

Oligochaeta and Aphanoneura (Annelida) Fauna of the Gediz Delta (Menemen-İzmir)

Süleyman BALIK, M. Ruşen USTAOĞLU, Seray YILDIZ
Ege University, Fisheries Faculty, Department of Hydrobiology, 35100 Bornova, İzmir - TURKEY

Received: 09.01.2003

Abstract: The specimens were collected from 16 stations between February 1998 and May 1999 with the aim of seasonally determining the Oligochaeta and Aphanoneura fauna of the Gediz Delta. The specimens obtained by collection of mud samples with an Ekman grab and elimination with a fine 500 µm sieve were preserved in 4% formaldehyde solution.

A total of 47 species were determined, comprising 25 species from Tubificidae, 17 species from Naididae, 3 species from Enchytraeidae and 2 species from Aeolosomatidae. Seventeen of the species determined are new records for the inland water fauna of Turkey.

Key Words: Oligochaeta, Aphanoneura, Fauna, Gediz Delta, İzmir.

Gediz Deltası'nın (Menemen-İzmir) Oligochaeta ve Aphanoneura (Annelida) Faunası

Özet: Gediz Deltası'nın Oligochaeta ve Aphanoneura faunasını belirlemek amacıyla, Şubat 1998-Mayıs 1999 tarihleri arasında, 16 istasyondan mevsimsel örneklemeler yapılmıştır. İstasyonlardan alınan çamur örneklerinin 500 µm göz açıklığındaki elekten geçirilmesiyle elde edilen örnekler % 4'lük formolde tespit edilmiştir.

Örneklerin değerlendirilmesi sonucunda, Tubificidae familyasından 25 takson, Naididae familyasından 17 takson, Enchytraeidae familyasından 3 takson ve Aeolosomatidae familyasından 2 takson olmak üzere toplam 47 takson saptanmış olup, bunlardan 17'si Türkiye faunası için ilk defa bildirilmektedir.

Anahtar Sözcükler: Oligochaeta, Aphanoneura, Fauna, Gediz Deltası, İzmir.

Introduction

Rivers provide cheap, clear and continuous energy resources and are the first requirement of plant production potential and a good environment for transport, tourism and recreational activities. In addition to these characteristics they have always been an important focus for human beings with their resources and valuable fish stocks. The physical, chemical and biological characteristics of rivers must be determined in order to use them in the best way and to protect their natural potential and resources and to ensure their continuity.

A review of the studies of the benthic fauna of the Gediz Delta indicated that Şahin (1987 a, 1987 b) studied the Chironomidae limnofauna of Western Turkey and the Chironomidae fauna of Marmara, the Aegean and the River Sakarya; Şahin (1991) studied the Chironomidae

fauna of the Gediz river system in a study of Turkey's Chironomidae potamofauna; and Balık et al. (1999) studied the faunas of the rivers in the Northern Aegean region.

Balık et al. (1999) reported Mollusca, Malacostraca and Chironomidae taxa, as well as 9 distinct annelid taxa *Stylaria lacustris* (Linnaeus, 1767), *Homochaeta naidina* (Bretscher, 1896), *Pristina menoni* (Aiyer, 1919), *Pristinella bilobata* (Bretscher, 1903), *Uncinails uncinata* (Ørsted, 1842), *Potamodrilus fluviatilus* Lastoĉkin, 1935, *Aeolosoma tenebrarum* Vejdovský, 1880, *Aeolosoma headleyi* Beddard, 1888 and *Aeolosoma variegatum* Vejdovský, 1885, as a result of benthic sampling of the River Gediz.

The purpose of this study is to contribute to the search for biological diversity in Turkey by determining Oligochaeta fauna of wetland region of the River Gediz.

Materials and Methods

The River Gediz is in İzmir province. It lies in the region occupying the former riverbeds of the River Gediz 26 km north-west of İzmir (38°30" N – 26°55" E). Its delta with a 20.400 total area of ha is a coastal wetland consisting of brackish and freshwater marshes (5000 ha), salt pans and coves (3300 ha) and 4 lagoons Homa Lagoon (1824 ha), Çilazmak Lagoon (725 ha), Kırdeniz Lagoon (450 ha) and Ragıppaşa Lagoon (500 ha).

Between February 1998 and May 1999 seasonal samplings from 16 stations were performed to detect the

Oligochaeta and Aphanoneura fauna of the River Gediz. Two of these stations are on the River Gediz (Stations 1 and 2), 1 is where the River Gediz opens into the Aegean Sea (Station 4), 3 are on the drainage channels (Stations 3, 5 and 6), 2 are inside (Station 7) and outside (Station 8) the Kırdeniz Lagoon, which has a likelihood of being affected by the River Gediz water close to the river outlet, 2 are inside and outside Homa Lagoon (Stations 9 and 10), 2 are inside and outside Çilazmak Lagoon (Stations 11 and 12), 2 are inside and outside Ragıppaşa Lagoon (Stations 14 and 15) and 2 are on former arms of the River Gediz (Station 13 and 16) (Figure 1).

