ABANT IZZET BAYSAL UNIVERSITY
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

DETERMINATION OF THE RELATIONSHIP OF OSTRACOD'S (CRUSTACEA) REPRODUCTIVE MODES AND ECOLOGICAL FACTORS IN MUŞ AND MARDİN (TURKEY)

MASTER OF SCIENCE

OZAN YILMAZ

BOLU, FEBRUARY 2016

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APPROVAL OF THE THESIS

DETERMINATION OF THE RELATIONSHIP OF OSTRACOD'S (CRUSTACEA) REPRODUCTIVE MODES AND ECOLOGICAL FACTORS IN MUŞ AND MARDİN (TURKEY) submitted by **OZAN YILMAZ** in partial fulfillment of the requirements for the degree of master of science in department of biology, **ABANT İZZET BAYSAL UNIVERSITY** by,

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February 03, 2016

Prof. Dr. Duran KARAKAS D. Karakas
Director, **Graduate School of Natural and Applied Sciences**

To my family

DECLARATION

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Ozan YILMAZ

ABSTRACT

DETERMINATION OF THE RELATIONSHIP OF OSTRACOD'S (CRUSTACEA) REPRODUCTIVE MODES AND ECOLOGICAL FACTORS IN MUŞ AND MARDİN (TURKEY)
MSC THESIS
OZAN YILMAZ
ABANT IZZET BAYSAL UNIVERSITY GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
DEPARTMENT OF BIOLOGY
(SUPERVISOR: PROF. DR. OKAN KÜLKÖYLÜOĞLU)

BOLU, FEBRUARY 2016

This study includes a total of 164 different water bodies randomly sampled from Mardin (65 sites) and Muş (99 sites) during 13- 20 August 2013. 78 taxa (55 living spp.) belonging to 31 genera were recorded from both provinces. Of them, 31 living species with 16 sub-*fossils* were found from 58 of 65 sampling sites of Mardin while 45 living with 15 sub-*fossils* were identified from 91 of 99 sites in Muş province. The bisexual populations of 13 taxa (*Candona angulata, C. neglecta*, *C. sonociensis*, *C. lindneri*, *Ilyocypris gibba, I. inermis*, *Prionocypris zenkeri*, *Psychrodromus fontinalis*, *P. olivaceus*, *P.* cf. *robertsoni*, *Stenocypria fischeri*, *Trajancypris clavata*, and *Zonocypris* cf. *costata*) were found during the study. All species were new records for both provinces. *Cypretta* sp. *Vestalenula* cf. *boteai*, *Hemicypris inversus*, *H*. cf. *congenera*, *Hemicypris* n. sp., bisexual populations of *Trajancypris clavata* and *Psychrodromus* cf. *robertsoni* are the first reports for Turkish Ostracoda fauna. The last two are also new for the literature. Total number of bisexual species increased up to 77. The first two axes of Canonical Correspondence Analyses for Mardin, Muş and both provinces explained 67.5, 74.2 and 73.3 % of relationships between species and environmental variables, respectively. The most effective variables on species were elevation, water temperature and pH. UPGMA analyses did not cluster species with different sexual mode. Ecological optimum and tolerance levels of species with different sexual mode revealed fluctuations for different variables. Specific Overlap and General Overlap indices were used on ostracods for the first time. Accordingly, there was a complete overlap for some of those environmental variables by those species (3 spp. overlap for pH; 6 spp. for dissolved oxygen, 7 spp. for water temperature, 10 spp. for electrical conductivity, 6 spp. for elevation). This means that all these species used a common utilization curves for each of these variables.

KEYWORDS: Ostracoda, Ecology, Distribution, Reproduction, General and Specific Niche Overlap Indices, CCA, *Hemicypris* n. sp.,

ÖZET

MUŞ VE MARDİN (TÜRKİYE) İLLERİNDEKİ OSTRAKODLARIN (CRUSTACEA) ÜREME ŞEKİLLERİ İLE EKOLOJİK FAKTÖRLER ARASINDAKİ İLİŞKİNİN BELİRLENMESİ
YÜKSEK LİSANS TEZİ
OZAN YILMAZ
ABANT İZZET BAYSAL ÜNİVERSİTESİ FEN BİLİMLERİ ENSTİTÜSÜ
BİYOLOJİ ANABİLİM DALI
(TEZ DANIŞMANI: PROF. DR. OKAN KÜLKÖYLÜOĞLU)

BOLU, ŞUBAT - 2016

Bu çalışma, Mardin (65 örnekleme yeri) ve Muş (99 örnekleme yeri) dan toplamda 164 farklı su kütlesinden 13 ile 20 ağustos 2013 tarihileri boyunca rastgele yapılmış örneklemleri içermektedir. Bu iki alandan 31 cinse ait 78 taksa (55 canlı) kayıt edildi. Mardin ilinde ise 65 yerin 58'inde 31 canlı tür ile 16 subfosil bulunurken Muş ilinde 99 yerin 91'inde 45 canlı ile 15 subfosil tanımlandı. Çalışma süresince, 13 taksanın (*Candona angulata*, *C*. *neglecta*, *C*. *sonociensis*, *C*. *lindneri*, *Ilyocypris gibba, I inermis*, *Prionocypris zenkeri*, *Psychrodromus fontinalis*, *P*. *olivaceus*, *P*. cf. *robertsoni*, *Stenocypria fischeri*, *Trajancypris clavata*, and *Zonocypris* cf. *costata*) biseksüel populasyonları tespit edildi. Bulunan bütün türler iki bölge için yeni kayıttır. *Cypretta sp*. *Vestalenula* cf. *boteai*, *Hemicypris inversus*, *H*. cf. *congenera*, *Hemicypris* n. sp. türleri ile *Trajancypris clavata* ve *Psychrodromus* cf. *robertsoni* türlerinin biseksüel populasyonları Türkiye Ostrakoda faunası için ilk kayıtlardır. Son ikisi aynı zamanda literatür içinde yenidir. Böylece Türkiye'deki toplam biseksüel tür sayısı 77'ye yükseldi. Kanonik Uyum Analizinin ilk iki ekseni Mardin, Muş ve iki bölge için, türler ile ekolojik değiskenler arasındaki ilişkileri sırasıyla yüzde 67.5, 74.2 and 73.3 olarak açıkladı. Yükseklik, su sıcaklığı ve pH türler üzerine en etkili değişkenler oldu. UPGMA analizi farklı üreme modlarına sahip türleri birlikte guruplamadı. Farklı üreme moduna sahip türlerin ekolojik optimum ve tolerans seviyelerinde dalgalanmalar oldu. Genel Örtüşme indeksleri ilk defa ostrakodlar üzerinde kullanıldı. İndekslere göre, çevresel değişkenlerin bazıları (pH için 3 tür örtüştü; çözünmüş oksijen için 6 tür, su sıcaklığı için 7 tür, elektiksel iletkenlik için 10 tür, yükseklik için 6 tür) bazı türlerle tam bir örtüşme gösterdi. Bunun anlamı kullanılan bütün türlerin ortak bir tüketim eğrisine sahip olduğunu ifade eder.

ANAHTAR KELİMELER: Ostrakoda, Dağılım, Ekoloji, Üreme, Genel ve Özel Niş Örtüşme İndexleri, CCA, *Hemicypris* n. sp.,

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LIST OF ABBREVIATION

A1: First antenna
A2: Second antenna
Md: Madibula
Mx: Maxillula
T1: First thoracopod
T2: Second thoracopod
T3: Third thoracopod
Hp: Hemipenis
Zk: Zenker organ
Rk: Food-rake organ

1. INTRODUCTION

1.1 Ostracoda

The Ostracoda “mussel-shrimps or seed shrimps” (Karanovic, 2012) are microcrusteceans and normally have 0.3-5 mm long but some marine paleagic ostracods rarely reach uoto 30 mm in size (e.g., Gigantocypris Müller, 1895) (Meisch, 2000). They basically compose of a bivalve calcified shell and articulated soft body (Figure 1.1.). They are living in almost all kinds of aquatic habitat of marine, brackish and freshwater bodies and occur in benthic and periphytic animal communities (Martens et al., 2008).

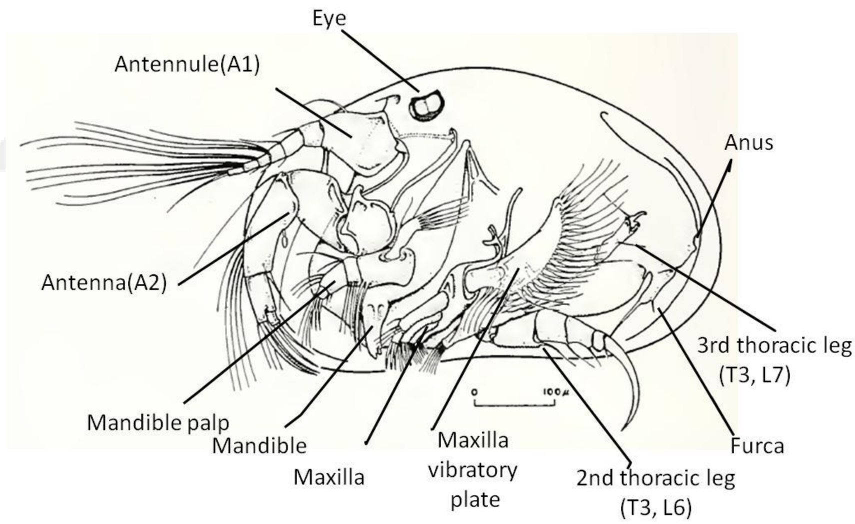

Figure 1.1. The soft body parts of *Cypridopsis vidua* in lateral view of right valve. Modified from Kesling (1951).

The Class Ostracoda belongs to the Subphylum Crustacea in the Phylum Arthropoda have four orders (Paleocopida, Myodocopida, Platycopida, Podocopida) (after Van Morkhoven 1962, Maddocks 1982, Meisch 2000). When Myodocopa consists of two orders as Myodocopida and Halocyprida, Podocopa mostly includes Recent and living freshwater (and some brackish water) ostracods in two superorders

(Metacopina, Podocopina). Podocopina includes seven superfamilies within five infraorders. The other orders mostly have marine forms.

1.1.1 History

The word “ostracod” originates from Greek “ostrakon” that means shell or tile (Moore et al. 1961, Van Morkhoven 1962). *Monoculus conchapedata* was firstly defined by Linne in 1748 (Alm 1916). Afterwards, O. F. Müller firstly illustrated Ostaracoda in Europe (Viehberg, 2006). Later, in 1802 P. A. Latreille initially stated “Ostrachoda” ,then in 1806 he altered this pharese as “Ostracoda” (Ikeya et al., 2005; Rodriguez-Lazaro and Ruiz-Munoz, 2012).

Ostracods carapace includes more than 80% of $CaCO_3$ which can readily fossilized and conserved in sediments (Holmes and Horne, 1999). They are known as “oldest microfauna” (Delorme, 1991). The fossil report of ostracods which belong to the Cambrian period (circa 500 mya) is known (Sars,1928; Henderson, 1990) but ostracods existence in sediments was starting from the early Ordovician time (about 490 mya) (Ozawa, 2013). The oldest recording of freshwater ostracods goes back to the Devonian period about 360 mya (Martens et al., 2008). Thus, fossil ostracods are used to describe habitat characteristics of the past environmental conditions (Tuncer and Tunoğlu, 2014; Tunoğlu et al. 2014).

In Turkey, German scientist H. W. Schäfer was the first to report non-marine ostracods in 1952. Following him, another German scientist G. Hartmann studied and reported species in 1964. Afterward, D. Gülen who is the first Turkish non-marine ostracod worker and his colleagues made various studies on non-marine ostracods (e.g., Gülen,1975, 1985; Gülen et al., 1994; Gülen and Altınsaçlı, 1999, Özuluğ et al., 2001; Özuluğ, 2005, 2012; Özuluğ and Yaltalıer, 2008). O. Külköylüoğlu worked and published several studies about these oraganisms, especially ostracods’ ecology, taxonomy and distribution and his works continues (e.g., Külköylüoğlu et al., 1993, 1995; Külköylüoğlu, 1998; Külköylüoğlu, 2003b, 2004, 2009; Külköylüoğlu and Sarı, 2012; Külköylüoğlu et al., 2012a, 2013, 2014, 2015a-d).

1.1.2 Morphology of Ostracoda

The Ostracoda have a carapace with two calcium carbonated valves. They are linked at about medio-dorsal part with a structure called "hinge" (Figure 1.2) (Meisch, 2000). This shell thoroughly embraces soft body parts of ostracods. It composes well calcified outer and soft inner lamella which they converge on end of the valve margine (Smith, 2000; Karanovic, 2012). The outer side of valves may come into existence of different structures such as tubercules, nodes, pores and spines which play important role for ostracod activities (Martens, 1998; Meisch, 2000; Karanovic, 2012). The motions of valves are provided by central adductor muscles. The scar of this muscles may be seen from outside of the valves and can be used to describe taxonomy of some ostracods as is the case in superfamily Darwinuloidea (Meisch, 2000).

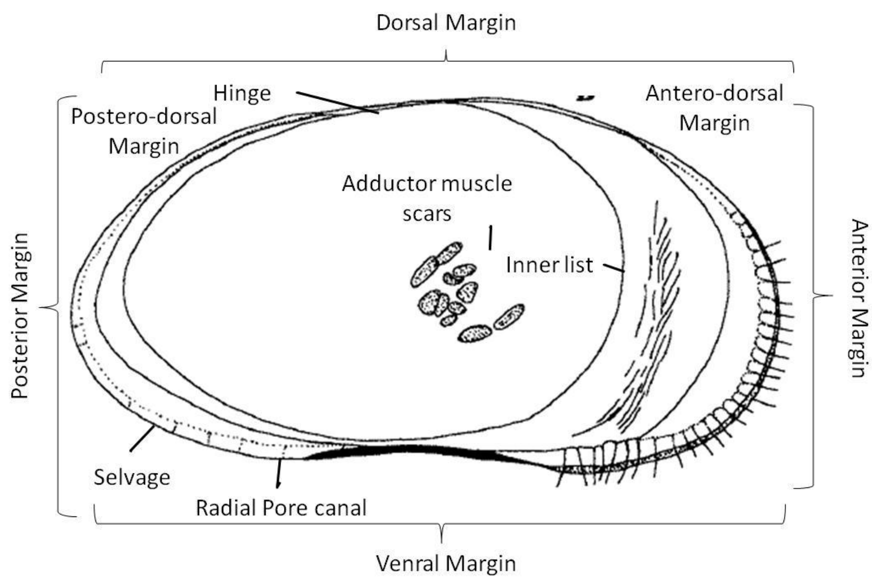

Figure 1.2. The inside wiev is left valve of *Strandesia kimberleyi*. Modified from Karanovic (2005).

Antennula (A1), Antenna (A2), Mandibula (Md), Maxillula (Mxl), First thoracopod (T1, Clasping organ in male) or Fifth limb (L5), Second thoracopod (T2) or Sixth limb (L6 = walking leg), Third thoracopod (T3) or Seventh limb (L7 = cleaning leg), Uropod (Furca), and Hemipenis (Hp), Zenker organ (Zk) are some members of ostracods' soft body (Meisch, 2000; Martens, 2003; Karanovic, 2012). Unlike other arthropods, ostracod body does not have manifest segmentation. However, antennula, antenna, mandible, maxillule and naupliar eye (except some species) make head (cephalon). Morever, other parts of them form thorax (Meisch,2000; Karannovic, 2012). These appendages undertake different tasks for ostracods such as movement, hunting, swimming, feeding, mating, etc.

1.1.3 Reproduction

While the majority of marine ostacods have bisexual reproduction mode (Cohen and Morin, 1990), non-marine ostracods are shown mainly parthenogenetic reproduction mode (Bell, 1982; Butlin et al., 1998). Ostracods have long-term history of sexual dimorphism (morphological differences between females and males) since the early Palaeozoic (i.e. Ordovician about 490 million years ago) (Benson et al., 1961). On the other hand, the family Darwinulidea are a putative oldest asexual reproduction group of ostracods (Schön et al., 1998, 2008; Van Donnick et al., 2002; Schön and Martens, 2003; Van Donnick et al., 2003; Martens et al., 2005). Martens et al. (2003) declared that this family has been asexually reproducing for over 200 million years based on fossil records but one male of the species *Dawinula stevensoni* was firstly reported in Japan by (Smith et. al., 2006). Yet, its reproductive role does not clearly known.

Non-marine ostracods have four reproductive modes (Meisch, 2000). The first of all, fully sexual ,or bisexual, mode has both male and female individuals in population; for example, this is the case in the genus *Cyclocypris* (Meisch, 2000). Second mode includes a population with mixed reproduction. It consist of three kinds of populations: (1) fully sexual reproduction of bisexual population that is not shown parthenogenetic reproduction, (2) bisexual population with mixed reproduction population comprise population of diploid females with active diploid males, population of diploid parthenogenetic females, and population of triploid females off-spring (i.e. *Eucypris virens* (Adolfsson et al., 2009)), (3) fully parthenogenetic populations occur geographic parthenogenetic species. *Heterocypris incongruens, Potamocypris villosa* and *Eucypris virens* (Adolfsson et al., 2009) are good examples of this kind of mode. Third mode is fully parthenogenetic reproducing populations or so called "recent asexual population". (Butlin et al., 1998). The population belonging to this mode consist of females and are widespread among the species of the Cyprididae (e.g., *Heterocypris salina*, *Potamocypris unicaudata*). The last mode is ancient asexual populations. They have sustained parthenogenetic reproduction during very long time. The Darwinuloidea is a good example for this (Meisch, 2000).

The species of Podocopida have a pair of reproductive organs (Meisch, 2000). Female organs consist of ovary, seminal receptal, genital lob, and vagina. however, male organs are such as hemipenis, zenker organ (absent in Cytheroidea and Myodocopa), clasping organ (derived from maxullar palp), testes (or seminiferous tubules) (Figure 1.3). Ostracods own the spermatozoa that is the largest one in the animal kingdom (e.g., *Cyclocypris ovum* have about 6 mm long sperms but ratio of its carapace length is 0.5-0.7) (Meisch, 2000; Karanovic, 2012).

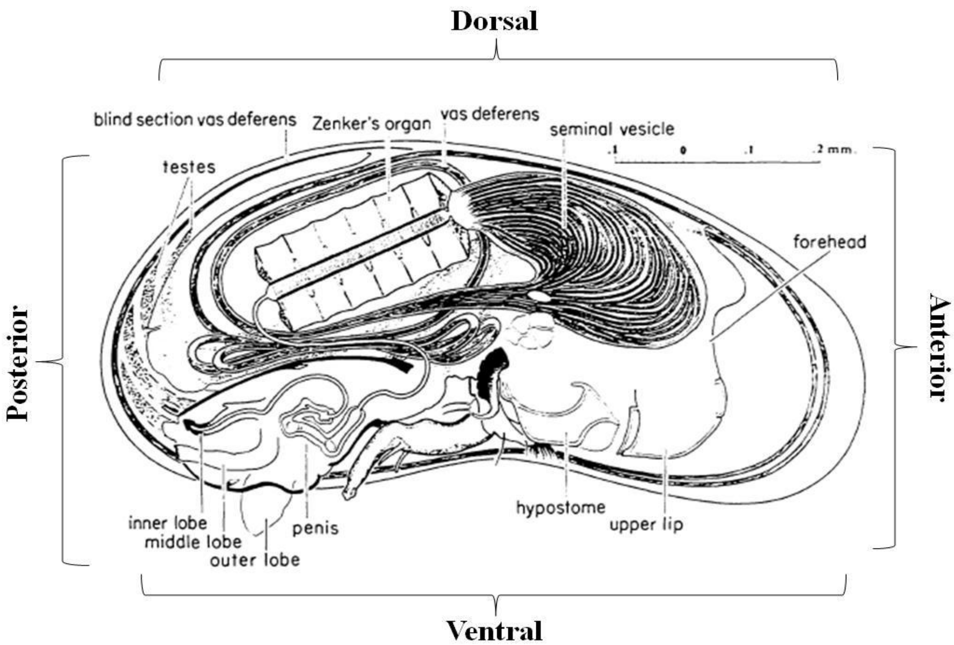

Figure 1.3. The genital organs of male individual (*Candona suburban*). After Kesling (1957).

The Ostracoda shows internal fertilization (Cohen et al., 2007). The mating process in ostracods consist of four stages such as mate recognition, copulation, insemination, and the post-mating (Horn et al., 1998; Karanovic, 2012). In order to sense each other they use sensory organs (eyes) or directly touch (via the second antenna or prehensile palps). In Podocopida six varied positions are shown heretofore (Karanovic, 2012). They display bizarre courting behaviors. For example *Bicornucythere bisanensis* (in Podocopida) which inhabits shallow brackish water in Japon. Before mating, it shows odd courting behavior that males of this species spine out the female three or four times via getting help from dissymmetric right fifth limb like dancing (Ozawa, 2013).

1.1.4 Ecology and Distribution

One of the most prevalent and diverse crustacean groups is the Ostracoda in the world and they are found all continents. They live in different aquatic habitats from littoral zone to the abyssal depths of the ocean (e.g. in hydrothermal vents Fricke et al., 1989), marines, lakes, rivers, lagoons, dams, thermal water, estuaries, springs, caves, troughs, ponds etc. (Meisch, 2000; Horne, 2003; Özuluğ, 2012; Karanovic, 2012; Külköylüoğlu, 2013; Külköylüoğlu et al., 2013; Yavuzatmaca et al., 2015). Insomuch as, they can inhabit semi-terrestrial environments (e.g., *Metacypris cordata*) (Danielopol and Vespremeanu, 1964; Delorme, 1991; Douglas and Healy, 1991; Külköylüoğlu and Vinyard, 2000) and terrestrial environments (De Deckker, 1983). Besides, they were recorded in extreme physical and chemical conditions, for example living moist organic mats of fens and in axial cups certain plants such as bromeliads, populating highly sulfuric condition (e.g., *Cyprideis torosa* (Jahn et al., 1996), *Limnocythere staplini*), surviving in great salinity water (Delorme, 1991).

The Palearctic zoogeographic region receive a numerical superiority of hosting ostracod (702 species) then Afrotropical (455), Nearctic (298), Neotropical (275) Oriental (199), Australasian (176), Pacific Oceanic Islands (5) and Antarctic (3) (Martens et al., 2008). In a subsequent study (Martens and Savatenalinton, 2011), total 2103 subjective species belonging to 209 genera of recent, non-marine, free living ostracods were estimated in the world. Morever, it is predicted that there are about 65,000 living and fossil ostracod species from all aquatic environments (Ikeya et al., 2005).

This wide distribution of ostracods is owed the ways of passive and active transports of them (Danielopol et al., 1994). The first mode occur that individuals or their eggs are relocated by different factors such as wind, with plants (McKenzie and Moroni, 1986), some insects and amphibians (e.g. *Cyclocypris globosa* which settle on body of toads and feed their skin and mucus (Seidel, 1989)), fishes, birds and human (Bronstein, 1947; Horne and Martens, 1998; Külköylüoğlu, 1999; Meisch, 2000; Rossi et al., 2003; Rodriguez-Lazaro and Ruiz-Munoz, 2012). In the active mode, they use swimming setae (or known as natatory setae on the second antenna (A2)), crawling, walking etc.

In aquatic ecosystems, ostracods generally play important role as predators, herbivores, omnivores and dentritivores (Delorme, 1991; Horne, 2003). Yet, some taxa (Cytherocopina) may prefer symbionts, commensals and ectoparasites on the body or on the appendages of hypogean isopods, amphipod and decapods (Meisch, 2000; Horne, 2003; Karanovic, 2012). Of course, they host some microscopic living things as protozoans, helminthes, cestodes, peritrichs, acanthocephalans (Karanovic, 2012) and bacteria (e.g., *Wolbachia* spp.) that affect reproductive system of the male and change reproduction mode of the population (Baltanás et al., 2007). Because those of freshwater ostracods are called as generalists, they feed on algae, organic detritus, bacteria, invertebrate faeces (e.g., *Limnocythere inopinata*), periphyton (*Notodromas monacha*) (Roca et al., 1993), body of dead animals, fish foods (Baltanás et al., 2000). In contrast, some fishes consume them as main foods (Meisch, 2000; Karanovic, 2012). For example, English trout which eat very numbers of individuals of *Herpetocypris reptans* (Whatley, 1983).

The distribution of ostracods based on ingredients of their habitats and their niches as sediment type, vegetation, physicochemical variables of water (e.g., pH, dissolved oxygen, temperature, salinity etc.), habitat types (i.e., lakes, ponds, rivers, springs, wetlands, pools etc.) (Malmqvist et al., 1997; Mezquita at al., 2001; Külköylüoğlu, 2005a; Perez et al., 2010; Szlauer-Lukaszewska, 2012; Yavuzatmaca et al., 2015). Moreover, while some species possess low tolerance level of environmental variables with limited distribution, others own high tolerance level with wide dispersion. These species are called “cosmopolitan species” and they can easily settle from one to new other condition (Külköylüoğlu, 2004; 2005a). Whereas cosmopolitan species, some species have exclusive tolerance levels of biotic and abiotic factors as called indicator species in order to calculate environment impairment (Benson, 1990; Delorme, 1991; Külköylüoğlu, 1999).

2. AIM AND SCOPE OF THE STUDY

From the moment when Ostracoda was firstly described at, until now, many studies have been performed on non-marine ostracods such as taxonomy (e.g., Baird, 1835; Sars, 1910; Bronstein, 1947; Hoff, 1943; Danielopol, 1968; De Deckker, 1974; Martens, 1986; Okubo, 1990; Karanovic, 2000; Külköylüoğlu, 2008; Külköylüoğlu et al., 2015), distribution and ecology (e.g., Teeter, 1973; Benson, 1990; Delorme, 1991; Mezquita et al., 1999a, 2001; Meisch, 2000; Külköylüoğlu, 2005a; Özuluğ, 2012; Külköylüoğlu et al., 2013; Escrivá et al., 2014, Yavuzatmaca et al., 2015), morphology and reproduction (e.g., Bell, 1982; Harten, 1983; Chaplin and Ayre, 1989; Havel et al., 1990; Chaplin, 1992; Butlin et al., 1998; Meisch, 2000; Baltanás et al., 2002; Rossi et al., 2007; Adolfsson et al., 2010; Swetha et al., 2011; Ozawa, 2013). However, the relationships between reproduction modes and ecological variables has not been investigated in samples from extensive geographic range. Thus, the main aim of this work was to find out how such relationships between environmental variables and reproductive modes of ostracods occur among different aquatic habitats.

Furthermore, niche overlap indices were applied to ascertain the connection among species with different reproductive modes along with ecological and geographical variables such as elevation, pH, water temperature, electrical conductivity, dissolved oxygen etc. Although there are several works on different species such as on lizards by Pianka (1973), beavers (Jenkins, 1980), flatfishes (Cabral et al. 2002), cichlid fishes (Martin and Genner, 2009), fish (Sá-Oliveira et al., 2014), foxes (Vieira and Port, 2007), wasps, (Santos and Presley, 2010), aquatic ortheptera (Capello et al., 2012), birds (Darwin's finches) (De León et al., 2014), there are no examples of using such niche overlap indicies on Ostracoda. Therefore, possible correlations between environmental variables and reproductive modes of the species were studied for those species.

Accordingly, the main aim of this study can also be related to the following ideas as:

i. To contribute knowledge into the ostracod fauna of Mardin and Muş regions of Turkey,
ii. To determine the species diversity of ostracods in both provinces,
iii. To detect the most influential environmental variable(s) on species,
iv. To estimate ecological optimum and tolerance levels of species for different variables,
v. To evaluate the relationship between geographical properties (latitude, longitude, elevation, etc.) and distribution of species in these two areas,
vi. To analyse ostracod species diversity in different aquatic habitats.

3. MATERIAL AND METHODS

3.1 Site Descriptions

3.1.1 Mardin

The study area with 10 counties (Mardin, Dargeçit, Derik, Kızıltepe, Mazıdağı, Midyat, Nusaybin, Ömerli, Yeşilli, and Savur) is located in the southeastern section of Turkey and covers 8,891 km^2 of surface area in between 36^0 55' – 38^0 51'N and 39^0 56' – 42^0 54'E. It borders on Syria, Şanlıurfa, Diyarbakır, Batman, Siirt and Şırnak. 4.8 % of its lands area is covered by mountains towards from east to west directions in the north part of this area. Altitudinal range is about 600 m a.s.l. in its plain regions and 1000 meter a.s.l. in its mountainous areas. The typical continental climate is usually shown at Mardin but some parts of this region have microclimates which comprise common features of both the Continental and the Mediterranean climates. While maximum average temperature of air is 35.3°C at July, the minimum average temperature of air is about 0.7°C at January. In general, conditions are dry with some flowing streams (Gümüş Çayı, ÇağÇağ suyu, Savur Çayı etc.) (Mardin Valiliği, 2015; Mardin Kültür-Turizm, 2015).

3.1.2 Muş

Muş with (Muş, Varto, Hasköy, Korkut, Bulanık, and Malazgirt) is located in the Eastern Anatolia region of Turkey and covers 8,196 km^2 of surface area between 39°29' – 38°29'N and 41°06' – 41°47'E. The 34.9 % of its surface area are consisted of mountains such as Akdoğan, Şerafettin, Bilican, Bingöl, Otluk, Haçreş and Yakupağa. The continental climate is shown in there. Winters are cold, snowy and long term in there while summers are also warm, dry and short term. Moreover, it has rivers and natural lakes such as Murat, Karasu rivers and Haçlı, Hamurpet, Gaz (Kaz) lakes. The average elevation of Muş is 1250 meters a.s.l. The highest and lowest weather temperatures during the year are calculated as 37 °C and -29°C, respectively (Muş Valiliği, 2015).

3.2 Methodology

The total of 164 samples that are both in Mardin (65 sites) and Muş (99 sites) were randomly picked up from different water bodies during 13- 20 August 2013 (Figures 3.1 and 3.2). In Mardin, samples were comprised from eleven different types of aquatic habitats like as lakes, creeks, troughs, streams, ponds, rivers, springs, irrigation canals, pools, wetland, and water body. Similarly, eleven (but different) kinds of aquatic habitats (creeks, lakes, dams, streams, troughs, rivers, ponds, water

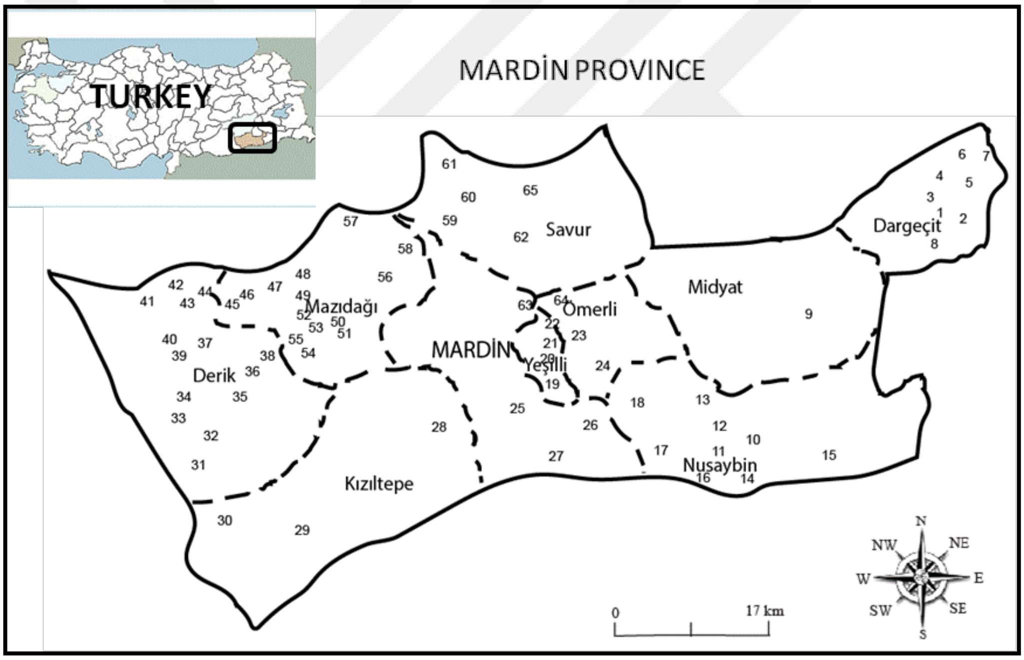

Figure 3.1. The distribution of 65 randomly selected sampling sites from 10 counties of Mardin.

body, pool, springs, and thermal springs) were sampled from Muş province. In order to abstain from the effects of "Pseudoreplication" (Hurlbert, 1984), environmental variables (pH, water temperature (Tw, °C), dissolved oxygen (DO, mgL^{-1}), percent oxgen saturation (%DO), electrical conductivity (EC, μScm^{-1}), atmospheric pressure (mmHg), and redox potential (ORP, mV)) were measured first by means of using a YSI- Professional Plus device at every sites. Moreover, the atmospheric and geographic data of each sampling sites (e.g., wind speed (kmh^{-1}), air moisture (%), the air temperature (Ta, °C), elevation, and coordinates) were taken by Testo 410-2 model anemometer and GARMIN e-trex Vista H GPS model of coordinates input apparatus *in situ*.

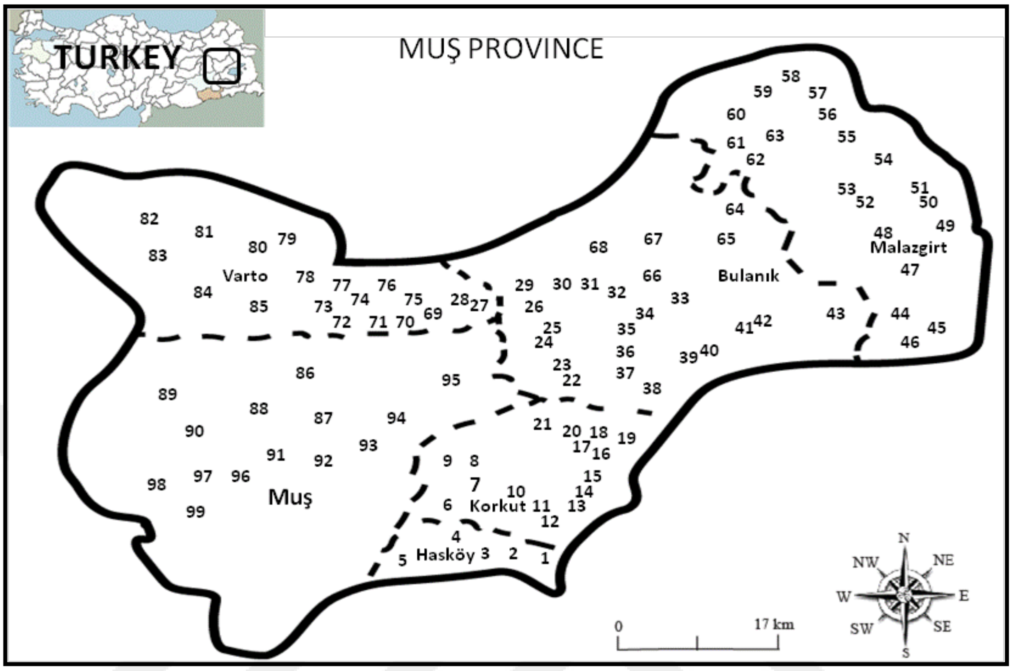

Figure 3.2. The distribution of 99 sampling sites from six counties of Muş.

