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Diversity and Distribution of Odonates of the Meriç Delta Wetland in Turkish Thrace, with a New Record for the Region

Yurdagül KISA MENCÜTEKİN[1] Nurten HACET[2*]

[1,2] Department of Biology, Faculty of Science, Trakya University, TR-22030 Edirne, TURKEY
e-mails: [1]yurda_gul52@hotmail.com, [2*]nhacet@hotmail.com

ABSTRACT

This study was performed in the Meriç Delta located in the Edirne province of the Turkish Thrace Region in order to reveal the diversity and distributions of odonates in the delta wetlands. Samplings were performed from spring to autumn in 2014 and 2015 in different wetland localities represented by lagoons, lakes and a river. A total of 30 Odonata species were recorded during the study, of which *Libellula quadrimaculata* is a new record for both the study area and Turkish Thrace. In addition, *Calopteryx splendens* (Harris, 1780), *Lestes dryas* Kirby, 1890, *Lestes macrostigma* (Eversmann, 1836), *Coenagrion puella* (Linnaeus, 1758), *Coenagrion pulchellum* (Vander Linden, 1825), *Coenagrion scitulum* (Rambur, 1842), *Enallagma cyathigerum* (Charpentier, 1840), *Ischnura pumilio* (Charpentier, 1825), *Aeshna affinis* Vander Linden, 1820, *Aeshna isoceles* (Müller, 1767), *Anax imperator* Leach, 1815, *Lindenia tetraphylla* (Vander Linden, 1825), *Libellula depressa* Linnaeus, 1758, *Libellula fulva* Müller, 1764, *Orthetrum brunneum* (Fonscolombe, 1837) and *Sympetrum meridionale* (Selys, 1841) are the species determined to be new records for the Meriç Delta wetland. While the Odonata fauna of the Meriç Delta was represented so far by 14 species, this number increased to 31 with the addition of 17 new species during this study. The diversity of the Odonata species recorded in the delta and their conservation categories according to the Red List criteria of the World Conservation Union (IUCN) are also considered.

Key words: Odonata, wetland, diversity, fauna, Meriç Delta, Edirne.

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INTRODUCTION

The Meriç Delta is an important wetland and lies along the westernmost land border between Greece and the European part of Turkey (Dochy, 2008). The delta formed by the Meriç River (*Evros* in Greek and *Maritza* in Bulgarian), which originates from the Rila Mountain of Bulgaria and flows northwards, then eastwards and southward to the Aegean Sea, is shared by two countries: Turkey and Greece. The total surface area of the delta is about 188 km^2, and 150 km^2 of it lies in Greek land. The 100 km^2 of the Evros Delta (the Greek part) in Greece is protected under the Ramsar Convention as a wetland of international importance (Kibaroğlu *et al.*, 2005). The Turkish part of the delta, named the Meriç Delta, is located inside the borders of the Enez and İpsala municipalities in the Edirne province in Turkish Thrace. The delta includes Lake Gala National Park, which was declared in 2005, and is characterized by different wetland systems, i.e., lagoons, lakes, seasonal swamps, large marshes, floodplains, paddy fields and the Meriç River system, all of which have different features (Kantarcı, 1989; Karauz Er, 2006).

Although none of the studies performed so far in the Meriç Delta paid special attention to the local Odonata fauna, 14 Odonata species were already known before our work based on few samplings mostly done in Lake Gala and its surroundings, and Enez was given as the locality for some of these species (Havza, 1987; Hacet and Aktaç, 2004). The diversity and abundance of water sources with different features in the delta make it possible for more representatives of the order to be present. In addition, when Odonata species recorded from both the Greek part of the delta and from the nearby regions within Turkish Thrace are also considered (Yazıcıoğlu, 1982; Havza, 1987; Hacet and Aktaç, 2004, Lopau, 2010), it is also possible to expect more species to be present in the Meriç Delta.