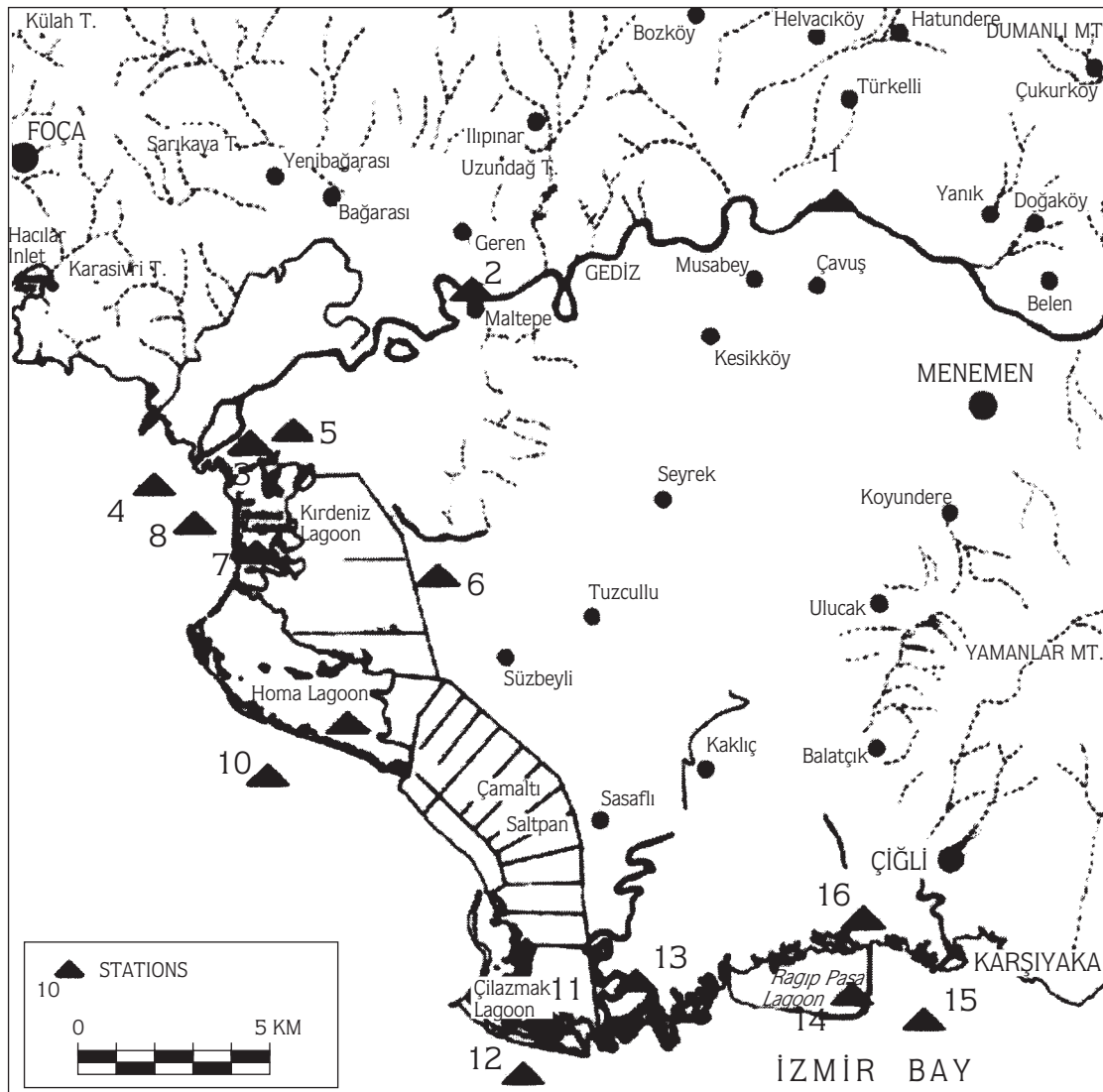


Figure 1. Sampling stations in the Gediz Delta.

To detect physico-chemical characteristics of the samples taken from the stations temperature was measured by a 0.1 sensitivity thermometer, pH was measured by a Hanna HI 8014 model pH-meter, conductivity was measured by a Hanna HI 8033 model conductivimeter, salinity was measured by the Mohr-Knudsen method, and dissolved oxygen was measured by the titration method (Winkler method).

Oligochaeta specimens obtained by collecting mud samples with an Ekman grab and elimination with a fine sieve with a pore diameter of 500 µm were fixed in 4% formaldehyde solution and were preserved in 70% alcohol after washing with pressurised water in the laboratory.

For taxonomical identification of the specimens, publications by Stephenson (1930), Sperber (1950), Nielsen and Christensen (1959), Brinkhurst (1971), Brinkhurst and Jamieson (1971), Brinkhurst and Wetzell (1984), Milligan (1997), Kathman and Brinkhurst (1998) were used.

Results

Measurements from the 16 stations of the River Gediz performed between February 1998 and May 1999

showed that temperature values are between 8 °C (Station 9) and 31 °C (Station 11), dissolved oxygen values are between 0 mg/l (Station 16) and 14 mg/l (Station 8); pH values are between 7 (Station 8) and 9.93 (Station 3) and salinity values are between 0.56‰ (Stations 1 and 2) and 38.8‰ (Station 12) (Table 1).

As a result of the evaluation of the specimens a total of 47 taxa were detected. These 47 taxa comprised 25 taxa of the family Tubificidae, 17 taxa of the family Naididae, 3 taxa of the family Enchytraeidae and 2 taxa of the family Aeolosomatidae. The systematic positions of these species were as follows:

KINGDOM: ANIMALIA

SUBKINGDOM: EUMETAZOA

PHYLUM: ANNELIDA

Classis: Oligochaeta

Ordo: Tubificida

Subordo: Tubificina

Familia: Tubificidae

Tubifex ignotus (Stolc, 1886)

Tubifex tubifex (Müller, 1774)

Table 1. Temperature, pH, salinity and dissolved oxygen characteristics of the stations in the Gediz Delta.

Sta.	Temperature (°C)			pH			Salinity (‰)			Dis. Oxygen (mg/l)		
	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
1	12.0	26.0	18.16	7.49	8.03	7.87	0.56	0.60	0.58	1.2	7.8	5.43
2	12.0	28.0	19.16	7.48	8.10	7.87	0.56	1.76	0.78	2.4	8.2	5.33
3	16.0	28.0	20.83	7.49	9.93	8.23	0.58	12.87	9.07	6.0	11.4	8.86
4	12.5	27.0	19.58	7.58	8.25	7.97	0.59	36.30	14.08	2.8	8.0	5.86
5	15.0	28.0	21.50	7.50	8.39	8.02	5.57	16.08	9.82	4.8	12.0	8.76
6	15.0	29.0	21.75	7.22	8.13	7.80	3.14	16.67	7.35	6.0	11.2	8.71
7	12.0	26.0	19.25	7.43	8.42	8.07	23.99	38.15	30.21	4.8	12.4	7.80
8	15.0	27.0	19.91	7.00	8.47	7.94	23.99	38.10	30.57	7.2	14.0	10.35
9	8.0	29.0	23.83	7.41	8.27	8.01	24.27	36.27	31.74	7.2	12.4	9.03
10	11.5	24.5	19.25	7.56	8.22	8.06	27.49	38.70	33.57	6.4	10.4	7.80
11	13.0	31.0	20.83	7.77	8.36	8.08	28.66	38.10	33.79	6.2	11.0	8.10
12	13.0	28.0	20.00	7.55	8.35	8.02	26.62	38.80	32.05	4.4	13.2	8.20
13	15.0	28.0	20.33	7.53	8.23	7.97	19.02	38.60	25.52	2.8	11.2	6.58
14	11.5	28.0	20.33	7.46	8.68	8.13	25.44	33.42	29.98	5.0	12.4	7.86
15	13.0	29.0	20.25	7.17	8.78	7.97	21.00	29.83	26.99	4.8	12.4	8.66
16	17.0	29.0	26.41	7.37	8.54	7.79	7.80	13.45	9.86	0.0	12.0	5.20

Tubifex costatus (Claparede, 1863)
Limnodriloides pierantonii (Hrabe, 1971)
Ilyodrilus templetoni (Southern, 1909)
Psammoryctides albicola (Michaelsen, 1901)
Psammoryctides barbatus (Grube, 1861)
Psammoryctides deserticola (Grimm, 1877)
Psammoryctides moravicus (Hrabe, 1934)
Limnodrilus claparedeianus (Ratzel, 1868)
Limnodrilus hoffmeisteri (Claparede, 1862)
Limnodrilus profundicola (Verrill, 1871)
Limnodrilus udekemianus (Claparede, 1862)
Spirosperma ferox (Eisen, 1879)
Haber speciosus (Hrabe, 1931)
Haber swirencowi (Jaroschenko, 1948)
Spirosperma velutinus (Grube, 1879)
Peloscolex euxinicus Hrabe, 1966
Varichaetadrilus psammophilus (Loden, 1977)
Potamothrix bavaricus (Öschman, 1913)
Potamothrix hammoniensis (Michaelsen, 1901)
Potamothrix vejdvovskiyi (Hrabe, 1941)
Aulodrilus limnobius Bretscher, 1899
Aulodrilus pigueti Kowalewski, 1914
Aulodrilus pluriseti (Piguet, 1906)