The samples were gathered with the aid of standard hand-net (150 µm mesh size) by sweeping at bottom of water bodies from 0 to 100 cm intervals of their depth. Then after, they were immediately fixed in 250 ml plastic jars in % 70 alcohol *in situ*. These samples were washed under tap water and again were stored in their jars in alcohol at the laboratory. To identify species, the soft body parts and carapace's structures of ostracods were used under a stereomicroscope (Olympus ACH 1X) and a light microscope (Olympus BX-51). During this process, taxonomic keys of Meisch (2000) and Karanovic (2012) and other related literature were used. Both the soft body parts and carapaces were kept in slides with lactophenol solution and in micropaleontological slides, respectively. Carapace and soft body parts were photographed with a scanning electron microscope (Jeol/JSM 65102V, SEM) and an inverted microscope (Leica DMi1), respectively.All of ostracods samples are saved at the Limnology Laboratory of Abant İzzet Baysal University.

3.3 Statistical Analyses

In order to explain relationships between ostracod distributions and environmental variables, different statistical methods and analyses were used such as C2 program, Canonical Correspondence Analysis (CCA), Unweigthed Pair Group Mean Average (UPGMA) and Spearman Correlation Analyses. Besides, “Specific and General Niche Overlap” analyses (Levins, 1968; Hurlbert, 1978, 1982; Petraitis, 1985; Ludwig and Reynolds, 1988) were used for the first time for ostracod niche partitioning among various (e.g., food, time of activity, their location, time of foraging etc.) types of communities.

Application of Niche Overlap Indices

Niche Overlap Indices propounded concepts to answer a main question of “How do coexisting species use common resources in a community?” (Ludwig and Reynolds, 1988). Additionally, such indices have already been used to explain the relationship among some other different species like in beavers (Jenkins, 1980), flatfishes (Cabral et al. 2002), cichlid fishes (Martin and Genner, 2009), fish (Sá-Oliveira et al., 2014), foxes (Vieira and Port, 2006), wasps, (Santos and Presley, 2010), aquatic ortheptera (Capello et al., 2012), birds (Darwin’s finches) (De León et al., 2014), by the way of utilizing ecological niches (e.g. food, time of activity, their location, time of foraging etc.). However, as indicated above, there is no application of these indices on ostracods.

As stated by Ludwig and Reynolds (1988) The Specific Overlap (SO) is a contrast of species’ utilization curves. In other words, the proportion of coinciding the utilization curves of both species i and k are called the sum of specific overlap by species i onto species k ($SO_{i,k}$). It can tested two hypotheses; first is the null hypothesis that “two species completely overlap so their utilization curves are equal” (by Equations 3.6, 3.7, and 3.8), and second is the null hypothesis which “the specific overlap by species i onto species k ($SO_{i,k}$) is greater than the overlap of species i onto a second species m ($SO_{i,m}$)

The equations below are main equations to calculate the amounts of the specific and general overlap.

Table 3.1. Description of terms to calculate the specific and general measures of overlap. Symbols meaning; r, row of resource, S, species, i, the ith species, j, the jth resource, T, grand total, n, species' tally, t_j, the sum of jth resource's tally, $p_{i,j}$, proportion of $n_{i,j}$ species tally, c_j, combined proportion of jth resource. Modified from Ludwig and Reynolds (1988).

	Resource Classes (r)			
Species Tally	(1)	(2)	(3)	Total
(1)	$n_{1,1}$	$n_{1,2}$	$n_{1,3}$	$\mathbf{N_1}$
(2)	$n_{2,1}$	$n_{2,2}$	$n_{2,3}$	$\mathbf{N_2}$
Total Tally	t_1	t_2	t_3	**T**
Proportion				
(1)	$p_{1,1}$	$p_{1,2}$	$p_{1,3}$	
(2)	$p_{2,1}$	$p_{2,2}$	$p_{2,3}$	
Combined Proportion	c_1	c_2	c_3	

$$N_i = \sum_{j=1}^{r}(n_{i,j})$$ Equation 3.1

$$t_j = \sum_{i=1}^{S}(n_{i,j})$$ Equation 3.2

$$T = \sum_{j=1}^{r}(t_j)$$ Equation 3.3

$$p_{i,j} = \frac{n_{i,j}}{N_i}$$ Equation 3.4

$$c_i = \frac{t_i}{T}$$ Equation 3.5

$$SO_{i,k} = e^{E_{i,k}}$$ Equation 3.6

where e is the Euler's number and equal to about 2.71828

$$E_{i,k} = \sum_j^r (p_{ij} \ln p_{kj}) - \sum_j^r (p_{ij} \ln p_{ij}) \qquad \text{Equation 3.7}$$

where ln is the natural logarithm of a number to the base e (Euler's number).

To test first hypothesis, the below equation were used,

$$U_{i,k} = -2N_i \ln(SO_{i,k}) \qquad \text{Equation 3.8}$$

where $U_{i,k}$ is distributed as chi-square with degrees of freedom that equal r-1.

The second hypothesis of specific overlap was examined by Equation 3.9.

$$W = N_i \ln\left(\frac{SO_{i,k}}{SO_{i,m}}\right) \qquad \text{Equation 3.9}$$

W mean the log-likelihood ratio. If W is greater than 2, this hypothesis will be accepted.

The General Overlap is the probability which the utilization curves of all species in a community tally with a common utilization curve. And an unlimited numbers of species can be contrasted. It test one hypothesis which is "there is complete overlap of the species". Below Equations were used.

$$GO = e^E \qquad \text{Equation 3.10}$$

where

$$E = \frac{\sum_i^s \sum_j^r [n_{ij}(\ln c_j - \ln p_{ij})]}{T} \qquad \text{Equation 3.11}$$

$$V = -2T \ln GO \qquad \text{Equation 3.12}$$

V is scattered like chi-square variate with degrees of freedom (S-1) (r-1). If the value of *V* exceeds the table value of chi-square at, say, P = 0.05, the hypothesis must be rejected. In a sense, there is no whole overlap of all species (Ludwig and Reynolds, 1988).

These statistics were performed on some of ostracods species based on the suitable environmental variables such as pH, EC, Tw, Elev., and DO on the combination of data of both provinces (MaMu).

Furthermore, Canonical Correspondence Analysis (CCA) (with 999 Monte Carlo Permutation test), which is a multivariate statistical method, was used to assess possible associations levels among ostracods and ecological variables such as ORP, pH, Tw, site type, and EC. Suitability of the data for CCA usage was subjected to log-transformed and then was first tested with Detrended Correspondence Analysis (DCA) (Ter Braak and Barendregt, 1986; Ter Braak, 1987; Birks et al., 1990). Hence, as a recommendation, if length of DCA is 3 or more, the data is suitable to use for CCA application. During CCA, rare species were downloaded. To reduce the effects of multicollinearity, we choose variables not correlated to each other.

To understand the relationships among species and sampling sites of Mardin, Muş, and MaMu (compounded data), Unweighted Pair Group Mean Averages (UPGMA) with Jaccard's Coefficient were separately applied with log(e) transformed data for possible clustering relationships among species (Multi-Variate Statistical Package (MVSP) version 3.1 (Kovach, 1998)).

Optimum (uk) and tolerance (tk) levels of ostracods species were estimated with C2 program where species occurred at least three or more times were used. C2 software program includes a transfer function of weighted averaging regression (Juggins, 2003).

A non-paramatric statistical method of Spearman Correlation Analyses were used to delineate correlations among species and environmental variables.

Lastly, Microsoft software packages (2007) was utilized to show the intercourses among sampling sites, bisexual and asexually reproducing species, elevation, swimming and non-swimming species.

4. RESULTS

4.1 Taxonomic Result

During this study, 78 taxa (55 Recent living) were recorded in both provinces. While 31 species and 16 subfossils of 47 taxa were found from 58 of 65 sampling sites, 45 species and 15 subfossils of 60 taxa were identified from 91 of 99 sites in Muş province. 20 of 55 species were common for both provinces. The bisexual populations of 13 species (*C. angulata*, *C. neglecta*, C. *sanociensis*, C. *lindneri*, *I. gibba*, *I. inermis*, *Ps. fontinalis*, *P. olivaceus*, *P.* cf. *robertsoni*, *S. fischeri*, *Pr. zenkeri*, *T. clavata*, and *Z.* cf. *costata*) were found during this study. All species were new records for both provinces while individuals of *Cypretta sp. V.* cf. *boteai*, *H.s inversus*, *H.* cf. *congenera*, and *Hemicypris* n. sp. and males of *T. clavata* and *Ps.* cf. *robertsoni* are firstly new records for the Turkish ostracod fauna and the last two are a new for the literature.

4.2 Taxonomical Description

PHYLUM: ARTHROPODA

SUBPHYLUM: CRUSTACEA Pennat, 1777

CLASS: OSTRACODA Latreille, 1802

SUBCLASS: PODOCOPA Müller, 1894

ORDER: PODOCOPIDA Sars, 1866

Suborder Podocopina Sars, 1866

Infraorder Cypridacopina Jones, 1901

Superfamily Darwinuloidea Brady and Norman, 1889

Family Darwinulidea Brady and Norman, 1889

Genus *Darwinula* Brady and Robertson, 1885

Darwinula stevensoni (Brady and Robertson, 1870)

Darwinula sp.

Genus *Vestalenula* Rossetti and Martens, 1998

Vestalenula boteai (Danielopol, 1970)

Superfamily Cypridoidea s. str. Baird, 1845

Family Candonidae Kaufmann, 1900

Subfamily Candoninae Kaufmann, 1900

Genus *Candona* s. str. Baird, 1845

Candona angulata Müller, 1900

Candona candida (O. F. Müller, 1776)

Candona lindneri Petkovski, 1969

Candona muelleri Hartwig, 1899

Candona neglecta Sars, 1887

Candona sanociensis Sywula, 1971

Candona weltneri Hartwig, 1899

Candona sp.

Genus *Fabaeformiscandona* Krstic, 1972

Fabaeformiscandona breuili (Paris, 1920)

Fabaeformiscandona sp.

Genus *Pseudocandona* Kaufmann, 1900

Pseudocandona albicans (Brady, 1864)

Pseudocandona sp.

Genus *Trapezicandona* Schornikov, 1969

Trapezicandona sp.

Subfamily *Cyclocypridinae* Kaufmann, 1900

Genus *Cypria* Zenker, 1854

Cypria ophtalmica (Jurine, 1820)

Cypria sp.

Genus *Cyclocypris* Brady and Norman, 1889

Cyclocypris ovum (Jurine, 1820)

Family Ilyocyprididae Kaufmann, 1900

Subfamily Ilyocypridinae Kaufmann, 1900

Genus *Ilyocypris* Brady and Norman, 1889

Ilyocypris bradyi Sars, 1890

Ilyocypris decipiens Masi, 1905

Ilyocypris gibba (Ramdohr, 1808)

Ilyocypris inermis Kaufmann, 1900

Ilyocypris monstrifica (Norman, 1862)

Ilyocypris sp.

Family Cyprididae Baird, 1845

Subfamily Cyprettinae Hartmann, 1964

Genus *Cypretta* Vavra, 1895

Cypretta sp.

Subfamily Cypridinae Baird, 1845

Genus *Cypris* O. F. Müller, 1776

Cypris pubera O. F. Müller, 1776

Subfamily Eucypridinae Bronshtein, 1947

Genus *Eucypris* Vavra, 1891

Eucypris virens (Jurine, 1820)

Eucypris sp.

Genus *Prionocypris* Brady and Norman, 1896

Prionocypris zenkeri (Chyzer and Toth, 1858)

Genus *Tonnacypris* Diebel and Pietrzeniuk, 1975

Tonnacypris lutaria (Koch, 1838)

Tonnacypris sp.

Genus *Trajancypris* Martens, 1989

Trajancypris clavata (Baird, 1838)

Trajancypris serrata (G. W. Müller, 1900)

Trajancypris sp.

Subfamily Dolerocypridinae Triebel, 1961

Genus *Dolerocypris* Kaufmann, 1900

Dolerocypris fasciata (O. F. Müller, 1776)

Dolerocypris sinensis (Sars, 1903)

Dolerocypris sp.

Subfamily Isocypridinae Rome, 1965

Genus *Isocypris* G. W. Müller, 1908

Isocypris beauchampi (Paris, 1920)

Subfamily Cypridopsinae Kaufmann, 1900

Genus *Cypridopsis* Brady, 1867

Cypridopsis vidua (O. F. Müller, 1776)

Cypridopsis sp.

Genus *Cavernocypris* Hartmann, 1964

Cavernocypris sp.

Genus *Plesiocypridopsis* Rome, 1965

Plesiocypridopsis sp.

Genus *Sarscypridopsis* McKenzie, 1977

Sarscypridopsis aculeata (Costa, 1847)

Sarscypridopsis sp.

Genus *Potamocypris* Brady, 1870

Potamocypris arcuata (Sars, 1903)

Potamocypris fallax Fox, 1967

Potamocypris similis G. W. Müller, 1912

Potamocypris smaragdina (Vávra, 1891)

Potamocypris unicaudata Schäfer, 1943

Potamocypris variegata (Brady and Norman, 1889)

Potamocypris villosa (Jurine, 1820)

Potamocypris zschokkei (Kaufmann, 1900)

Potamocypris sp.

Genus *Zonocypris* G. W. Müller, 1898

Zonocypris cf. *costata* (Vávra, 1897)

Subfamily Herpetocypridinae Kaufmann, 1900

Genus *Herpetocypris* Brady and Norman, 1889

Herpetocypris brevicaudata Kaufmann, 1900

Herpetocypris helenae G. W. Müller, 1908

Herpetocypris intermedia Kaufmann, 1900

Herpetocypris sp.

Genus *Psychrodromus* Danielopol and McKenzie, 1977

Psychrodromus fontinalis (Wolf, 1920)

Psychrodromus olivaceus (Bardy and Norman, 1889)

Psychrodromus cf. *robertsoni* (Brady and Norman, 1889)

Psychrodromus sp.

Genus *Stenocypria* G. W. Müller, 1901

Stenocypria fischeri (Lilljeborg, 1883)

Genus *Stenocypris* Sars, 1889

Stenocypris major (Baird, 1859) Brady, 1886

Stenocypris sp.

Subfamily Cyprinotinae Bronshtein, 1947

Genus *Heterocypris* Claus, 1892

Heterocypris barbara (Gauthier and Brehm, 1928)

Heterocypris incongruens (Ramdohr, 1808)

Heterocypris rotundata (Bronshtein, 1928)

Heterocypris salina (Brady, 1868)

Heterocypris sp.

Genus *Hemicypris* Sars, 1903

Hemicypris cf. *congenera* (Vávra, 1897)

Hemicypris inversus (Daday, 1913)

Hemicypris n. sp.

Superfamily Cytheroidea Baird, 1850

Family Limnocytheridae Klie, 1983

Subfamily Limnocytherinae Klie, 1938

Genus *Limnocythere* s. str. Brady, 1867

Limnocythere inopinata (Braid, 1843)

Limnocythere sp.

Family Cytherideidae Sars, 1925

Genus *Cyprideis* Jones, 1857

Cyprideis torosa (Jones, 1850)

4.3 Ecological Results

4.4 Data of Mardin

As shown in Table 4.1, the first two axes of Canonical Correspondence Analysis (CCA) elucidated 67.5 % of relationships between 14 species and five ecological variables.

Table 4.1. CCA summary table with five ecological variables (DO, pH, Tw, ORP and Styp) and 14 species with three or more times occurrences from Mardin (∗DCA results).

Axes	**1**	**2**	**2**	**3**	**Total inertia**
∗Lengths of gradient	7.782	4.422	4.399	3.791	
Eigen values	0.722	0.408	0.242	0.194	7.049
Species-environment correlations	0.911	0.739	0.604	0.596	
Cumulative percentage variance					
of species data	10.2	16.0	19.4	22.2	
of species-environment relation	43.2	67.5	82.0	93.6	
Sum of all eigenvalues					7.049
Sum of all canonical eigenvalues					1.672

CCA diagram (Figure 4.1.) shows that three variables (pH (F = 3.031, P = 0.001), site type (Styp) (F = 2.250, P = 0.004), and water temperature (Tw) (F = 1.684, P = 0.049)) were the most effective on species. While two variables ((DO) (F = 1.679, P = 0.064) and (ORP) (F = 1.349, P = 0.172)) were not significantly effective. However, all of species -except *H. incongruens* and *H. rotundata*- were almost off the center of diagram. When *H. rotundata* was located near pH, four species (*Zonocypris* cf. *costata*, *Psychrodromus olivaceus*, *Ilyocypris inermis*, *Prionocypris zenkeri*) were situated at the opposite direction. *Trajancypris clavata*, *P. variegata*, *P. arcuata*, and *Ilyocypris gibba* were reversely positioned at the arrows of both ORP and DO, to which *H. incongruens* was closer. The other four species (*L. inopinata*, *D. stevensoni*, *H. salina*, and *I. bradyi*) did not show correlation to ecological variables.

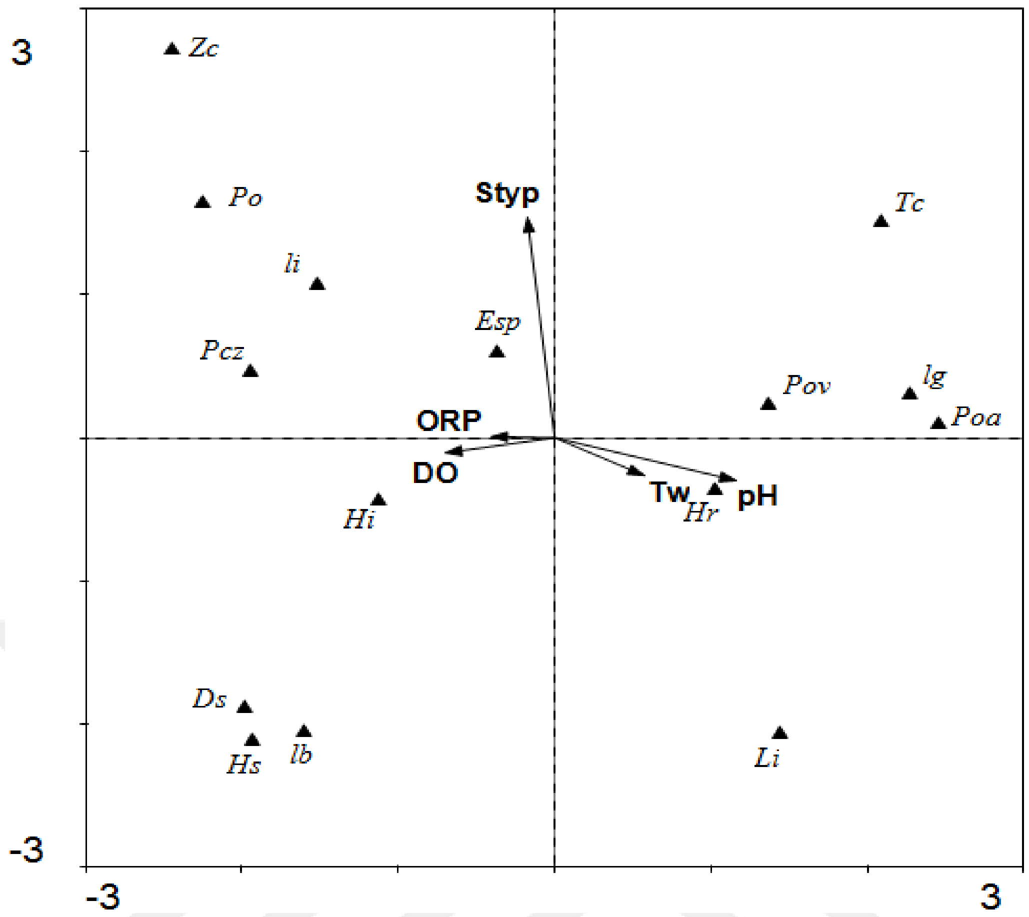

Figure 4.1. The diagram of CCA exposes the relationships of between five acological variables (redox potential (ORP), pH, dissolved oxygen concentration (DO), water temperature (Tw), and sites type (Styp) and 14 species (*Z.* cf. *costata* (Zc), *P. olivaceus* (Po), *I. inermis* (Ii), *I. bradyi* (Ib), *I. gibba* (Ig), *H. incongruens* (Hi), *H. rotundata* (Hr), *H. salina* (Hs), *D. stevensoni* (Ds), *P. variegate* (Pov), *P. arcuata* (Poa), *T. clavata* (Tc), *L. inopinata* (Li), and *P. zenkeri* (Pcz)) from 39 different sites in Mardin.

Accordingly, five main clustering groups were shown in UPGMA dendtrogram for 14 species. Both the first (Group1) and the second (Group2) groups consisted of two subgroups with three species. While Group1 had *T. clavata*, *P. arcuata*, and *I. gibba*, the other two species were closer to each other. The second group comprised of *P. olivaceus*, *Z.* cf. *costata*, and *P. zenkeri* . Two sub clusters that were occured by four species; *P. variegata*, *L. inopinata*, *I. bradyi*, and *H. salina* belonged to Group3 main group. Group4 owned two species (*H. incongruens* and *H. rotundata*). Group5 contained two species like *I. inermis* and *D. stevensoni* as the Group4. All of these species were found at least three different sites during this study. *P. arcuata* was the most found species of them by ten different sites. In the pursuit of Poa, H. incongruens was an eight times, both *H. rotundata* and *P. zenkeri* were a seven-different regions. Moreover, *I. bradyi*, *I. gibba*, and *T. clavata* were detected at six varied sites. *Zonocypris* cf. *costata* and *I. inermis* were ascertained at five different sites. At last, the rest of the five species (*P. olivaceus*, *L. inopinata*, *H. salina*, *D. stevensoni*, and *P. variegata*) were reported three-times in different sites. Additionally, three of five species found as bisexual populations were placed at the second clustering group. Other two species (*T. clavata* and *I. inermis*) were in the first and the fifth main groups, respectively (Figure 4.2).

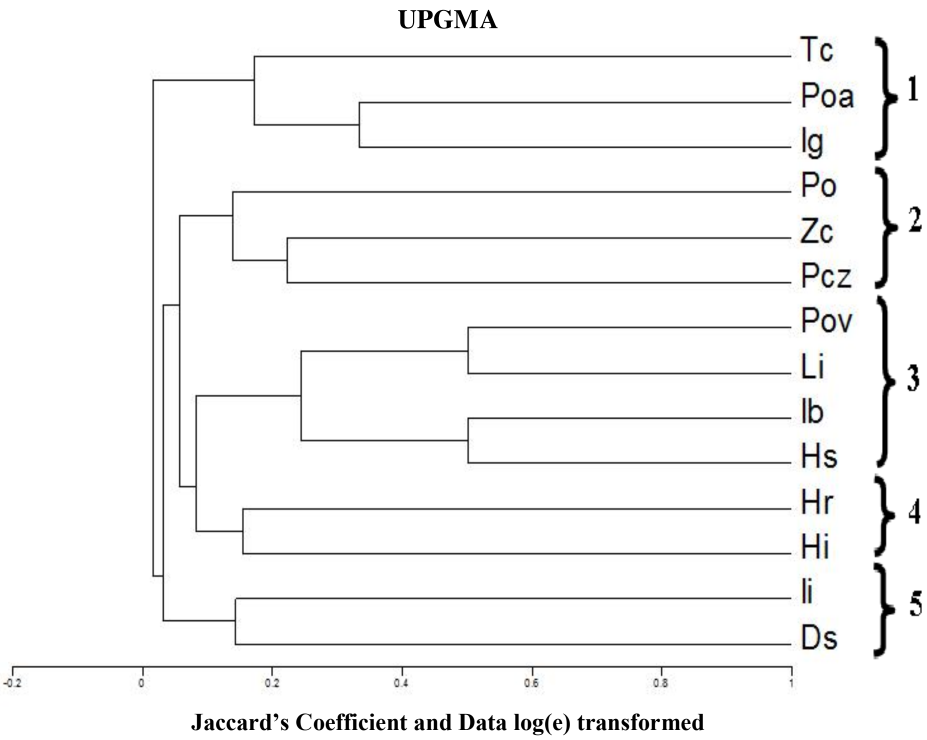

Figure 4.2. The diagram of Unweighted Pair Group Mean Averages (UPGMA) is about the relationships of among 14 species that were collected at least 3 times in 39 different sites (with Jaccard's Coefficient and Data log(e) transformed). Abbreviations for species are in Figure 4.1.

Heterocypris rotundata, *I. gibba*, *L. inopinata*, *P. arcuata*, and *P. variegata* had higher optimum and tolerance values for pH (Table 4.2). Whereas five bisexual species such as *I. inermis*, *T. clavata*, *Z.* cf. *costata*, *P. olivaceus*, and *P. zenkeri* bear lower optimum and tolerance levels.

A bisexual species, *P. zenkeri*, possessed the highest optimum and tolerance levels for DO but *T. clavata* had the lowest levels. In addition, six cosmopolitan species *(D.stevensoni, H. incongruens, H. rotundata, H. salina, I.bradyi,* and *L. inopinata*) showed relatively high optimum values and *P. variegata* had the same value of mean of optimum level.

In contrast to DO, *Trajancypris clavata* indicated the highest values of optimum and tolerance for electrical conductivity (EC), and following, other bisexual species; *I. inermis* and *P. zenkeri* also showed higher values. Yet, the rest two bisexual species; *P. olivaceus* and *Z.* cf. *costata* exhibited lower optimum and tolerance values. Else, *H. rotundata, I. gibba*, and *P. arcuata* had higher values for EC.

Except *I. inermis*, all of bisexual species (*P. zenkeri, P. olivaceus, T. clavata, Z.* cf. *costata*) had lower optimum values for water temperature but *T. clavata* displayed the highest tolerance level while *P. variegata* showed the highest optimum value.

Finally, for redox potential (ORP), while bisexual species *I. inermis* and *Z.* cf. *costata* had lower optimum values, other three (*P.olivaceus, P. zenkeri,* and *T. clavata*) showed higher optima values. Moreover, although *H. incongruens* was a cosmopolitan species, it illustrated lower tolerance levels for all environmental variables during this study.

According to Spearman Correlation Analysis (Appendix B.1), *I. bradyi* ($P < 0.01$) showed positive and negative correlations to sampling site type and redox potential, respectively. Likewise, *T. clavata* ($P < 0.01$) exhibited negatively significant correlation with ORP. Also, a negative correlation between *I. inermis* and elevation ($P < 0.05$) was significant while the correlation was positive with *P. zenkeri* ($P < 0.05$). In addition, correlations among the variables were found as expected. For example, redox potential displayed negative correlation with water temperature ($P < 0.01$) and pH ($P < 0.01$).

Table 4.2. The optimum (uk) and tolerance (tk) levels of 14 species to five ecological variables in Mardin. (*D. stevensoni* (Ds), *H. incongruens* (Hi), *H. rotundata* (Hr), *H. salina* (Hs), *I. bradyi* (Ib), *I. inermis* (Ii), *L. inopinata* (Li), *P. arcuata* (Poa), *P. variegata* (Pov), *P. zenkeri* (Pcz), *P. olivaceus* (Po), *T. clavata* (Tc), *Z.* cf. *costata* (Zc))

				pH		**DO**		**EC**		**Tw**		**ORP**	
Code	**Cnt**	**Mx**	**N2**	uk	tk	uk	tk	uk	tk	uk	tk	uk	tk
Ds	3	62	1.13	7.81	0.23	9.38	1.75	479.14	75.49	22.04	1.93	70.58	9.97
Hi	8	51	3.49	7.86	0.32	7.91	1.25	435.07	55.75	21.32	3.01	59.99	9.58
Hr	7	16	5.13	8.52	0.98	8.08	3.63	616.07	433.28	25.25	6.95	61.24	14.89
Hs	3	19	2.05	7.70	0.17	8.06	0.56	548.21	184.30	20.03	1.93	72.84	20.64
Ib	6	280	1.93	7.78	0.20	8.92	1.32	474.58	82.26	21.31	2.15	69.04	8.64
Ig	6	50	3.18	8.73	0.57	6.89	2.53	796.71	451.36	23.39	7.12	66.67	22.83
Ii	5	74	1.94	7.84	0.20	6.20	2.82	665.32	162.30	27.40	7.54	54.81	21.06
Li	3	35	1.83	8.81	0.49	7.79	0.51	310.82	194.69	22.50	1.12	61.81	8.51
Poa	10	350	3.41	8.76	0.52	6.17	3.13	834.22	436.79	23.44	6.68	63.31	22.26
Pov	3	32	1.76	8.82	0.50	7.69	0.58	511.87	149.12	28.61	5.53	55.60	17.47
Pcz	7	26	4.16	7.89	0.36	10.82	4.55	601.77	125.70	21.10	2.34	77.34	10.30
Po	3	15	2.91	7.42	0.15	6.91	0.67	471.19	126.55	17.54	1.41	67.74	11.88
Tc	6	11	3.61	8.06	0.21	3.64	1.68	1057.60	234.99	14.97	12.18	84.19	8.55
Zc	4	800	1.04	7.55	0.29	9.21	3.84	402.02	33.54	18.11	1.05	61.24	15.37
		Mean	2.68	8.11	0.37	7.69	2.06	586.04	196.15	21.93	4.35	66.17	14.43
		Max	5.13	8.82	0.98	10.82	4.55	1057.60	451.36	28.61	12.18	84.19	22.83
		Min	1.04	7.42	0.15	3.64	0.51	310.82	33.54	14.97	1.05	54.81	8.51

As shown in the Figure 4.3., elevation was not clearly effective on species. For example, while 13 species were found at 400-500 m, four species were shown at 602-702 m. However, at 1006-1106 m and 602-702 m ranges, a sudden falling values of all variables were shown. The number of bisexual species was lower than the asexual species at all of ranges. The number of species was only higher than the number of sites at two ranges such as 400-500 m and 804-904 m 13 and 10 species, respectively. The highest number of species was at 905-1005 m elevational range.

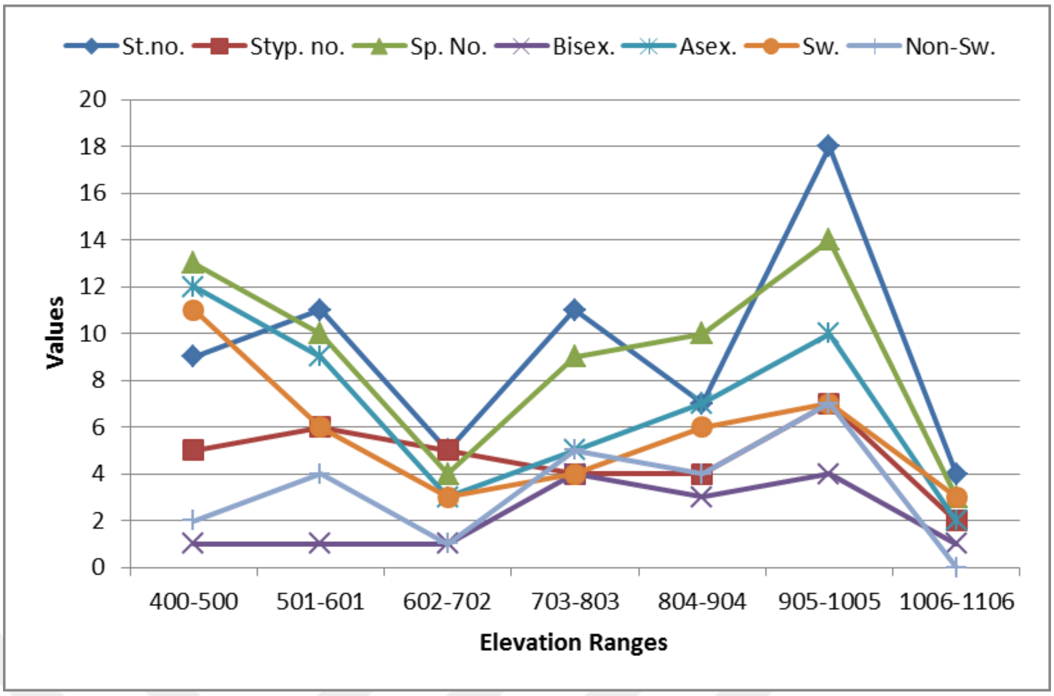

Figure 4.3. The graphic is about counts of sites, sampling site types, species, bisexual and asexual reproductively species, swimmer and non-swimmer species at seven different 100 m a.s.l. elevational ranges in Mardin. Abbreviations: St.no.(site number), Styp.no.(site type), Sp. no. (Species count), Bisex.(species has male in population in this study), Asex. (species has not male in population in this study), Sw. (natatory setae of A2 present), Non-Sw. (natatory setae absent)

4.5 Data of Muş

The first axes of CCA imparted 74.2 percent of the relationships between 21 taxa and five ecological variables in Muş (Table 4.3).

Table 4.3. It is about results of CCA for 21 taxa at least 3 times occurrences from 82 different sites and five environmental variables in Muş (*DCA result).

Axes	**1**	**2**	**3**	**4**	Total inertia
Eigenvalues	0.270	0.176	0.088	0.043	6.788
*Lengths of gradient	7.125	4.713	4.811	4.576	
Species-environment correlations	0.653	0.596	0.476	0.355	
Cumulative percentage variance					
of species data	4.0	6.6	7.9	8.5	
of species-environment relation	44.9	74.2	88.8	96.1	
Sum of all eigenvalues					6.788
Sum of all canonical eigenvalues					0.601

In the diagram of CCA, the most effective five variables such as pH (F = 2.413, P = 0.003), water temperature (Tw) (F = 1.929, P = 0.011), EC (F = 1.072, P = 0.340), ORP (F = 0.697, P = 0.735), and DO (F = 0.560, P = 0.898) were shown on distribution of ostracods species from 82 different sites in Muş. The cosmopolitan species *H. incongruens, I. bradyi, P. variegata* were located at the center. Except *C. muelle*ri and *L. inopinata*, all species gathered at near of center. While *P. variegata* was on the direction of DO. *C. sanociensis* and *H. salina* were at counterside of DO. *C. neglecta*, *P. olivaceus*, and *I. inermis* were located close of ORP, but at opposite of Tw. Furthermore, *P. albicans* and *I. decipiens* were situated between arrows of Tw and pH.

