior surface and bipinnate spine at outer margin located medially; exp-1 and exp-2 with spinular rows as figured; enp-1 about 2 times as long as exopod and about 8 times as long as maximum width, with fine setules along inner margin, with spinular row along anterior surface; enp-2 with 1 strong claw. Armature of swimming legs as follows:

	Exopod	Endopod
P1	0.022	0.020
P2	0.1.122	0.020
P3	0.1.222	0.120
P4	0.1.222	0.021

P5 (Figure 8B); with complex spinular ornamentation as figured; endopodal lobe nearly reaching exopod; baseoendopodal seta broken; endopodal lobe with 2 unipinnate lateral, 1 subterminal plumose and 1 terminal plumose seta; exopod elongate, with 3 plumose and 2 bare setae.

Distribution in Turkey

New record

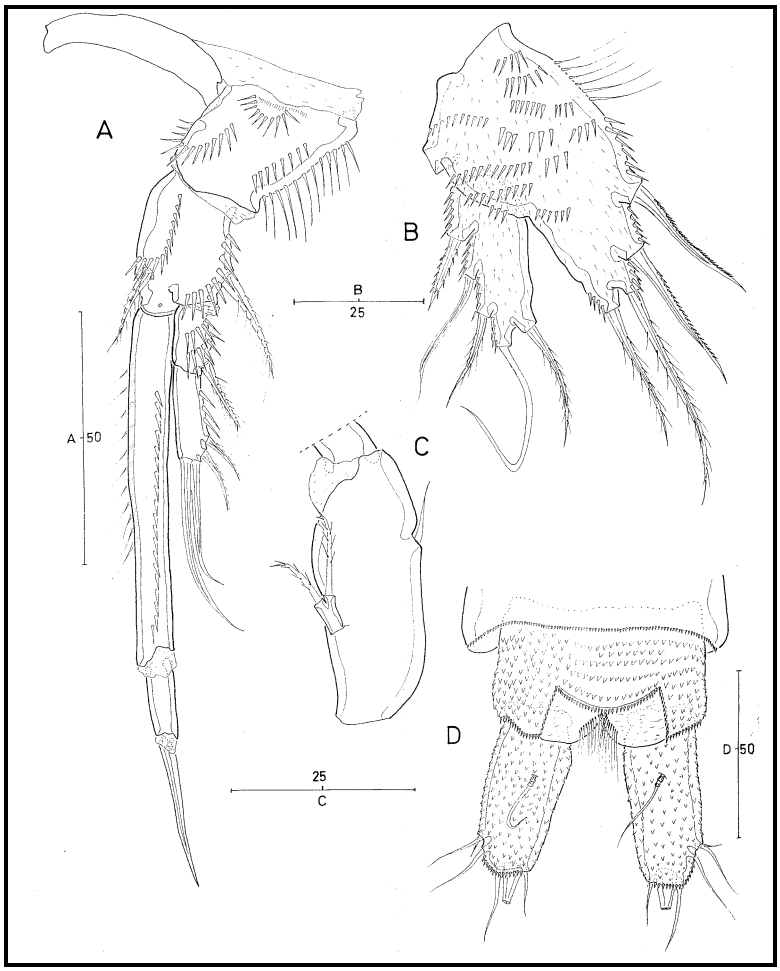

Figure 8. *Asellopsis sarmatica* ♀. (A) P1, anterior; (B) P5, anterior; (C) antenna exopod; (D) anal somite and caudal rami, dorsal.

Discussion

Coastlines, especially containing sandy beaches are highly valued by society since they are the prime sites for human recreation. But coastal zones are not only inhabited by human, they support a range of under-appreciated biodiversity. High energy sandy beaches are the most dynamic of soft bottom habitats and are very rich in species, that a single beach can harbour several hundred species of invertebrates (Giere, 1999; Defeo et al., 2009).

The Black Sea ecosystem and diversity underwent dramatic adverse changes during recent years mainly due to pollution and subsequent shoreline development. As a result of anthropogenic effects especially during the last few decades, the Turkish Black Sea ecosystem has also been subject to extreme changes (Tokarev and Shulman, 2007). The effective conservation and management of biodiversity largely depends on the taxonomic determination of species composition. Unfortunately, inadequate taxonomic information hinders our ability to make informed decisions about conservation and sustainable management of ecosystems.

Although Turkish Black Sea coastline is very long, little is known about the harpacticoid copepods which are an important part of the meiofauna, being the second most abundant group after the nematodes (Huys et al., 1996; Boeckner et. al., 2009). Based on published records, only 118 species have been reported from the Turkish waters so far (Alper et al., 2010). Identification of the specimens collected from the Turkish Black Sea coast revealed 7 species and 1 subspecies belonging to 4 genera which are all recorded for the first time from the study area. On the other hand 1 genus (*Asellopsis*) and 4 species identified in our samples have not

previously been reported from Turkish waters and therefore are new records for the Turkish fauna. As a result of this study the number of harpacticoid species reported from the Turkish coastal waters is now 122.

Acknowledgements

This is a part of MSc thesis of the senior author. This study is supported by TBAG-1962(100T120) run by Drs. Süphan KARAYTUĞ and Serdar SAK. Prof. Dr. Rony HUYS is gratefully thanked for providing the relevant literature.

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