Familia: Naididae

Amphichaeta leydigii (Tauber, 1879)
Amphichaeta sannio (Kallstenius, 1892)
Paranais frici (Hrabe, 1941)
Paranais simplex (Hrabe, 1936)
Paranais botniensis (Sperber, 1948)
Paranais litoralis (Müller, 1784)
Homochaeta naidina (Bretscher, 1896)
Homochaeta setosa (Moszynski, 1933)
Nais elinguis (Müller, 1773)
Slavina appendiculata (d'Udekem, 1855)
Vejdovskyella comata (Vejdovsky, 1883)

Stylaria lacustris (Linnaeus, 1767)
Piguetiella blancii (Piguet, 1906)
Dero digitata (Müller, 1773)
Dero obtusa (d'Udekem, 1855)
Pristina amphibiotica (Lastockin, 1927)
Pristinella bilobata (Bretscher, 1903)

Subordo: Enchytraeina

Familia: Enchytraeidae

Enchytraeus albidus (Henle, 1837)
Lumbricillus lineatus (Müller, 1774)
Lumbricillus tuba Stephenson, 1911

Classis: Aphanoneura

Ordo: Aeolosomatida

Familia: Aeolosomatidae

Aeolosoma leidyi (Cragin, 1887)
Aeolosoma tenebrarum (Vejdovsky, 1880)

Regarding the family distribution of the taxa observed in the Gediz Delta, Tubificidae (53.07%) is the predominant family in the delta, followed by Naididae (34.69%), Enchytraeidae (8.16%) and Aeolosomatidae (4.08%).

Regarding the species diversity of the stations, Station 1 (22 species) and Station 2 (21 species) are the most abundant. Following these 2 stations in terms of species diversity were Stations 13 and 14 with 7 species, Station 10 with 5 species and Stations 4 and 11 with 4 species (Table 2).

The most common species observed within the samples are *Aulodrilus pigueti*, *Haber swirencovi*, *Haber speciosus*, *Paranais frici*, *Paranais simplex*, *Aulodrilus pluriseti* and *Ilyodrilus templetoni* (Table 2).

Regarding the seasonal distribution of the species, the highest numbers of species were observed in March 1999 (23 species), in February 1998 (20 species), in May 1998 (17 species), in May 1999 (17 species), in August 1998 (16 species) and in November 1998 (14 species) (Table 3).

Table 2. Distribution of the taxa in the stations in the Gediz Delta.

TAXA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Tubifex ignotus</i>	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
<i>Tubifex tubifex</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Tubifex costatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
<i>Limnodriloides pierantonii</i>	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
<i>Ilyodrilus templetoni</i>	-	-	-	+	-	-	-	-	-	+	-	-	+	-	-	-
<i>Psammoryctides albicola</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Psammoryctides barbatus</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Psammoryctides deserticola</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Psammoryctides moravicus</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Limnodrilus claparedeianus</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Limnodrilus hoffmeisteri</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Limnodrilus profundicola</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Limnodrilus udekemianus</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Spirosperma ferox</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Haber speciosus</i>	+	+	-	+	-	-	-	-	-	-	-	-	+	-	-	-
<i>Haber swirenkovi</i>	-	-	-	-	-	-	-	-	+	+	+	+	+	-	-	-
<i>Spirosperma velutinus</i>	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
<i>Peloscolex euxinicus</i>	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-
<i>Varichaetadrilus psammophilus</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
<i>Potamothenrix bavaricus</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Potamothenrix hammoniensis</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Potamothenrix vej dovskyi</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Aulodrilus limnobius</i>	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-
<i>Aulodrilus pigueti</i>	-	-	-	-	-	-	-	+	+	+	+	-	+	+	-	-
<i>Aulodrilus pluriseta</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+
<i>Amphichaeta leydigii</i>	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
<i>Amphichaeta sannio</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Paranais frici</i>	+	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-
<i>Paranais simplex</i>	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-
<i>Paranais botniensis</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-
<i>Paranais litoralis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
<i>Homochaeta naidina</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Homochaeta setosa</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Nais elinguis</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Slavina appendiculata</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Vejdovskyella comata</i>	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
<i>Stylaria lacustris</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Piguetiella blancii</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dero digitata</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dero obtusa</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pristina amphibiotica</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pristinella bilobata</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Aeolosoma leidyi</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Aeolosoma tenebrarum</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Enchytraeus albidus</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lumbricillus tuba</i>	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
<i>Lumbricillus lineatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-

Table 3. Seasonal distribution of the taxa in the stations in the Gediz Delta.

TAXA	2/98	5/98	8/98	11/98	3/99	5/99
<i>Tubifex ignotus</i>	+	-	+	+	-	+
<i>T. tubifex</i>	-	+	+	+	+	+
<i>T. costatus</i>	+	-	-	-	-	-
<i>Limnodriloides pierantonii</i>	-	-	-	-	+	+
<i>Ilyodrilus templetoni</i>	+	-	-	-	+	-
<i>Psammoryctides albicola</i>	-	-	-	-	+	+
<i>P. barbatus</i>	-	-	+	-	-	-
<i>P. deserticola</i>	-	-	-	-	+	+
<i>P. moravicus</i>	-	-	-	-	+	-
<i>Limnodrilus claparedeianus</i>	-	-	+	-	+	-
<i>L. hoffmeisteri</i>	+	-	+	+	+	-
<i>L. profundicola</i>	-	-	-	+	-	+
<i>L. udekianus</i>	-	-	-	-	+	+
<i>Spirosperma ferox</i>	-	+	-	+	+	-
<i>Haber speciosus</i>	+	-	+	-	+	-
<i>H. swirenkovi</i>	-	+	+	+	+	+
<i>Spirosperma velutinus</i>	+	-	-	-	-	-
<i>Peloscolex euxinicus</i>	-	+	+	-	-	-
<i>Varichaetadrilus psammophilus</i>	-	-	-	-	+	+
<i>Potamothrix bavaricus</i>	-	-	-	+	+	-
<i>P. hammoniensis</i>	-	-	+	+	+	+
<i>P. vejnovskyi</i>	-	+	-	-	-	-
<i>Aulodrilus limnobius</i>	-	+	-	-	-	+
<i>A. pigueti</i>	-	+	+	-	+	+
<i>A. pluriseta</i>	+	+	+	-	-	+
<i>Amphichaeta leydigii</i>	+	-	-	-	-	-
<i>A. sannio</i>	+	-	+	-	-	-
<i>Paranais frici</i>	+	+	-	+	-	+
<i>P. simplex</i>	+	+	-	-	-	-
<i>P. botniensis</i>	-	+	-	-	+	-
<i>P. litoralis</i>	-	-	-	-	-	+
<i>Homochaeta naidina</i>	+	+	+	+	+	-
<i>H. setosa</i>	-	-	+	-	-	-
<i>Nais elinguis</i>	+	-	-	+	-	-
<i>Slavina appendiculata</i>	+	-	-	-	-	-
<i>Vejnovskyella comata</i>	-	-	-	-	+	+
<i>Stylaria lacustris</i>	+	+	-	-	-	-
<i>Piguetiella blancii</i>	+	-	-	-	-	-
<i>Dero digitata</i>	-	+	+	+	+	-
<i>D. obtusa</i>	-	-	-	+	-	-
<i>Pristina amphibiotica</i>	+	-	-	-	+	-
<i>Pristinella bilobata</i>	+	+	-	-	-	-
<i>Aeolosoma leidy</i>	-	+	-	-	-	-
<i>A. tenebrarum</i>	+	-	-	-	-	-
<i>Enchytraeus albidus</i>	+	-	-	-	-	-
<i>Lumbricillus tuba</i>	-	-	-	-	+	+
<i>L. lineatus</i>	-	+	-	-	-	-