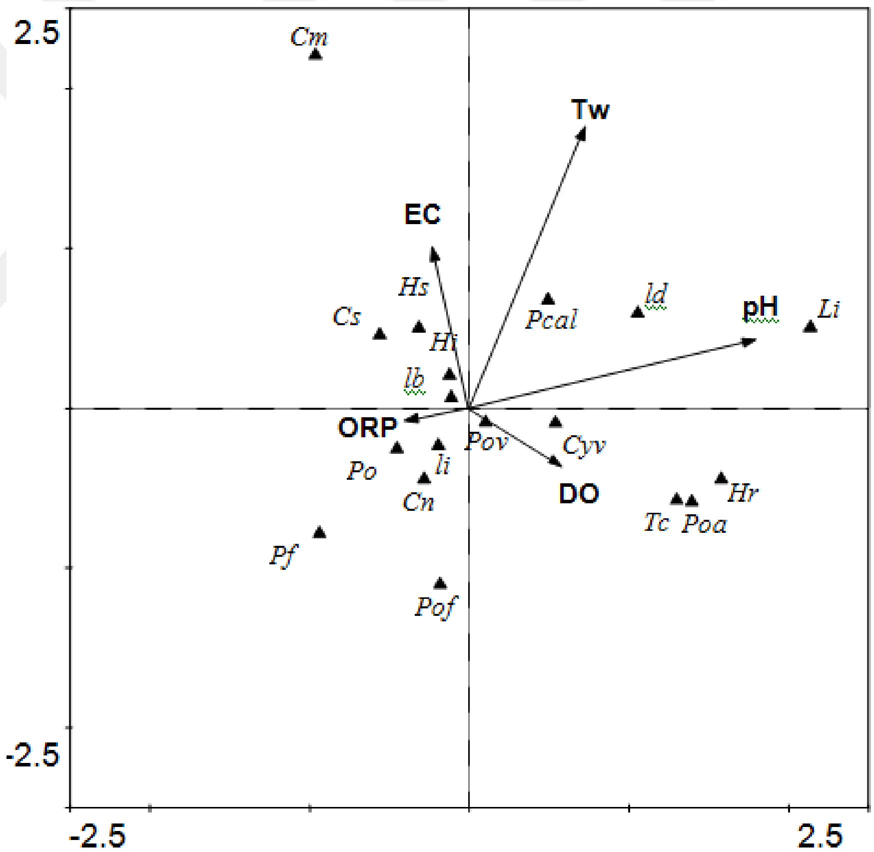

Figure 4.4. The diagram of CCA is about the distribution of 18 species with depending five ecological variables (Arrows of DO, Tw, EC, ORP, and pH) in Muş. (*C. neglecta* (Cn), *C. muelleri* (Cm), *C. sanociensis* (Cs), *I. bradyi* (Ib*)*, *I. decipiens* (Id), *I. inermis* (Ii), *C. vidua* (Cyv), *P. olivaceus* (Po), *P. fontinalis* (Pf), *L. inopinata* (Li), *T. clavata* (Tc), *P. albicans* (Pcal), *H. incongruens* (Hi), *H. rotundata* (Hr), *H. salina* (Hs), *P. arcuata* (Poa), *P.fallax* (Pof), *P. variegata* (Pov))

According to Table 4.4., *H. incongruens* exhibited almost the lower optimum values for all variables -except electrical conductivity and redox potential . In contrast, a bisexual species, *I. inermis* displayed slightly higher and lower optimum and tolerance values for pH, respecetively.

While the highest optimum value for pH was found for *P. smaragdina*, *C. muelleri* possessed the highest tolerance value amid 21 taxa. Although the optimum values of other bisexual species (*C. neglecta* and *C. sanociensis*) were lower than the mean of pH, the tolerance values of them higher than the mean of pH.

In the view of the values for dissolved oxygen among 21 taxa, the optimum values of both (*C. neglecta* and *C. sanociensis*) species were lower than the mean value, but the tolerance values of them were higher than the mean. The reverse of this situation was correct for the other two bisexual species, *I. inermis* and *P. fontinalis*. In addition, *P. arcuata* had the highest tolerance value for DO when *L. inop*inata showed the highest optimum level.

When looked at the values of electrical conductivity, all bisexual species (C. neglectn, C. sanociensis, I. inermis, P. fontinalis) among 21 taxa exhibited lower tolerance values than the mean value. Insomuch as, *P. fontinalis* had minimum tolerance value among all taxa in Table 4.4. Furthermore, *H. salina* had the highest optimum level and higher tolerance value. On the other hand, *H. incongruens* indicated the highest tolerance value and higher optimum level among all species in Muş.

Four species (*C. muelleri*, *I. bradyi*, *I. inermis*, and *P. smaragdina*) illustrated higher tolerance and optimum values for water temperature. While two of bisexual species (*C. neglecta* and *P. fontinalis*) showed lower optimum levels than the mean, the other two species such as *C. sanosiensis* and *I. inermis* had higher optimum values for Tw. Additionally, *I. decipiens* was a species whose tolerance value was the lowest for Tw.

Lastly, in the light of the values of redox potential, *P. variegata* showed the lowest tolerance level but *C. sanociensis* owned the highest value comparing to other taxa. The optimum values of the bisexual species revealed higher level than the mean value, except *C. sanociensis*. The highest optimum value belonged to *P. arcuata*.

Table 4.4. Optimum (uk) and tolerance (tk) values of 21 taxa to five environmental variables in Muş (species were found at least three different site).(*C. muelleri* (Cm), *C. neglecta* (Cn), *C. sanociensis* (Cs*)*, *Candona* sp. (Csp), *Cypridopsis vidua* (Cyv), *H. incongruens* (Hi), *H. rotundata* (Hr), *H. salina* (Hs), *I. bradyi* (Ib), *I. decipiens* (Id), *I. inermis* (Ii), *L. inopinata* (Li*)*, *P. arcuata* (Poa), *P. fallax* (Pof), *P. smaragdina* (Posm), *P. variegata* (Pov), *Potamocypris* sp. (Posp), *Psychrodromus fontinalis* (Pf), *P. olivaceus* (Po), *T. clavata* (Tc))

					pH		**DO**		**EC**		**Tw**		**ORP**	
	Code	**Count**	**Max**	**N2**	uk	tk	uk	tk	uk	tk	uk	Tk	uk	tk
1	**Cm**	3	3	2.27	8.00	1.16	4.96	2.66	472.34	215.06	25.62	5.94	67.46	30.20
2	**Cn**	15	87	6.33	7.87	0.49	4.89	3.56	518.42	230.08	17.19	5.07	75.43	11.21
3	**Cs**	6	33	3.68	7.73	0.77	4.76	2.60	324.41	194.48	21.94	3.66	55.37	54.30
4	**Csp**	5	1	5.00	8.07	0.39	4.65	2.62	341.04	59.62	18.04	3.93	75.92	34.06
5	**Cyv**	8	3	7.05	8.25	0.47	5.09	1.19	506.14	304.71	19.61	3.94	77.18	26.79
6	**Hi**	27	500	2.84	8.14	0.25	5.34	1.09	682.42	387.34	21.34	2.64	80.20	25.19
7	**Hr**	5	123	1.72	8.20	0.57	5.40	1.00	354.52	226.47	18.68	3.74	36.01	43.77
8	**Hs**	28	103	8.32	8.16	0.37	5.55	1.34	847.64	377.06	21.98	2.54	79.01	21.22
9	**lb**	39	390	9.54	8.04	0.36	5.80	1.38	552.88	256.74	20.84	3.82	76.57	20.05
10	**ld**	5	11	3.56	8.59	0.18	6.24	1.00	477.39	213.08	23.16	0.92	80.52	12.16
11	**li**	10	98	7.04	8.20	0.32	6.30	0.73	549.88	316.64	20.12	5.11	85.96	13.19
12	**Li**	9	4	7.05	8.96	0.47	6.77	1.69	478.56	330.16	24.57	3.66	79.22	16.74
13	**Poa**	4	58	2.16	8.67	0.35	6.54	3.78	667.63	136.71	17.69	4.33	91.39	29.47
14	**Pof**	13	416	1.94	7.82	0.37	6.53	1.03	298.58	189.89	14.90	3.36	50.84	31.30
15	**Posm**	3	63	1.83	9.08	0.74	6.03	1.64	344.01	279.89	24.23	4.46	54.42	25.05
16	**Pov**	4	76	1.76	8.06	0.49	6.14	0.85	318.36	243.76	18.26	3.89	87.87	2.39
17	**Posp**	5	1	5.00	7.96	0.27	5.75	0.55	539.30	327.84	19.54	3.64	83.32	14.92
18	**Pcal**	9	14	3.05	8.44	0.32	5.39	1.78	761.61	317.81	22.72	3.14	80.70	22.88
19	**Pf**	4	216	1.05	7.55	0.49	6.17	0.48	510.81	55.36	14.08	6.00	82.86	14.24
20	**Po**	5	10	3.17	7.94	0.28	5.09	2.85	481.41	235.03	17.91	2.21	86.25	8.03
21	**Tc**	3	2	2.78	8.34	0.35	5.64	0.57	513.36	236.50	19.00	1.70	56.34	36.79
			Mean	4.15	8.19	0.45	5.67	1.64	549.56	330.20	20.07	3.70	73.47	23.52
			Max	9.54	9.08	1.16	6.77	3.78	847.64	387.34	25.62	6.00	91.39	54.30
			Min	1.05	7.55	0.18	4.65	0.48	298.58	55.36	14.08	0.92	36.01	2.39

The relationship between numbers of site and species differentiated among 150 m. ranges from 1249 to 2163 in Muş (Table 4.5). At the range of 1502-1652 m, all variables were higher in terms of values than the other elevational ranges, except the number of sampling site type and swimmer species. Species number was lower than the the number of sites at 1200-1350 and 1502-1652 m elevational ranges. The number of asexual species was higher than the number of sexual species at all elevational ranges such as 1200-1350 m bisexual (bisex.), 2 asexual (asex.), 17;

1351-1501 m bisex. 3, asex. 20; 1502-1652 m bisex. 6, asex. 21; 1653-1803 m bisex. 5, asex. 9; 1804-1954 m bisex. 3, asex. 7; 1955- 2105 m bisex. 0, asex. 5,; 2106-2256 m bisex. 0, asex. 2 during this study.

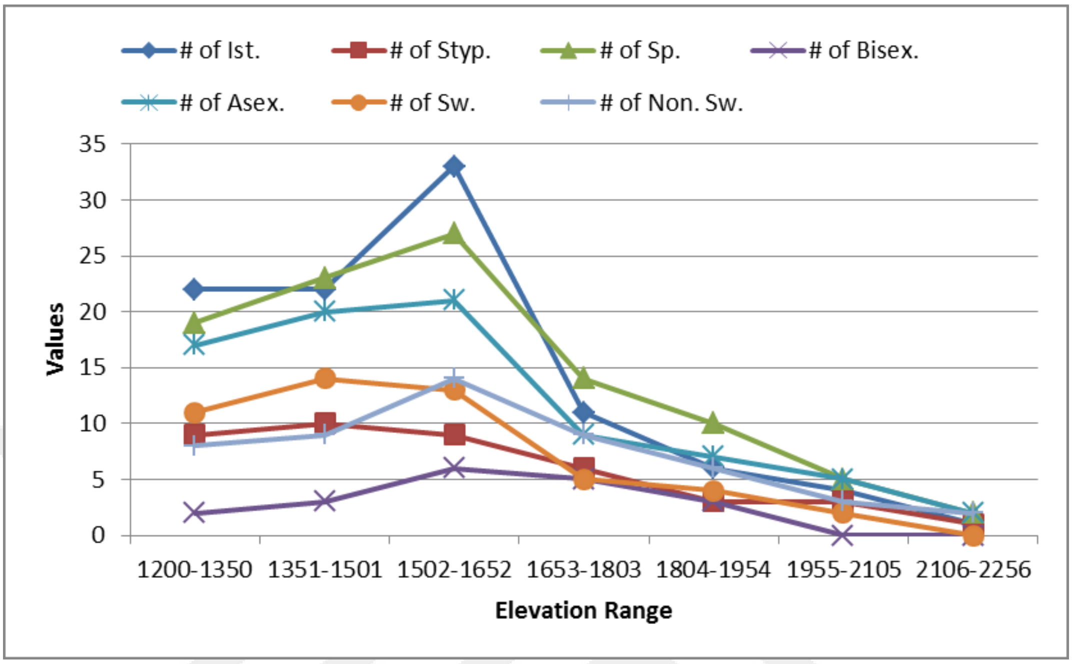

Figure 4.5. The count of species, sampling site type, site, swimming and non-swimming species, sexual and asexual reproducing species at seven 150 m a.s.l. elevational ranges from 1249 to 2163 m in Muş. For abbreviations seen Figure 4.3.

According to UPGMA results for Muş, there are five main clustering groups. The first group consists of two taxa *L. inopinata* and *Potamocypris* sp. when the second group has four subgroups with six taxa (*P. arcuata, P. smaragdina, T. clavata, H. rotundata, Candona* sp., and *C. vidua*). Similarly, the third group consists of six taxa and three subgroups (*P. albicans*, *H. salina, H. incongruens, I. bradyi, I. inermis, P. fallax*). Afterwards, the fourth and the fifth clustering groups are comprised of three and two species, respectively. Additionally, all species of the fifth group have bisexual population in this study while two species (*C. muelleri* and *P. olivaceus*) showed independent (out group) clustering (Figure 4.6).

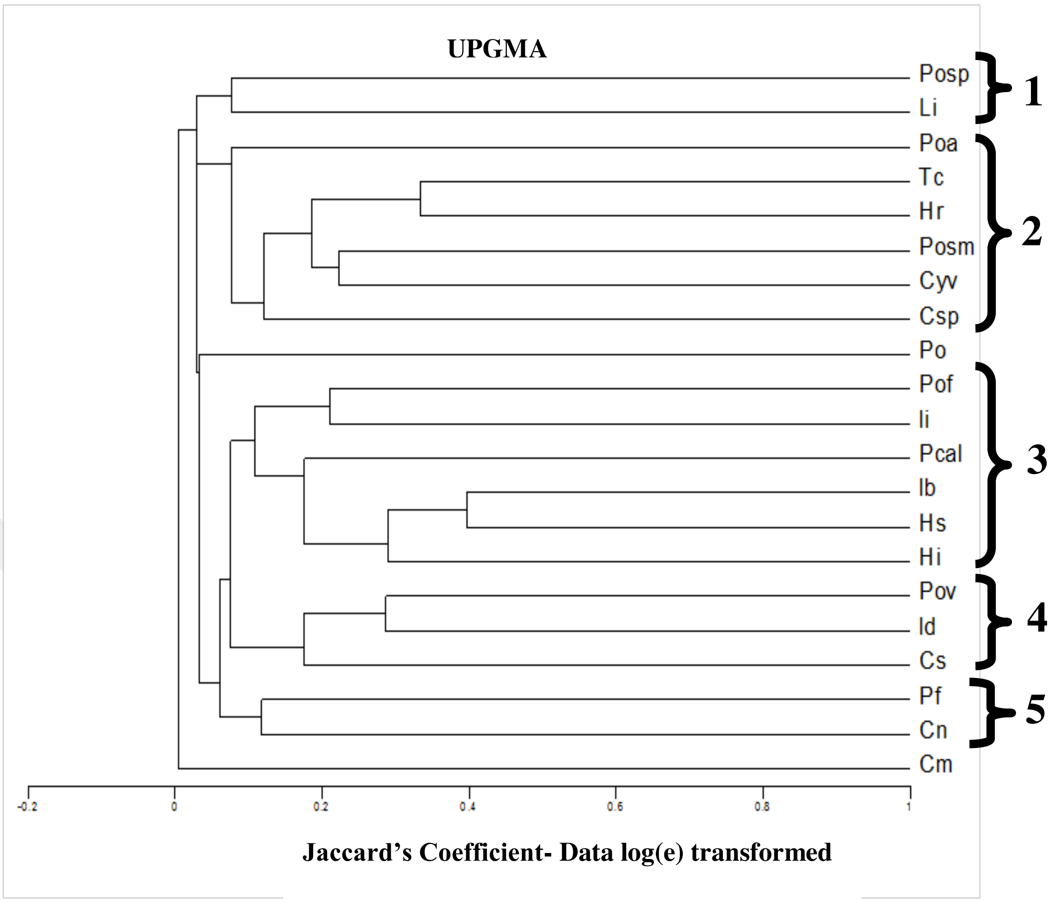

Figure 4.6. The diagram of UPGMA (Unweigthed Pair Group Mean Average with Jaccard's Coefficient- Data log(e) transformed) shows the relation among 21 taxa from Muş. Codes of species are in Appendix B.

In the summary table of Spearman Correlation Analysis (Appendix B.2), there were correlations among six ecological variables and 14 species. pH exhibited positive correlation with *I. inermis* ($P < 0.05$) and negative correlation with *P. fallax* ($P < 0.05$). While it had negative correlation with site type (Styp) ($P < 0.05$), pH showed positively significant correlation with two environmental variables ,dissolved oxygen ($P < 0.01$), and water temperature ($P < 0.01$). There was a negative correlation between water temperature and redox potential.

4.6 Data of Mardin and Muş

As seen in the Table 4.5, the first hypothesis of General Species Niche Overlap, which assumes complete overlap of the two or more species, was accepted for all environmental variables such as pH, dissolved oxygen, water temperature, electrical conductivity, and elevation. This means that all species used a common utilization curves for each variables. Thus, 3 species overlap for pH, 6 species for DO, 7 species. for Tw; 10 spcies. for EC, and 6 species for Elev. As a result, all ecological variables were important for ostracod distribution (Table 4.5).

Table 4.5. Computation of General overlap between most effective environmental variables (pH, DO, Tw, EC, and Elev.) and ostracods. Abbreviations: DO; dissolved oxygen (mgL^{-1}), Tw; water temperature (°C), Elev.; Elevation (meter), pH; Acidity, EC; electrical conductivity (μScm^{-1}), V_C; Calculated value, V_T; Table value ($P = 0.05$), df; Degrees of freedom, No. of Sp.; Number of Species.

		General Species Niche Overlap			
Niche	No. Of Sp.	GO	V_C	V_T	df
pH	3	0.950	8.233	12.592	6
DO	6	0.940	18.473	24.996	15
Tw	7	0.979	7.071	28.869	18
EC	10	0.934	26.385	40.113	27
Elev.	6	0.901	27.761	31.410	20

The results of Specific Overlap test for three species (*H. incongruens*, *H. salina*, and *P. arcuata*) are shown for pH. Two hypotheses were tested here as U: two species completely overlap, in other words, "their utilization curves are equal" while W: specific overlap by species I onto one species, k, is greater than the overlap of species i onto a second species, m". The first null hypothesis (U) was rejected for all pairs of species -except the pairs 1 to 2 and 2 to 1- because calculated values of them were greater than the value in table (V_T = 7.815, P = 0.05). Besides, the second null hypothesis (W) was only rejected for species pair (3-1/3-2) for the estimated value of them was lower than number 2 (Table 4.6).

Table 4.6. The Specific Niche Overlap Test for pH with four range and three species Abbreviations: Hi, (*Heterocypris incongruens*); Hs, (*H. salina*); Poa, (*Potamocypris arcuata*); U, (for the first hypothesis); W, (for the second hypothesis); df, (degrees of freedom, r-1); V_T, (table value for P = 0.05).

	Resource Classes (pH)				
Species	**6.00-6.99**	**7.00-7.99**	**8.00-8.99**	**>=9.00**	**Total**
Hi (1)	1	11	22	1	35
Hs (2)	2	7	21	1	31
Poa (3)	1	1	9	3	14
Total Tally	4	19	52	5	80
	Proportion				
1	0.029	0.314	0.629	0.029	
2	0.065	0.226	0.677	0.032	
3	0.071	0.071	0.643	0.214	
Combined Proportion	0.050	0.238	0.650	0.063	
		Specific Overlap (SO)			
	Species	**1**	**2**	**3**	
	1	1	0.970	0.647	
	2	0.969	1	0.764	
	3	0.670	0.743	1	
Species	**Pair**	**U**	**W**	**df**	**V_T**
1	2	2.132	14.173	3	7.815
1	3	30.479		3	7.815
2	1	1.952	7.369	3	7.815
2	3	16.690		3	7.815
3	1	11.213	-1.448	3	7.815
3	2	8.318		3	7.815

Like the table of Specific Overlap for pH, the tables of other four environmental variables were made by us (Appendices C.1, C.2, C.3, C.4). Calculating four or five interval classes was the most suitable for each variable. Therefore, pH (1 unit), dissolved oxygen (DO, 3.00 mgL^{-1}), water temperature (Tw, 5 °C), electrical conductivity (EC, 250.0 μScm^{-1}) were prepared as four interval classes but elevetion (Elev., 300 m a.s.l.) was assessed as five interval class.

According to CCA, first two axes explained about 73.3 % of the relationships among 23 species and five ecological variables in MaMu.

Table 4.7. The CCA table for 23 species from 122 different locations and five environmental variables in MaMu. (*DCA result)

Axes	1	2	3	4	Total inertia
Eigenvalues	0.488	0.195	0.119	0.094	9.405
*Lengths of gradient	7.958	6.018	5.073	6.721	
Species-environment correlations	0.780	0.579	0.496	0.437	
Cumulative percentage variance					
of species data	5.2	7.3	8.5	9.5	
of species-environment relation	52.4	73.3	86.1	96.2	
Sum of all eigenvalues					9.405
Sum of all canonical eigenvalue					0.932

The most influential five variables on dispersion of ostracods were as follows: pH ($P = 0.01$, $F = 3.749$), elevation (Elev.) ($P = 0.001$, $F = 3.506$), water temperature (Tw) ($P = 0.003$, $F = 2.437$), dissolved oxygen (DO) ($P = 0.054$, $F = 1.620$), and electrical conductivity (EC) ($P = 0.163$, $F = 1.375$) in the figure of CCA. While, the species *P. olivaceus, P. fontinalis, I. inermis, I. bradyi, H. salina, H. incongruens, P. fallax*, and *C. neglecta* were located opposite of Tw, EC, and pH, other ten species *C. vidua, P. arcuata, P. variegata, P. smaragdina, I. decipiens, I. gibba, L. inopinata, T. clavata, H. rotundata*, and *P. albicans* were situated on site of them. And also *C. vidua* was closer than other species at EC. *Z.* cf. *costata* and *P. zenkeri* positioned on outmost of center. Contrary to the *Z.* cf. *costata* and *P. zenkeri*, *H. incongruens* was the closest to the center. Furthermore, *D. stevensoni* stayed near

DO. Also, the species *C. sanociensis* and *C. muelleri* were near elevation, and also the latter species was closer than former one.

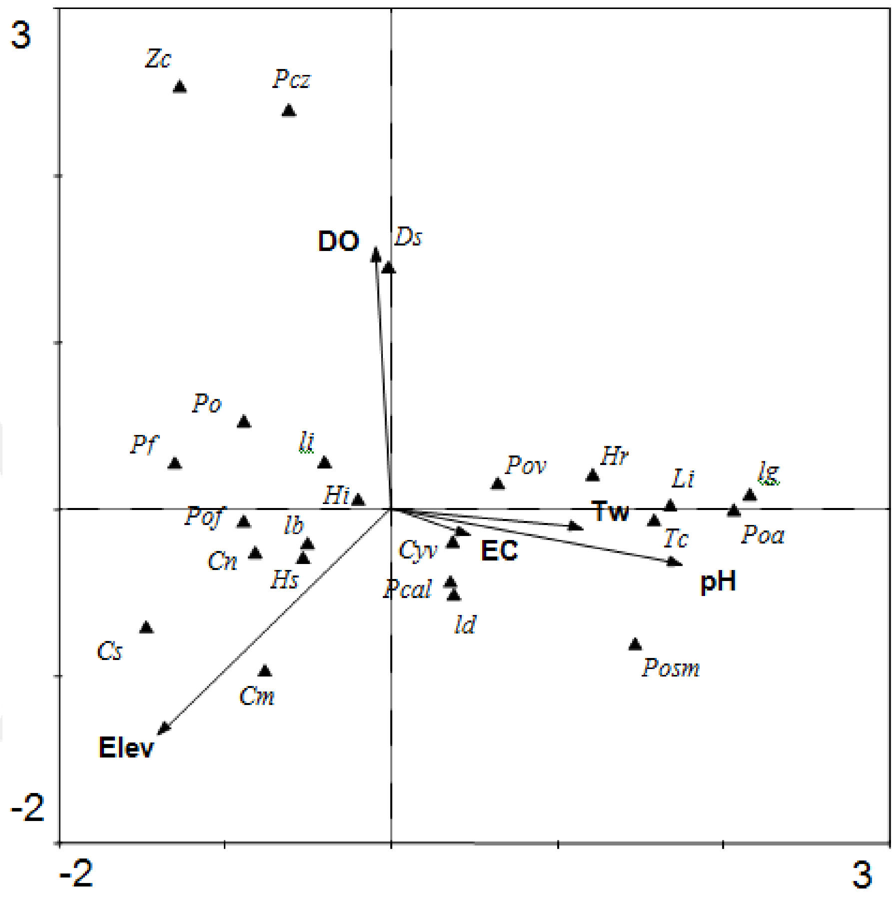

Figure 4.7. The model of CCA states the relation between 23 species and five environmental variables (arrows of DO, Elev., pH, Tw, and EC) from MaMu about species' dispersion. (*C. neglecta* (Cn), *C. sanociensis* (Cs), *C. muelleri* (Cm), *D. stevensoni* (Ds), *P. olivaceus* (Po), *P. fontinalis* (Pf), *I. bradyi* (Ib), *I. decipiens* (Id), *I. gibba* (Ig), *I. inermis* (Ii), *P. albicans* (Pcal), *H. incongruens* (Hi), *H. rotundata* (Hr), *H. salina* (Hs), *C. vidua* (Cyv), *P. arcuata* (Poa), *P. fallax* (Pof), *P. smaragdina* (Posm), *P. variegate* (Pov), *L. inopinata* (Li), *P. zenkeri* (Pcz), *T. clavata* (Tc), *Z.* cf. *costata* (Zc)

The figure of .UPGMA displayed the relationships among 27 taxa (23 Recent, 4 subfossils) in the figure 4.6. According to the result of this analysis, there were seven main clustering groups. The first group consisted of three bisexual species such as *P. olivaceus, Z. cf. costata*, and *P. zenkeri*. But, the second group was only comprised of two subfossils species such as *Ilyocpris* sp. and *Eucypris* sp.. As for the third group, it has two sub clusters with five taxa like *Potamocypris* sp., *P.*

arcuata, *I*. *gibba*, *T*. *clavata*, and *H*. *rotundata*. Then, *L*. *inopinata, P*. *smaragdina*, *C*. *vidua*, and *Candona* sp. belonged to the fourth clustering group, while the fifth group had six species all of which were almost cosmopolitan species. The last two clusters owned three species each. Additionally, *C*. *muelleri* did not include any clustering groups as in the diagram of Muş.

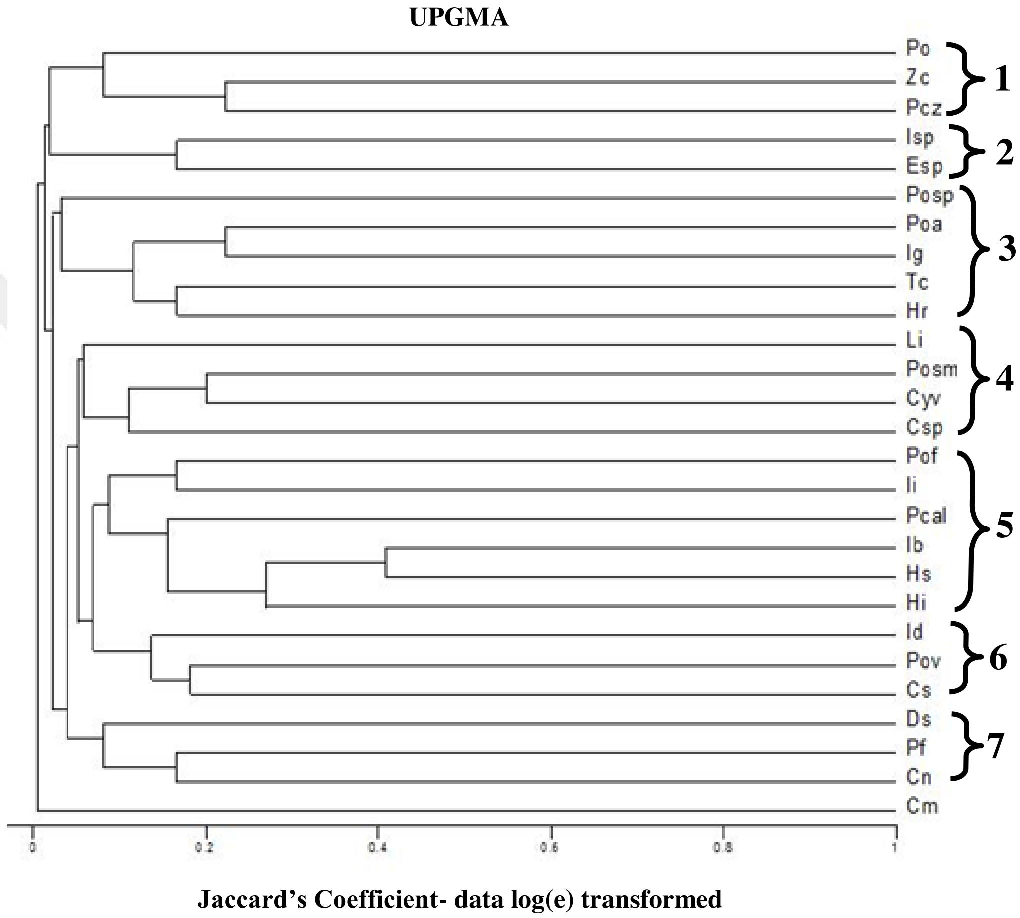

Figure 4.8. The form of UPGMA shows the relationships among 27 taxa (23 recent and 4 subfossils) with Jaccard's Coefficient- data log(e) transformed in Mardin and Muş. (*C*. *neglecta* (Cn), *C*. *sanociensis* (Cs), *C*. *muelleri* (Cm), *Candona* sp. (Csp), *D*. *stevensoni* (Ds), *P*. *olivaceus* (Po), *P*. *fontinalis* (Pf), *I*. *bradyi* (Ib), *I*. *decipiens* (Id), *I*. *gibba* (Ig), *I*. *inermis* (Ii), *Ilyocypris* sp. (Isp), *P*. *albicans* (Pcal), *Eucypris* sp. (Esp), *H*. *incongruens* (Hi), *H*. *rotundata* (Hr), *H*. *salina* (Hs), *C*. *vidua* (Cyv), *P*. *arcuata* (Poa), *P*. *fallax* (Pof), *P*. *smaragdina* (Posm), *P*. *variegata* (Pov), *Potamocypris* sp. (Posp), *L*. *inopinata* (Li), *P*. *zenkeri* (Pcz), *T*. *clavata* (Tc), *Z*. cf. *costata* (Zc))

All bisexual species (*P*. *fontinalis, P*. *olivaceus, T*. *clavata, Z*. *cf*. *costata, P*. *zenkeri, I*. *inermis, C*. *sanociensis*, and *C*. *neglecta*) showed lower optimum values for pH in this study. However, the tolerance values of *C. sanosiensis* and *C. neglecta* were higher than the mean. While *P. smaragdina* possessed the highest optimum level, *C. muelleri* owned the highest tolerance value among species (Table 4.8.).

The highest optimum and tolerance values belonged to the bisexual species, *P. zenkeri* for DO but another bisexual species *P. fontinalis* had the lowest tolerance value.

Two of the bisexual species as *T. clavata* and *P. zenkeri* displayed higher optimum and tolerance values than the mean for EC while *Zonocypris* cf. *costata* had the lowest tolerance levels among species. Additionally, the cosmopolitan species *H. salina* and *H. incongruens* had higher optimum and tolerance values (Table 4.8).

According to results of water temperature, while three bisexual species (*C. sanociensis, I. inermis*, and *P. zenkeri*) exhibited a greater optimum level, others dis show lower values. Although *I. decipiens* possessed higher optimum value, the tolerance value of it was the lowest among all species. Furthermore, *T. clavata* had the greatest tolerance values for this study.

The sexual species *P. zenkeri* indicated the lowest optimum and highest tolerance levels for Atmp, respectively. On the other hand, four species (*P. zenkeri, C. sanociensis, C. neglecta*, and *P. fontinalis*) did reveal lower optimum and tolerance values for Atmp. Moreover, *D. stevensoni* had the highest optimum value, and the tolerance value of *P. fallax* was the lowest value among all species.

All of the bisexual species except *C. neglecta* and *Z.* cf. *costata*, had higher optimum values for ORP than the mean (Table 4.8.). The highest and the lowest optimum values were possessed by *P. fontinalis* and *H. rotundata,* respectively. Because, the highest and the least tolerance values were seen concerning to *C. neglecta* and *D. stevensoni*, respectively.

Besides, except *P. olivaceus* and *I. inermis*, all other bisexual species had lower tolerance values than the mean of total of elevation. In addition, the greatest tolerance value (843.6 m) belonged to *D. stevensoni*, while *Z.* cf. *costata* had the lowest tolerance values (13.8 m.) from MaMu during this study.