This study was performed to determine the current composition and status of the Odonata fauna in the Turkish part of the Meriç Delta wetland. The results of the study will provide the most recent data to fill the gaps concerning the fauna in the region. Odonates are considered to be an important bioindicator group (Bulánková, 1997; Bhandari *et al.*, 2016), and the data obtained in the present study can be used in the evaluation of the delta wetlands from many points of view. In addition, species listed under a threatened conservation status in the Mediterranean and European Odonata Red Lists by the IUCN were recorded during this study (Boudot *et al.*, 2009; Riservato *et al*., 2009; Kalkman *et al.*, 2010). This will contribute to update and improve their conservation status.

MATERIALS AND METHODS

The Meriç Delta wetland and a buffer zone in its vicinity, all corresponding to 27.490 ha, were designated as wetland protection area in 2008 (Köse, 2015). This protected area includes important water surfaces (river, lakes, and lagoons), which were sampled in this study. The study material was collected from locations selected in lagoons and lakes, as well as along the Meriç River in the Meriç Delta wetland (Fig. 1). Samplings

were carried out from May to October in 2014-2015, which corresponds to the flight period of odonates in the region.

Observations and collections were made every month in all localities as planned (Fig. 1), except for some locations in Meriç River and Gala Lake when it was impossible to enter to the sampling locations for sampling. The periodic sampling allowed for i) the determination which species were adapted to different water types in the delta, ii) the observation any possible changes in the species' compositions in the sampling locations from May to October and iii) the sampling the species during different periods (Table 1).

Odonate records in Hacet and Aktaç (2004) were given with a single locality information, Enez, although the samplings were performed in various parts, i.e. Lake Gala and the bank of Meriç River, inside municipality borders of Enez. However, detailed locality information of these records have been formerly given in the Doctoral Dissertation (Hacet, 2000) which Hacet and Aktaç (2004) based their work on. So, for water bodies studied in the present paper, the distribution data in Hacet (2000) were also given in Table 1.

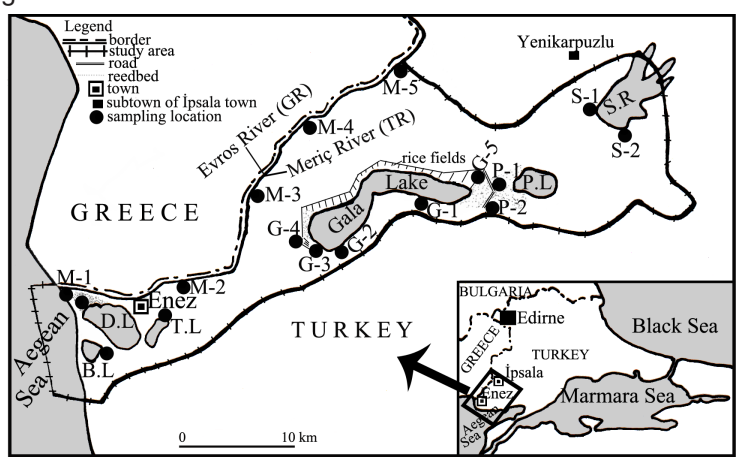

Fig. 1. Sampling locations in the Meriç Delta Wetland. (D.L: Dalyan Lagoon; B.L: Bücürmene Lagoon; T.L: Taşaltı Lagoon; P.L: Lake Pamuklu; S.R: Sığırcı Reservoir).

The Shannon-Wiener index was used to determine the species diversity of the sampled localities (Krebs, 1999). The Bray-Curtis similarity index was used to compare the similarities of the wetlands in terms of species compositions (Krebs, 1999). The results were supported by a correspondence analysis index (Krebs, 1999).

Waters sampled in the Meriç Delta

The Meriç Delta is an 'A Class' wetland area according to international standards (Yaşar, 2010). The ecological equilibrium of the delta needs special attention to allow many animals and plants to survive in the delta, in particular, the birds that use the delta as wintering and breeding areas.

Water sources in the delta can be classified in two groups: freshwater and brackish water. The inland freshwater ecosystems are Lake Gala, Lake Pamuklu, the Sığırcı

Reservoir as well as the Meriç River. Brackish water ecosystems are located on the Aegean Sea coast and are represented by the Dalyan, Taşaltı and Bücürmene lagoons (Kantarcı, 1989).