Morphometric, biological and ecological characteristics and the distribution of Oligochaeta species specified as new records for the inland water fauna of Turkey are as follows; (L: Total length, S: Number of segments):

Tubifex costatus (Claparede, 1863)

(Figures 2 f, g; 3 e)

Morphometric Characteristics:

L = 20-45 mm

S = 50-90

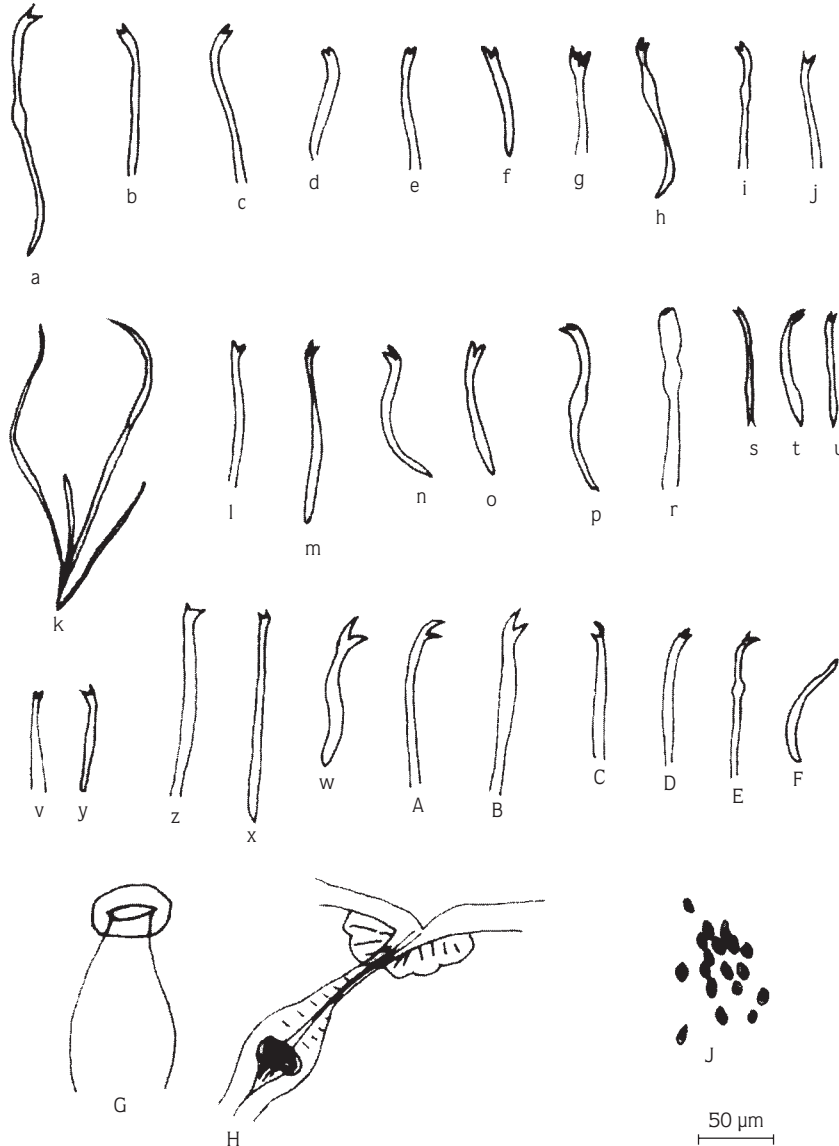


Figure 2. Setae (a. *Piguetiella blancii*, b. *Amphichaeta leydigii*, c. *Paranais simplex* II. ventral setae, d. *Spirosperma velutinus* anterior dorsal, e. *Spirosperma velutinus* anterior ventral, f. *Tubifex costatus* anterior ventral, g. *Tubifex costatus* anterior dorsal, h. *Limnodrilus profundicola* anterior setae, i. *Limnodrilus profundicola* posterior setae, j. *Amphichaeta sannio*, k. *Aeolosoma leidy*, l. *Potamothrix vej dovskyi* anterior dorsal, m. *Potamothrix vej dovskyi* anterior ventral, n. *Potamothrix vej dovskyi* posterior ventral, o. *Potamothrix vej dovskyi* posterior dorsal, p. *Aulodrilus limnobius* anterior ventral, r. *Aulodrilus limnobius* mid-posterior, s. *Haber swirenkovi* anterior dorsal, t. *Haber swirenkovi* anterior ventral, u. *Haber swirenkovi* posterior ventral, v. *Pelosclex euxinicus* anterior dorsal, y. *Pelosclex euxinicus* anterior ventral, z. *Varichaetadrilus psammophilus* anterior dorsal, x. *Varichaetadrilus psammophilus* anterior ventral, w. *Paranais botniensis* anterior dorsal, A. *Paranais botniensis* anterior ventral, B. *Paranais botniensis* posterior ventral, C. *Paranais litoralis* anterior dorsal, D. *Paranais litoralis* anterior ventral, E. *Homochaeta setosa*, F. *Lumbricillus tuba*), penis sheath (G. *Varichaetadrilus psammophilus*), spermatheca (H. *Lumbricillus tuba*) and papillae (J. *Haber swirenkovi*) of new records.

Anterior dorsal bundles of segments V to XIV with 5-11 palmate setae, dorsal chaetae of segments II to V may be somewhat intermediate between bifid crotchets and palmate chaetae. Ventral chaetae with the upper tooth longer and thinner than the lower.

World Distribution: Europe (Brinkhurst and Jamieson, 1971).

Ecology: Estuarine, euryhaline, marine Oligochaeta. Local and abundant in brackish water.