Table 4.8. Optimum (uk) and Tolerance (tk) values of 23 species (*C. neglecta* (Cn), *C. sanociensis* (Cs), *C. muelleri* (Cm), *D. stevensoni* (Ds), *P. olivaceus* (Po), *P. fontinalis* (Pf), *I. bradyi* (Ib), *I. decipiens* (Id), *I. gibba* (Ig), *I. inermis* (Ii), *P. albicans* (Pcal), *H. incongruens* (Hi), *H. rotundata* (Hr), *H. salina* (Hs), *C. vidua* (Cyv), *P. arcuata* (Poa), *P. fallax* (Pof), *P. smaragdina* (Posm), *P. variegate* (Pov), *L. inopinata* (Li), *P. zenkeri* (Pcz), *T. clavata* (Tc), *Z.* cf. *costata* (Zc)) at least three different site from MaMu (Mardin and Muş) to seven environmental variables. N2 represents Hill's coefficient value is the measure of effective number of occurrences and its value depends on the abundance of species (Gotelli & Chao, 2013).Abbreviations: DO (dissolved oxygen, mgL^{-1}), EC (electrical conductivity, μScm^{-1}), Tw (water temperature, ºC), Atmp (atmospheric pressure, hgmm), ORP (redox potential,), Elev (Elevation, m), Max (maximum) and Min (minimum). For species codes see Appendices A and B.

					pH		**DO**		**EC**		**Tw**		**Atmp**		**ORP**		**Elev**	
	Code	**Count**	**Max**	**N2**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**
1	**Cm**	3	3	2.27	8.00	1.16	4.96	2.66	472.34	215.06	25.62	5.94	625.86	18.82	67.46	30.20	1606.0	277.9
2	**Cn**	16	87	6.41	7.87	0.49	4.91	3.55	517.88	229.18	17.20	5.05	631.97	11.45	75.33	11.24	1533.5	146.5
3	**Cs**	6	33	3.68	7.73	0.77	4.76	2.60	324.41	194.48	21.94	3.66	623.36	9.02	55.37	54.30	1634.7	138.4
4	**Cyv**	9	6	6.87	8.24	0.40	5.98	1.93	566.37	284.52	20.70	3.94	651.50	23.22	77.31	23.08	1275.0	317.8
5	**Ds**	5	62	1.34	7.92	0.80	9.37	1.38	453.54	151.92	21.80	2.43	697.81	63.55	70.21	8.22	691.4	843.6
6	**Hi**	35	500	3.67	8.10	0.27	5.67	1.46	650.79	355.42	21.34	2.56	639.25	29.48	77.61	23.81	1423.3	381.5
7	**Hr**	12	123	3.09	8.28	0.70	6.13	2.61	425.42	323.26	20.46	5.88	658.67	30.12	42.85	33.46	1193.7	398.2
8	**Hs**	31	103	9.24	8.14	0.37	5.70	1.44	830.12	372.48	21.86	2.52	618.27	101.34	78.65	20.86	1491.9	202.5
9	**Ib**	45	390	11.39	7.99	0.35	6.42	1.84	537.31	231.52	20.93	3.46	640.43	46.11	75.07	18.27	1400.5	420.6
10	**Id**	6	11	4.02	8.53	0.29	6.40	1.15	492.16	211.32	23.05	1.01	589.74	182.26	81.21	11.87	1480.5	263.0
11	**Ig**	8	50	4.23	8.75	0.52	6.44	2.41	681.00	468.28	23.13	6.13	677.75	24.30	69.33	20.37	921.5	323.7
12	**Ii**	15	98	8.89	8.14	0.33	6.28	1.09	570.24	290.75	21.40	5.91	645.34	30.58	80.47	18.44	1357.0	386.8

Table 4.8. (continued)

					pH		DO		EC		Tw		Atmp		ORP		Elev	
	Code	**Count**	**Max**	**N2**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**	**uk**	**tk**
13	**Li**	12	35	3.15	8.85	0.44	7.54	1.15	352.76	246.55	23.01	2.45	681.88	36.07	66.16	14.40	871.0	483.5
14	**Poa**	14	350	4.14	8.76	0.48	6.20	3.04	817.53	405.86	22.86	6.53	678.21	26.42	66.12	23.90	909.5	344.9
15	**Pof**	13	416	1.94	7.82	0.37	6.53	1.03	298.58	189.89	14.90	3.36	630.88	6.84	50.84	31.30	1547.6	93.5
16	**Posm**	3	63	1.83	9.08	0.74	6.03	1.64	344.01	279.89	24.23	4.46	637.90	11.82	54.42	25.05	1460.8	139.9
17	**Pov**	7	76	3.02	8.28	0.58	6.60	1.07	375.50	207.33	21.31	6.79	654.06	41.50	78.34	19.62	1239.5	556.8
18	**Pcz**	7	26	4.16	7.89	0.36	10.82	4.55	601.77	125.70	21.10	2.34	571.02	288.29	77.34	10.30	851.8	84.2
19	**Pcal**	11	14	3.50	8.41	0.33	5.39	1.80	745.50	308.46	22.98	3.26	638.96	25.98	78.91	22.72	1442.2	340.3
20	**Pf**	5	216	1.11	7.55	0.32	6.21	0.90	508.48	58.02	14.23	4.71	622.76	29.41	82.17	15.36	1632.7	296.7
21	**Po**	8	15	5.55	7.61	0.33	6.24	1.91	474.96	158.49	17.68	1.60	656.70	33.83	74.56	13.72	1200.5	468.4
22	**Tc**	9	11	4.78	8.11	0.25	3.93	1.69	977.57	310.99	15.56	10.89	668.93	14.65	80.10	18.47	1030.7	197.1
23	**Zc**	4	800	1.04	7.55	0.29	9.21	3.84	402.02	20.53	18.11	1.05	670.25	87.63	61.24	15.37	932.2	13.8
			Mean	4.32	8.16	0.48	6.42	2.03	540.01	245.21	20.67	4.17	643.98	50.99	70.48	21.06	1266.4	309.6
			Max.	11.39	9.08	1.16	10.82	4.55	977.57	468.28	25.62	10.89	697.81	288.29	82.17	54.30	1634.7	843.6
			Min.	1.04	7.55	0.25	3.93	0.90	298.58	20.53	14.23	1.01	571.02	6.84	42.85	8.22	691.4	13.8

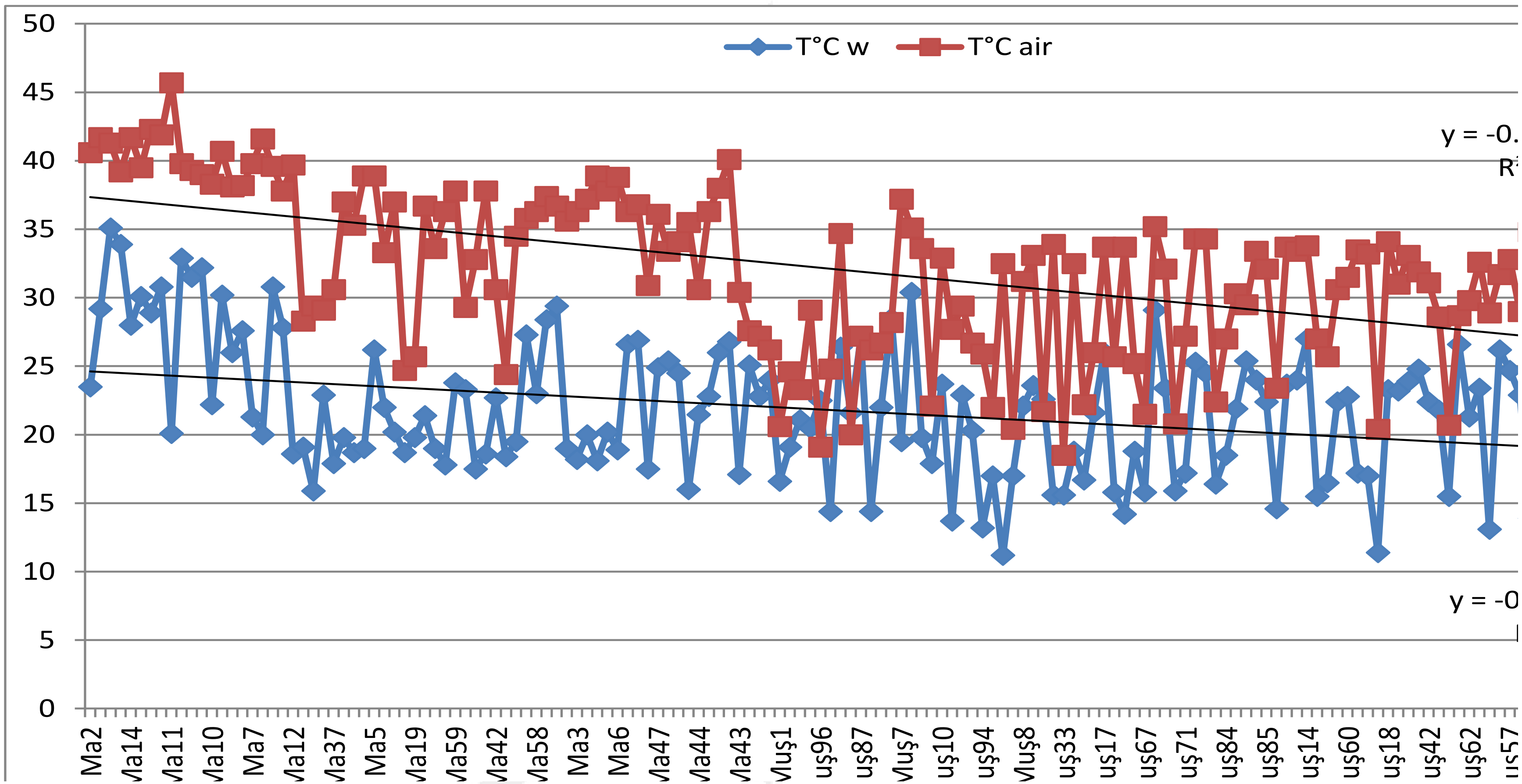

Figure 4.9. It shows water and air temperature fluctutaitons at different elevational ranges from 410 m to 2163 m a.s.l. in Mardin and Muş.

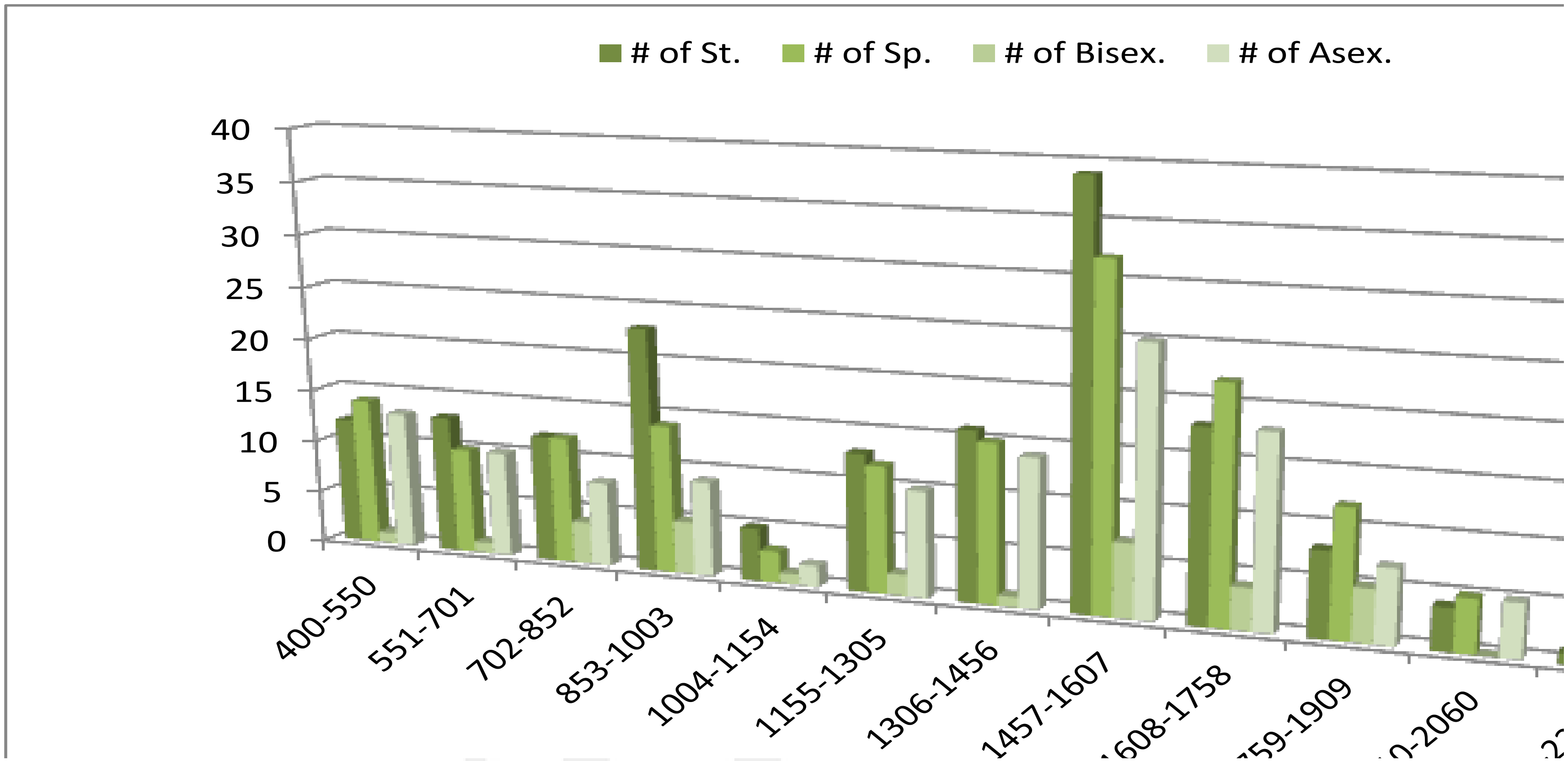

Figure 4.10. The chart of numbers of site, site type, species, species that have bisexual and asexual populations, swimmer and non-swimmer species tempering to elevetional ranges (150 m a.s.l.) from Mardin and Muş. Abbreviations: # of St. number of sampling site, # of Sp. number of species, # of Bisex .number of bisexual species, # of Asex. number of asexual species.

In the figure 4.7, the relationship between air and water temperature of sampling sites was expressed based on elevation. There was an inverse propotion between rising elevation and air, water temperature. In another word, air temperature decreased as the elevation increased. Depending on this condition, water temperature diminished.

Information of species and sites from different elevational ranges are shown in the figure 4.8. It cannot be said that there was a relation between the number of species and rising or decreasing elevetional ranges. Because, different ranges had the same number of species; for example, 12 species were found at 702-852 m, 1155-1305 m, 1759-1909 m. However, an obvious relation between the number of species and sampling site was not observed at the elevational ranges; for instance, 10 species / 13 sites at 551-701 m, 14 / 23 at 853-1003 m, 12 / 8 at 1759-1909 m were spotted. Additionally, the range of 1457-1607 m was the greatest in number when compared to other ranges in terms of variables (Figure 4.8).

Table 4.9 showed the summary of the results of Spearman Correlation Analysis from MaMu. According to this table, *I. inermis* ($P < 0.01$) exhibited positively significant correlation and *P.fallax* and *P. olivaceus* screened negative correlation ($P < 0.05$) with pH. And *P. olivaceus* ($P <. 0.05$) also showed positive correlation with habitat type. While there was a positive correlation between *D. stevensoni* ($P < 0.05$) and water temperature, *P. zenkeri* and *T. clavata* had positive correlations with elevation and redox potential ($P < 0.05$), respectively. In addition, water temperature indicated significantly positive correlation with pH, but negative correlation with elevation and ORP ($P < 0.01$).

Finally, the relationship among the number of taxa, sampling site, site type was exhibited in Figures 4.11 and 4.12. Site types were divided 12 groups such as lake (1), creek (2), trough (3), reservoir (or dam 4), stream (5), well (6), pond (7), river (8), spring water (9), canal (10), water body (11) and, pool (12). Creek (n = 44) has the most number of sampling site, creek is followed by pond and water body (n = 20), stream (n = 19), spring (n = 17), lake and trough (n = 10) (Figure 4.11). But, there was no well sampling.

Table 4.9. The summary table of non-parametric Spearman Correlation Analysis between environmental variables (pH, dissolved oxygen (DO), electrical conductivity (EC), water temperature (Tw), redox potential (ORP), and elevation (Elev.)) and six species such as *Darwinula stevensoni* (Ds), *Ilyocypris inermis* (Ii), *Potamocypris fallax* (Pof), *Prionocypris zenkeri* (Pcz), *Psychodromus olivaceus* (Po), *Trajancypris clavata* (Tc) from combined data of Mardin and Muş.

Spearman's rho		Ds	Ii	Pof	Pcz	Po	Tc	pH	DO	EC	Tw	ORP	Elev	Styp
pH	Corr. Coeff.	.667	.654**	-.554*	.214	-.755*	-.242	1.000						
	Sig. (2-tailed)	.219	.008	.049	.645	.031	.531							
	N	5	15	13	7	8	9	122						
DO	Corr. Coeff.	.718	-.411	-.107	.667	-.204	-.173	.349**	1.000					
	Sig. (2-tailed)	.172	.128	.728	.102	.629	.657	.000						
	N	5	15	13	7	8	9	122	122					
EC	Corr. Coeff.	-.205	.139	.161	.036	-.084	.587	.050	-.189*	1.000				
	Sig. (2-tailed)	.741	.621	.600	.939	.844	.097	.587	.037					
	N	5	15	13	7	8	9	122	122	122				
Tw	Corr. Coeff.	.975**	.393	-.291	0.000	-.108	-.380	.539**	.067	.262**	1.000			
	Sig. (2-tailed)	.005	.147	.335	1.000	.799	.314	.000	.466	.004				
	N	5	15	13	7	8	9	122	122	122	122			
ORP	Corr. Coeff.	-.564	.343	0.000	.536	-.467	.759*	.035	.090	-.057	-.341**	1.000		
	Sig. (2-tailed)	.322	.211	1.000	.215	.243	.018	.702	.322	.533	.000			
	N	5	15	13	7	8	9	122	122	122	122	122		
Elev	Corr. Coeff.	-.205	.050	-.260	.786*	-.671	-.190	-.016	-.067	-.295**	-.292**	.323**	1.000	
	Sig. (2-tailed)	.741	.860	.390	.036	.069	.625	.861	.464	.001	.001	.000		
	N	5	15	13	7	8	9	122	122	122	122	122	122	
Styp	Corr. Coeff.	-.667	-.364	-.107	.019	.781*	-.215	-.237**	-.153	.162	.042	-.203*	-.155	1.000
	Sig. (2-tailed)	.219	.182	.727	.968	.022	.578	.009	.092	.074	.649	.025	.089	
	N	5	15	13	7	8	9	122	122	122	122	122	122	122

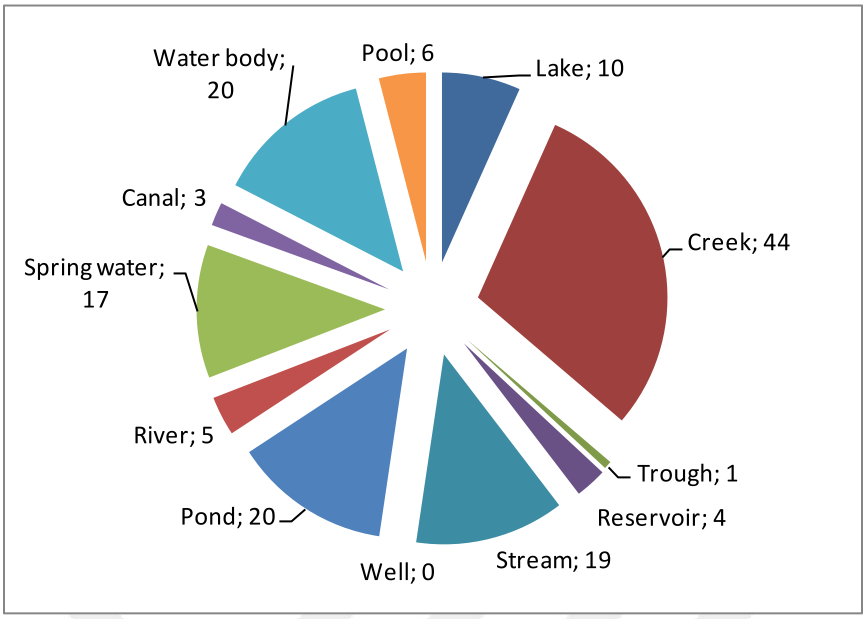

Figure 4. 11. Distribution of the numbers of habitat types in Mardin and Muş (Mamu). For example, “Creek; 44” indicates 44 samplings from creeks.

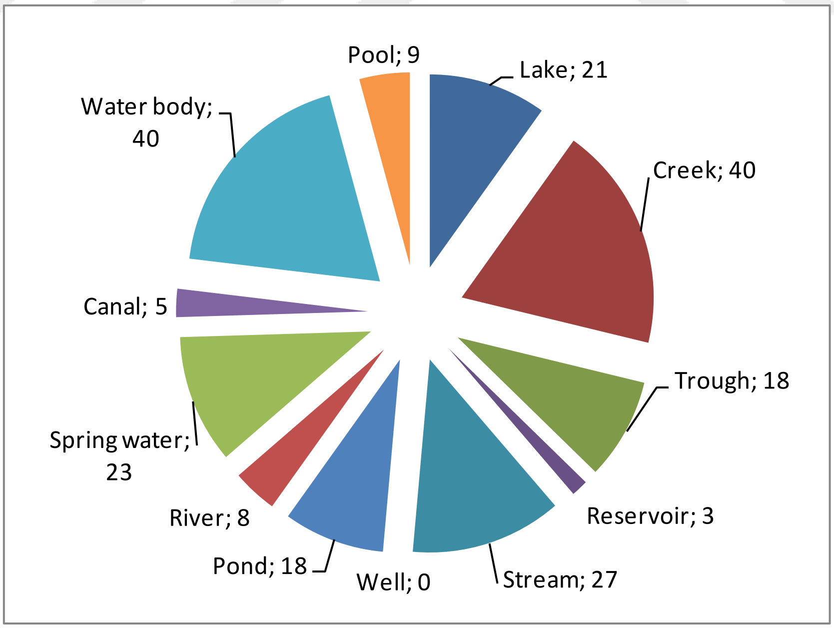

Figure 4.12. Distribution of taxa among habitat types in Mardin and Muş (MaMu). For example, “Canal; 5” five taxa were found from canals.

5. DISCUSSION and CONCLUSION

Throughout this study, 78 taxa (55 Recent and 23 subfossils) of Ostracoda were reported from Mardin and Muş. While Mardin province had 47 taxa (31 recents and 16 subfossils), there were 60 taxa (45 recents and 15 subfossils) in Muş. All species were new records for these two regions. 20 species were common in both regions. Five of all (*Cypretta* sp., *Hemicypris* cf. *congenera*, *Hemicypris inversa* and *Hemicypris* n. sp., *Vestalenula* cf. *boteai*) were new for Turkish Ostracoda fauna, and *Hemicypris* n. sp. was a new species for the literature. Male population of 13 species (*Candona angulata*, *C. neglecta*, *C. sanociensis*, *C. lindneri*, *Ilyocypris gibba*, *I. inermis*, *Prionocypris zenkeri*, *Psychrodromus fontinalis*, *P. olivaceus*, *P. cf. robertsoni*, *Stenocypria fischeri*, *Trajancypris clavata*, *Zonocypris* cf. *costata*) was found in total. Previously, in Turkey, male individuals of two species, *P. zenkeri* and *S. fischeri*, were previously recorded by Gülen (1985a, 1985b) and Shäfer (1952), respectively. Male individuals of these species were reported second time for Turkey when males of *P.* cf. *robertsoni* and *T. clavata* were new in literature (this study).

5.1 Evaluation data

The difference between numbers of sampling sites in Mardin (65 sites) and Muş (99 sites) was found despite the fact that they almost have the same size of surface area (Mardin, 8,891 km^2; Muş, 8,196 km^2). One possible explanation for this difference may be related to the climatic conditions in Mardin region (Figure 4.9.). During the field work, scarcity of water bodies was clearly observed under high temperature ranges. Such a difference might cause changes in the number of ostracod species in both provinces. For example, 47 taxa were found in 58 sites of Mardin while 60 taxa in 91 sites of Muş. This is an important result when we compare with some of those previous studies. For example, there were 14 taxa from 38 sites in northern Finland (Iglikowska & Namiotko, 2010), 25 taxa from 50 sites in Diyarbakır (Akdemir & Külköylüoğlu, 2011), 34 taxa from 133 sites in Ordu (Külköylüoğlu at al., 2012c), 54 taxa from 132 sites in upper Paraná River, Brazil (Higuti et al., 2009a), and 74 taxa from 320 sites in Northeast Italy (Pieri et al., 2009). Additionally, such a difference in the number of species can also be related to the number of sampling sites. According to "Sampling Effect Hypothesis", the number of species increases as the number of sampling sites increases (Williamson, 1988; Hill et al., 1994). However, this hypothesis may not be enough to explain relationship between the number of species and the number of sampling area depending on increasing elevation. Hence, the diversity (Williams, 1943) and suitability (Külköylüoğlu et al., 2012a) of habitats may play an effective role on diversity and the number of ostracods species especially on non-cosmopolitan species such as *T. clavata*, *S. fischeri*, and *H. brevicaudata*.

When the results of General Niche Overlap tests are analyzed in Table 4.5., calculated values (V_C) of all ecological variables are lower than table values (V_T) (*P = 0.05*) of them. This means that we accept the null hypothesis as "there are complete overlap of the species." In pH ecological variable, three ostracod species (*H. incongruens*, *H. salina* and, *P. arcuata*) were suitable and meaningful according to four interval classes of pH (from 6.00 to >9.00 units). They are located closer than *P. arcuata* in CCA diagram (Figure 4.4, 4.7) and they are in the same clustering groups of UPGMA dendrogram (Figure 4.6 and 4.8.). Although *H. incongruens* is a cosmoecious species (Külköylüoğlu, 2013) that has wide tolerance and distribution (Martens et al., 2013; Yavuzatmaca, 2015), the species (with *H. salina* as well) showed lower optimum and tolerance values (Table 4.2, 4.4, 4.8) than *P. arcuata*. This result can also be compared to previous studies (Mischke et al., 2003; Külköylüoğlu et al., 2012; Külköylüoğlu & Sarı, 2012).

The results of Specific Niche Overlap (SO) analyses support this condition. According to Table 4.6, while the first (*U*) and second (*W*) hypothesis of SO are accepted for *H. incongruens* and *H. salina*, they were rejected for *P. arcuata*. However, some former enquiries do not agree with this result (Sarı, 2007; Uçak, 2012). Lastly, when correlation analyses (Table 4.9, Appendices B.1, B.2) were considered, these three species did not show any correlation with pH, similar to previous studies (e.g., Sarı, 2007). Yet, two bisexual species (*I. inermis* and *P. olivaceus*) exhibited significantly posivite and negative correlation with pH, respectively.

There are six species; *C. neglecta*, *H. incongruens*, *H. salina*, *I. bradyi*, *I. gibba* and, *P. arcuata* to be appropriate for DO, four interval classes from 0.00 to >9.00 mgL^{-1}) in order to apply General and Specific Niche Overlap tests. These results are showed in Table 4.5 and Appendix C.1. All species almost have wide distribution and high tolerance level with ecological variables (Meisch, 2000; Mischke, 2001; Karakaş Sarı & Külköylüoğlu, 2008; Yavuzatmaca et al., 2012; Külköylüoğlu, 2013; Yavuzatmaca, 2015) except *P. arcuata*. Even though they can draw a common utilization curve depending on the result of GO (Table 4.5), they can be divided into two groups in SO table. The most compatible species with other is *I. gibba* in comparison with results of *U* calculating (Appendix C.1). Thereby, it is possible that it has higher tolerance values than other species for DO. While *C. neglecta*, *H. incongruens*, *H. salina*, *I. bradyi* consist of the first group, *I. gibba* and *P. arcuata* belong to the second group. However, for bisexual species (*C. neglecta* and *I. gibba*) the first ($U < 7.815$) and second ($W > 2$) hypotheses are accepted (P = 0.05, Table value 7.815). Indeed, these two species also showed close relationship when compared with their high tolerance values for DO. However, the members of the second group are located closer to one another (see Figure 4.4, 4.7) in CCA diagram. The elements of the first group, likewise, are closer to each other, yet far away the center. The results of UPGMA support this relationship among the species; for example, while *I. gibba* and *P. arcuata* are in the same clustering group in Figure 4.8 (3rd cluster), *H. incongruens, H. salina* and, *I. bradyi* stay on third and fifth group in Figures 4.6, 4.8, respectively. Additonaly, the results of some studies (Külköylüoğlu, 2013; Yavuzatmaca, 2015) are also supportive for this result of relationship. Finally, any correlation between these species and DO is not found in Correlation Analysis (Table 4.9, Appendices B.1 and B.2) as it was also the case in a recent study of Yavuzatmaca (2015). Some previous studies, however, showed correlation between some of these species and DO; for instance, *C. neglecta* had positive correlation with this variable in study of Külköylüoğlu (2009).

When the summary table of GO and SO (Table 4.5, Appendix C.2) are observed for water temperature, seven species (*C. neglecta*, *C. vidua*, *H. incongruens*, *H. salina*, *I. bradyi*, *I. inermis*, *P. fallax*) are suitable for four interval classes from 10 to >25 °C. Four (*C.neglecta*, *C. vidua*, *H. incongruens* and, *I. bradyi*) of them are cosmoecious species (Külköylüoğlu, 2013). Unlike these results, no clear correlation between these species and water temperature was found (Table 4.9, Appendix C.2), similar to Yavuzatmaca (2015) for *I. bradyi* and *H. salina*. However, some previous studies revealed the opposite (Külköylüoğlu, 2005a; 2009; 2013; Külköylüoğlu et al., 2013; Szlauer-Lukaszewska, 2014). Moreover, among the seven species, *C. vidua* followed by *C. neglecta* and *I. inermis* is the best one to fit into the first hypothesis (*U*). However, *P. arcuata* also is the most discordant species. This is probably because of its capacity of extensive dispersion and great tolerance level for different environmental variables (Delorme, 1991; Meisch, 2000; Külköylüoğlu, 2013). In contrast, two bisexual species (*C. neglecta* and *I. inermis*) possess higher tolerance values than the mean in Table 4.8. While Yavuzatmaca (2015) declared the same result for *I. inermis*, the opposite was reported for *C. neglecta* (Uçak, 2012). Furthermore, in accordance with the results of SO, this pair shows closer relation to each other ($U_{1,6} = 0.919$ and $U_{6,1} = 0.873$, table value *7.815*, df 3, $P = 0.05$) (Appendix C.2). The results of CCA and UPGMA support this finding. While five species such as *H. incongruens*, *H. salina*, *I. bradyi*, *I. inermis* and, *P. fallax* were located in the same clustering group in Figures 4.6, 4.8 (3rd and 5th cluster, respectively), they are closer to the center of CCA axes and opposite the arrow of Tw (Figures 4.4, 4.7). In addition, *D. stevensoni* shows significantly positive correlation with Tw ($P < 0.01$) (Table 4.9). Yet, Yavuzatmaca (2015) found negatively significant correlation ($P < 0.01$). It is one of the cosmoecious species (Külköylüoğlu, 2013) that have widespread dispersion and highest tolerance level for ecological variables (Delorma, 1991; Meisch, 2000; Escrivá et al., 2014).

For ten species (*C. neglecta*, *C. vidua*, *H. incongruens*, *H. salina*, *I. bradyi*, *I. gibba*, *I. inermis*, *L. inopinata*, *P. fallax*, and *Pschrodromus olivaceus*), these statistics could be applied in four interval classes from 0.0 to >750.0 μScm^{-1} for electrical conductivity (EC) (Appendix C.3). five of all, *C. vidua*, *C. neglecta*, *I. gibba*, *I. inermis* and *P. olivaceus*, gave agreeable results for *U* calculating. All except *I. inermis*, are cosmoecious species (Külköylüoğlu, 2013). In other words, they have and show high tolerance levels for ecological variable and widespread distribution on the world's water (Delorme, 1991; Meisch, 2000; Martens & Savatenalinton, 2011; Yavuzatmaca et. al., 2012; Külköylüoğlu, 2013; Uçak, 2014; Yavuzatmaca, 2015). Four of five species except C. vidua, were found in bisexual population during the study, two (I. gibba and I. inermis) of four bisexual species show higher tolerance levels than the mean, though, in Table 4.8 like previous studies of Mezquita (2001), Hussein et al. (2004), Külköylüoğlu (2012a). They exhibit lower tolerance values than the mean in tables 4.4 and 4.2 (Yavuzatmaca, 2015). Even though I. bradyi is a cosmoecious species (Külköylüoğlu, 2013), it is the most divergent ostracod in all. In the UPGMA diagrams (Figures 4.8, 4.6) it is in the same groups of four species as *H. incongruent*, *H. salina*, *I. inermis*. However, all species in the statistics for EC except *I.* gibba and *L.* inopinata, were almostly located in the center of CCA figures (Figures 4.7, 4.4) alike Uçak (2014) and Yavuzatmaca (2015). In addition to those, any correlations were not found between species and EC in the present study (Table 4.9, Appendix C.3). Yet, some previous studies stated that there was a correlation positively or negatively (Külköylüoğlu et al., 2013; 2014; Rasouli at al., 2014; Szlauer-Lukaszewska, 2014).

During the study, ostracod species were retained at different elevations from 410 to 2163 m a.s.l.. Depending on this situation, five interval classes by 300 m ranges were set from 400 to >1600 m a.s.l. ($P < 0.05$, df. = 4, $V_T = 9.488$) (Appendix C.4). *H. incongruens*, *H. rotundata*, *I. bradyi*, *I. inermis*, *L. inopinata* and, *P. arcuata* species became meaningful results at the statistics for elevation. All species almost had asexual populations throughout the present study except *I. inermis*. All of them showed higher tolerance values than the mean in Table 4.8. This case is undergirded with the diagrams of CCA (Figures 4.7, 4.4) because these species are in the center of these figures except some like *L. inopinata* and *P. arcuata*. While *I. inermis* was the most coherent species among them, the most incompatible species was *I. bradyi* in spite of a cosmoecious species that has great tolerance leves for elevation (Külköylüoğlu, 2013; Akdemir & Külköylüoğlu, 2014). Both *H. rotundata* and *P. arcuata* have a complete utilization curve in reference to results of *U* calculating (Appendix C.4). *I. inermis* displays moderately negative correlation with elevation ($P <0.05$) whereas *P. zenkeri* has positive correlation (Appendices B.1.) as reported earlier (Akdemir & Külköylüoğlu, 2014; Yavuzatmaca, 2015). Unlike these studies, some other species did not exhibit significant correlation to elevation; for instance, *I. bradyi* (Külköylüoğlu et al., 2012a; Akdemir & Külköylüoğlu, 2014), *H. incongruens* (Külköylüoğlu et al., 2012c; Yavuzatmaca, 2015), *L. inopinata* (Külköylüoğlu et al., 2012b; 2014).

When viewing the figures 4.3, 4.5, 4.10, an obscure relation is realized between altitudinal ranges and other variables such as the number of sampling sites, abundance of species, bisexual and asexual species and swimmer and non-swimmer species. According to Rapoport Rule (Stevens, 1992), increasing altitude corresponds to a decrease in the number of species. This is actually not clearly found during this study. This is because of the differences in the number of sampling sites among the elevational ranges. Accordingly, elevational ranges that have the most number of sampling site possess more than that of other variables; for example, 14 species from 18 sites of 7 different habitats were found at 905-1005 m range in Mardin; 27 species from 33 sites of 9 habitat types at 1502-1652 m range in Muş; 32 species from 39 sites of 12 habitat types at 1457-1607 m range in combined data of Mardin and Muş (MaMu). This result was supported with the findings of Uçak (2012), Yılmaz (2014), Yavuzatmaca (2015).

In the present study, ostracods were collected at different water bodies such as lake (n = 10), creek (n = 44), pond (n = 20), spring (n = 17), water body (n = 20), pool (n = 6), trough (n = 10) (see details in Figure 4.11). Among these habitats, higher numbers of taxa were found from creek (40 taxa), stream (27), spring (23), lake (21), pond and trough (18), respectively. Külköylüoğlu and colleagues (2012a) Yılmaz (2014) and Yavuzatmaca (2015) reached to the similar findings from Kahramanmaraş, Düzce-Karabük and, Adıyaman-Burdur regions, respectively.

In conclusion, bisexual populations of 13 species (out of 78 taxa) were found in the present study. When compared to the Turkish ostracods, 75 of 142 species are bisexual species (Külköylüoğlu et al. 2012, Külköylüoğlu, pers.comm.) (Appendix D) but this number is believed to be underestimated. Additionaly, similar results seemed to be found for European ostracods whose number of bisexual species (120) is more than the those of asexual species (38) (Meisch, 2000).

5.2 Ecology and Reproduction of species reported in Mardin and Muş

In the part of the study, some information about reproduction and ecology of 55 species that were reported in here, are shortly given by comparing some previous study.

5.2.1 *Darwinula stevensoni* (Brady and Robertson, 1870)

This parthenogenetic species also called as "ancient asexual" (Chaplin et al., 1994; Judson & Normark, 1996; Butlin et al., 1998; Martens et al., 2003) has a quite large tolerance level for several different ecological variables. In addition, it shows great dispersion in almost all continents except some parts of the Antarctic (Martens & Savatenalinton, 2011). Külköylüoğlu (2013) stated that it was one of the good examples of cosmoecious species which refers to a combination of two terms "cosmopolitan" (wide distribution) and "euryoecious" (wide tolerances) species.