Table 1. The list of Odonata species recorded in Meriç Delta Wetland up to present, and recording months.

	water bodies studied in the Meriç Delta								months of record					
Species names	T.L	B.L	D.L	M.R	G.L	P.L	S.R	E.T	M	J	J	A	S	O
Family: Calopterygidae														
Calopteryx splendens (Harris, 1780) *			+	+(3,4,5)	+				+	+	+			
Family: Lestidae														
Lestes barbarus (Fabricius, 1798)			+, b					c		b, c	+			
Lestes dryas Kirby, 1890 *			+							+				
Lestes macrostigma (Eversmann, 1836) *	+		+						+	+				
Family: Coenagrionidae														
Coenagrion puella (Linnaeus, 1758) *					+	+				+				
Coenagrion pulchellum (Vander Linden , 1825) *					+	+	+			+				
Coenagrion scitulum (Rambur, 1842) *			+								+			
Enallagma cyathigerum (Charpentier, 1840) *			+		+	+					+			+
Erytromma viridulum (Charpentier, 1840)			+	+(1,3)	+,a,b	+		c	+	+,a,b,c	+	+		
Ischnura elegans (Vander Linden , 1820)	+	+	+	+(1,2,3,4,5)	+	+	+	b,c	+,b,c	+,b,c	+	+, b	+	+
Ischnura pumilio (Charpentier, 1825) *			+				+					+		
Family: Platycnemididae														
Platycnemis pennipes (Pallas, 1771)			+	+(2,3,4,5) b	b			c	+,b,c	+,b,c	+			
Family: Aeshnidae														
Aeshna affinis Vander Linden, 1820 *	+	+	+						+	+	+			
Aeshna isoceles (Müller, 1767) *	+		+	+(2)	+	+	+		+	+	+			
Aeshna mixta Latreille, 1805	+	+	+, b	+(3,4), b	+	+	+	c	+	+, b,c	+		+	+
Anax ephippiger (Burmeister, 1839)			+					b,c				+,b,c		
Anax imperator Leach, 1815 *	+		+		+				+	+		+		
Anax parthenope (Selys, 1839)		+	+		+,b,a	+		b,c	+	+,a,b,c	+	+	b,c	
Family: Gomphidae														
Lindenia tetraphylla (Vander Linden, 1825) *					+					+				
Family: Corduliidae														
Somatochlora meridionalis Nielsen, 1935								b,c					b,c	

Abbreviations: (T.L) Taşaltı Lagoon; (B.L) Bücürmene Lagoon; (D.L) Dalyan Lagoon; (M.R) Meriç River; (G.L) Lake Gala; (P.L) Lake Pamuklu; (S.R) Sığırcı Reservoir; (E.T) Enez Town. Markings: (+) present data; (1,2,3,4,5) locations in the Meriç River (1: brackish water; 2-5: fresh waters); (a) Havza, 1987; (b) Hacet, 2000; (c) records given from Enez town as location by Hacet and Aktaç (2004); (*) new record for the delta; (**) new record for Turkish Thrace Region.

Table 1. Continued.

	water bodies studied in the Meriç Delta								months of record					
Species names	TL	BL	DL	MR	GL	PL	SR	E.T	M	J	J	A	S	O
Family: Libellulidae														
Crocothemis erythraea (Brullé, 1832)	+, a	+, a	+, a, b	+(1,2,3,4,5),b	+, b	+	+	c	+,b,c	+,b,c	+	+,a	+	
Libellula depressa Linnaeus, 1758 *	+				+				+		+			
Libellula fulva Müller, 1764 *					+	+			+	+	+			
Libellula quadrimaculata Linnaeus, 1758 **				+(2)					+					
Orthetrum albistylum (Selys, 1848)	+	+	+	+(3,4,5)	+	+	+	b,c	+	+,b,c	+	+	+	
Orthetrum brunneum (Fonscolombe, 1837) *	+	+	+	+(2,3)			+		+	+	+	+	+	
Orthetrum cancellatum (Linnaeus, 1758)	+	+	+	+(2,3,4,5),b	+, b	+	+	c	+	+,b,c	+	+		
Orthetrum coerulescens (Fabricius, 1798)	+		+		a	a	+, a		+	+,a	+	+, a		
Sympetrum fonscolombii (Selys, 1840)	+, a	+, a	+, a	+(1,2,3,4,5),b	+	+, a	+, a	b,c	+, b,c	+,b ,c	+	+, a	+	+
Sympetrum meridionale (Selys, 1841)*	+	+	+	+(1,3,4)	+	+			+	+		+	+	+
Sympetrum striolatum (Charpentier, 1840)	+, a		+						+	+		+, a		
Number of species in the water bodies	15	10	24	13	20	15	11	12						