Limnodrilus profundicola (Verrill, 1871)

(Figures 2 h, i; 4 d)

Morphometric Characteristics:

L = 20-45 mm

S = 50-90

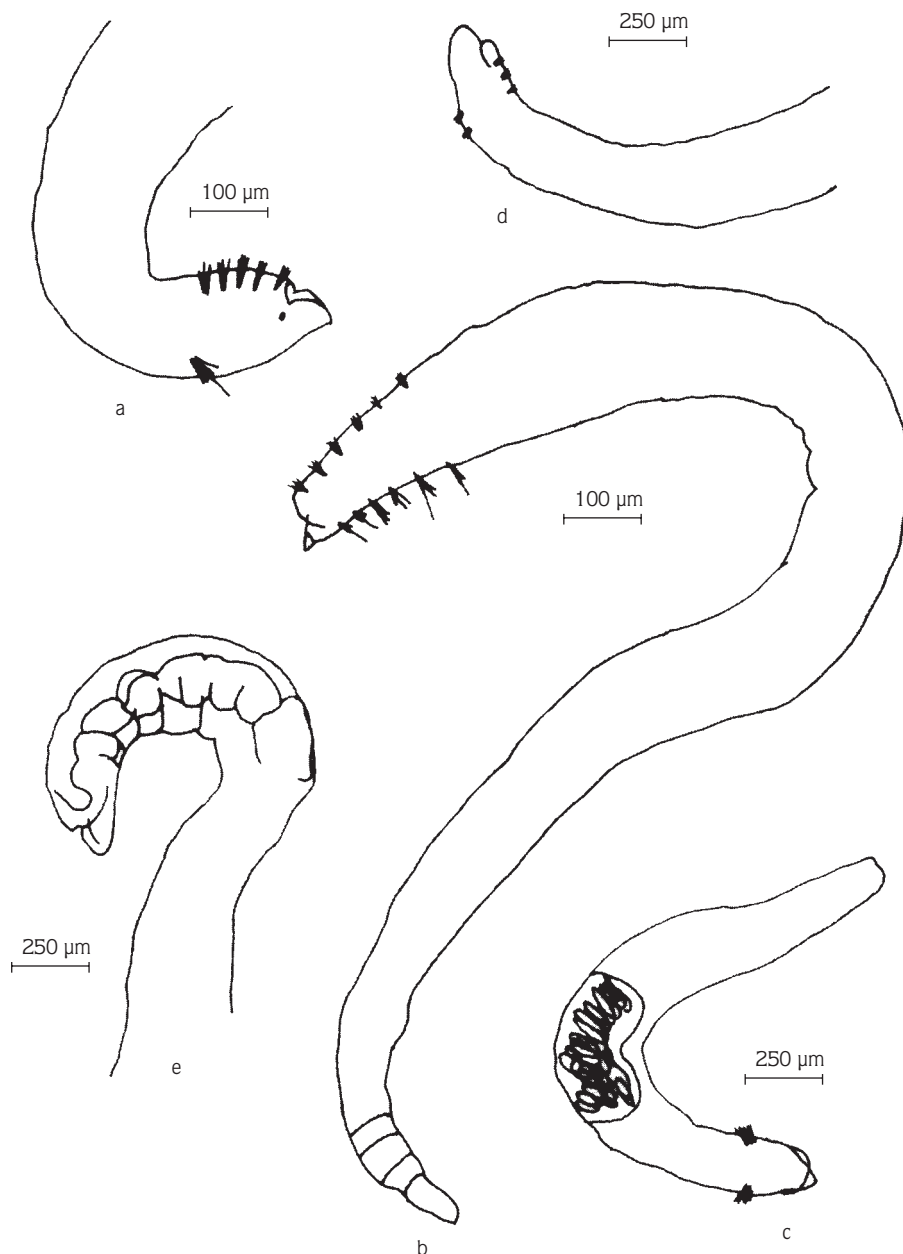


Figure 3. Whole body (b. *Potamothrix vejdvovskiyi*, c. *Amphichaeta leydigii*) and anterior ends (a. *Piguetiella blancii*, d. *Amphichaeta sannio*, e. *Tubifex costatus*) of some new records.

Penis sheaths 3-5 times longer than broad, usually with the distal end strongly reflected. Chaetae 7-7 in dorsal, 4-6 in ventral bundles, the upper tooth slightly thinner than the lower.

World Distribution: Cosmopolitan (Brinkhurst and Jamieson, 1971).

Ecology: Typically a cold water form in spring fed streams or deep lakes or at high altitudes. This species has been found in marshes that freeze nightly. A species of cold oligotrophic sites.

Haber swirenkovi (Jaroschenko, 1948)

(Figures 2 s, t, u, j; 5 c)

Morphometric Characteristics:

L = 13 mm S = 50

Dorsal anterior bundles with up to 4 smooth hair chaetae and 1-3 bifid chaetae with upper tooth somewhat longer than lower, posteriorly (behind XIV at least) bifid chaetae replaced by simple-pointed chaetae. Ventral anterior bundles with 2-4 bifid chaetae, teeth equally

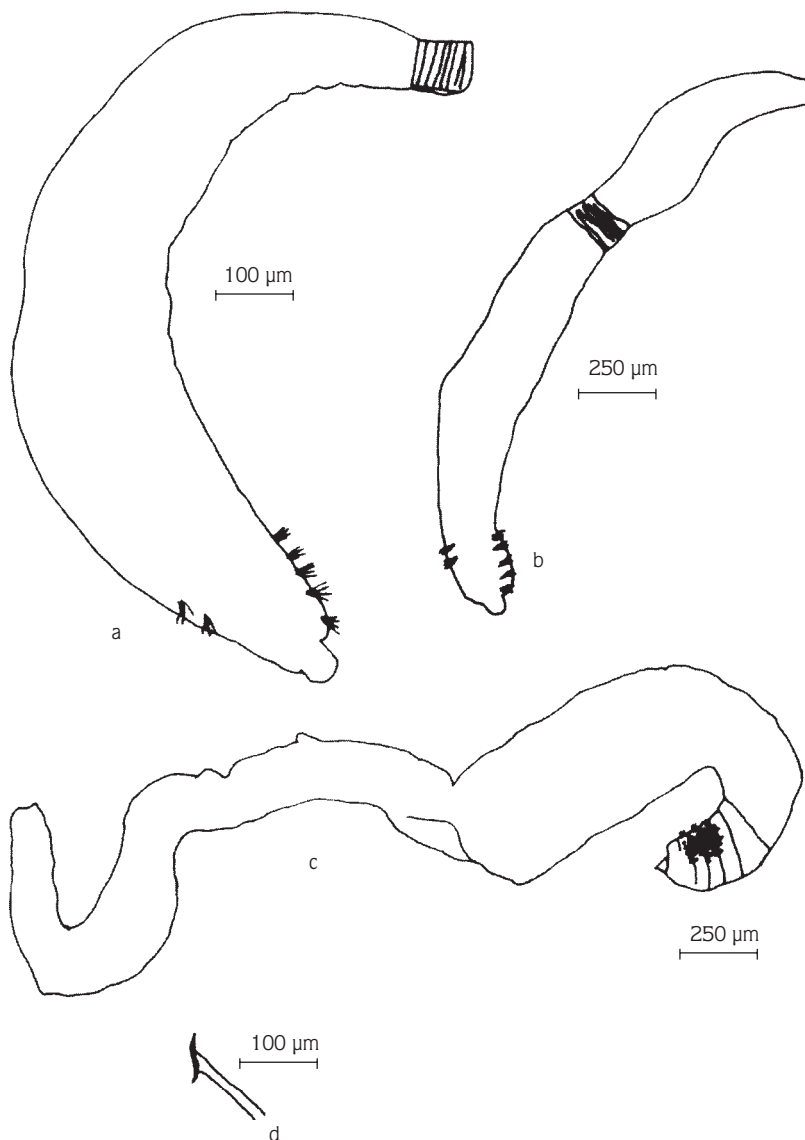


Figure 4. Whole body (a. *Paranais botniensis*, b. *Paranais simplex*, c. *Spirosperma velutinus*) of some new records and penis sheath (d) of *L. profundicola*.

long, posteriorly 2 per bundle with upper tooth 1_ times longer than lower, all ventral chaetae with teeth equally thick.