In this study, *D. stevensoni* was found from four different habitats (lake, creek, stream, and spring water) totaling about 72 individuals (66 in Mardin, 6 in Muş). Minimum and maximum range of some environmental variables at which the species was found are as pH 7.53-9.36, DO 6.17-9.82 mgL^{-1}, EC 439.9-617.0 μScm^{-1}, Tw 20.9-39.7 °C, ORP 55.1-83.2 mV, elevation 557-2163 m. This corresponds to earlier reports.

Accompanying species: *Candona neglecta*, *Cypridopsis* sp., *Herpetocypris helenae*, *Heterocypris incongruens*, *H. rotundata*, *H. salina*, *Ilyocypris bradyi*, *I. inermis, Limnocythere inopinata*, *Potamocypris fallax*, *Pseudocandona albicans*, *Psychrodromus fontinalis*, *Trajancypris clavata*, *Zonocypris* cf. *costata* (Appendices A.1 and A.2).

5.2.2 *Vestalenula* cf. *boteai* (Danielopol, 1970)

This is a member of the Darwinulidae family, in which most (if not all) of the members have asexual reproductive characteristic (Butlin et al., 1998). There is not enough ecological information about the species while Danielopol (1970) was first to find it in a river from Rumania as "*Darwinula boteai*".

In the present study, it was reported with 2 individuals in a creek where ecological variables ranged as pH 8.01, DO 5.57 mgL^{-1}, EC 282.9 μScm^{-1}, Tw 17.9 °C, ORP 20.3 mV, elevation 1329 m from Muş.

Accompanying species: *Candona* sp., *Cypridopsis vidua*, *Heterocypris rotundata*, *H. salina*, *Ilyocypris bradyi*, *Potamocypris smaragdina*, *P. villosa*, *Pseudocandona albicans*, *Psychrodromus* sp. *Trajancypris clavata* (Appendix A.2).

5.2.3 *Candona angulata* Müller, 1900

This species exhibites large dispersive patterns in the west part of Palearctic region and the north of Africa (Algeria and Tunisia) (Meisch, 2000; Martens & Savatenalinton, 2011). It prefers salty waters such as costal ponds, lakes ditches, rivers, creeks, and, troughs (Meich, 2000; Martin-Rubio et al., 2005; Özuluğ, 2012; Külköylüoğlu et al. 2013; Yavuzatmaca et al., 2015).

The species always has male individuals in populations. Two individuals were found from one site (trough) in Mardin. The range of the ecological variables follow as pH 7.62, DO 7.72 mgL^{-1}, EC 435.1 μScm^{-1}, Tw 18.9 °C, ORP 60.3 mV, elevation 942 m.

Accompanying species: *C. neglecta*, *H. incongruens*, *H. salina*, *I. bradyi*, *P. fontinalis* and, *Z.* cf. *costata* (Appendix A.1).

5.2.4 *Candona candida* (O. F. Müller, 1776)

Candona candida that is one of the most familiar species of the genus Candona is included among the cosmoecious species (Külköylüoğlu, 2013). It lives amid the most different types of water body such as ponds, lakes, swamps, brooks, rivers, springs, wells, ditches. (Meisch, 2000; Külköylüoğlu, 2004; Yılmaz & Külköylüoğlu, 2006; Yılmaz, 2014). However, it seems that its distribution is limited in Europe and nearby region. Bisexual populations of *C. candida* present when the ratio of male individual is usually less than the females.

During the study, 1 female individual (and 1 juvenile) was reported from a creek in Muş where range of environmental variables were as pH 7.89, DO 5.75 mgL^{-1}, EC 293.3 μScm^{-1}, Tw 13.7 °C, ORP 66.0 mV, elevation 1346 m.

Accompanying species: *Eucypris* sp., *Potamocypris* sp., *Psychrodromus* sp., *I. bradyi*. Note that similar types of species were also reported in the studies of Sarı (2007) and Yılmaz (2014).

5.2.5 *Candona lindneri* Petkovski, 1969

Even though Meisch (2000) stated that the species exhibited limited distribution in Europe, Martens and Savatenalinton (2011) listed its dispersion in Palearctic region. Ecological preferences of *C. lindneri* resembling those of *C. neglecta* were somehow not well known where the species has been reported from lake and spring water in previous studies (Meisch, 2000). It was first found in a pool from Çankırı area in Turkey by Külköylüoğlu and colleagues (2015). During the present study, minimum and maximum ranges of the variables were as Tw 12.8 °C, EC 285.3 μScm^{-1}, pH 8.28, DO 8.88 mgL^{-1}, elevation 1221 m, and salinity 0.18 ppt.

Male individuals of *C. lindneri* are invariably present in population in the present study where 7 individuals (3 males) of it were located from a water body in Muş that has similar values of ecological variables with those of Çankırı (Külköylüoğlu et al., 2015a) such as DO 7.72 mgL^{-1}, pH 7.81, ORP 66.0 mV, Tw 13.7 °C, elevation 1346 m , EC 351.1 μScm^{-1}.

Accompanying species: *Dolerocypris* sp., *Fabeaformiscandona* sp., *I. bradyi*, *Pseudocandona* sp., and, *P. fallax* (Appendix A.2).

5.2.6 *Candona muelleri* Hartwig, 1899

This ostracod is the other member of the genus Candona and shows widespread scatter in Palearctic region (Meisch, 2000; Martens & Savatenalinton, 2011). Nothing much is known about its ecology but individuals of *C. muelleri* were collected from temporal pools, lakes and ditches in previous studies (Meisch, 2000). The species was explored from four different sites (lake, stream, water body and, warm spring water) in Muş. Minimum and maximum ranges of some ecological variables in sampling sites are as Tw 18.4-29.1 °C, ORP 22.5-80.2 mV, elevation 1273-2021 m, pH 6.33-8.94, EC 113.7-4419 μScm^{-1} and DO 1.36-5.31 mgL^{-1} (Appendix A.2).

Although males of the species always almost present in populations, we did not find males (6 female individuals and 30 carapaces).

Accompanying species: *Cypridopsis* sp., *Cypris pubera*, *Dolerocypris sinensis*, *Eucypris* sp., *H. salina*, *I. gibba*, *P. fallax*, *Tonnacypris* sp., *L. inopinata* (Appendix A.2).

5.2.7 *Candona neglecta* Sars, 1887

One of the good examples of cosmoecious species is *C. neglecta* (Külköylüoğlu, 2013) that shows wide distribution in Holarctic region (Meisch, 2000) and in the world's different aquatic bodies (Külköylüoğlu, pers. comm.) and has great tolerance level for ecological variables (Külköylüoğlu, 2005c; Karakaş Sarı and Külköylüoğlu, 2006; Sarı, 2007; Külköylüoğlu et al., 2010; Yavuzatmaca, 2015). It prefers a variety of aquatic habitat such as lakes, springs, wells, streams, creeks, rice fields etc. (Fox, 1965; Meisch, 2000; Külköylüoğlu et al., 2012b; Yavuzatmaca et al., 2015).

The species were retained from 19 different sampling sites within 6 different types of habitats (creeks, springs, trough, rivers, water body and wetland) in Mardin (3 sites), Muş (16 sites). Minimum and maximum ranges of ecological variables are as ORP 37.8-93.3 mV, pH 7.08-9.22 , Tw 11.4-26.6 °C, DO 1.03-14.89 mgL^{-1}, elevation 801-1873 m, EC 145.0-973.0 μScm^{-1}. *Candona neglecta* with 27 different ostracod species were collected as seen Appendices A.1 and A.2.

This ostracod shows sexual dimorphizm that male and female individuals morphologically have different extremitites. Additionaly, it has bisexual population. The present study supports these conditions.

5.2.8 *Candona sanociensis* Sywula, 1971

While Martens and Savatenalinton (2011) informed that *C. sanociensis* exhibited distribution in Palearctic region of world, its dispertion was limited in Europe (Meisch, 2000). This species was mostly reported from springs, streams, wells, and ponds (Sywula, 1974; Danielopol 1978; Sarı, 2007).

There are bisexual populations and its males are very similar males of *C. weltneri* (Meisch, 2000). 89 individuals (with males) of the species were reported from 6 different (5 creeks and 1 pool) sites in Muş. The ranges of some ecological variables in the present study are as following: elevation 1473-1778 m, ORP -32.7-90.7 mV, Tw 16.7-25.3 °C, EC 161.4-854.0 μScm^{-1}, DO 0.68-7.16 mgL^{-1}, pH 6.61-8.62 (Appendix A.2). In the result of this study, it was understood that *C. sanociensis* shares its habitats with 13 different ostracod taxa like *C. neglecta*, *Cypridopsis* sp., *Eucypris* sp., *Herpetocypris intermedia*, *H. incongruens*, *H. salina*, *I. bradyi*, *I. decipiens*, *I. inermis*, *P. fallax*, *P. variegata*, *P. albicans*, *P. fontinalis*, *P. olivaceus*. The study of Sarı (2007) shows a similar result.

5.2.9 *Candona weltneri* Hartwig, 1899

The present species belongs to Candida group of Candona genus. It shows similarity to *C. sanociensis*. Whereas male individuals of the species were not found in the present study, its bisexual populations are well known (Meisch, 2000).

The species *C. weltneri* exhibits distribution in Palearctic region, and prefers some different aquatic habitats like diches, swamps, lakes, ponds (Meisch, 2000). Total of 6 individuals were collected from two different sites (creek and spring) in Muş during the study. Sarı (2007) reported it from a creek in Bolu Turkey. Values of some of those environmental variables are as EC 491.0-686.0 µScm^{-1}, Tw 17.7-18.5 °C, pH 7.54-8.02, elevation 1512-1845 m, ORP 78.3-91.5 mV, DO 0.98-6.04 mgL^{-1}.

Accompanying species: *Herpetocypris* sp., *H. salina, I. bradyi, Potamocypris* sp., *P. albicans* and, *P. olivaceus* (Appendix A.2).

5.2.10 *Fabaeformiscandona breuili* (Paris, 1920)

The species *F. breuili* shows dispersion in central and south parts of Europe. It lives in limited aquatic bodies like springs, waters from caves and underground. However, in the studies of Sarı (2007) and in the present study, it was reported from a creek in Bolu and a stream in Muş, respectively. This ostracod was collected with four different taxa of Ostracoda like *C. neglecta*, *Cypria* sp., *Ilyocypris* sp. and, *T. serrata* (Appendix A.2).

Eleven individuals (males and females) of *F. breuili* were found in populations. Sampling site where this species was gathered, has values of some ecological variables such as EC 690.0 µScm^{-1}, elevation 1643 m, ORP 69.1 mV, Tw 15.2 °C, pH 7.7, DO 1.03 mgL^{-1} (Appendix A.2).

5.2.11 *Pseudocandona albicans* (Brady, 1864)

This ostracod has wide distribution in Holarctic region (Martens & Ortal, (1999). Great tolerance levels against ecological variables is observed in its lifespan. Its habitat preference shows large scale amid springs, creeks, streams, lakes, dams, sloughs, fish ponds, well etc. (Meisch, 2000; Iglikowska and Namiotko, 2012; Külköylüoğlu et al., 2012a, b; Yılmaz, 2014; Yavuzatmaca, 2015).

The males of the species are of a rare occurrences within the populations where the ratio of male to female can be 1 over 1000 or more (Meisch, 2000). This rare occurrence might be the reason why we did not find males during the study. A total of 30 females were collected from 30 different sites in Mardin (17 sites), Muş (13 sites), with 31 different ostracods. Minimum and maximum values of ecological variables are such as Tw 13.7-29.2 °C, elevation 410-1845 m, ORP -13.7-105.3 mV, pH 7.28-9.30, EC 229.8-1081 μScm^{-1}, DO 3.05-10.36 mgL^{-1} (Appendices A.1 and A.2).

5.2.12 *Cypria ophtalmica* (Jurine, 1820

Karanovic (2012) stated that *C*. *ophtalmica* distributed in five different regions as Palearctic, Afrotropical, Oriental, Neotropical and, Nearctic geographical area. The species exhibits very large tolerance levels of ecological variables. Külköylüoğlu (2013) said that the present ostracod was cosmoecious species. It inhabits in many different aquatic bodies such as flowing waters, wells, caves, fountains, channel, lakes, ditches, wetlands etc. (Meisch, 2000; Martin-Rubio et al., 2005; Sarı, 2007; Pieri et al., 2009; Rasouli et al., 2014; Yılmaz, 2014, Yavuzatmaca, 2015). The species, *C*. *ophtalmica,* was collected from a wetland in Muş with 2 females along with some other ostracods like *C*. *pubera*, *P*. *arcuata*, *Stenocypria fischeri*. Some environmental variables ranged as pH 6.84, elevation 1494 m, DO 3.10 mgL^{-1}, EC 489.3 μScm^{-1}, Tw 17.2 °C, ORP -78.5 mV.

The species shows sexual reproduction in its populations (Meisch, 2000) but we did not find male individuals during the study. This might be due to the differences in its seasonal occurrences. Further studies should be done to clarify the issue.

5.2.13 *Cyclocypris ovum* (Jurine, 1820)

The species is well known distribution in the Holarctic region (Meisch, 2000; Martens & Savatenalinton, 2011). Although, *C*. *ovum* belongs to the genus that all members of it shows fully sexual reproduction, 21 individuals of it collected from a wetland in Muş are females. The species was found with *C*. *neglecta* in the same sampling site.

Additionaly, *C*. *ovum* shows great tolerance towards ecological factors and can live in almost all different kind of aquatic conditions in lakes, springs, swamps, salty waters, etc. (Meisch, 2000). Values of some ecological variables are as in EC 227.9 µScm^{-1}, Tw 26.5 °C, elevation 1726 m, DO 2.14 mgL^{-1}, ORP 37.8 mV, pH 7.08 (Appendix A.2).

5.2.14 *Ilyocypris bradyi* Sars, 1890

This cosmoecious species (Külköylüoğlu, 2013) has wide distribution in the world's waters (Meisch, 2000; Martens & Savatenalinton, 2011). *Ilyocypris bradyi* locates in almost all aquatic types as ponds, lakes, rivers, springs, troughs, streams, canals, dams, lagoons, sulfidic springs etc. (Meisch, 2000; Pieri et al., 2009; Sarı, 2007; Balcı, 2008; Li et al., 2010; Külköylüoğlu et al., 2012b; Peterson et al., 2013; Uçak et al., 2014; Yavuzatmaca et al., 2015). In the present study, 2097 individuals of it were collected from 46 different aquatic habitats (creeks, ponds, streams, troughs, springs and limnocrene water) in Mardin (six sites) and Muş (40 sites). Values of minimum and maximum ranges of ecological variables are as in DO 1.58-11.67 mgL^{-1}, pH 7.26-9.30, EC 100.8- 2524 µScm^{-1}, Tw 12.4-27.0 °C, ORP -46.3-105.3 mV, elevation 557-1991 m (Appendices A.1 and A.2).

The species is known with its asexual reproduction in all populations, However, Karanovic and Lee (2013) with only one or two individuals was first to describe male individual of it. Even so, bisexual population of *I. bradyi* were not found in the present study.

5.2.15 *Ilyocypris decipiens* Masi, 1905

Unlike the rare occurrence of the males in *I. bradyi*, this species (*I. decipiens*) has bisexual populations. It is dispersed in Palearctic region and seems to prefer lakes, ponds, streams, pools, fountains and freshwaters caves as well (Meisch, 2000; Külköylüoğlu et al., 2014).

In this study, 30 females were collected from six different sites with four different aquatic habitats (lake, creeks, dam, river) in Mardin (one site) and Muş (five site) where the species was accompanied with 15 different ostracod species as seen Appendices A.1 and A.2 . Ecological ranges of the variables followed as pH 7.78-9.33, elevation 785-1669 m, DO 4.38-8.53 mgL^{-1}, EC 304.7-944.0 μScm^{-1}, ORP 63.4- 90.8 mV, Tw 21.4-26.2 °C.

5.2.16 *Ilyocypris gibba* (Ramdohr, 1808)

This is yet another cosmoecious species (Külköylüoğlu, 2013) with relatively broad geographical distributions among three big regions like Palearctic, Neotropical and, Nearctic (Martens & Savatenalintion, 2011). Like *I. bradyi*, it is seen to live quite large scale of habitat types as in rice filds, pools, springs, salty waters, ponds, dams, troughs, streams etc. (Malmqvist et al., 1997; Meisch, 2000; Külköylüoğlu, 2005a; Sarı, 2007; Uçak et al., 2014; Yavuzatmaca, 2015).

The present species normally exhibits sexual propagation in its populations (Meisch, 2000). The present study supports this situation. Near quarter of 138 individuals is males collected from eight different sampling sites that consist of four ponds, two lakes, a stream and one water body in Mardin (four sites), Muş (two sites). Additionaly, some ecological variables of these sites are as pH 7.58-9.43, DO 2.57-9.58 mgL^{-1}, EC 201.3-1180.0 μScm^{-1}, Tw 16.6-30.8 °C, ORP 35.5-85.0 mV, elevation 468-1274 m (Appedices A.1 and A.2).

5.2.17 *Ilyocypris inermis* Kaufmann, 1900

This species distributes in Palearctic region of the world (Meisch, 2000; Martens & Savatenalintion, 2011). During the present study, it showed wide tolerance levels towards some of ecological variables such as pH 7.38-8.62, DO 5.16-11.72 mgL^{-1}, EC 121.1-1081 μScm^{-1}, Tw 11.4-30.8 °C, ORP 45.8-107.1 mV, elevation 588-1845 m in the study. Some previous studies agreed with this condition (Roca and Baltanás, 1993; Mezquita et al., 1999c; Meisch, 2000; Külköylüoğlu & Yılmaz, 2006; Pieri et al., 2010; Van der Meeren et al., 2010; Külköylüoğlu et al., 2012a, 2012b, 2012c; Akdemir & Külköylüoğlu, 2014, Yavuzatmaca, 2015). Like *I. bradyi*, the species can live within large scale of aquatic habitats such as streams, wells, lakes, troughs, ditches, dams, pools etc. (eg. Meisch, 2000; Peterson et al., 2013; Escrivá et al., 2014; Uçak et al., 2014; Yavuzatmaca, 2015). In the present study, *I. inermis* was collected from five sampling site types like creeks, springs, streams, pool, water body, with 16 other ostracod species.

Until recently (Sarı et al., 2010), males of the species has not been known (Meisch, 2000). Six of 15 different sites where the species was found were defined with male individuals of it.

5.2.18 *Ilyocypris monstrifica* (Norman, 1862)

Two individuals of *I. monstrifica* were collected from a wetland with six different ostracod species as *Candona* sp., *C. vidua*, *L. inopinata*, *C. pubera*, *P. smaragdina* and, *P. zenkeri*, in Muş. Ecological variables of these habitats are as pH 94, DO 9.07 mgL^{-1}, EC 874.0 μScm^{-1}, Tw 27.0 °C, ORP 46.8 mV, elevation 1292 m (Appendix A.2). Some previous study showed the similar results (Henderson, 1990; Meisch, 2000; Rasouli, 2014; Yavuzatmaca, 2015).

The species exhibits distribution in Palearctic region (Meisch, 2000; Martens & Savatenalintion, 2011) but its occurrence is not well known from the other continents. Although males of *I. monstrifica* mostly occurred in its population, two females were also reported in this site.

5.2.19 *Cypris pubera* O. F. Müller, 1776

According to Martens & Savatenalintion (2011), *C. pubera* is distributed in Palearctic and Nearctic regions. It prefers aquatic types following as ponds, lakes, pools, ditches, rivers, ricefilds, canals etc. (Meisch, 2000). Its individuals were collected with 21 varied ostracods from eight different sampling sites in Mardin (3) and Muş (5). These sites are lake, wetlands, ponds and water bodies. Ranges of minimum and maximum values of some of those important ecological variables are as pH 6.84-9.40, DO 0.29-14.89 mgL^{-1}, EC 489.25-973 μScm^{-1}, Tw 17.2-29.1 °C, ORP -78.50-80.20 mV, elevation 908- 1614 m (Appendices A.1 and A.2). Furthermore, while Uçak (2012) reported this species from trough in Ankara, Yılmaz (2014) found it in stream and lake in Düzce.

Males of *C. pubera* only reported from Turkey by Schäfer (1952). However, there was no male individuals in the present study.

5.2.20 *Eucypris virens* (Jurine, 1820)

Martens and colleagues (2013) declared that the species has a distribution in Nearctic, Palearctic, Afrotropical, Australian regions whereas it is stated that *E. virens* dispersed on Holarctic region by Meisch (2000). According to Külköylüoğlu (2013), the species is one of the cosmoecious species which has wide distribution and great tolerance levels towards ecological variables. Despite the fact that the species was found with some other well known cosmoecious species (*Candona* sp., *H. incongruens*, *H. salina*, *I. bradyi* and *P. fallax*) from one site (creek) in Muş. Sampling site has values of some environmental variables ranges as pH 8.52, DO 5.47 mgL^{-1}, EC 445.1 μScm^{-1}, Tw 21.6 °C, ORP 81.2 mV, elevation 1877 m (Appendix A.2).

This species can live in low temperature and high alkalinity waters and would rather pools, springs, slightly salty waters, wells, ricefields and lake (Baltanás, 1992; Meisch, 2000; Külköylüoğlu, 20004; Yılmaz, 2005).

Eucypris virens is a geographical bisexual species. It means that it asexually repruduces but its sexual populations were also found from near coast of the Mediterranean sea in North Africa (Gauthier, 1928) and Spain (Baltanás, 1992).

5.2.21 *Prionocypris zenkeri* (Chyzer and Toth, 1858)

Total of 74 individuals of *P. zenkeri* were collected with 21 other ostracod species from seven varied aquatic habitats such as lakes, creeks streams, pools, canals, wetland and water bodies in Mardin (18) and Muş (1). Minimum and maximum ranges of ecological variables in these locations are as pH 7.28-9.90, DO 3.05-18.80 mgL^{-1}, EC 324.4-874.0 μScm^{-1}, Tw 17.8-35.1 °C, ORP 31.1-91.2 mV, elevation 452-1292 m (Appendices A.1 and A.2) while these values were compared with those of some previous studies (e.g. Uçak et al., 2014; Külköylüoğlu, 2013; Külköylüoğlu et al., 2013; Yavuzatmaca, 2015).

This is one of the cosmoecious species *P*. *zenkeri* (Külköylüoğlu, 2013). because it shows wide distribution in the world (Meisch, 2000; Martens et al., 2013) within variety of habitats The species possess its populations with rare male individuals. For example, its males were firstly reported from Turkey by Gülen (1985a, b). In the present study, six male individuals of *P*. *zenkeri* were secondly found from one sampling site in Mardin. Some of the male extremities and organs of the species can be seen in Figure 5.1. Accordingly, these parts are shown in the first time with the present study.

Figure 5.1. Photos of valves and soft body parts are the male of *Prionocypris zenkeri*. A-D soft body parts, A; Zenker organs, B; one part of Hemipenis, C; right clasping organ in maxilliped, D; left asymmetric clasping organ. E and F SEMs photos of valves, E; outer view of right valve, F; outer side of left valve

5.2.22 *Tonnacypris lutaria* (Koch, 1838)

This ostracod species exhibits dispersion in Palearctic region (Meisch, 2000; Martens et al., 2013). Habitat preferences of the species mostly range from temporary ponds and ditches, springs of aquatic types. However, in the studies of Yılmaz (2005) and the present, *T. lutaria* were collected from different lakes in Bolu and Mardin. The species was found with *Cypridopsis* sp., *I. gibba*, *P. arcuata* and *P. zenkeri*, counter intuitive.

Additionaly, values of some of those ecological variables ranged as pH 9.43, DO 9.58 mgL^{-1}, EC 324.4 μScm^{-1}, Tw 30.1 °C, ORP 44.3 mV, elevation 486 m (Appendix A.1). During the study, males of the present species were not found in the regions, though, Gülen (1985a) described its male individual in Turkey.

5.2.23 *Trajancypris clavata* (Baird, 1838)

According to Meisch (2000), this species is dispersed in the Palearctic region (Martens et al., 2013). Generally, the species inhabits in rice fields, shallow water, lakes, ponds, springs, troughs (Meisch, 2000; Pieri et al., 2006; Uçak, 2012; Yavuzatmaca, 2015). Likewise, *T. clavata* was also found from 16 sampling sites (ponds, 12; lake, 1; creek, 1; trough, 1; water body, 1) in Mardin and Muş during this study (Appendices A.1 and .A.2). The minimum and maximum ranges of some ecological variables are as following pH 7.80-8.73, DO 1.57-9.53 mgL^{-1}, EC 282.9-1847.0 μScm^{-1}, Tw 17.1-29.4 °C, ORP 20.3-87.7 mV, elevation 557-1488 m. Similar results were reported in the study of Yavuzatmaca (2015).

Until now, the species was known with parthenogenetic reproduction (Meisch, 2000). However, in the present study, its males were firstly identified from a pond in Mardin (st. 42). This is the first report of the males of this species, indicating that bisexual populations of the species can be possibly present in other regions.

As seen Figures 5.2 A-F, alike other members of subfamily Eucpridinae, males of *T*. *clavata* have SEM photos of left (F) and right (E) valves and some male organs like asymmetrical clasping organs (B and C), Zenker's organ with large numbers of whorls (A), strongly chitinous hemipenis with left and right parts (D).

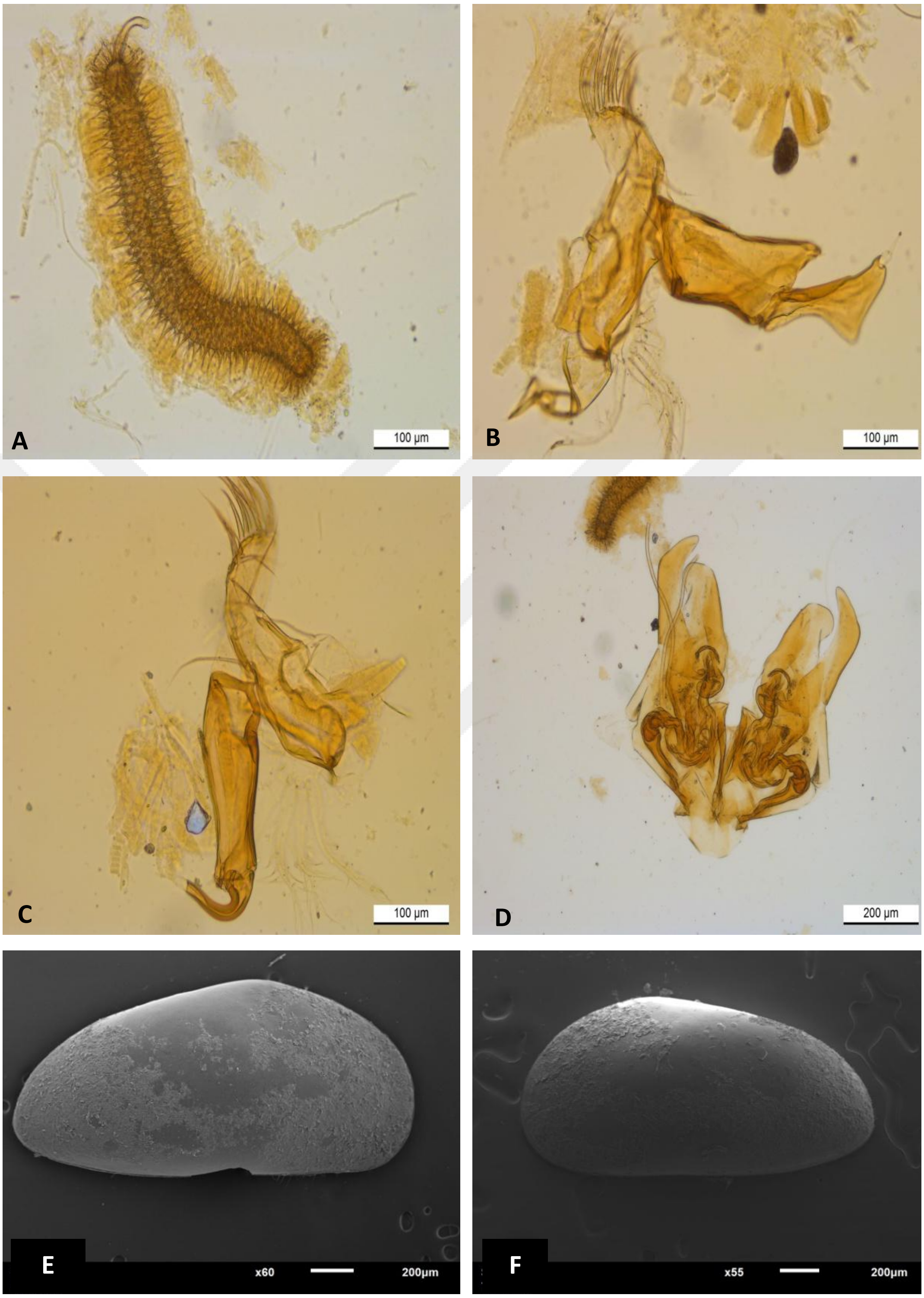

Figure 5.2. The male of *Trajancypris clavata* are photos of valves (E, F) and some male organs (A-D). A, Zenker organs has great number of whorls; B, right maxilliped with strong clasping organ; C, left maxilliped with asymmetrical clasping organ; D, hemipenis with strongly chitinous two parts; E and F, outer view of left and right valves, respectively.

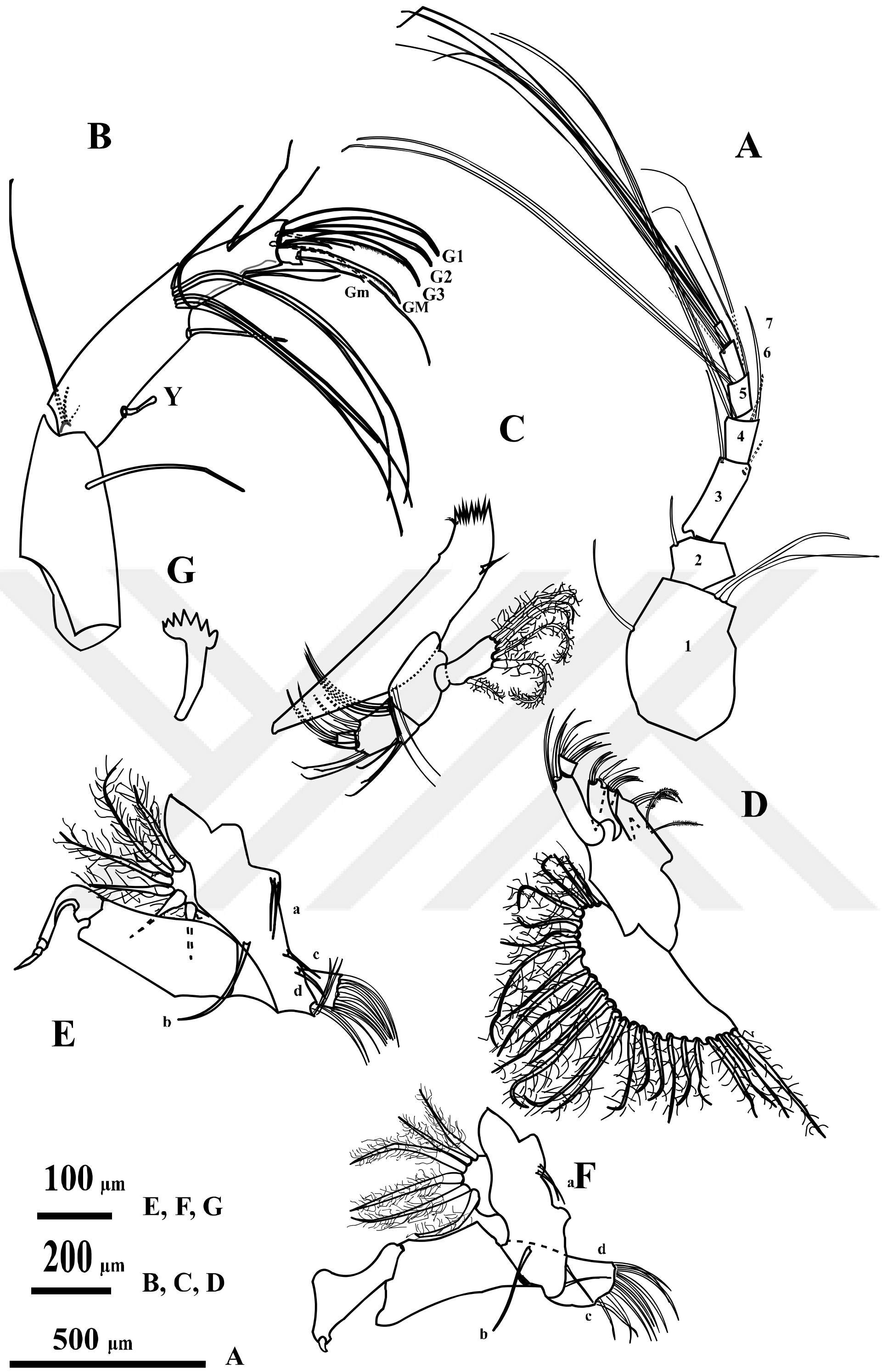

Figure 5.3. *Trajancypris clavata* (male, in this study) A (A1), B (A2), C (Md), D (Mx), E (T1, left), F (T1, right), G (Rk).

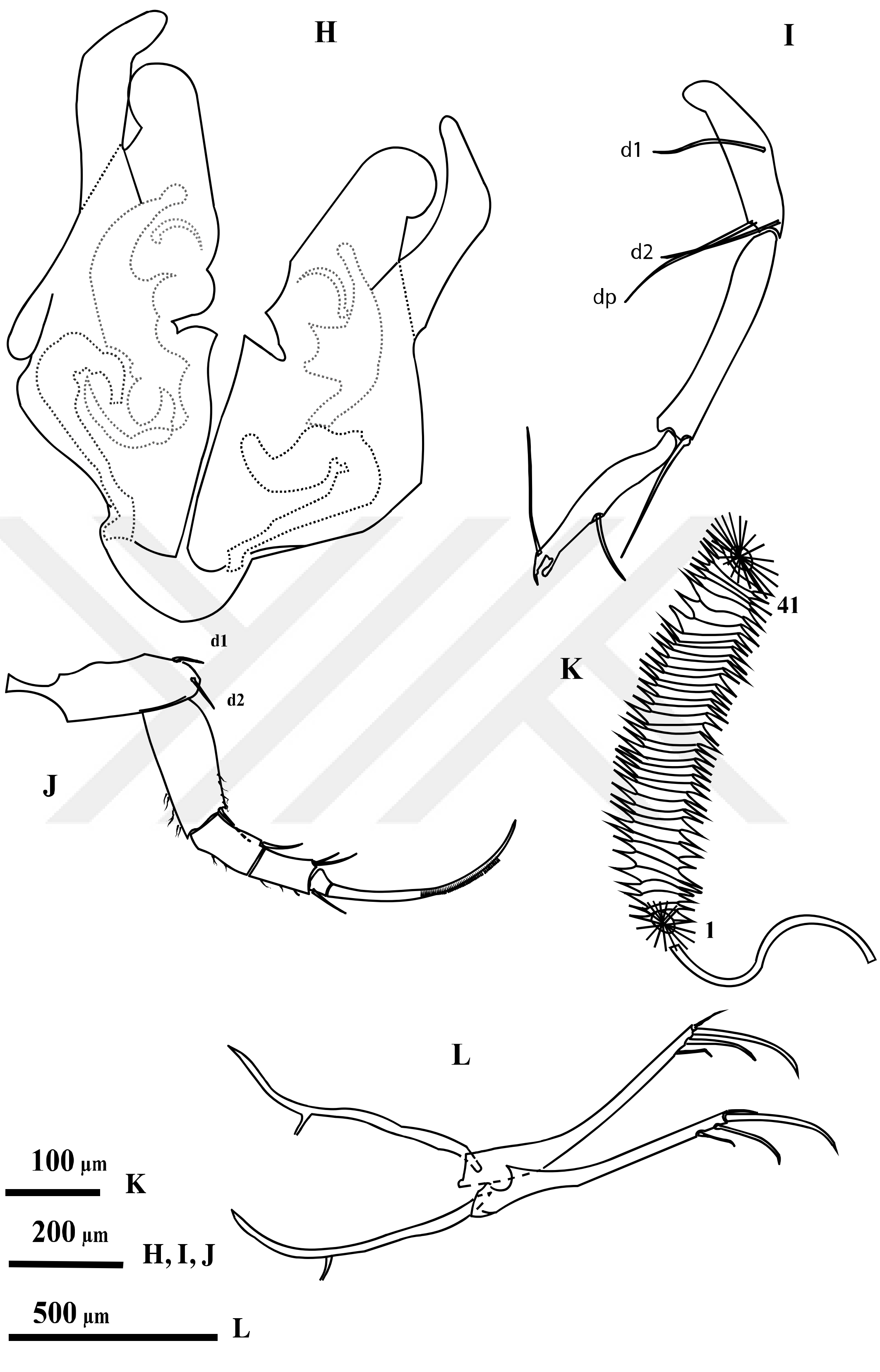

Figure 5.4. *Trajancypris clavata* (male, in this study) H (Hp), I (T3), J (T2), K (Zk), L (Fu).