Macrophytes determined in the freshwater ecosystems are reeds (*Phragmites australis*), bulrushes (*Tyhpha latifolia*), club-rushes (*Schoenoplectus lacustris*), water lilies (*Nymphaea alba*), pondweeds (*Potamogeton fluitans* and *Potamogeton pectinatus*), hornwort (*Ceratophyllum demersum*), water plantain (*Alisma plantago-aquatica*) and filamentous green algae. White poplar (*Populus alba*) and willows (*Salix* sp.) are common along the shores of the Meriç River (Kantarcı, 1989).

Taşaltı (Harmanlı) Lagoon (T.L.): Edirne- Enez, sampling location: 40°43'11"N, 26°05'47"E, sea level.

This lagoon covers an area of 70 ha and is characterized by brackish water (Yaşar, 2010). The total area of the lagoon widens with the effects of rainfall in winter, but it narrows during the summer, and the lagoon transforms into a swampy area with the withdrawal of water. The lake shows a shallow lagoon feature (Balcı Akova, 2008). While there are paddyfields in its north border, the others are occupied by marshes.

Bücürmene (Işık or Üzmene) Lagoon (B.L.): Edirne- Enez, sampling location: 40°42'17"N, 26°04'02"E, sea level.

This lagoon is located on the Aegean Sea coast and occupies an area of 76 ha, but the flooded surface may change seasonally. The water of the lake is brackish. The north and east parts of the lagoon are surrounded by a high vegetation of reeds, shrubs and club-rushes, while the other shores are mostly composed of sandy areas (Balcı Akova, 2008; Çamur-Elipek and Kırgız, 2010).

Dalyan Lagoon (Tekke or Peso) (D.L.): Edirne-Enez, sampling location: 40°43'39"N, 26°02'41"E, sea level.

This lagoon is a brackish water ecosystem covering an area of 3.4 km². The area of the lagoon changes in summer and winter according to the amount of water carried by the Meriç River. The coastal part of the lagoon as well as its other sides are covered with sand (Balcı Akova, 2008).

There are a few small water deposits with reeds around them and both swampy and sandy areas covered by shrubs and short reeds in the part of lagoon near the Meriç River.

The Meriç River (M.R): Edirne- Enez, sampling locations: M-1, brackish water, M-(2-5), fresh waters. M-1: 40°43'46"N, 26°02'20"E, sea level; M-2: 40°44'11"N, 26°06'03"E, 9 m; M-3: 40°46'16"N, 26°07'41"E, 7 m; M-4: 40°48'11"N, 26°09'14"E, 6 m; Edirne- İpsala, sampling location: M-5: 40°50'20"N, 26°12'53"E, 8 m.

The river forms the border between Greece and Turkey. The sampling locations in the study area are located within both the Enez and İpsala municipalities.

The amount of water carried by the Meriç River is quite important, and in the rainy seasons, it sometimes leads to overflooding events around it. Wide reeds margins are typical in natural vegetation and willows are present in coastal areas. The river is connected to Lakes Pamuklu and Gala and to Dalyan Lagoon (Balcı Akova, 2008; Yaşar, 2010).