World Distribution: Black Sea (Brinkhurst and Jamieson, 1971).

Ecology: In North America it has been collected from coastal Atlantic states and also from streams with high conductivity.

Spirosperma velutinus (Grube, 1879)

(Figures 2 d, e; 4c)

Morphometric Characteristics:

L = 25-50 mm S = 40-70

Dorsal bundles containing 1-4 hair chaetae and 4 short, hair-like crotchets; ventral crotchets all more or less simple-pointed, 1-2 per bundle; ventral chaetae of

modified spermathecal chaetae, long, straight with hollow ends. No cuticular penis sheath. Body wall closely covered with papillae.

World Distribution: Europe (Brinkhurst and Jamieson, 1971).

Ecology: This species is indicative of oligotrophic conditions.

Peloscolex euxinicus Hrabe, 1966

(Figures 2 v, y; 6 b)

Morphometric Characteristics:

L = 8 mm S = 53

Dorsal bundles with 2-3 non-serrate straight hair chaetae and 2 bifid chaetae with teeth equally long, upper somewhat thinner than lower, posteriorly 1 hair and 1 bifid; ventral bundles with 2-3 bifid chaetae anteriorly,

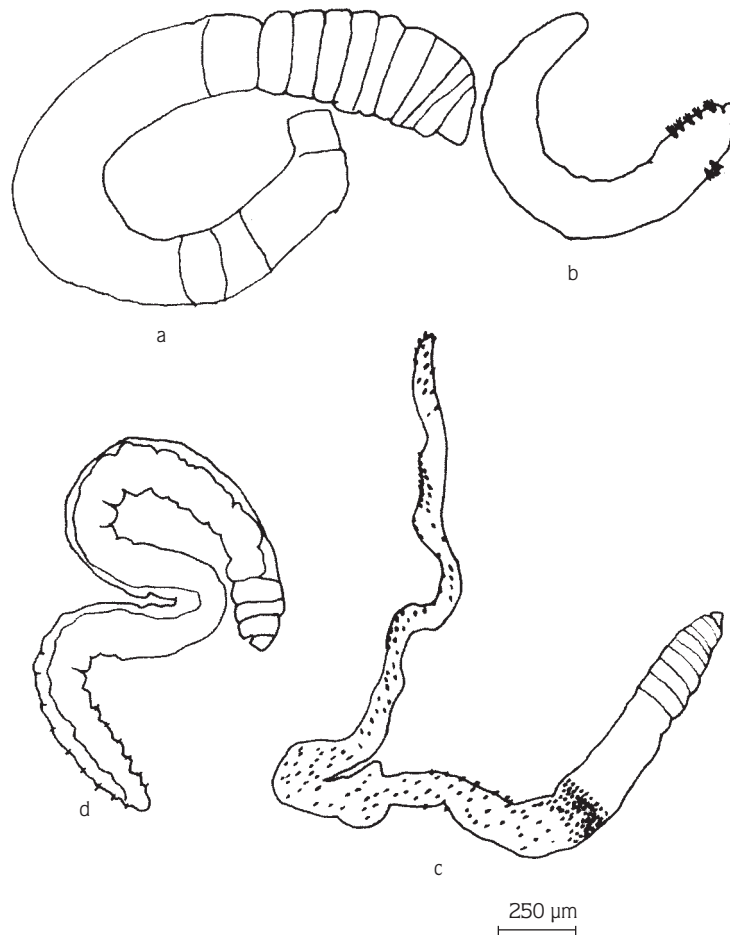


Figure 5. Whole body (a. *Aulodrilus limnobius*, b. *Paranais litoralis*, c. *Haber swirenkovi*, d. *Lumbricillus tuba*) of some new records.

upper tooth thinner but about as long as the lower, posteriorly 1-2 bifid chaetae, upper tooth diverging from lower. Penis with cuticular sheath. Body wall with a sheath.

World Distribution: Black Sea (Brinkhurst and Jamieson, 1971).

Varichaetadrilus psammophilus (Loden, 1977)

(Figures 2 z, x, G)

Morphometric Characteristics:

L = 8 mm S = 53

All anterior chaetae 3-5 per bundle, upper teeth slightly longer and thinner than the lower, but often worn down. Posteriorly 1-2 chaetae per bundle, the upper teeth shorter and thinner than the lower. Penis sheathes

170-330 μm long, broad, basally, narrowing towards the middle, flaring slightly to the head plate, which is set at nearly 90° to the shaft.

World Distribution: North America (Florida, Louisiana, Tennessee) (Brinkhurst and Jamieson, 1971).

Ecology: This species occurs in streams with a sand and gravel substrate, hence the etymology, "sand-loving".

Potamothrix vej dovskyi (Hrabe, 1941)

(Figures 2 l, m, n, o; 3 b)

Morphometric Characteristics:

L = 15-21 mm S = 80-93

Dorsal bundles with 2-4 short, bent hair chaetae and 4-6 bifid chaetae with rounded subequal teeth. Ventral

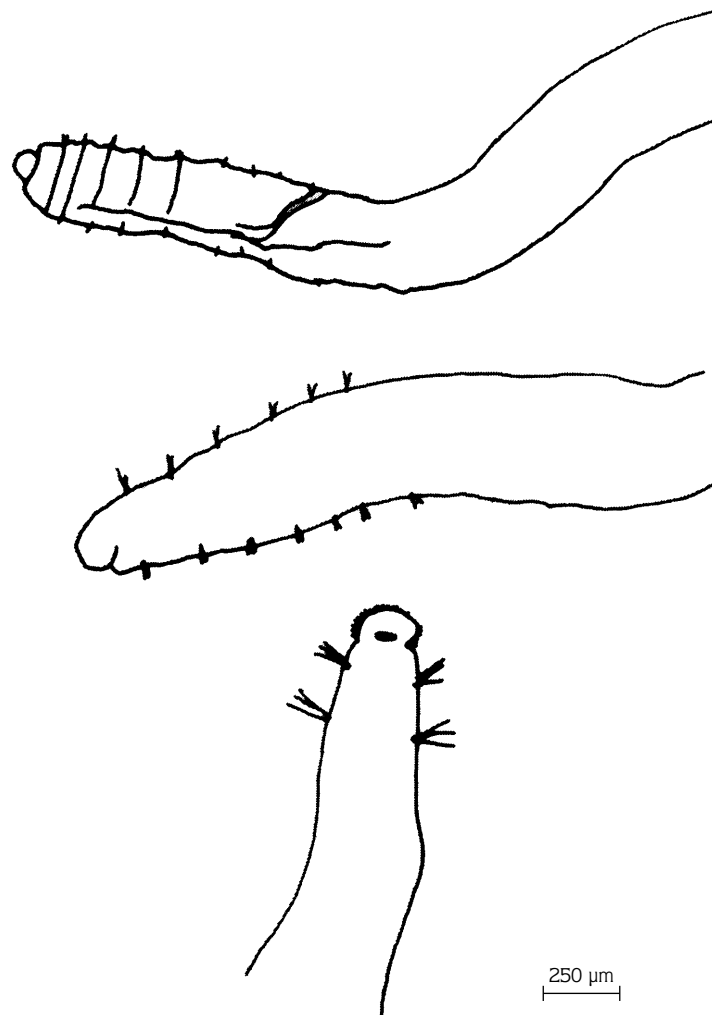


Figure 6. Anterior ends (a. *Homochaeta setosa*, b. *Peloscolex euxinicus*, c. *Aeolosoma leidy*) of some new records.

bundles with up to 10 chaetae, similar to dorsals. Spermathecal chaetae long, hollow, parallel sided with a trough shaped distal end. Small prostate glands present. The spermathecae may be absent or present in X.