5.2.24 *Trajancypris serrata* (G. W. Müller, 1900)

Similar to *T. clavata*, *T. serrata* shows wide distribution in the Palearctic region (Martens et al., 2013). Ecological information about the species is scarce. However, the species was mostly reported from canals, pools, small lakes and ditches (Meisch, 2000). Also, *T. serrata* was collected from four different sites as ponds, stream, and water body, with 11 varied ostracod species in Muş. The highest and the lowest values of some ecological variables are like pH 7.7-9.36, DO 1.03-14.89 mgL^{-1}, EC 461.6-973.0 μScm^{-1}, Tw 15.6-26.6 °C, ORP 64.1-103.0 mV, elevation 1249-1614 m (Appendix A.2).

Previously, males of *T. serrata* have been recorded by Gülen et al. (1994) and Rasouli (2012) in Turkey but we did not observe males in the present study.

5.2.25 *Dolerocypris fasciata* (O. F. Müller, 1776)

The species was collected from one site (water body) with other six taxa as *Candona* sp., *H. incongruens*, *Ilyocypris* sp., *Potamocypris* sp., *P. zenkeri*, and *Stenocypris* sp. in Mardin (Appendix A.1). Some previous studies supported this in terms of its habitat preferences; for example, *D. fasciata* was found in small water bodies, lakes, ponds and swamps (Meisch, 2000). Values of some ecological variables are as pH 8.78, DO 6.65 mgL^{-1}, EC 650.0 μScm^{-1}, Tw 32.9 °C, ORP 31.1 mV, elevation 506 m (Appendix A.1).

As yet, there is no record about male individuals of the species (Meisch, 2000) that the species is known with parthenogenetic reproduction.

5.2.26 *Dolerocypris sinensis* (Sars, 1903)

Compared to the previous species (*D. fasciata*), there are not many differences on the ecological prefeneces of the species.It exists in rice fields, small water bodies and lakes and distributes in Palearctic region (Meisch, 2000). The present study supports previous information about the species that was collected from a small water body with different five taxa of Ostracoda such as *C. muelleri*, *C. pubera*, *Eucypris* sp., *Ilyocypris* sp., *Tonnacypris* sp. in Muş The ranges of some of those ecological values are as pH 8.26, DO 5.31 mgL^{-1}, EC 943.0 μScm^{-1}, Tw 29.1 °C, ORP 80.2 mV, elevation 1493 m (Appendix A.2).

Like *D. fasciata*, this is a parthenogenetic species. In other words, its male individuals were not found anywhere up to now (Meisch, 2000).

5.2.27 *Isocypris beauchampi* (Paris, 1920)

The species dispersed in a wide areaa from Nearctic, Palearctic to Neotropical regions in the World (Martens et al., 2013). Because of this, it can be named cosmopolitan species. In Turkey, the species was first reported from a dam lake in Bolu (Külköylüoğlu 2003a). In addition, *I. beauchampi* is generally present in lakes, streams, canals, dam, ricefields and ponds (Meisch, 2000; Akdemir & Külköylüoğlu, 2014; Rasouli et al., 2014; Yavuzatmaca, 2015). In the present study, it and other seven ostracods such as *C. pubera*, *Hemicypris inversa*, *Ilyocypris* sp., *P. arcuata*, *P. zenkeri*, *Tonnacypris* sp. and *T. clavata*, were encountered from a lake and a water body in Muş and Mardin, respectively, as seen Appendices A.1 and A..2. Values of some ecological variables are as in pH 8.36-8.61, DO 6.17-11.9 mgL^{-1}, EC 539.0-649.0 μScm^{-1}, Tw 18.8-33.9 °C, ORP 50.7-79.8 mV, elevation 464-1488 m .

Furthermore, this ostracod shows parthenogenetic reproduction which propagate without male individuals (Meisch, 2000).

5.2.28 *Cypridopsis vidua* (O. F. Müller, 1776)

The species is dispersed in a very large geographical areas in the world (Palaeactic, Nearctic, Afrotropical, Neotropical, Pacific and Oceanic regions) (Martens et al., 2013). According to Külköylüoğlu (2013), it is a good example of the cosmoecious species. *Cypridopsis vidua* mostly likes to inhabit in waters with rich vegetation such as ponds, lakes, springs, pools, streams, creeks and rivers (Meisch, 2000; Sarı, 2007; Yılmaz, 2014). *Cypridopsis vidua* with 25 varied ostracods were collected from nine different aquatic bodies as creeks, pond, spring, wetland and water body, in Mardin (1) Muş (8). Ranges of ecological variables are like pH 7.62-9.40, DO 4.18-9.07 mgL^{-1}, EC 100.8-944.0 μScm^{-1}, Tw 12.8-27.0 °C, ORP 20.3-103.0 mV, elevation 834-1854 m (Appendices A.1 and A.2).

The male of *C*. *vidua* is not known. The species makes parthenogenetic reproduction. (Meisch, 2000).

5.2.29 *Sarscypridopsis aculeata* (Costa, 1847)

The species is known as one of cosmoecious species according to Külköylüoğlu (2013). It shows great dispersion in the areas of the world (Afrotropical, Australasian, Nearctic, Neotropical and Palaearctic) (Martens et al., 2013). Additionaly, it lives in salty waters such as small size aquatic conditions (Meisch, 2000).

In the study, *S*. *aculeata* was gathered with *Ilyocypris* sp., *L*. *inopinata*, *P*. *albicans*, from a lake in Mardin. Values of some ecological variables are like pH 9.03, DO 7.96 mgL^{-1}, EC 229.8 μScm^{-1}, Tw 22.9 °C, ORP 58.1 mV, elevation 679 m (Appendix A.1).

This is a parthenogenetic species that reproduces without male individuals in populations (Meisch, 2000).

5.2.30 *Potamocypris arcuata* (Sars, 1903)

Potamocypris arcuata is distributed in Palaearctic region (Meisch, 2000; Martens et al., 2013). It inhabits some aquatic bodies such as ponds, lakes, troughs, creeks, pools and ricefields (Meisch, 2000; Mezquita et al., 2001; Pieri et al., 2009; Akdemir & Külköylüoğlu, 2011; Uçak, 2012; Yılmaz, 2014; Yavuzatmaca, 2015).

The species generally reproduces without male individuals but, in North Africa, its males were reported by Gautheir (1928). In the present study, they were not encountered.

During the study, the species and other 18 ostracods were collected from 14 different sampling sites such as lakes, ponds, wetland and small water bodies, in Mardin (10) Muş (4). As seen Appendices A.1 and A.2, lowest and highest values of some ecological variables are as pH 6.84-9.90, DO 0.29-14.89 mgL^{-1}, EC 324.4-1847.0 μScm^{-1}, Tw 15.8-35.1 °C, ORP -78.5-103.0 mV, elevation 452-1614 m .

5.2.31 *Potamocypris fallax* Fox, 1967

Likewise, *P. arcuata*, it has got distribution of Palearctic region (Martens et al., 2013). In the present study, 603 individuals of it were gathered with 24 different ostracod species from 13 different sampling sites as creeks, troughs, streams, springs and water body, in Muş. Additionlly, ranges of some important ecological variables are like pH 7.43-8.87, DO 1.58-8.43 mgL^{-1}, EC 113.7-944.0 μScm^{-1}, Tw 11.4-26.0 °C, ORP 36.3-90.7 mV, elevation 1346-2021 m (Appendix A.2).

Potamocypris fallax makes an asexual reproduction (Meisch, 2000).

5.2.32 *Potamocypris similis* G. W. Müller, 1912

Some of those previous studies stated that *P. similis* was collected from the aquatic bodies as ponds, lakes, troughs, creeks,streams, waterfall, rivers, and springs (Meisch, 2000; Sarı, 2007; Akdemir & Külköylüoğlu, 2011; Külköylüoğlu et al., 2012a, 2013; Uçak, 2012; Yılmaz, 2014). Likewise, with the two species of Potamocypris above, it shows distribution of Palaearctic region (Martens et al., 2013).

The species was gathered with five other ostracods like *P. albicans*, *P. fallax*, *L. inopinata*, *I. bradyi* and *H. salina* from one site (stream) in Muş. Ecological variables of this site were measured as pH 8.73, DO 6.52 mgL^{-1}, EC 485.5 μScm^{-1}, Tw 26.0 °C, ORP 88.4 mV, elevation 1482 m (Appendix A.2).

According to Meisch (2000), it performs asexual reproduction.

5.2.33 *Potamocypris smaragdina* (Vávra, 1891)

It was collected with 14 other species of Ostracoda from three different sites as creek, stream and wetland in Muş. The lowest and the highest values of ecological variables of the habitats where the species was found are as pH 8.01-9.40, DO 5.17-9.07 mgL^{-1}, EC 275.4-874.0 μScm^{-1}, Tw 17.9-27.0 °C, ORP 20.3-64.3 mV, elevation 1292-1521 m as seen Appendix A.2.

According to Martens and his friends (2013), it exhibits wide distribution from Nearctic, Neotropical to Palaearctic regions. Moreover, the species prefers more different aquatic bodies such as troughs, lakes, dams, creeks, streams, pools, ricefield and springs (Meisch, 2000; Cusminsky et al., 2005; Sarı, 2007; Külköylüoğlu et al., 2012a; Yılmaz, 2014; Yavuzatmaca, 2015).

Males are only recorded from north of America (Meisch, 2000).

5.2.34 *Potamocypris unicaudata* Schäfer, 1943

Whereas *P. similis*, it disperses in both Palaearctic and Nearctic regions (Meisch, 2000; Martens et al., 2013). It prefers to live in temporary and little salty waters such as creeks, troughs, ponds, pools, lakes and water bodies (Meisch, 2000; Akdemir, 2009; Uçak, 2012; Rasouli et al., 2014; Zhai et al., 2014). The species along with *H.salina* and *L. inopinata* was found from a water body in Muş. This sampling site has alkaline water values ranged as pH 9.95, DO 6.09 mgL^{-1}, EC 1237 μScm^{-1}, Tw 24.0 °C, ORP 60.4 mV, elevation 1256 m (Appendix A.2).

Until now, *P. unicaudata* was known a parthenogenetic species (Meisch, 2000).

5.2.35 *Potamocypris variegata* (Brady and Norman, 1889)

Like *P*. *unicaudata*, it shows distribution in the Holarctic regions (Meisch, 2000; Martens et al., 2013). A total of 149 individuals were gathered with other 19 ostracod species from 7 different locations and two varied aquatic habitats like creeks and water body in Mardin (3), Muş (4). Some previous studies supported this condition in terms of habitat preference (Külköylüoğlu et al., 1995; Akdemir, 2009; Uçak, 2012; Rasouli et al., 2014). Ranges of some ecological variables are found as pH 7.86-9.02, DO 4.38-8.53 mgL^{-1}, EC 257.6-944.0 μScm^{-1}, Tw 16.7-30.8 °C, ORP 48.7-90.7 mV, elevation 492-1956 m in the present study (Appendices A.1 and A. 2).

Potamocypris variegata is also ostracod species that has only asexual populations (Meisch, 2000). Male individuals of it were not encountered during the study.

5.2.36 *Potamocypris villosa* (Jurine, 1820)

While Meisch (2000) stated that it shows widely dispersion in the world except Australia. According to Martens and his friends (2013), the species only distributes in Neotropical and Palaearctic regions. Külköylüoğlu (2013) characterized it to be a cosmoecious species. It was collected with 10 other different ostracods from two locations (creek and stream) in Muş. Values of some ecological variables are ranged as pH 8.01-9.30, DO 5.17-5.76 mgL^{-1}, EC 275.4-282.9 μScm^{-1}, Tw 17.9-25.4 °C, ORP 20.3-64.3 mV, elevation 1329-1521 m (Appendix A.2). In the former studies, *P*. *villosa* was found from varied aquatic habitats such as springs, troughs, creeks, lakes, water bodies, pools, and ponds (Meisch, 2000; Sarı, 2007; Rasouli, 2012; Uçak et al., 2014).

Meisch (2000) stated bisexual population of the species from Italy, Spain and Turkey but males of *P*. *villosa* were not found in the present study.

5.2.37 *Potamocypris zschokkei* (Kaufmann, 1900)

The distribution of *P. zschokkei* was known in Palaearctic region by Martens and his colleagues (2013). Meisch (2000), however, limited its distribution within the European habitats. There is not detailed ecological information about the species since its occurrence is rare. Some previous studies (Meisch, 2000; Uçak, 2012) stated that the species prefers troughs, streams, creeks and ponds. 5 individuals of the present species with *C. neglecta*, *Eucypris* sp., and *I. bradyi* were collected from a spring that has values of some environmental variables such as pH 7.78, DO 7.98 mgL^{-1}, EC 337.2 μScm^{-1}, Tw 12.4 °C, ORP 90.5 mV, elevation 1663 m, in Muş (Appendix A.2).

Although the male individual of it was not found during the study, those of it are only known in Spain (Meisch, 2000).

5.2.38 *Zonocypris* cf. *costata* (Vávra, 1897)

This species and other 14 ostracods species were collected from eight different locations such as creeks trough, stream, canal and pool in Mardin. Lowest and highest values of ecological variables are like pH 7.50-8.29, DO 3.05-18.80 mgL^{-1}, EC 353,2-699.0 μScm^{-1}, Tw 17.5-21.4 °C, ORP 33.3-90.8 mV, elevation 607-954 m (Appendix A.1). The species distributes in Palaearctic and Afrotropical regions (Martens et al., 2013). It mostly prefers slightly saline waters like springs, lakes, ponds, and little water bodies (Hare & Carter, 1987; Verschuren et al., 2000; Yavuzatmaca, 2015).

Zonocypris costata is known as a sexual species that there are both male and female individuals in populations (Mueller, 1898). In the study, males were found from two different sites.

5.2.39 *Herpetocypris brevicaudata* Kaufmann, 1900

While Meisch (2000) underlined that the distribution of *H. brevicaudata* is known from Palaearctic region, Martens et al. (2013) extended its distribution into Nearctic and Palaearctic regions. Some former studies reported it from streams, lakes, troughs, springs, (Meisch, 2000; Aygen et al., 2004; Sarı, 2007; Akdemir, 2009; Uçak, 2012). *Herpetocypris brevicaudata* and *P. fallax* were collected from the same sampling site (trough) in which values of some ecological variables were found as pH 7.90, DO 6.85 mgL^{-1}, EC 216.7 μScm^{-1}, Tw 15.5 °C, ORP 36.3 mV, elevation 1542 m, in Muş (Appendix A.2).

Its males are only known from north of Africa (Meisch, 2000) but we did not find the males during the present study.

5.2.40 *Herpetocypris helenae* G. W. Müller, 1908

The dispersion of it is known from Afrotropical and Palaearctic regions (Martens et al. 2013). We collected the species with *Cypridopsis* sp., *D. stevensoni*, *H. incongruens*, *H. rotundata*, *I. bradyi*, *P. albicans* and *T. clavata* from a trough in Mardin. The values of some ecological variables of the trough were measured as pH 7.80, DO 9.53 mgL^{-1}, EC 632.0 μScm^{-1}, Tw 22.2 °C, ORP 71.3 mV, elevation 557 m (Appendix A.1). Some of those former studies reported similar results about habitat preferences of the specis from as troughs, dams, creeks, (Külköylüoğlu et al., 2012a; Uçak et al., 2014; Yavuzatmaca, 2015).

There is no record of males (Meisch, 2000).

5.2.41 *Herpetocypris intermedia* Kaufmann, 1900

Even though Meisch (2000) expressed that the species is dispersed in the Palaearctic region, its distribution was added from Afrotropical region by Martens and his friends (2013). *Herpetocypris intermedia* prefers to live in variety of aquatic habitats such as dams, troughs, lakes, springs, creeks, pools, streams (Meisch, 2000; Akdemir, 2009; Akdemir et al., 2011; Külköylüoğlu et al., 2012a, 2012c; Rasouli et al., 2014; Uçak et al., 2014). In this study, the species and eight other ostracods (*C. sanociensis, C. vidua, H. incongruens, H. rotundata, H. salina, I. bradyi, P. arcuata, T. serrata*) were collected together from two aquatic habitats like pond and pool in Muş. Some measured values of ecological variables of these sites are as pH 6.61-

8.65, DO 0.68-5.53 mgL^{-1}, EC 403.1-632.0 μScm^{-1}, Tw 15.8-25.3 °C, ORP -32.7-103.0 mV, elevation 1484-1507 m (Appendix A.2).

Males are not known so far (Meisch, 2000).

5.2.42 *Psychrodromus fontinalis* (Wolf, 1920)

Martens and his friends (2013) agreed with Meisch (2000) about the distribution of the species (Palaearctic region). Until now, it was reported from a large number of aquatic types such as cold waters, ponds, creeks, troughs, cave waters, springs, lakes, (Meisch, 2000; Yılmaz, 2005; Sarı, 2007; Dügel et al., 2008; Akdemir, 2009; Özulug, 2011; Külköylüoğlu et al., 2012b; Uçak et al., 2014; Yavuzatmaca, 2015). In the present study, the species and other 10 ostracods were gathered from five different sampling sites and four varied habitats like creeks, trough, stream and spring, in Mardin (1) and Muş (4). Furthermore, the lowest and highest values of some ecological variables are ranged as pH 7.53-8.33, DO 5.05-7.72 mgL^{-1}, EC 372.5-985.0 μScm^{-1}, Tw 13.9-24.0 °C, ORP 58.1-91.7 mV, elevation 942-1800 m (Appendices A.1 and A.2).

The bisexual populations of *P. fontinalis* were reported from Macedonia by Petkovski and Meisch (1995). In Turkey, Yılmaz (2005) and Sarı (2007) found from Bolu region. We encountered males of it from a spring in Muş (st 55).

5.2.43 *Psychrodromus olivaceus* (Bardy and Norman, 1889)

Külköylüoğlu (2013) stated that *P. olivaceus* was one of the cosmoecious species. It has wide distribution in the world (Meisch, 2000; Sarı and Külköylüoğlu, 2010; Martens et al., 2013) and great tolerance levels towards different ecological variables (Meisch, 2000; Yılmaz, 2005; Sarı, 2007; Akdemir, 2009; Külköylüoğlu et al., 2012a, 2012b, 2012c; Uçak et al., 2014; Yavuzatmaca, 2015).

The species and other 11 ostracods were collected from eight locations and three varied habitat types such as creeks, springs and canal, in Mardin (3) Muş (5).

Ranges of ecological variables are shown as pH 7.28-8.27, DO 0.98-7.74 mgL^{-1}, EC 175.7-854.0 μScm^{-1}, Tw 14.6-24.7 °C, ORP 59.0-94.2 mV and elevation 730-1873 m (Appendices A.1 and A.2).

Male individuals of the species were reported from the Macedonia, Caucasus, and Turkey (Gülen, 1985b; Meisch, 2000; Sarı, 2007; Rasouli, 2012). Alike *P. fontinalis*, its males were encountered from a spring in Mardin (st 56).

5.2.44 *Psychrodromus* cf. *robertsoni* (Brady and Norman, 1889)

There is not much ecological information about the species. Martens and his colleagues (2013) said that this species distributed in Palaearctic region. Habitat preferrences of *P. robertsoni* favor for ponds, pools, rivers and springs (Meisch, 2000; Akdemir, 2009). During the study, it was gathered with other three species as *C. neglecta*, *I. inermis* and *P. fallax*, from a spring that own values of some ecological variables like pH 7.44, DO 5.47 mgL^{-1}, EC 495.8 μScm^{-1}, Tw 11.4 °C, ORP 82.7 mV, elevation 1579 m in Muş (Appendix A.2).

Until the present study, the male of the species was known from nowhere (Meisch, 2000; Akdemir, 2009). However, its males were collected from a spring water in Muş (st 34). This is the first report of the males in the literature. Detailed descriptions of the soft body parts and valves are also shown in Figure 5.3A-F.

The male organs consist of a well-built chitinous hemipenis, constructed symmetrical a pair of clasping organs in maxilliped, a pair of Zenker's organ with in a multitude of whorls (No: 42) (Figure 5.3).

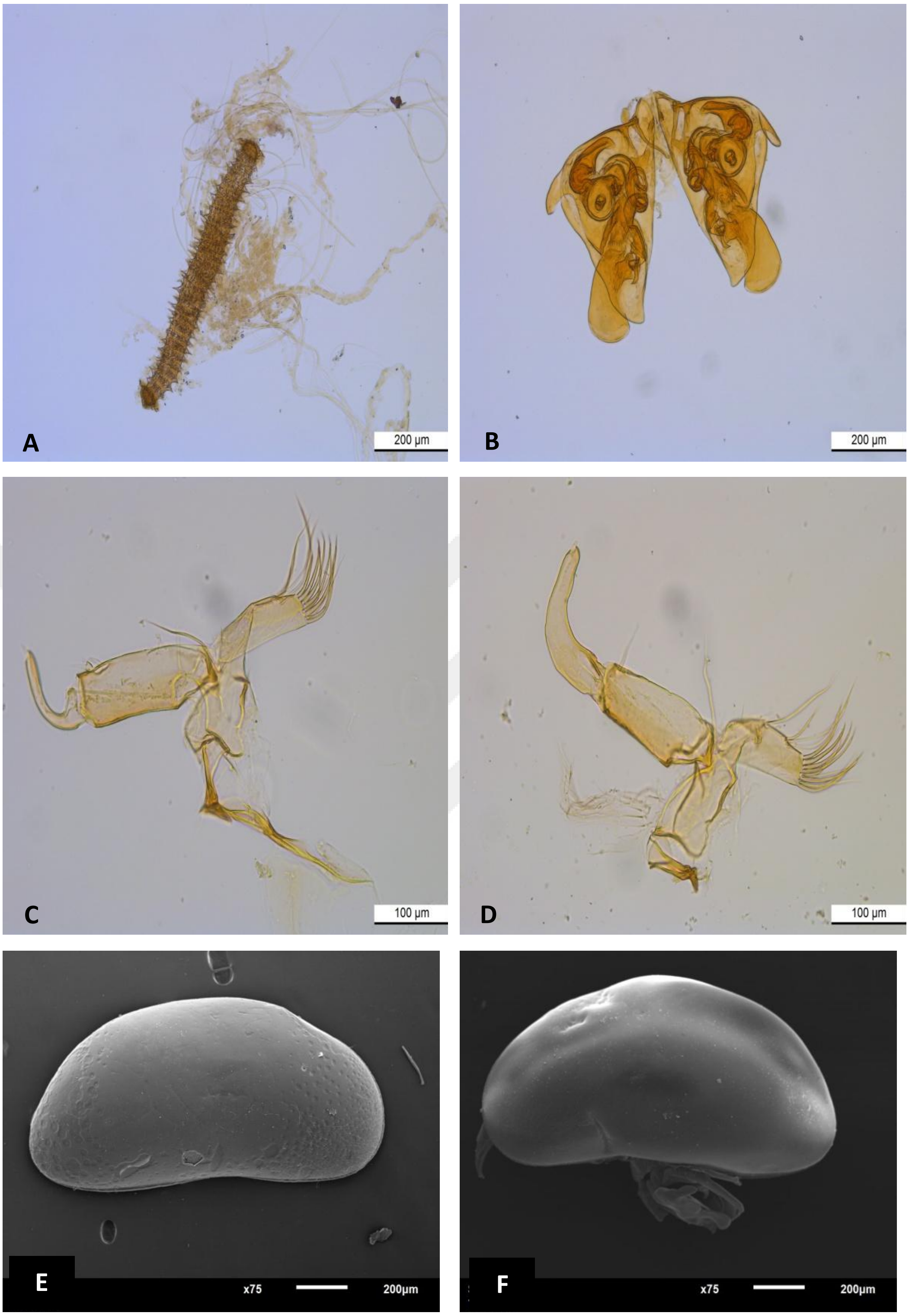

Figure 5.5. The soft bady parts (A-D) and the valves of the male *Psychrodromus* cf. *robertsoni* (E, F). . A, Zenker's organ with whorls; B, hemipenis with strong chitinous two parts; B, left maxilliped with asymmetrical clasping organ; C, right maxilliped with strong clasping organ; E and F, outer view of left and right valves, respectively.

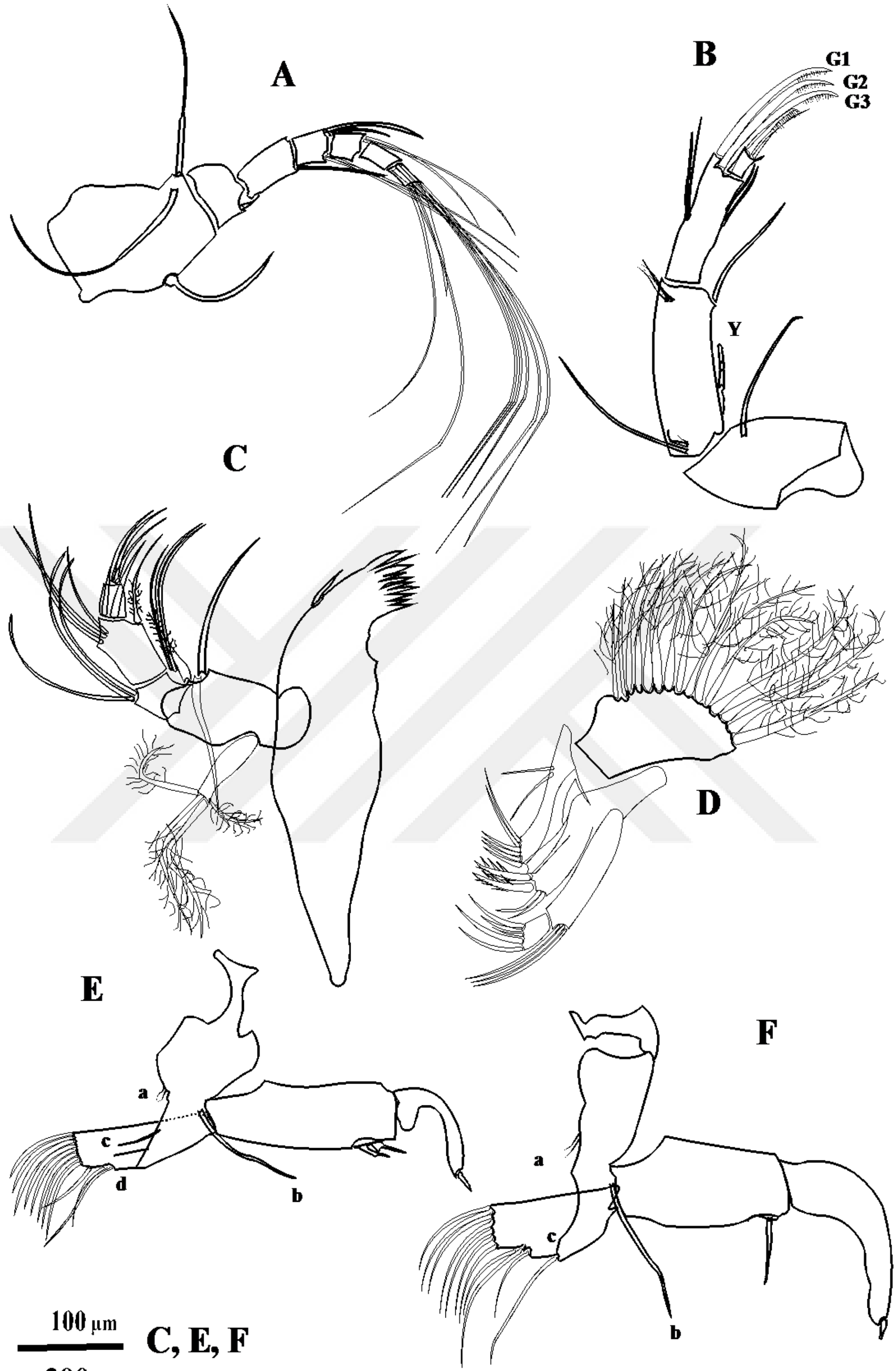

Figure 5.6. *Psychrodromus* cf. *robertsoni* (male, in this study), A (A1), B (A2), C (Md), D (Mx), E (T1, left), F (T1, right).

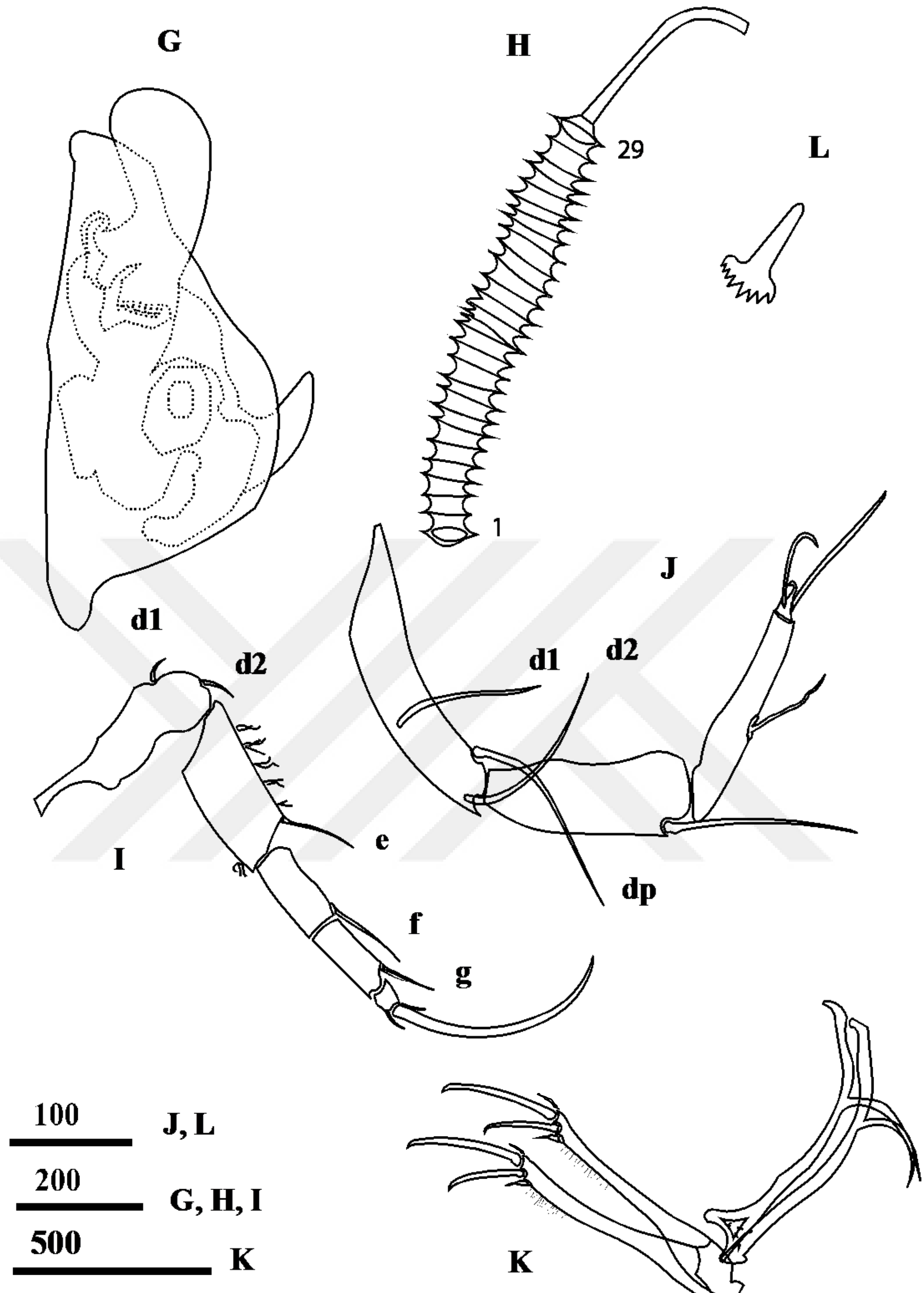

Figure 5.7. *Psychrodromus* cf. *robertsoni* (male, in this study), G (Hp), H (Zk), I (T2), J (T3), K (Fu), L (Rk).

5.2.45 *Stenocypria fischeri* (Lilljeborg, 1883)

The species with relatively limited distribution in the Palaearctic region (Meisch, 2000; Martens et al., 2013) was mostly found from small water bodies and shallow zones of lakes as well (Meisch, 2000; Balcı, 2008; Akdemir, 2009; Rasouli, 2012). Total of 71 individuals of *S. fischeri* was collected along with *C. ophtalmica*, *C. pubera* and *P. arcuata* from a wetland in Muş. Values of some ecological variables of this site were measured as pH 6.84; DO 0.29 mgL^{-1}; EC 489.25 μScm^{-1}; Tw 17.2 °C, ORP -78.5 mV, elevation 1494 m (Appendix A.2)

After about 55 years of its first report by Schäfer (1952), Külköylüoğlu et al. (2010) reported the species from Lake Sünnet (Turkey) for the second time from Turkey. During the present study, males (12 individuals) of the species were encountered from Muş (st 71). Like those of *P.*cf. *robertsoni*, some of the soft body parts and valves of the male are shown Figure 5.4.

Figure 5.8. Soft body parts (A-D) and the valves (E,F) of the male of *Stenocypria fischeri*.. A, Zenker's organ; B, hemipenis; C, left maxilliped with asymmetrical clasping organ; D, right maxilliped with strong clasping organ; E, external view of right valve and anterior margin of RV .