The Sığırcı Reservoir (S.R.): Edirne- İpsala, sampling locations: S-1: 40°49'10"N, 26°18'29"E, 15 m; S-2: 40°48'54"N, 26°19'30"E, 8 m.

Sığırcı Dam Lake, covering an area of 1.8 km^2, is located in the south of the İpsala town in the Edirne province. It is a shallow lake and was built between 1989 and 1994. The water level of the pond falls in the summer. Some of its coastal regions have reeds, and some parts turn into marshes (Anonymous, 2017).

Pamuklu (P.L) and Gala Lakes (G.L): Pamuklu Lake: Edirne- İpsala, sampling locations: P-1: 40°46'46"N, 26°14'26"E, 7 m; P-2: 40°46'07"N, 26°13'59"E, 4 m.

Gala Lake: Edirne- Enez, sampling locations: G-1: 40°46'18"N, 26°13'10"E, 6 m; G-2: 40°44'59"N, 26°10'55"E, 14 m; G-3: 40°45'15"N, 26°10'05"E, 7 m; G-4: 40°45'30"N, 26°09'35"E, 5 m; G-5: 40°47'08"N, 26°14'02"E, 10 m.

Lake Gala is an alluvial lake formed by the Meriç River and is separated into two parts as the Great Gala and Small Gala Lakes during the summer (Çamur-Elipek and Kırgız, 2010). The alluvium brought by the river occasionally closes the river mouth of the lake and causes the lands around the lake to be submerged, thereby merging the lake with Lake Pamuklu (Balcı Akova, 2008). Lakes Gala and Pamuklu (2.369 ha) were declared to be a nature conservation area in 1991. The border of the nature protection area was later expanded (6.087 ha), and it was declared a national park in 2005 (Köse, 2015).

The Small Gala and Pamuklu Lakes are wetlands that consist of bulrushes and reeds and contain, from time to time, water lilies, pondweeds and filamentous green algae. Some parts of the lakes turn into marshes with the withdrawal of water during

summer months. Great Gala Lake, which is mostly bordered by a forest ecosystem, is also an important wetland where bulrushes are common and is partly covered with water lilies and has shrubs.

RESULTS AND DISCUSSION

Thirty Odonata species (12 Zygoptera and 18 Anisoptera) were recorded in the study area (Table 1).

Libellula quadrimaculata Linnaeus, 1758 is reported as a new species both for the Meriç Delta and the Thrace region (see the updated species distribution in Boudot and Kalkman (2015). Its nearest known locality is in north-eastern Greece, close to the Bulgarian border) (Lopau, 2010). In addition*, Calopteryx splendens*, *Lestes dryas*, *L. macrostigma*, *Coenagrion puella*, *C. pulchellum*, *C. scitulum*, *Enallagma cyathigerum*, *Ischnura pumilio*, *Aeshna affinis*, *A. isoceles*, *Anax imperator*, *Lindenia tetraphylla*, *Libellula depressa*, *L. fulva, Orthetrum brunneum* and *Sympetrum meridionale* are new species for the Meriç Delta.

Although the Odonata fauna of the Meriç Delta were represented by 14 species, these 17 new species increased the total number of Odonata species known from the delta to 31.

Conclusions on some species recorded in the study area

Libellula quadrimaculata has a Holarctic distribution and is widely distributed in Eurasia and North America (Askew, 2004; Boudot and Kalkman, 2015). The species had not been recorded so far in Turkish Thrace Region. While shallow ponds and lake edges with emergent vegetation have been given as the habitats where *L. quadrimaculata* generally breeds, it has also been reported that the species is common in the pools situated in mossy and open areas in the north of Europe (Askew, 2004). *Libellula quadrimaculata* was recorded from only one location, a bushy area in at the border of a swampy area near the edge of the Meriç River about 7 or 8 km inwards from the shore of the Aegean Sea. Since this species could not be found in any of our other sampling sites, neither along the river nor in other water bodies in the delta, we conclude that it is not likely for *L. quadrimaculata*, known as a vagrant and migrant species (Askew, 2004), to be native in our study area, so that this record most likely belongs to a vagrant individual. *Libellula quadrimaculata* is known from Greece (Lopau, 2010) and might occur in the Evros Delta, which is the part of the Meriç Delta in Greece. The record from the Meriç Delta probably represents an individual originating from a Greek population. When both the dispersal capacity of this species and its adaptation to various water types are considered, the presence of suitable habitats in the delta indicates that *L. quadrimaculata* might well settle in this area in the future.