World Distribution: Ontario, Great Lakes basin, Ohio, Virginia, Estonia (from the mouth of the Pärnu River) (Brinkhurst and Jamieson, 1971).

Ecology: This species is indicative of mesotrophic conditions. In fresh and slightly brackish water.

Aulodrilus limnobius Bretscher, 1899

(Figures 2 p, r; 5 a)

Morphometric Characteristics:

L = 12-15 mm S = 80

The dorsal bundles with bifid or simple chaetae but no hairs. The dorsal chaetae before 7 are bifid with a reduced upper tooth and up to 10 per bundle. The dorsal chaetae behind 7 are spatulate in facial view and compressed with small teeth in lateral view.

World Distribution: Cosmopolitan (Brinkhurst and Jamieson, 1971).

Ecology: This species lives in reinforced tubes of silty, mesotrophic, weedy areas in fresh waters. Reported in the drift. It often occurs with *A. pigueti*.

Amphichaeta leydigii Tauber, 1879

(Figures 2 b; 3 c)

Morphometric Characteristics:

L (mature specimens) = up to 1.7 mm (4 mm in chains). S = 13-14.

Dorsal hair chaetae are absent. The dorsal needle chaetae begin on segment 3, which has normally has 5 chaetae, followed by 2 chaetae on segment 4. The pharynx is elongate creating a gap between the chaetae on segments 3 and 4. The ventral chaetae on segments 3 and 4 are directed backwards.

World Distribution: Europe (Brinkhurst and Jamieson, 1971).

Ecology: Strictly freshwater on sandy substrates. Does not swim. Feeds on benthic diatoms.

Amphichaeta sannio Kallstenius, 1892

(Figures 2 j; 3 d)

Morphometric Characteristics:

L (the first zooid of a chain) = 1.5 mm.

Ventral chaetae of II usually 4 per bundle; dorsal chaetae of III 4 per bundle; other chaetae usually 3 per bundle. Left branch of the ventral vessel making a loop into the prostomium.

World Distribution: Europe (Brinkhurst and Jamieson, 1971).

Ecology: Occurs in brackish water. It is smaller than *A. leydigii*. It prefers tidal brackish water. Feeds on benthic diatoms.

Paranais simplex Hrabe, 1936

(Figures 2 c; 4 b)

Morphometric Characteristics:

L (mature) = 4-4.5 mm. S = 28-41

Ventral chaetae of II 5-6 per bundle, not longer than in neighbouring segments, with equally long teeth; in the remaining segments and dorsally 3-4 per bundle, with upper tooth shorter than lower; chaetae in anterior segments longer than the rest. No distinct stomachal dilatation.

World Distribution: Russia (Brinkhurst and Jamieson, 1971).

Ecology: Found in freshwater.

Paranais botniensis Sperber, 1948

(Figures 2 w, A, B; 4 a)

Morphometric Characteristics:

L = 6-10 mm. S = 22

Dorsal chaetae with distinct nodulus, 2-4 per bundle, slightly thinner than ventral, with teeth equally long. Stomachal dilatation in VIII, VII, without intracellular canals. Penial chaetae 2 per bundle, long, straight, double-pronged, with nodulus strongly distal.

World Distribution: Europe (Brinkhurst and Jamieson, 1971).

Ecology: In brackish water (Botnia Gulf), seldom (1 finding from a coastal pool, Hirumaa Island).

Paranais litoralis (Müller, 1784)

(Figures 2 C, D; 5 b)

Morphometric Characteristics:

L = 9-14 mm. S = 13-46

Dorsal hair chaetae are absent. The dorsal needle chaetae begin on segment 5. There are 4 to 7 slightly elongate ventral chaetae on segment 2 with the upper

teeth longer than the lower. Segments behind the second have 3 chaetae with equal teeth per ventral bundle. When mature the penial chaetae on segment 5 are short with curved tips. There are no eyes. Coelomocytes are present. The body wall non-papillate, but may have some foreign matter attached.

World Distribution: Hong Kong, Australia, Africa, Europe and N. America. A Holarctic species that is widespread (Brinkhurst and Jamieson, 1971).

Ecology: It is mostly found in coastal brackish or fresh tidal water. Salt or brackish water, generally coastal. Feeds on benthic diatoms.

Homochaeta setosa (Moszynski, 1933)

(Figures 2 E; 6 a)

Morphometric Characteristics:

L = up to 10 mm. S = up to 50

Prostomium short, obtuse. No pigment. All chaetae of the same shape, with lower tooth longer than upper; in II and III 4-8 chaetae per bundle, in the other segments up to 12.

World Distribution: Europe, ? Africa (Brinkhurst and Jamieson, 1971).

Ecology: It is found in fresh water.

Piguetiella blanci (Piguet, 1906)

(Figures 2 a; 3 a)

Morphometric Characteristics:

L = 3-7 mm. S = 24-42

No pigment. Dorsal bundles consisting of 0-3 hairs and 2-6 bifid chaetae, entirely similar to the ventral chaetae, with nodulus slightly distal and upper tooth as long as or slightly longer than lower, but considerably thinner; ventral chaetae 3-9 per bundle, all of same type, those of II slightly longer than the rest.

World Distribution: Europe, Asia (Brinkhurst and Jamieson, 1971).

Ecology: *P. blanci* feeds on lake sediments and lives in the littoral and sublittoral zones of lakes, especially on mud or muddy sand in fresh water. No swimming. Stout, pinkish worm with slow movements.

Aelosoma leidy Cragin, 1887

(Figures 2 k; 6 c)

Morphometric Characteristics:

L = Chains of 2 or 3 zooids 1.5-3 mm X 120-170 μ .

Setae bundles composed of long, flexible hair setae and short, stiff sigmoid setae. Sigmoid setae may occur in all bundles but are mostly absent from II. Epidermal glands green. With crotchet setae on the first 3 setigerous segments; crotchet setae not bifid; oil globules pale green.

World Distribution: U.S.A., Kansas, Shawne County, in creek; Michigan, Ann Arbor, dry bottom of temporary pool. France, Lac Leman. The Netherlands, several localities, in watermains and sandfilters of waterworks (Brinkhurst and Jamieson, 1971).

Ecology: These animals move rather slowly and they attach to detritus particles. Mucous secretion is considerable, so this probably is a tube-building species.