5.2.46 *Stenocypris* major (Baird, 1859) Brady, 1886

This species is a synonym *S. malcomsoni* Baird 1859 (Martens and Savatenalinton, 2011; Karanovic, 2012). It can be found in all regions of the world except Australasian and Antarctic regions (Martens et al., 2013). It is known as eurytropic and nektobenthic species, and prefers shallow and running waters such as lakes, wetland, swamps, freshwater lagoons (Venkataraman, 1999; Meisch et al., 2007; Lisboa, 2011). Total of 36 individuals were gathered with *Cypretta* sp., *Hemicypris* n. sp., *Heterocypris* sp., *I. gibba*, *P. variegata*, *Tonnacypris* sp., and *Trajancypris* sp., from an alkaline water body where ecological values were ranged as pH 9.02, DO 7.57 mgL^{-1}, EC 471.9 μScm^{-1}, Tw 30.8 °C, ORP 48.7 mV, elevation 492 m (Appendix A.1.).

Males of *S. major* have not been known anywhere (Martens, 2001).

5.2.47 *Heterocypris barbara* (Gauthier and Brehm, 1928)

Heterocypris barbara is dispersed in Palaearctic region (Meisch, 2000; Martens et al., 2013). It lives in lakes and small water bodies (Meisch, 2000; Rasouli, 2012). The species was collected with Candona sp., *H. salina*, *I. bradyi* and *Trajancypris* sp., from a water body where some of the ecological values are ranged as pH 8.47, DO 6.93 mgL^{-1}, EC 479.1 μScm^{-1}, Tw 24.8 °C, ORP 91.4 mV, elevation 1598 m in Muş (Appendix A.2).

Although males of the species have already been reported (Meisch, 2000), we did not encounter its males during the study.

5.2.48 *Heterocypris incongruens* (Ramdohr, 1808)

Heterocypris incongruens is one of the most well known cosmopolitan species. The study of Külköylüoğlu (2013) named it as cosmoecious species. It is almost present in all regions of the world (Meisch, 2000; Martens et al., 2013). The species has highest tolerance levels towards ecological variables (Mezquita et al., 2001; Sarı, 2007; Külköylüoğlu, 2009, 2013; Van der Meeren et al., 2010; Külköylüoğlu et al., 2012a; Uçak, 2012; Rasouli et al., 2014; Yavuzatmaca, 2015).

In this study, it was gathered from 35 different stations and eight varied aquatic bodies like creeks, troughs, ponds, streams, springs, pools, rivers, and small water bodies in Mardin and Muş. The lowest and the highest values of some ecological variables are ranged as pH 6.61-9.36, DO 0.68-9.53 mgL^{-1}, EC 100.8-2524 μScm^{-1}, Tw 12.8-32.9 °C, ORP -46.3-107.1 mV, elevation 410-1877 m (Appendices A.1 and A.2).

Whereas males of it were not found in the study, there were records of its males from Spain, North Africa, Turkey, Romania. The species shows geographic parthenogenesis (Meisch, 2000). However, most recently, Yavuzatmaca et al. (2015a) were able to describe details about the soft body parts of the males from Adıyaman.

5.2.49 *Heterocypris rotundata* (Bronshtein, 1928)

A total of 225 individuals of the species were found from 12 different and 5 varied aquatic habitas as lakes, creeks, troughs, ponds, and small temporary water bodies in Mardin and Muş. Ranges of some important ecological variables are as pH 7.8-9.9, DO 3.24-12.70 mgL^{-1}, EC 282.9, 1847.0 μScm^{-1}, Tw 15.8-35.1 °C, ORP 20.3-103.0 mV, elevation 452-1638 m as seen Appendices A.1 and A.2. According to Martens and his colleagues (2013), the species is known from Palaearctic region. It prefers to live in littoral zone of lakes, ricefields, creeks, pools, troughs, streams (Meisch, 2000; Sarı, 2007; Rasouli, 2012).

Up to now, there are no reports of the males (Meisch; 2000).

5.2.50 *Heterocypris salina* (Brady, 1868)

The cosmopolitan species (Martens et al., 2013) spreads its occurrences in the Nearctic, Neotropical and Palaearctic regions. Some previous studies stated that it preferred salty waters such as lakes, ponds, creeks, troughs, streams, wetlands (Meisch, 2000; Akdemir, 2004; Sarı, 2007; Van der Meeren et al., 2010; Uçak, 2012; Rasouli et al., 2014; Yılmaz, 2014; Yavuzatmaca, 2015).

A total of 557 individuals of *H. salina* were collected with 31 ostacods from 31 different locations that consist of five kinds of aquatic condition such as creeks, troughs, stream, springs and little water bodies in Mardin and Muş. These sampling sites showed relatively wide ranges of ecological variables such as pH 6.33-9.95, DO 0.68-10.36 mgL^{-1}, EC 100.8-4419.0 μScm^{-1}, Tw 12.8-26.0 °C, ORP -32.7-105.3 mV, elevation 785-1956 m (Appendices A.1 and A.2).

Heterocypris salina shows fully parthenogenetic reproduction (Meisch, 2000) that is also the case in the present study.

5.2.51 *Hemicypris* cf. *congenera* (Vávra, 1897)

There are not detailed information about ecological preferences of the species. According to Martens et al. (2013), the distribution of the species was limited in Afrotropical region. However, we found 5 individuals of it from a small water body along with *H. rotundata*, *Ilyocypris* sp., *P. arcuata*, *P. zenkeri* and *P. albicans* in Mardin region. This sampling site had values of some ecological variables as pH 7.85, DO 3.24 mgL^{-1}, EC 686.0 μScm^{-1}, Tw 29.2 °C, ORP 58.6 mV, elevation 452 m (Appendix A.1).

5.2.52 *Hemicypris inversa* (Daday, 1913)

Similar to *H. congenera*, this species shows limited distribution in the Afrotropical region (Martens et al., 2013). In the present study, 14 individuals of it was collected with *Ilyocypris* sp., *I. beauchampi*, *Potamocypris* sp. and *P. zenkeri*, from a little water body in Mardin where measured values of environmental variables were reported as pH 8.36, DO 11.9 mgL^{-1}, EC 539.0 μScm^{-1}, Tw 33.9 °C, ORP 50.7 mV, elevation 464 m (Appendix A.1).

The study of Daday (1913) exhibited male individuals of *H. inversa*. but we did not encounter the males, among 14 individuals.

5.2.53 *Hemicypris* n. sp.

Until now, 43 species were identified within the genus of Hemicypris (Karanovic, 2012; Martens et al., 2013). The distribution of this genus covers Neotropical, Palaearctic, Afrotropical and Oriental regions (Martens et al. 2013).

The species were collected with *Cypretta* sp., *Heterocypris* sp., *I. gibba*, *P. variegata, S. major*, *Tonnacypris* sp., and *Trajancypris* sp., from a small water body in Mardin. Values of some ecological variables are such as pH 9.02, DO 7.57 mgL^{-1}, EC 471.9 μScm^{-1}, Tw 30.8 °C, ORP 48.7mV and elevation 492 m.

Valves and soft body parts of the first report of the species are given in the Figure 5.5 and 5.6.

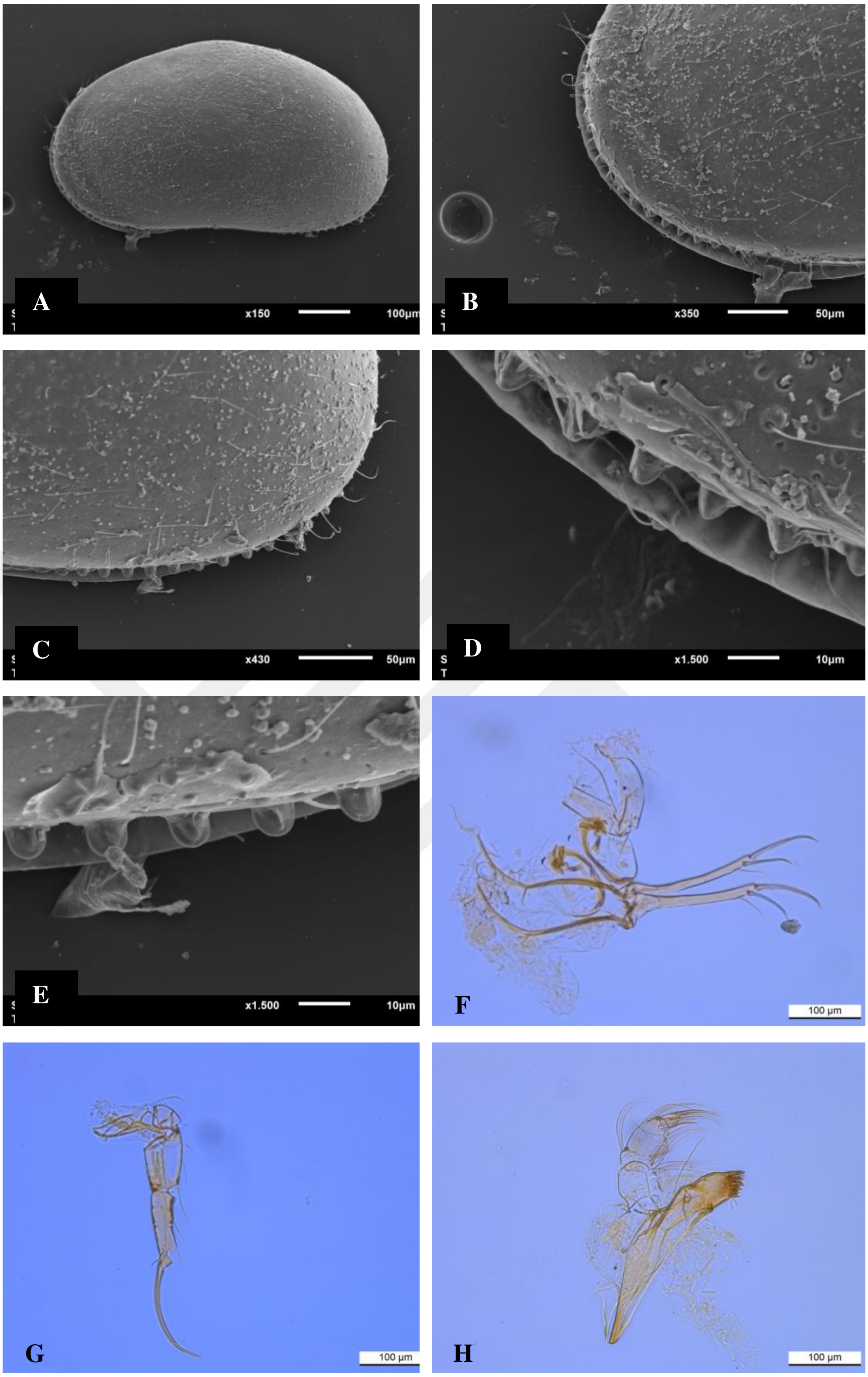

Figure 5.9. Valves (A-E) and soft body (F-G) parts fo *Hemicypris* n. sp. A; Out side view of left valve, B and D; Anterior part of left valve with denticles, C; Posterior part of left valve with denticles, F; Uropod with uropodal attachment, G; second thoracopod (walking leg T2), H; Mandibula with mandibular palp.

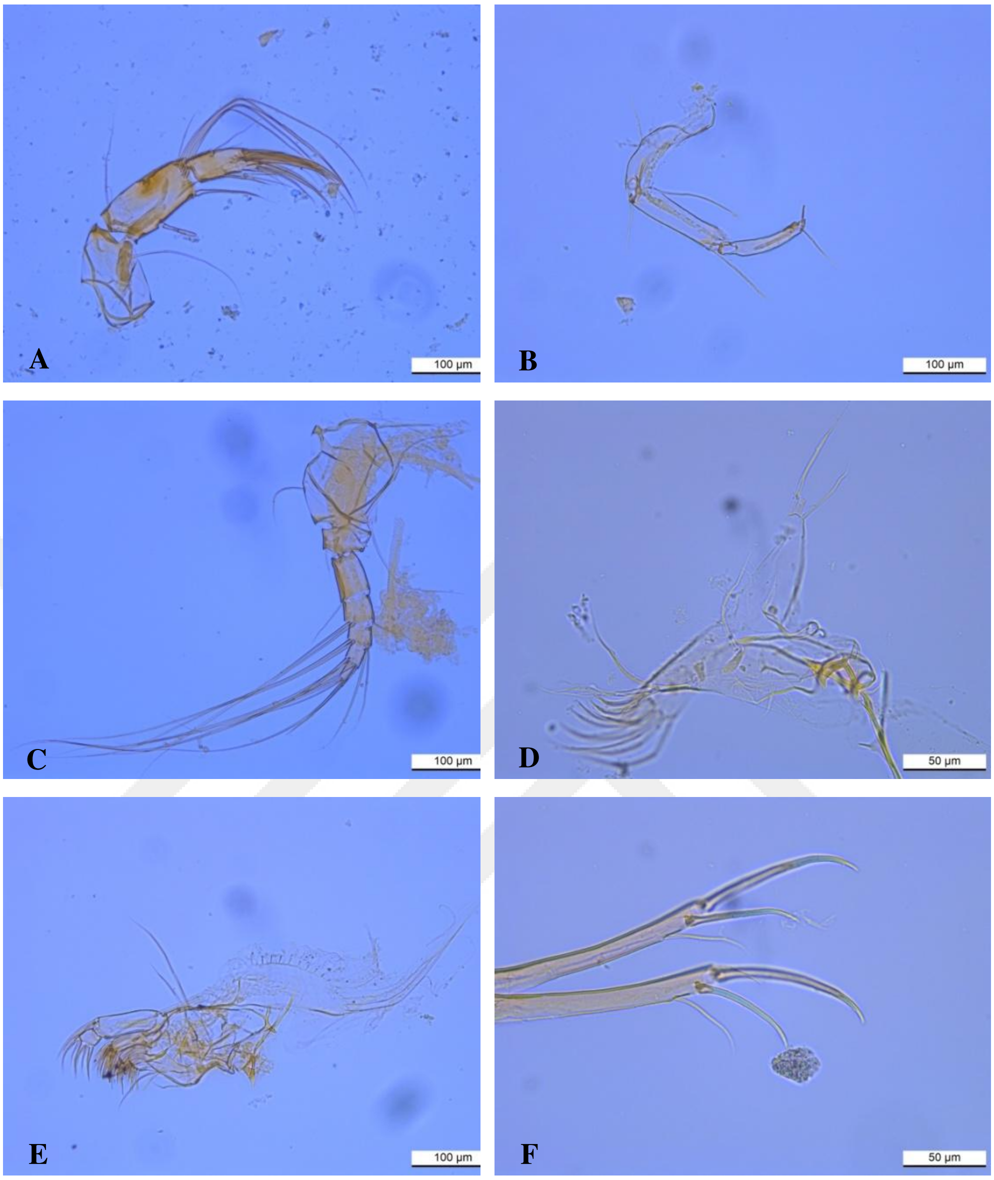

Figure 5.6. Additional soft body parts of *Hemicypris* n. sp.. A; Antenna with long notatory setaes, B; Third thoracopod (cleaning leg, T3), C; Antennula with long and less numbers setaes, D; First thoracopod (maxilliped of female), E; Maxillula (vibratory plate, masticatory lobes, palp), F; Anrerior and posterior claws and setae of Furca.

5.2.54 *Limnocythere inopinata* (Braid, 1843)

The species along with 22 other species of Ostaracoda were collected from 13 several sampling sites such as lakes, creeks, streams, dam, wetland and water body, in Mardin and Muş. Minimum and maximum levels of some ecological variables are measured as pH 7.90-9.95, DO 4.75-9.82 mgL^{-1}, EC 104.2-1237 μScm^{-1}, Tw 15.5-28.5 °C, ORP 46.8-100.5 mV, elevation 573-2163 m (Appendices A.1 and A.2). *Limnocythere inopinata* exhibits large ranges of dispersion in the habitats of Afrotropical, Nearctic and Palaearctic regions (Martens et al., 2013). Like the study, it inhabits a variety of aquatic habitats such as ponds, lakes, rivers, streams, swamps, rice field (Meisch, 2000; Külköylüoğlu, 2005c; Karan-Žnidaršič and Petrov, 2007; Uçak, 2012; Peterson et al., 2013; Yılmaz, 2014; Yavuzatmaca, 2015).

Limnocythere inopinata is known with bisexual populations (Meisch, 2000) but its males were not found among the samples during the study.

5.2.55 *Cyprideis torosa* (Jones, 1850)

According to Martens and his friends (2013), the present species shows a widespread distribution in the world (Afrotropical, Australasian, Nearctic, and Palaearctic region). The species was reported from two sites in a creek and a stream with *Candona* sp., *H. incongruens*, *H. salina*, *I. bradyi*, *Trajancypris* sp., in Muş where measured values of some ecological variables ranged as pH 8.01-8.44, DO 2.46-7.71 mgL^{-1}, EC 392.9-606.0 μScm^{-1}, Tw 22.9-23.4 °C, ORP 71.2-82.3 mV, elevation 1622-1648 m (Appendix A.2). *Cyprideis torosa* prefers salty waters like streams connected to sea and salty lakes (Meisch, 2000).

The species has bisexual populations (Meisch, 2000) where both male and female individuals are present.

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APPENDICES

7. APPENDICES

Appendix A.1. Ecological variables and taxa were found from different aquatic lands in Mardin. Abbreviations: St. no: site number, St. Ty.: site type, DO (dissolved oxygen, mgL-1), % DO (percent saturation), EC (electrical conductivity, µScm-1), Tw (water temperature, ºC), Ta (air temperature, ºC), Atmp. (atmospheric pressure, mmHg), ORP (radox potantial), Moist. (Moisture, %), W. s. (wind speed, kmh-1), Elev. (Elevation, m a.s.l), Ca: Candona angulata, Cn: C. neglecta, Csp: Candona sp., Ctsp: *Cypretta* sp., Cyv: *Cypridopsis vidua*, Cysp: *Cypridopsis* sp., Cpp: Cypris pubera, Ds: *Darwinula stevensoni*, Dsp: *Darwinula* sp., Dof: *Dolerocypris fasciata*, Esp: *Eucypris* sp., Hensp: *Hemicypris* n. sp., Hec: *H.* cf. *congenera*, Hei: *H. inversus*, Hrh: *Herperocypris helenae*, Hi: *Heterocypris incongruens*, Hr: *H. rotundata*, Hs: *H. salina*, Hsp: *Heterocypris* sp., lb: *Ilyocypris bradyi*, ld: *I. decipiens*, lg: *I. gibba*, li: *I. inermis*, lsp: *Ilyocypris* sp. Li: *Limnocythere inopinata*, Lsp: *Limnocythere* sp., lsbe: *Isocypris beauchampi*, Plsp: *Plesiocypridopsis* sp. Poa: *Potamocypris arcuata*, Pov: *P. variegata*, Posp: *Potamocypris* sp., Pcz: *Prionocypris zenkeri*, Pcal: *Pseudocandona albicans*, Pf: *Psychrodromus fontinalis*, Po: *P. olivaceus*, Psp: *Psychrodromus* sp., Sca: *Sarscypridopsis aculeata*, Scsp: *Sarscypridopsis* Sp., Sm: *Stenocypris major*, Ssp: *Stenocypris* sp., Tol: *Tonnacypris luteria*, Tosp: *Tonnacypris* sp., Tc: *Trajancypris clavata*, Tsp: *Trajancypris* sp., Tpsp: *Trapezicandona* sp., Zc: *Zonocypris* cf. *costata*. The subfossil form of taxa are exhibited in parenthesis. Site types; 1: lake, 2: creek, 3: trough, 4: dam (or pool), 5: stream, 6: well, 7: pond water fall, 8: river and 9: spring, 10: irrigation channel, 11: water body, 12: pool.

Appendix A.1. (continued)

St. No	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W.S.	Elev.	Coordinate	Date	Taxa
1	Mardin	11	7.91	5.16	68.10	709.00	30.80	39.60	707.10	45.80	14.20	3.70	588	N 37° 32.610' - E 041° 48.828'	13,08,2013	**Ii; (Esp)**
2	Mardin	8	8.18	7.57	88.40	386.30	23.50	40.60	717.40	52.60	15.20	10.70	410	N 37° 31.267' - E 041° 50.271'	13,08,2013	**Hi; Pcal**
3	Mardin	3	7.40	7.32	77.10	488.00	18.20	36.30	675.10	53.30	15.40	19.80	926	N 37° 34.147' - E 041° 43.271'	13,08,2013	**(Esp; Isp)**
4	Mardin	12	7.55	9.17	96.80	401.80	18.10	38.90	671.00	60.80	12.30	4.20	932	N 37° 35.621' - E 041° 43.084'	13,08,2013	**Zc; (Isp)**
5	Mardin	9	7.90	6.34	78.10	785.00	26.20	38.90	690.60	66.10	13.80	3.60	753	N 37° 36.739' - E 041° 47.025'	13,08,2013	**Li; (Psp)**
6	Mardin	3	7.62	7.72	82.00	435.10	18.90	38.80	674.80	60.30	13.70	5.70	942	N 37° 36.616' - E 041° 44.348'	13,08,2013	**Ca; Cn; Hi; Hs; Ib; Pf**
7	Mardin	2	8.34	7.26	81.60	452.50	21.30	39.80	705.50	68.80	15.40	1.70	573	N 37° 38.754' - E 041° 46.102'	13,08,2013	**Hi; Ib; Li; Pov; (Isp)**
8	Mardin	9	7.52	1.12	12.00	319.50	19.00	33.60	687.30	50.90	18.20	0.00	792	N 37° 28.391' - E 041° 50.032'	13,08,2013	
9	Mardin	3	7.87	4.51	47.80	382.20	18.40	24.40	680.10	69.80	27.90	6.70	888	N 37° 22.225' - E 041° 26.758'	14,08,2013	**Hi; Hr; (Esp)**
10	Mardin	3	7.80	9.53	108.80	473.10	22.20	38.30	708.10	71.30	12.80	4.60	557	N 37° 07.210' - E 041° 14.263'	14,08,2013	**Ds; Hrh; Hi; Hr; Ib; (Cysp)**
11	Mardin	10	8.14	10.39	115.50	480.10	20.10	45.70	710.10	73.60	20.80	2.30	494	N 37° 06.380' - E 041° 14.109'	14,08,2013	**(Hsp; Isp; Pcz)**
12	Mardin	5	7.62	8.20	87.90	439.90	18.60	39.70	700.60	72.70	19.80	1.80	607	N 37° 13.493' - E 041° 20.007'	14,08,2013	**Ds; Ii; (Pcal; Psp; Zc)**
13	Mardin	5	8.04	7.94	87.00	478.10	20.00	41.60	703.20	35.70	24.80	0.00	580	N 37° 10.908' - E 041° 16.553'	14,08,2013	**(Isp)**
14	Mardin	2	8.08	5.34	68.10	555.00	28.00	41.70	711.70	-13.70	14.30	0.00	472	N 37° 05.392' - E 041° 12.935'	14,08,2013	**(Hsp; Isp; Pcal)**
15	Mardin	10	8.45	10.37	139.20	503.00	28.90	42.30	709.50	47.00	11.90	14.20	491	N 37° 07.012' - E 041° 25.940'	14,08,2013	**(Pcz)**

Appendix A.1. (continued)

St. No	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W. S.	Elev.	Coordinate	Date	Taxa
16	Mardin	11	9.02	7.57	100.10	471.90	30.80	41.90	709.60	48.70	14.80	4.70	492	N 37° 06.245' - E 041° 06.947'	14,08,2013	**Hensp; Ig; Pov; Sm; (Ctsp; Hsp; Tosp; Tsp)**
17	Mardin	11	8.38	5.77	77.40	688.00	30.20	40.70	703.70	52.80	13.20	7.80	561	N 37° 09.902' - E 041° 04.429'	14,08,2013	**(Isp; Ssp)**
18	Mardin	9	7.28	6.24	66.00	585.00	19.00	38.90	689.80	59.00	17.30	3.20	730	N 37° 13.984' - E 041° 03.444'	14,08,2013	**Pcz; Po; (Isp; Pcal)**
19	Mardin	12	7.61	6.74	74.10	529.00	19.80	25.70	688.00	54.40	25.60	4.80	779	N 37° 17.650' - E 040° 51.854'	15,08,2013	**Hi**
20	Mardin	2	7.50	3.05	32.60	642.00	18.70	24.70	689.20	71.60	40.70	2.40	771	N 37° 17.712' - E 040° 51 931'	15,08,2013	**Pcz; (Isp; Pcal; Psp; Zc)**
21	Mardin	12	7.66	6.70	69.30	527.00	17.50	32.80	682.70	83.70	18.50	4.00	885	N 37° 18.362' - E 040° 52.861'	15,08,2013	
22	Mardin	10	7.56	7.51	78.50	353.20	17.50	30.90	675.30	79.10	21.20	1.40	954	N 37° 19.963' - E 040° 51.151'	15,08,2013	**Po; Zc; (Isp)**
23	Mardin	9	9.43	9.98	115.10	651.00	22.80	36.30	670.10	52.10	17.30	10.90	1017	N 37° 20.232' - E 040° 55.990'	15,08,2013	**(Hsp; Isp)**
24	Mardin	12	7.61	11.72	126.40	501.00	19.50	34.50	680.80	69.50	15.40	6.30	892	N 37° 18.054' - 040 56.166'	15,08,2013	**Ii; Pcz**
25	Mardin	11	7.87	1.98	27.20	996.00	32.20	39.00	708.10	51.20	15.80	12.20	542	N 37° 09.800' - E 040° 52.637'	15,08,2013	
26	Mardin	2	8.15	6.76	74.30	617.00	19.80	37.00	693.40	55.10	20.50	2.40	723	N 37° 14.222' - E 040° 59.353'	15,08,2013	**Ds; (Isp; Pcal; Psp)**
27	Mardin	11	8.25	7.97	101.60	847.00	31.50	39.30	709.00	62.70	16.80	13.40	520	N 37° 08.966' - E 040° 49.254'	15,08,2013	**(Hsp; Isp; Pcz)**
28	Mardin	1	9.43	9.58	126.40	324.40	30.10	39.50	711.10	44.30	15.60	4.30	486	N 37° 13.537' - E 040° 36.538'	15,08,2013	**Ig; Poa; (Cysp; Pcz)**
29	Mardin	11	7.85	3.24	41.90	686.00	29.20	41.70	714.00	58.60	22.10	8.20	452	N 37° 04.690' - E 040° 21.169'	15,08,2013	**Hec; Hr; Poa; Pcz; Pcal; (Isp)**
30	Mardin	1	9.90	12.70	182.10	705.00	35.10	41.30	713.10	39.50	17.20	5.10	461	N 37° 02.597' - E 040° 13.413'	15,08,2013	**Hr; Poa; (pcz)**

Appendix A.1. (continued)

St. No	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W. S.	Elev.	Coordinate	Date	Taxa
31	Mardin	11	8.36	11.90	166.10	539.00	33.90	39.20	713.00	50.70	17.50	7.80	464	N 37° 10.681' - E 040° 09.037'	15,08,2013	**Hei; Isbe; (Isp; Posp; Pcz)**
32	Mardin	11	8.78	6.65	91.30	650.00	32.90	39.80	708.90	31.10	15.90	4.70	506	N 37° 15.623' - E 040° 07.726'	15,08,2013	**Dof; Hi; (Csp; Isp; Posp; Pcz; Ssp)**
33	Mardin	1	9.37	8.17	99.70	257.90	26.00	38.10	704.20	-8.20	16.60	8.30	564	N 37° 18.771' - E 040° 04.212'	15,08,2013	**(Lsp)**
34	Mardin	7	8.60	5.38	68.30	538.00	27.60	38.20	703.30	38.60	13.20	10.80	572	N 37° 18.975' - E 040° 04.824'	15,08,2013	**Hi; Poa**
35	Mardin	7	8.99	7.94	98.20	294.40	27.80	37.80	701.20	46.40	13.50	7.30	599	N 37° 21.372' - E 040° 08.593'	15,08,2013	
36	Mardin	9	7.23	6.48	69.10	519.00	18.70	35.30	691.50	66.00	14.10	5.10	725	N 37° 23.163' - E 040° 12.220'	15,08,2013	**(Isp)**
37	Mardin	11	7.37	8.07	85.30	607.00	17.90	30.60	695.20	76.00	42.70	0.00	690	N 37° 26.301' - E 040° 08.976'	15,08,2013	
38	Mardin	2	7.85	6.63	71.60	635.00	19.10	28.30	697.10	68.50	19.40	5.10	628	N 37° 20.651' - E 040° 13.957'	16,08,2013	**(Hsp; Pcal)**
39	Mardin	11	7.62	0.46	4.50	605.00	15.90	29.40	696.60	64.50	23.30	9.10	671	N 37° 24.302' - E 040° 09.115'	16,08,2013	
40	Mardin	1	9.03	7.96	93.70	229.80	22.90	29.10	695.70	58.10	21.10	6.70	679	N 37° 25.118' - E 040° 08.664'	16,08,2013	**Li; Sca; (Isp; Pcal)**
41	Mardin	7	8.23	3.79	44.30	353.80	23.30	29.30	681.20	73.40	20.60	4.50	873	N 37° 30.512' - E 040° 04.634'	16,08,2013	**(Csp; Isp; Posp)**
42	Mardin	7	7.93	2.65	30.90	927.00	22.70	30.60	679.90	87.70	21.50	7.10	887	N 37° 30.732' - E 040° 07.775'	16,08,2013	**Tc; (Hsp; Isp)**
43	Mardin	7	8.41	6.34	66.00	1180.00	17.10	30.40	667.90	85.00	20.70	4.50	1038	N 37° 29.238' - E 040° 10.027'	16,08,2013	**Ig; Poa; Tc**
44	Mardin	7	8.08	3.68	41.70	1272.00		30.60	670.40	85.20	22.30	11.40	1005	N 37° 28.998' - E 040° 10.277'	16,08,2013	**Tc**
45	Mardin	7	8.72	9.30	110.80	497.00	24.50	34.10	673.80	35.50	18.20	5.80	967	N 37° 29.530' - E 040° 16.626'	16,08,2013	**Ig; (Cpp; Esp; Hsp; Plsp; PospTosp; Tc)**

Appendix A.1. (continued)

St. No	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W.S.	Elev.	Coordinate	Date	Taxa
46	Mardin	7	8.24	3.07	37.60	798.00	25.40	33.40	673.70	49.10	21.80	6.20	965	N 37° 29.545' - E 040° 16.643'	16,08,2013	**Ig; Poa; Tc; (Cpp; Esp; Plsp)**
47	Mardin	7	8.73	2.33	28.00	825.00	24.90	36.10	674.20	51.10	16.80	1.90	959	N 37° 30.318' - E 040° 17.275'	16,08,2013	**Poa; (Hsp; Isp; Tc)**
48	Mardin	7	8.38	4.76	59.30	1847.00	26.90	36.80	674.70	60.80	17.20	4.10	953	N 37° 30.533' - E 040° 17 451'	16,08,2013	**Hr; Poa; (Tc)**
49	Mardin	7	9.39	5.96	74.80	326.80	27.30	35.80	678.50	54.30	16.90	2.40	907	N 37° 29.740' - E 040° 20.006'	16,08,2013	**Hr; (Hsp;Isp; Posp)**
50	Mardin	11	8.00	5.33	58.00	433.40	20.00	37.20	676.80	72.20	18.10	2.40	931	N 37° 26.352' - E 040° 25.045'	16,08,2013	**Hr; Tc; (Posp)**
51	Mardin	7	8.45	4.17	52.30	676.00	26.60	36.30	675.60	73.60	12.20	11.20	945	N 37° 26.098' - E 040° 25.370'	16,08,2013	**Ig; Poa; (Tc)**
52	Mardin	7	8.37	3.46	46.70	815.00	29.40	36.70	678.10	62.60	12.60	12.30	920	N 37° 27.581' - E 040° 23.107'	16,08,2013	**Poa; (Tc)**
53	Mardin	7	10.10	15.40	201.00	287.70	28.40	37.40	677.50	45.90	10.60	3.20	918	N 37° 27.208' - E 040° 22.865'	16,08,2013	
54	Mardin	7	8.10	3.85	47.30	473.20	26.00	38.00	669.30	74.10	11.00	9.50	1022	N 37° 25.900' - E 040° 20 431'	16,08,2013	**(Isp; Posp; Tc)**
55	Mardin	7	7.82	1.57	19.80	947.00	26.80	40.10	669.50	81.90	11.10	6.40	1022	N 37° 25.896' - E 040° 20.486'	16,08,2013	**Tc; (Isp; Posp)**
56	Mardin	9	7.38	6.74	68.90	523.00	16.00	35.50	673.20	60.30	15.10	2.40	976	N 37° 28.984' - E 040° 31.412'	16,08,2013	**Ii; Po**
57	Mardin	2	7.78	5.42	59.80	604.00	20.20	37.00	689.00	33.30	22.80	0.00	761	N 37° 35.014' - E 040° 27.777'	16,08,2013	**(Dsp; Isp; Pcz; Pcal; Psp; Scsp; Zc)**
58	Mardin	11	7.47	10.17	118.70	858.00	23.00	36.30	677.10	70.60	18.50	3.20	908	N 37° 30.081' - E 040° 38.852'	16,08,2013	**(Cpp; Posp; Pcal)**
59	Mardin	2	8.24	8.53	98.40	737.00	23.80	37.80	683.20	77.70	16.50	1.70	834	N 37° 31.788' - E 040° 42.862'	16,08,2013	**Cyv; Hs; Ib; Li; Pov; Pcz; (Pcal; Tpsp)**
60	Mardin	2	7.44	5.54	58.30	684.00	17.80	36.30	686.00	82.10	28.60	2.70	801	N 37° 34.265' - E 040° 43.357'	16,08,2013	**(Csp; Isp; Pcz; Pcal; Psp)**

Appendix A.1. (continued)

St. No	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W. S.	Elev.	Coordinate	Date	Taxa
61	Mardin	2	7.78	8.53	94.90	699.00	21.40	36.70		90.80	27.60	3.80	785	N 37° 35.144' - E 040° 43.622'	16,08,2013	**Hs; Ib; Id; Pcz; Zc; (Csp; Cysp; Hsp; Pcal; Psp)**
62	Mardin	2	7.57	4.65	49.90	664.00	18.60	37.80	681.30	83.10	15.60	4.30	885	N 37° 31.257' - E 040° 50.924'	16,08,2013	**(Cysp; Isp)**
63	Mardin	12	8.29	18.80	205.10	484.70	20.20	37.80	673.90	87.20	18.10	5.70	941	N 37° 26.434' - E 040° 51.319'	16,08,2013	**Pcz; Zc; (Csp; Isp)**
64	Mardin	2	7.74	5.76	61.90	704.00	19.00	35.60	676.10	88.80	27.90	0.00	924	N 37° 27.459' - E 040° 51.863'	16,08,2013	**Ib; (Csp; Pcz; Pcal)**
65	Mardin	5	7.94	6.24	71.70	848.00	22.00	33.30	690.20	91.20	23.20	2.40	757	N 37° 36.833' - E 040° 52.998'	16,08,2013	**Ii; (Csp; Pcz; Pcal)**
		Min.	7.23	0.46	4.50	229.80	15.90	24.40	667.90	-13.70	10.60	0.00	410			
		Max.	10.10	18.80	205.10	1847.00	35.10	45.70	717.40	91.20	42.70	19.80	1038			