Lestes dryas and *Lestes macrostigma* are species rarely recorded in the Thrace region. The main suitable habitats for the latter species are in brackish wetlands with sea club-rush (*Bolboschoenus maritimus*), common club-rush (*Scoenoplectus lacustris*) and/or sea rush (*Juncus maritimus*) in abandoned salt pans, salt marshes and dune and steppe lakes with salinity up to ca 20‰ (Boudot and Kalkman, 2015).

In this study, *L. macrostigma* was found on the banks of two lagoon lakes (i.e., Taşaltı and Dalyan). The habitats preferred by *L. dryas* were stagnant and well-vegetated waters, shallow ponds and swamps (Askew, 2004; Kalkman, 2006). This species was recorded at the edge of a swamp area at the border of the Dalyan Lagoon near the Meriç River. While the presence of *L. dryas* in the Meriç Delta is represented by two specimens caught in this lagoon lake, *L. macrostigma* was found in Dalyan Lagoon in higher numbers than in Taşaltı Lagoon. *L. macrostigma* is assessed as vulnerable (VU) in the European IUCN Red List (Kalkman *et al.*, 2010). Therefore, the presence of this threatened species in the delta makes the Meriç Delta an important area in terms of Odonates.

Coenagrion pulchellum, *C. scitulum* and *E. cyathigerum* are rarely seen in the Thrace region and the known records of these species have been gathered in the north of the region (Kalkman and Van Pelt, 2006; Hacet, 2017). These three species are known from locations in Greece close to the Meriç delta (Lopau, 2010). The present records of *C. pulchellum*, *C. scitulum* and *E. cyathigerum* in the delta extended their distributional range to include the southern parts of the Thrace region. However, their densities in the delta was low. *C. pulchellum* was evaluated as Near Threatened (NT) in the Red List of the Mediterranean Region Basin (Riservato *et al.*, 2009). The Meriç Delta is therefore an important location for these species in Turkish Thrace.

Lindenia tetraphylla, also assessed as VU according to the IUCN European Odonata Red List (Kalkman *et al*., 2010), is a new species for the delta. This nomadic species tends to migrate (Schneider, 1981) and has a distributional range extending from Central Asia to the West Mediterranean Basin through the Middle East. Permanent populations in the Mediterranean basin are known from the Adriatic coast of the Balkans and Turkey (Dijkstra and Lewington, 2006; Boudot and Kalkman, 2015). A number of new localities became recently available within the known species range (Gastarov and Beshkov, 2010; Kulijer *et al.*, 2012; Brochard and van der Ploeg, 2013; De Knijf *et al.*, 2013; Stille *et al.*, 2014; Boudot and Kalkman, 2015). The known distribution of the species from Turkey are mainly localized to the south of Anatolia, but the species has also been recorded in the Thrace region and Gökçeada Island in the north of the Aegean Sea (Hacet and Aktaç, 2006; Kalkman and Van Pelt, 2006; Hacet, 2017). The finding of *L. tetraphylla* in the Meriç Delta is based only on a dead male found around Gala Lake, and no other specimens could be found during the subsequent samplings in the area. *Lindenia tetraphylla* is prompt to vagrancy and shows often a migratory behaviour. Therefore, some recent records in Europe may represent temporary populations (Boudot *et al.*, 2009). It is possible that the single specimen found in our study area was either a vagrant or a migrant coming from Greece, where the indigenous populations of the species occur.