Lumricillus tuba Stephenson, 1911

(Figures 2 F, H; 5 d)

Morphometric Characteristics:

L = about 12 mm S = (33)-38-39-(41)

The chaetae are slightly sigmoid. Several transverse rows of cutaneous glands on each segment, especially pronounced anteriorly. The clitellum extends over XII-1/2 XIII; the gland cells arranged in indistinct rows. Chaetae: 2,3,4-2,3,4: 3,4,5-2,3,4.

World Distribution: Denmark: Kalø and Ebeltoft in the Kattegat area and Avedøre on the Øresund. Scotland (Brinkhurst and Jamieson, 1971).

Discussion and Conclusion

Regarding the family distribution of the taxa observed in the Gediz Delta, Tubificidae (53.07%) is the predominant family in the delta. Following these are Naididae (34.69%), Enchytraeidae (8.16%) and Aeolosomatidae (4.08%).

Regarding the species diversity of the stations, Station 1 (22 species) and Station 2 (21 species) are the most abundant stations. Following these 2 stations in terms of species diversity were Stations 13 and 14 with 7 species, Station 10 with 5 species, and Stations 4 and 11 with 4 species (Table 2).

Station 1 is on the River Gediz with salinity ranging between 0.056‰ and 0.146‰. The same conditions are

applicable to Station 2, and this station has freshwater characteristics (maximal salinity: 1.76‰). Species diversity observed in these 2 stations is due to the properties of the stations mentioned above. Furthermore, the ecological properties of Oligochaeta species found in these stations are suited to the environment in which they are located. These species are predominantly freshwater species, but they can pass to brackish waters and to areas in which water bodies overlap due to the tide. After the first 2 stations, increases and wide fluctuations are observed in the salinity values of other stations. Briefly, the wide salinity fluctuations observed in Station 3 (ranging between 0.58‰ and 12.87‰) are due to salinity increases from evaporation in the summer and dilution of the water with rain in the winter. Fluctuations due to effects of monthly changes in the temperature and rain are also observed in Station 5. The scarcity of species in Station 7, which is affected by temperature changes and located in the Kirdeniz lagoon, where the influence of the River Gediz prevails and in Station 15, which is under the influence of intense pollution from İzmir Bay, result from all of these negativities.

The most common species observed within the samples are *Aulodrilus pigueti*, *Haber swirenkovi*, *Haber speciosus*, *Paranais frici*, *Paranais simplex*, *Aulodrilus plurisetia* and *Ilyodrilus templetoni* (Table 2).

Among the species observed in only 1 station *Psammoryctides albicola*, *P. deserticola*, *P. barbatus*, *P. moravicus*, *Limnodrilus udekemianus*, *Potamothrix bavaricus*, *P. vej dovskyi*, *Homochaeta setosa*, *Slavina appendiculata*, *Stylaria lacustris*, *Piguetiella blancii*, *Dero obtusa*, *Pristinella bilobata*, *Aeolosoma leidyi*, *A. tenebrarum* and *Enchytraeus albidus* are freshwater forms. In accordance with their ecological characteristics,

they were observed in only Station 1 and Station 2, whereas the species *Amphichaeta leydigii* was observed in Station 6, which exhibits freshwater characteristics. The species *Tubifex costatus* is a real estuarine organism. It is exclusively found in these areas (in brackish waters) and it has been observed in the drainage portion of Station 13, which is a former branch of the River Gediz and exhibits brackish water characteristics. Members of the genus *Limnodriloides* are among the marine Oligochaeta. Members of this genus were observed in Station 8, showing a consistency with their ecological properties. The species *Varichaetadrilus psammophilus* prefers sandy and muddy regions. Station 7, where *Varichaetadrilus psammophilus* was observed, also possesses these characteristics. The species *Paranais litoralis* is located in brackish and fresh water in the vicinity of tide zones, so it is natural to observe it in Station 14. Members of the genus *Lumbricillus* are usually located in waters 25 to 30 m in depth, although occasionally they may be observed in freshwater as well as quite polluted rivers. Members of this genus were observed in Stations 8, 14 and 16 in accordance with their ecological characteristics (Table 2).

Four of the taxa observed from the Gediz Delta (*Stylaria lacustris*, *Homochaeta naidina*, *Pristinella bilobata*, and *Aeolosoma tenebrarum*) were previously reported from the River Gediz by Balık et al. (1999). However, the remaining 43 taxa observed from the Gediz Delta are reported for the first time. Seventeen of these 43 species (*Tubifex costatus*, *L. profundicola*, *Haber swirenkovi*, *Spirosperma velutinus*, *Pelosclex euxinicus*, *Varichaetadrilus psammophilus*, *Potamothrix vej dovskyi*, *Aulodrilus limnobius*, *Amphichaeta leydigii*, *A. sannio*, *Paranais simplex*, *P. botniensis*, *P. litoralis*, *Homochaeta setosa*, *Piguetiella blancii*, *Aeolosoma leidyi*, and *Lumbricillus tuba*) are first records for the fauna of Turkey.

References

- Balık, S., Ustaoglu, M.R. and Sari, H.M. 1999. Kuzey Ege Bölgesi'ndeki Akarsuların Faunası Üzerine İlk Gözlemler. E. Ü. Su Ürünleri Dergisi. 16, 3-4, 289-99.
- Brinkhurst, R.O. and Wetzel, M.J. 1984. Aquatic Oligochaeta of the World: Supplement, A Catalogue Of New Freshwater Species, Descriptions and Revisions, No: 44, Canadian Technical Report of Hydrography and Ocean Sciences, Canada. pp 101.
- Brinkhurst, R.O. 1971. A Guide for the Identification of British Aquatic Oligochaeta. Freshwater Bio. Ass. Sci. Pub. No: 22, pp 55.
- Brinkhurst, R.O. and Jamieson, B.G.M. 1971. Aquatic Oligochaeta of the World. Univ. of Toronto. pp 860.
- Kathman, R.D. and Brinkhurst, R.O. 1998. Guide to the Freshwater Oligochaetes of North America. Aquatic Resources Center, Tennessee, USA. pp 264.
- Milligan, M.R. 1997. Identification Manual for the Aquatic Oligochaeta of Florida, Vol: I, Freshwater Oligochaetes. State of Florida Department of Environmental Protection, Tallahassee, Florida. pp 175.

- Nielsen, C.O. and Christensen, B. 1959. The Enchytraeidae. Critical Revision and Taxonomy of European Species. (Studies on Enchytraeidae VII). Naturhistorisk Museum-Aarhus. pp 160.
- Sperber, C. 1950. A Guide for the Determination of European Naididae. Zool. Bidrag, Uppsala Bd 29. pp 81.
- Stephenson, J. 1930. The Oligochaeta. The Clarendon Press, Oxford. pp 978.
- Şahin, Y. 1987/a. Marmara, Ege Bölgeleri ve Sakarya Sistemi Akarsuları Chironomidae (Diptera) Larvaları ve Yayılışları. Doğa TU Zooloji D. 11, 3. 179-188.
- Şahin, Y. 1987/b. Burdur, Beyşehir ve Salda Gölleri Chironomidae (Diptera) Larvaları ve Yayılışları. Doğa TU Biyoloji Derg. C. 11, S., 59-70.
- Şahin, Y. 1991. Türkiye Chironomidae Potamofaunası. TÜBİTAK, TBAG-869 nolu proje. pp 88.