Lindenia tetraphylla is known from lakes and rivers with hydrophytes and helophytes (Schorr *et al.*, 1998; Boudot, 2014). Recent data have shown that man-made dam lakes may also constitute breeding places (Kalkman and Van Pelt, 2006; Hardersen and Leo, 2011; Brochard and van der Ploeg, 2013; Boudot, 2014; Hamzaoui *et al*., 2015). *L. tetraphylla* is a widespread eremic species occurring in North African and

Asian deserts (Suhling *et al*., 2003; Hamzaoui *et al*., 2015). A species that adapts to desert conditions will undoubtedly be more successful in spreading than a species that is specific to certain habitats. The water resources in the delta have features that can support permanent populations of *L. tetraphylla*, and, therefore, it may be expected that this species will be able to establish itself here in the future, although it is not a native population today.

Abundance and biodiversity of the species in the Meriç Delta

According to the value of the Shannon-Wiener index, the Dalyan Lagoon shows the highest species diversity (H'=1.38), followed by the Lake Gala (H'=1.2), the Taşaltı Lagoon, the Pamuklu Lake, the Meriç River (H'=1.1) and the Bücürmene Lagoon and the Sığırcı Reservoir (H'=1.0) (Fig. 2).

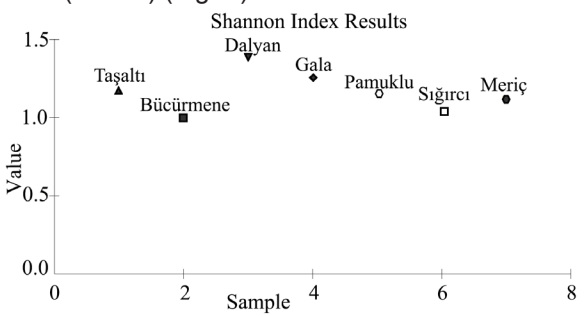

Fig. 2. The results of Shannon diversity index of Odonata in the sampling localities.

When the sampled localities were evaluated in terms of the number of species, the Dalyan Lagoon was found to harbour the highest number of species. The sampling point selected in the Dalyan Lagoon is close to the Meriç River. This edge of the Dalyan Lagoon includes marshy areas covered by reeds and also a sandy area covered by short reeds and shrubs throughout the sea border. Furthermore, this location has small pools and a channel bordered by short herbaceous plants, which enters inward from the Meriç River. This location, characterized by brackish water, is close to the Meriç River, which creates a suitable habitat both for different species occurring in either river or lagoon waters and for species showing tolerance to a broad spectrum of aquatic habitats. This should explain why it contains more species than the other sampled localities.

According to the results of the Bray-Curtis similarity index, Lakes Gala and Pamuklu, both with freshwaters, were found to be the most similar in the wetlands with 87 % similarities. The second leading similarity values were obtained for the Taşaltı and Bücürmene Lagoons (72 % similarity) and the Taşaltı and Dalyan Lagoons (71 %) (Fig. 3).

When the species recorded within the delta were evaluated according to their distributions in lagoons and fresh waters, 25 species were found to exist in lagoons and 23 species in fresh waters (Table 1). The numbers in lagoons and fresh waters are close to each other. The reason for this seems to be that *I. elegans*, *I. pumilio*, *E. viridulum*, *L. barbarus*, *L. macrostigma*, *A. mixta, A. ephippiger*, *O. cancellatum*, *S.*

fonscolombii, *S. striolatum* and *C. erythraea* are tolerant to both fresh and brackish waters and that the present water bodies in the delta are close and linked to each other, allowing species to disperse from their native habitats to another one. The Meriç River is linked to Lakes Gala and Pamuklu (Balcı Akova, 2008). Excess water from Gala Lake is discharged to the Taşaltı Lagoon by the Taşyarma Canal, and this lagoon is also linked to the Dalyan Lagoon (Yaşar, 2010).

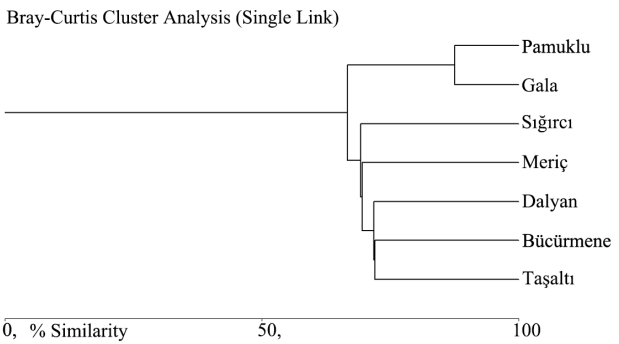

Fig. 3. Dendrogram of similarity of species composition for Odonata in the Meriç Delta Wetland.

The Bray-Curtis results were supported by correspondence analysis. Accordingly, the sampled localities were grouped according to the species sampled within them (Fig. 4).

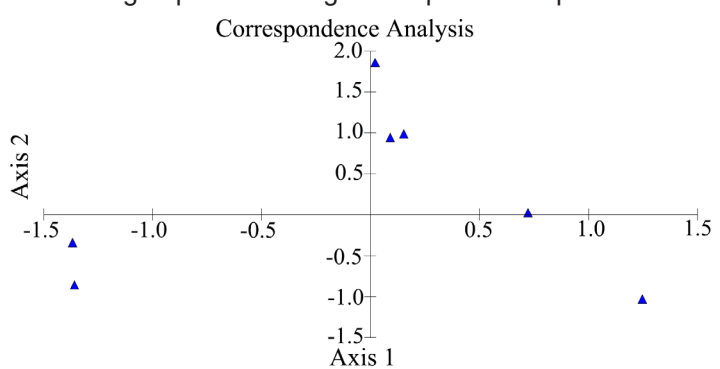

Fig. 4. Corresponding analysis results of species composition for Odonata in the sampling localities.

The most common species in the 7 different wetlands sampled are *I. elegans*, *A. mixta, C. erythraea*, *O. albistylum*, *O. cancellatum* and *S. fonscolombii,* while *A. isoceles* and *S. meridionale* were common in 6 wetlands, and *O. brunneum* and *O. coerulescens* were common in 5 wetlands (Table 1). The common occurrence of these species in different water types, i.e., lagoons with brackish to salty water and river and lakes with fresh water, can be explained by their low specialisation in terms of habitat preferences (i.e., ubiquist species).

Lestes barbarus, *L. dryas*, *C. puella*, *C. pulchellum*, *C. scitulum*, *E. cyathigerum* and *I. pumilio* were observed in low numbers in the delta. Their sampling dates showed

that they have earlier flight periods than other species (Table 1), which accounts for their lower frequency in our records. *Ischnura elegans*, *A. mixta*, *A. parthenope*, *C. erythraea*, *O. albistylum*, *O. brunneum*, *S. fonscolombii* and *S. meridionale* were observed in large numbers and showed longer flight periods (Table 1).

The number of species recorded from the Meriç Delta represents approximately half of the Odonata fauna from the Thrace region. Anisoptera and Zygoptera were found to be represented in the study area by about 61 % and 38 % respectively. The dominant families in the region were Libellulidae (36 %) and Coenagrionidae (23 %) (Fig. 5). The results of this study showed that the Meriç Delta constitutes an important living area for ubiquist Odonata. The delta is also important especially for species listed in the threatened and near threatened categories in the European and Mediterranean Odonata Red lists.

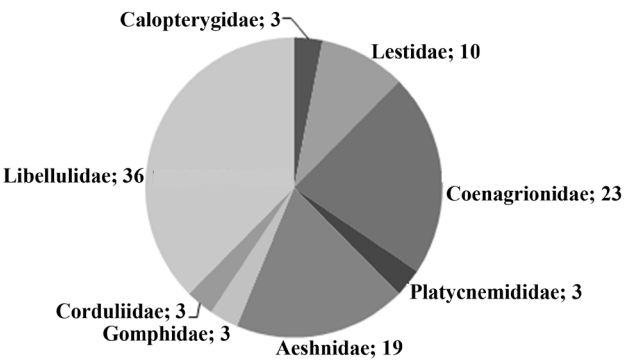

Fig. 5. Family distribution of Odonata in the Meriç Delta Wetland.

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