Appendix A.2. Ecological variables and taxa were found from different aquatic lands in Muş. Abbreviations: Cc: *C. candida*, Cl: *C. lindneri*, Cm: *C. muelleri*, Cs: *C. sanociensis*, Cw: *C. weltneri*, Cavsp: *Cavernocypris* sp., Cov: *Cyclocypris ovum*, Crop: *Cypria ophtalmica*, Crsp: *Cypria* sp., Ct: *Cyprideis torosa*, Dos: *Dolerocypris sinensis*, Dosp: *Dolerocypris* sp., Ev: *Eucypris virens*, Fbr: *Fabeaformiscandona breuili*, Fsp: *Fabeaformiscandona* sp., Hrb: *Herpetocypris brevicaudata*, Hri: *H. İntermedia*, Hrsp: *Herpetocypris* sp., Hb: *Heterocypris barbara*, Im: *Ilyocypris monstrifica*, Pof: *Potamocypris fallax*, Posi: *P. similis*, Posm: *P. smaragdina*, Pou: *P. unicaudata*, Povi: *P. villosa*, Poz: *P. zschokkei*, Pcsp: *Pseudocandona* sp., Pr: *Psychrodromus* cf. *robertsoni*, Sf: *Stenocypria fischeri*, Ts: *Trajancypris serrata*, Vb: *Vestalenula boteai*

St. No.	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W.s.	Elev.	Coordinate	Date	Taxa
1	Muş	5	7.58	2.57	25.7	255.4	16.6	20.6	651.8	84.6	33.4	2.5	1266	N 38 37.961 - E 041 55.169	17,08,2013	**Ig (Posp, Pcsp)**
2	Muş	5	8.37	6.36	71.4	281.9	21.1	23.3	651.8	94.4	22.8	4.1	1272	N 38 38.005 - E 041 51.078	17,08,2013	**Hi, Ib**
3	Muş	2	8.04	6.11	59	325.4	14.4	24.8	652	107.1	31.9	0	1287	N 38 38.659 - E 041 46.744	17,08,2013	**Hi, Ii (Csp)**
4	Muş	5	8.09	6.97	75.1	284.3	19.1	24.6	652.7	105.3	27.4	1.7	1267	N 38 40.482 - E 041 44.932	17,08,2013	**(Isp)**
5	Muş	2	8.68	7.93	88	290.1	20.3	26.7	646	98.5	22.8	6.8	1353	N 38 39.580 - E 041 39.844	17,08,2013	**Hi, Hs, Ib (Csp)**
6	Muş	2	7.86	4.07	44.7	362.4	20.5	29.1	652.7	103.3	23.2	2.6	1273	N 38 42.430 - E 041 42.894	17,08,2013	**(Csp)**
7	Muş	2	8.74	9.29	104.1	435.2	19.5	37.2	649.2	101.3	23.2	4.5	1312	N 38 44.620 - E 041 46.401	17,08,2013	**Ib (Cavsp, Esp)**
8	Muş	2	8.1	8.29	94.2	529	22.1	31.2	639.7	105.3	18.1	1.9	1433	N 38 47.493 - E 041 46.906	17,08,2013	**Hi, Hs, Ib, Pcal**
9	Muş	4	8.6	5.59	72.2	552	28.5	28.2	648.7	95	24.7	6	1311	N 38 47.571 - E 041 43.384	17,08,2013	**Li**
10	Muş	4	8.54	5.7	67.5	458.2	23.7	32.9	647.2	66.9	17.1	3.2	1340	N 38 44.344 - E 041 47.879	17,08,2013	**Id**

Appendix A.2. (continued)

St. No.	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W.s.	Elev.	Coordinate	Date	Taxa
11	Muş	5	8.45	7.15	77	502	19.8	33.6	648.7	78.6	15.5	2.1	1319	N 38 43.189 - E 041 51.366	17,08,2013	**Hi (Isp)**
12	Muş	5	7.95	3.91	48.1	670	26.4	34.7	650.5	89	12.8	2.9	1287	N 38 40.828 - E 041 51.917	17,08,2013	
13	Muş	2	9.4	6.66	88.3	700	30.4	35.1	648.4	77.1	16.2	6.8	1316	N 38 41.539 - E 041 56.124	17,08,2013	
14	Muş	2	8.21	6.85	85.8	473.6	27	33.8	631.8	74.7	13.6	6.7	1540	N 38 42.989 - E 041 58.076	17,08,2013	**Hi, Ib, Ii, Pcal**
15	Muş	15	7.89	6.85	69.2	361.6	16.2	31.5	609.5	83.9	14.3	10.8	1850	N 38 44.919 - E 041 59.856	17,08,2013	**Cn, Ib**
16	Muş	9	7.78	7.98	71.1	337.2	12.4	31.8	624	90.5	15.4	6.7	1663	N 38 46.389 - E 041 59.691	17,08,2013	**Cn, Ib, Poz (Esp)**
17	Muş	5	8.73	6.52	80.2	485.5	26	33.7	636.2	88.4	14.5	11	1482	N 38 47.703 - E 041 59.082	17,08,2013	**Hs, Ib, Li, Pof, Posi, Pcal (Posp)**
18	Muş	9	8.14	11.67	136.1	408.2	23.3	34.1	628.2	94.6	13.2	5.9	1584	N 38 48.483 - E 042 00.038	17,08,2013	**Ib**
19	Muş	2	8.62	6.92	80.4	343.6	22.6	32.8	621.3	90.7	15.3	3.5	1669	N 38 47.561 - E 042 03.182	17,08,2013	**Cn, Hi, Id, Ii, Pof, Pov (Pcsp)**
20	Muş	2	8.09	6.64	78.9	746	24	33.4	633.1	63.8	15.3	14.7	1526	N 38 49.489 - E 041 56.582	17,08,2013	**Hi, Hs, Ib (Posp)**
21	Muş	2	7.77	6.17	71.5	705	23.2	31	627	70.2	15.4	13.2	1595	N 38 51.972 - E 041 55.531	17,08,2013	**Hi, Hs, Ib, (Posp)**
22	Muş	5	8.01	2.46	28.8	392.9	23.4	32.6	624.6	71.2	16.4	2.5	1622	N 38 55.058 - E 041 58.473	17,08,2013	**Ct, Hi, Ib (Csp)**
23	Muş	9	7.6	1.58	15.1	413.9	14.2	33.7	634.4	82.5	13.3	2.4	1485	N 38 58.309 - E 041 58.147	17,08,2013	**Ib, Pof (Csp)**
24	Muş	9	7.39	6.65	66.5	513	15.6	33.9	636.2	90.9	13.8	3.5	1463	N 38 58.703 - E 041 57.254	17,08,2013	**(Isp)**
25	Muş	4	8.7	5.17	60.7	426.9	23.6	33.1	637.6	87	15.4	15.2	1445	N 38 59.278 - E 041 55.906	17,08,2013	

Appendix A.2. (continued)

St. No.	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W.s.	Elev.	Coordinate	Date	Taxa
26	Muş	2	7.26	1.65	16.8	421.1	18.8	32.5	635.8	41.8	16.5	14.1	1468	N 39 00.149 - E 041 51.248	17,08,2013	**Ib (Csp)**
27	Muş	8	7.38	4.79	43.3	426.7	11.2	32.5	643.2	45.8	14.8	3.2	1371	N 39 02.975 - E 041 48.363	17,08,2013	
28	Muş	5	7.8	4.17	47.3	164.7	21.9	30.3	632.3	68.7	16.9	17.4	1515	N 39 04.022 - E 041 49.359	17,08,2013	**Ib**
29	Muş	2	8.44	4.38	50.4	944	22.4	30.6	630.3	85.1	18.5	1.8	1554	N 39 07.038 - E 041 55.062	17,08,2013	**Cn, Cyv, Hi, Hs, Ib, Id, Pof, Pov, Pcal**
30	Muş	9	8.01	8.43	79.9	121.1	13.1	28.9	624.4	78.7	20.6	6.1	1629	N 39 07.854 - E 041 57.119	17,08,2013	**Hi, Ii, Pof (Csp)**
31	Muş	3	8.07	6.34	65	178	16.9	27.8	621.4	86	21.5	7.4	1668	N 39 07.597 - E 042 01.148	17,08,2013	**Hi (Csp, Isp)**
32	Muş	11	8.4	4.79	55.1	276.9	21.8	28.6	628.4	91.7	20.1	7.5	1614	N 39 08.758 - E 042 03.867	17,08,2013	**Cn, Hi, Ib**
33	Muş	5	7.7	1.03	10.3	690	15.6	18.5	637.7	69.1	36.1	0	1463	N 39 07.227 - E 042 10.544	18,08,2013	**Cn, Fbr, Ts (Crsp, Isp)**
34	Muş	9	7.44	5.47	50.2	495.8	11.4	20.4	628.7	82.7	30.5	6.8	1579	N 39 03.365 - E 042 06.039	18,08,2013	**Cn, Ii, Pof, Pr**
35	Muş	4	8.77	6.21	71.8	412.7	22.6	21.7	638.5	75.3	31.8	1.8	1462	N 39 01.423 - E 042 03.626	18,08,2013	**(Tsp)**
36	Muş	3	7.92	3.98	40.1	144.2	15.9	20.8	635.2	73.8	41.1	1.6	1494	N 38 57.947 - E 042 05.125	18,08,2013	
37	Muş	2	7.86	6.05	62	257.6	16.7	22.2	636.9	87.4	38.7	1.5	1473	N 38 56.135 - E 042 04.919	18,08,2013	**Cs, Hi, Hs, Pov (Cysp, Isp)**
38	Muş	2	7.7	5.29	54.2	181.2	16.4	22.4	633.8	93.3	30.3	9.8	1510	N 38 55.722 - E 042 06.352	18,08,2013	**Cn, Cyv (Dosp, Posp)**
39	Muş	9	7.62	4.18	39.3	100.8	12.8	23	608.8	85	38.7	6.4	1854	N 38 54.083 - E 042 13.087	18,08,2013	**Cyv, Hi, Hs, Ib**
40	Muş	2	7.62	4.8	50.1	161.9	18.1	26.7	614.1	90	35.4	13.2	1778	N 38 55.605 - E 042 15.000	18,08,2013	**Cs (Esp)**

Appendix A.2. (continued)

St. No.	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W.s.	Elev.	Coordinate	Date	Taxa
41	Muş	1	9.01	7.31	87.2	205.1	23.9	33.1	627.7	88.7	28.3	2.6	1598	N 39 00.105 - E 042 17.271	18,08,2013	**Li (Esp)**
42	Muş	11	7.81	7.27	82.4	450.4	22.4	31.1	627.5	96.7	27.3	4.6	1600	N 38 59.653 - E 042 18.973	18,08,2013	**(Csp, Cysp, Esp)**
43	Muş	2	8.44	7.71	89.1	606	22.9	29	623.1	82.3	20.3	8.4	1648	N 39 02.239 - E 042 29.851	18,08,2013	**Ct, Hi, Hs (Csp, Isp, Tsp)**
44	Muş	2	8.52	5.47	61.9	445.1	21.6	29.6	606.1	81.2	17.1	11.3	1877	N 39 01.161 - E 042 39.045	18,08,2013	**Ev, Hi, Hs, Ib, Pof (Csp)**
45	Muş	2	8.39	6.81	74.2	485.1	19.5	28.6	601.9	84.1	17.8	21.2	1956	N 38 59.315 - E 042 35.309	18,08,2013	**Hs, Ib, Pov (Pcsp)**
46	Muş	2	8.38	6.41	69.4	516	19.4	28.7	599.4	86.9	21.2	23.5	1991	N 38 57.922 - E 042 33.370	18,08,2013	**Ib (Hsp, Posp)**
47	Muş	11	8.47	6.93	83.1	479.1	24.8	31.9	627.3	91.4	15.8	29.3	1598	N 39 08.060 - E 042 32.656	18,08,2013	**Hb, Hs, Ib (Csp, Tsp)**
48	Muş	8	7.54	7.38	87.8	967	23.7	33.7	634.1	69.7	22.4	12.1	1534	N 39 09.327 - E 042 30.611	18,08,2013	**(Hsp, Isp, Pcsp)**
49	Muş	5	8.29	10.36	124.6	718	24.5	34.3	633.1	81.7	22.5	6.2	1509	N 39 12.525 - E 042 35.973	18,08,2013	**Hs, Pcal (Isp, Tsp)**
50	Muş	11	8.26	5.31	69.3	943	29.1	35.2	633.1	80.2	14.4	22.4	1493	N 39 15.161 - E 042 32.591	18,08,2013	**Cm, Cpp (Dosp, Esp, Isp)**
51	Muş	12	6.61	0.68	8.3	403.1	25.3	34.3	631.7	-32.7	15.8	19.8	1507	N 39 16.393 - E 042 32.489	18,08,2013	**Cs, Hri, Hi, Hs**
52	Muş	9	7.83	4.31	44.1	544	17	33.2	626.6	51.3	15.5	34.5	1576	N 39 13.793 - E 042 27.899	18,08,2013	**Ib**
53	Muş	2	8.33	6.53	78.2	372.5	24	33.4	629.5	58.1	11.4	24.1	1539	N 39 16.300 - E 042 29.832	18,08,2013	**Cn, Cs, Hs, Ib, Pf**
54	Muş	3	7.93	6.78	69.7	414.9	17.2	33.5	626.9	73.8	11.7	10.1	1575	N 39 20.599 - E 042 29.995	18,08,2013	**Hi (Isp)**
55	Muş	9	7.53	6.17	59.3	511	13.9	34.8	621	83.2	14.9	11.3	1656	N 39 23.552 - E 042 29.023	18,08,2013	**Cn, Ds, Hs, Ib, Pof, Pf**

Appendix A.2. (continued)

St. No.	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W.s.	Elev.	Coordinate	Date	Taxa
56	Muş	1	9.33	7.74	96	304.7	26.2	31.7	622.5	63.4	19.8	13.4	1638	N 39 23.491 - E 042 28.857	18,08,2013	**Hr, Id, Li (Psp)**
57	Muş	2	8.27	7.16	86.5	854	24.7	32.8	622.3	80.8	12.6	10.2	1638	N 39 24.555 - E 042 27.887	18,08,2013	**Cs, Hs, Ib, Pcal, Po**
58	Muş	5	8.15	5.37	59.4	409.5	20.9	32.9	610.5	75.6	14.8	4.3	1800	N 39 26.522 - E 042 23.406	18,08,2013	**Ib, Pf (Csp)**
59	Muş	2	8.11	5.8	63.7	400.9	19.9	30.8	614.7	79.1	14.7	18.4	1737	N 39 26.478 - E 042 20.859	18,08,2013	**Ii, Pof (Csp, Esp, Hrsp, Pcsp)**
60	Muş	5	8.26	6.06	70.6	1081	22.8	31.5	627.5	86.2	14.8	9.6	1560	N 39 24.399 - E 042 18.563	18,08,2013	**Hi, Hs, Ii, Pcal (Csp)**
61	Muş	8	8.52	6.44	76.2	557	23.4	32.1	633.4	80.6	13.7	12.7	1493	N 39 20.782 - E 042 15.616	18,08,2013	**Cn, Id (Hsp, Posp)**
62	Muş	5	8.11	4.99	56.1	622	21.3	29.8	623.7	85.7	15.4	19.1	1621	N 39 18.959 - E 042 18.824	18,08,2013	**Hi, Hs, Ib (Psp)**
63	Muş	1	8.64	7.15	78.4	407.9	20.3	28.1	616.7	82.8	16.1	8.4	1711	N 39 19.936 - E 042 19.530	18,08,2013	**(Esp, Isp)**
64	Muş	1	8.61	6.17	66.1	649	18.8	25.2	634.2	79.8	21.5	5.6	1488	N 39 11.495 - E 042 16.035	18,08,2013	**Cpp, Poa, Isbe, Tc (Tosp)**
65	Muş	7	8.48	5.5	62.4	703	21.6	26	634.8	81.5	19.5	9.2	1478	N 39 08.775 - E 042 16.513	18,08,2013	**Hr, Tc (Esp)**
66	Muş	7	8.19	3.85	40	12.66	17	20.4	638.7	84.6	51.7	5.1	1429	N 39 07.522 - E 042 06.611	19,08,2013	
67	Muş	5	8.34	5.6	56.1	337.9	15.8	21.5	635.3	80.3	47.4	0	1492	N 39 10.742 - E 042 05.758	19,08,2013	
68	Muş	2	8.06	5.14	51.5	1001	15.5	20.7	626.5	100.5	47.4	1.7	1614	N 39 10.355 - E 042 01.439	19,08,2013	**Hs, Ib, Li, Pcal (Posp)**
69	Muş	2	8.11	7.74	76.2	194.2	14.6	23.4	631.9	94.2	45.5	3	1531	N 39 03.896 - E 041 47.100	19,08,2013	**Ii, Po**
70	Muş	7	8.65	5.53	55.6	632	15.8	25.7	635.6	103	43.9	4.6	1484	N 39 03.350 - E 041 46.537	19,08,2013	**Cyv, Hri, Hr, Ib, Poa, Ts**

Appendix A.2. (continued)

St. No.	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W.s.	Elev.	Coordinate	Date	Taxa
71	Muş	16	6.84	0.29	3.1	489.25	17.2	27.2	635	-78.5	39.4	3.3	1494	N 39 02.856 - E 041 43.865	19,08,2013	**Crop, Cpp, Poa, Sf**
72	Muş	3	7.9	6.85	68.3	216.7	15.5	27	631.4	36.3	43.6	0	1542	N 39 03.072 - E 041 41.055	19,08,2013	**Hrb, Pof**
73	Muş	9	8.21	5.62	57.1	531	16.6	22.4	618.8	77.5	41.6	10.9	1705	N 39 05.699 - E 041 37.991	19,08,2013	**Cn, Hs (Isp, Pcsp)**
74	Muş	2	8.12	6.35	66	175.7	17.6	24.4	607.9	78.5	43.1	2.4	1873	N 39 05.246 - E 041 42.128	19,08,2013	**Cn, Ib, Po (Hrsp)**
75	Muş	11	7.78	6.95	72.5	312.5	17.8	23.7	597.9	41.3	42.5	5.1	2011	N 39 05.284 - E 041 43.620	19,08,2013	**(Csp, Isp, Posp)**
76	Muş	1	9.36	9.82	107.3	104.2	20.2	20.9	587.7	62.6	49.4	9.8	2163	N 39 07.997 - E 041 42.266	19,08,2013	**Ds, Li**
77	Muş	5	8.87	7.5	79.4	113.7	18.4	23.1	597.7	74.2	45.6	11.2	2021	N 39 08.983 - E 041 41.509	19,08,2013	**Cm, Pof (Isp)**
78	Muş	2	8.02	6.04	63.2	491	17.7	25.4	610.6	91.5	39.6	6.5	1845	N 39 07.982 - E 041 39.226	19,08,2013	**Cw, Hs, Ib, Pcal, Po (Posp)**
79	Muş	2	7.99	6.83	72.8	145	18.8	22.9	610.3	55.9	43.8	9.7	1845	N 39 14.232 - E 041 24.740	19,08,2013	**Cn, Ii**
80	Muş	16	7.08	2.14	26.3	227.9	26.5	31.5	619	37.8	39.7	5.1	1726	N 39 13.841 - E 041 24.723	19,08,2013	**Cn, Cov**
81	Muş	2	7.89	5.75	67.4	293.3	23.2	28.5	622.2	65.7	31.2	3.2	1667	N 39 14.836 - E 041 20.335	19,08,2013	**Cc, Ib (Esp, Posp, Psp)**
82	Muş	11	9.22	14.89	191.8	973	26.6	28.7	625.7	70.2	30.5	13.2	1614	N 39 15.541 - E 041 17.898	19,08,2013	**Cn, Cpp, Poa, Ts**
83	Muş	5	9.3	5.76	70.2	275.4	25.4	29.5	632.8	64.3	30.7	1.7	1521	N 39 14.421 - E 041 17.750	19,08,2013	**Ib, Posm, Povi, Pcal (Csp)**
84	Muş	9	7.54	0.98	10.3	686	18.5	27	633.4	78.3	43.6	7.8	1512	N 39 08.890 - E 041 23.245	19,08,2013	**Cw, Po (Hrsp)**
85	Muş	17	6.33	1.36	15.7	4419	22.4	32.1	632.3	22.5	40.8		1530	N 39 06.905 - E 041 23.629	19,08,2013	**Cm, Hs**

Appendix A.2. (continued)

St. No.	City	St. Ty.	pH	DO	% DO	EC	Tw	Ta	Atmp.	ORP	Moist.	W.s.	Elev.	Coordinate	Date	Taxa
86	Muş	8	8.73	11.07	108.3	418.4	14.4	26.2	650.8	29.2	37.3	14.4	1296	N 39 00.117 - E 041 31.233	19,08,2013	
87	Muş	16	9.4	9.07	113.7	874	27	27.2	651.5	46.8	36.8	15.4	1292	N 38 55.170 - E 041 30.674	19,08,2013	**Cyv, Cpp, Im, Li, Posm, Pcz (Csp)**
88	Muş	11	7.81	7.72	75.2	351.1	13.7	27.7	646.4	66	31.6	18.6	1346	N 38 54.731 - E 041 27.895	19,08,2013	**Cl, Ib, Pof, Pcal (Dosp, Fsp)**
89	Muş	2	8.27	5.62	65.4	898	22.9	29.4	645	70.3	27.9	6.4	1346	N 38 55.638 - E 041 18.342	19,08,2013	**Hi, Hs, Ii, (Csp)**
90	Muş	2	8.15	4.37	50.3	528	22.8	27.2	651.7	68.2	31.2	7.6	1256	N 38 52.822 - E 041 20.554	19,08,2013	**Cyv, Hr, Hs, Ib, Pcal (Csp)**
91	Muş	7	9.36	7.52	91.2	461.6	25.1	27.6	652.2	64.1	32.5	16.2	1249	N 38 51.021 - E 041 30.140	19,08,2013	**Hi, Ts (Pcsp)**
92	Muş	11	9.95	6.09	72.3	1237	24	26.2	651.8	60.4	36.3	12.4	1256	N 38 50.552 - E 041 31.687	19,08,2013	**Hs, Li, Pou**
93	Muş	3	7.63	6.19	70.8	251.5	22	26.7	647.8	76.8	32.9	16.5	1306	N 38 50.701 - E 041 35.597	19,08,2013	**Hi**
94	Muş	3	7.43	6.86	65.2	529	13.2	25.9	644	85.4	33	4.6	1354	N 38 51.869 - E 041 38.872	19,08,2013	**Hi, Ib, Pof**
95	Muş	2	7.9	5.05	51.7	985	16.5	25.7	631.3	91.7	33.3	6.8	1549	N 38 55.069 - E 041 41.556	19,08,2013	**Hs, Ib, Pf**
96	Muş	1	8.94	4.75	54.7	201.3	22.5	19.1	653.2	79.9	64.9	3.1	1274	N 38 47.480 - E 041 23.114	20,08,2013	**Cm, Ig, Li (Cysp, Posp)**
97	Muş	11	8.06	4.61	52.5	305.8	21.6	20	652.4	84.1	64.8	4.6	1290	N 38 47.290 - E 041 22.268	20,08,2013	**Cn, Cyv (Isp)**
98	Muş	2	7.61	2.68	27.8	2524	17	22	646.3	-46.3	52.6	0	1367	N 38 46.884 - E 041 17.662	20,08,2013	**Hi, Ib**
99	Muş	2	8.01	5.17	54.2	282.9	17.9	22.1	649.5	20.3	55.9	0	1329	N 38 46.680 - E 041 17.183	20,08,2013	**Cyv, Hr, Hs, Ib, Posm, Povi, Pcali Tc, Vb (Csp, Psp)**
		Min	6.33	0.29	3.1	12.66	11.2	18.5	587.7	-78.5	11.4	0	1249			
		Max	9.95	14.89	191.8	4419	30.4	37.2	653.2	107.1	64.9	34.5	2163			

Appendix B. 1. The summary table of non-parametric Spearman Correlation Analaysis about the relationships between ecolocigal variables and species in Mardin (For Abbrevation see Appebdix A. 1, A.2).

Spearman's rho		Styp	pH	DO	EC	Tw	ORP	Elev
Styp	Corr. Coeff.	1						
	Sig. (2-tailed)							
	N	39						
pH	Corr. Coeff.	-.24	1					
	Sig. (2-tailed)	.149						
	N	39	39					
DO	Corr. Coeff.	-.09	.051	1				
	Sig. (2-tailed)	.584	.756					
	N	39	39	39				
EC	Corr. Coeff.	-.03	.042	-.528**	1			
	Sig. (2-tailed)	.856	.802	.001				
	N	39	39	39	39			
Tw	Corr. Coeff.	-.02	.712**	-.14	.255	1		
	Sig. (2-tailed)	.886	.000	.388	.122			
	N	38	38	38	38	38		
ORP	Corr. Coeff.	-.13	-.442**	-.12	.267	-.537**	1	
	Sig. (2-tailed)	.444	.005	.485	.100	.001		
	N	39	39	39	39	38	39	
Elev	Corr. Coeff.	.172	-.17	-.30	.310	-.392*	.389*	1
	Sig. (2-tailed)	.294	.311	.067	.055	.015	.014	
	N	39	39	39	39	38	39	39
Hi	Corr. Coeff.	.098	-.68	.659	-.467	-.35	.240	.108
	Sig. (2-tailed)	.817	.062	.076	.243	.399	.568	.799
	N	8	8	8	8	8	8	8
Hr	Corr. Coeff.	-.62	-.07	.714	.107	-.25	.357	-.036
	Sig. (2-tailed)	.134	.879	.071	.819	.589	.432	.939
	N	7	7	7	7	7	7	7
Ib	Corr. Coeff.	.828*	.086	.319	-.600	-.03	-.829*	-.257
	Sig. (2-tailed)	.042	.872	.538	.208	.957	.042	.623
	N	6	6	6	6	6	6	6
Ig	Corr. Coeff.	-.51	-.14	-.09	.314	-.20	.657	.029
	Sig. (2-tailed)	.305	.787	.872	.544	.704	.156	.957
	N	6	6	6	6	6	6	6
Ii	Corr. Coeff.	.205	.400	-.20	-.200	.600	-.300	-.900*
	Sig. (2-tailed)	.741	.505	.747	.747	.285	.624	.037
	N	5	5	5	5	5	5	5
Poa	Corr. Coeff.	-0.2	.401	.292	0.085	-0.2	.176	.267
	Sig. (2-tailed)	.552	.250	.413	0.815	.521	.626	.455
	N	10	10	10	10	10	10	10
Pcz	Correlation Coefficient	.019	.214	.667	0.036	0.0	.536	.786*
	Sig. (2-tailed)	.968	.645	.102	0.939	1.0	.215	.036
	N	7	7	7	7	7	7	7
Po	Correlation Coefficient	.866	.500	.500	-0.500	.500	.500	-.500
	Sig. (2-tailed)	.333	.667	.667	0.667	.667	.667	.667
	N	3	3	3	3	3	3	3
Tc	Correlation Coefficient	-0.5	-0.1	-0.1	0.638	-0.2	.986**	-.058
	Sig. (2-tailed)	.278	.784	.784	0.173	.741	.000	.913
	N	6	6	6	6	5	6	6

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix B. 2. The summary table of non-parametric Spearman Correlation Analaysis about the relationships between ecolocigal variables and species in Muş (For Abbrevations see Appendix A. 1, A.2).

		Styp	pH	DO	EC	Tw	ORP	Cn	Cs	Cyv	Hi	Hr	Hs	Ib	Ii	Li	Pof	Pcal	Pf	Po	Tc
Styp	Corr. Coeff.	1.000	-,219*	-.173	.150	.011	-.154	-.395	.131	-.255	-.122	.369	-.282	.007	-.322	-.144	-.107	-.154	.500	.354	-.866
	Sig. (2-tailed)		.048	.121	.180	.922	.168	.145	.805	.542	.543	.541	.146	.968	.364	.713	.727	.692	.500	.559	.333
	N	82	82	82	82	82	82	15	6	8	27	5	28	39	10	9	13	9	4	5	3
pH	Corr. Coeff.	-,219*	1.000	,496**	.084	,513**	.166	-.189	-.200	.265	.008	-.400	-.344	-.076	,723*	-.399	-,554*	.208	-.316	-.800	0.000
	Sig. (2-tailed)	.048		.000	.455	.000	.136	.501	.704	.527	.967	.505	.073	.646	.018	.287	.049	.591	.684	.104	1.000
	N	82	82	82	82	82	82	15	6	8	27	5	28	39	10	9	13	9	4	5	3
DO	Corr. Coeff.	-.173	,496**	1.000	-.125	.133	.212	-.142	-.429	.038	-.295	0.000	-.291	-.129	-.236	-.071	-.107	-.485	.738	-.800	0.000
	Sig. (2-tailed)	.121	.000		.264	.233	.056	.612	.397	.929	.136	1.000	.134	.435	.511	.856	.728	.186	.262	.104	1.000
	N	82	82	82	82	82	82	15	6	8	27	5	28	39	10	9	13	9	4	5	3
EC	Corr. Coeff.	.150	.084	-.125	1.000	,232*	-.035	.319	-.257	.403	.148	-.100	.236	.111	.515	-.399	.161	-.079	-.211	-.200	-.866
	Sig. (2-tailed)	.180	.455	.264		.036	.756	.246	.623	.322	.462	.873	.226	.501	.128	.287	.600	.839	.789	.747	.333
	N	82	82	82	82	82	82	15	6	8	27	5	28	39	10	9	13	9	4	5	3
Tw	Corr. Coeff.	.011	,513**	.133	,232*	1.000	-,232*	-.242	.143	-.038	-.092	-.600	-.113	.007	.455	.319	-.291	-.050	-.316	-.100	-.866
	Sig. (2-tailed)	.922	.000	.233	.036		.036	.386	.787	.929	.648	.285	.567	.968	.187	.402	.335	.899	.684	.873	.333
	N	82	82	82	82	82	82	15	6	8	27	5	28	39	10	9	13	9	4	5	3
ORP	Corr. Coeff.	-.154	.166	.212	-.035	-,232*	1.000	-.128	-.086	.466	.290	-.200	.050	.026	.430	.222	0.000	-.099	-.211	-.200	-.866
	Sig. (2-tailed)	.168	.136	.056	.756	.036		.649	.872	.244	.142	.747	.802	.874	.214	.567	1.000	.800	.789	.747	.333
	N	82	82	82	82	82	82	15	6	8	27	5	28	39	10	9	13	9	4	5	3

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix C. 1. The result table of Specific Niche Overlap Analysis between six ostracod species and dissolved oxygen (DO). Abbrevaitons: **U**: the first hypotgesis results, **W**: the second hypothesis results of SO. (For species code see Appendix A.1, A.2)

	Resource Classes (DO)				
Species	**0.00-2.99**	**3.00-5.99**	**6.00-8.99**	**>=9.00**	**Total**
Cn (1)	2	6	7	1	16
Hi (2)	3	8	23	1	35
Hs (3)	2	10	18	1	31
Ib (4)	4	16	22	3	45
Ig (5)	1	3	2	2	8
Poa (6)	2	7	2	3	14
Total Tally	14	50	74	11	149
	Proportion				
1	0.125	0.375	0.438	0.063	
2	0.086	0.229	0.657	0.029	
3	0.065	0.323	0.581	0.032	
4	0.089	0.356	0.489	0.067	
5	0.125	0.375	0.250	0.250	
6	0.143	0.500	0.143	0.214	
Combined Proportion	0.094	0.336	0.497	0.074	

	Specific Overlaps (SO)					
	1	2	3	4	5	6
1	1.000	0.901	0.945	0.990	0.854	0.750
2	0.905	1.000	0.977	0.936	0.652	0.486
3	0.950	0.975	1.000	0.97591	0.717	0.571
4	0.991	0.930	0.973	1.000	0.827	0.698
5	0.813	0.587	0.644	0.798	1.000	0.948
6	0.766	0.508	0.584	0.731	0.951	1.000

Pair	U	W	Pair	U	W	Pair	U	W
1,2	3.320		**2,1**	6.963		**3,1**	3.210	
1,3	1.812	-0.754	**2,3**	1.643	-2.660	**3,2**	1.541	-0.835
1,4	0.319	-1.501	**2,4**	4.623	-1.170	**3,4**	1.512	-0.849
1,5	5.062	0.871	**2,5**	29.933	11.485	**3,5**	20.584	8.687
1,6	9.219	2.949	**2,6**	50.580	21.808	**3,6**	34.751	15.770
4,1	0.843		**5,1**	3.307		**6,1**	7.478	
4,2	6.500	2.829	**5,2**	8.536	2.614	**6,2**	18.987	5.755
4,3	2.466	0.812	**5,3**	7.046	1.870	**6,3**	15.067	3.795
4,5	17.148	8.153	**5,4**	3.606	0.149	**6,4**	8.755	0.639
4,6	32.422	15.790	**5,6**	0.862	-1.222	**6,5**	1.398	-3.040

Appendix C. 2. The result table of Specific Niche Overlap Analysis between seven ostracod species and water temperature (Tw). (For species code see Appendix A.1, A.2)

	Resource Classes (Tw)				
Spp	**10.0-14.9**	**15.0-19.9**	**20.0-24.9**	**>=25.0**	**Total**
Cn (1)	3	7	4	2	16
Cyv (2)	1	3	4	1	9
Hi (3)	4	8	18	5	35
Hs (4)	2	8	19	2	31
Ib (5)	5	15	22	3	45
Ii (6)	4	5	4	2	15
Pof (7)	6	3	3	1	13
Total Tally	25	49	74	16	164

	Proportion			
1	0.188	0.438	0.250	0.125
2	0.111	0.333	0.444	0.111
3	0.114	0.229	0.514	0.143
4	0.065	0.258	0.613	0.065
5	0.111	0.333	0.489	0.067
6	0.267	0.333	0.267	0.133
7	0.462	0.231	0.231	0.077
Combined Proportion	0.152	0.299	0.451	0.098

	Specific Overlaps (SO)						
	1	2	3	4	5	6	7
1	1.000	0.916	0.835	0.749	0.880	0.972	0.826
2	0.910	1.000	0.971	0.939	0.986	0.896	0.743
3	0.831	0.972	1.000	0.941	0.949	0.848	0.713
4	0.739	0.941	0.951	1.000	0.965	0.737	0.613
5	0.872	0.988	0.954	0.963	1.000	0.858	0.725
6	0.971	0.886	0.846	0.713	0.849	1.000	0.916
7	0.809	0.675	0.661	0.511	0.664	0.912	1.000

Pair	U	W	Pair	U	W	Pair	U	W
1,2	2.815		**2,1**	1.689		**3,1**	12.954	
1,3	5.755	1.470	**2,3**	0.537	-0.576	**3,2**	1.956	-5.499
1,4	9.263	3.224	**2,4**	1.139	-0.275	**3,4**	4.266	-4.344
1,5	4.096	0.640	**2,5**	0.259	-0.715	**3,5**	3.633	-4.661
1,6	0.919	-0.948	**2,6**	1.971	0.141	**3,6**	11.519	-0.718
1,7	6.133	3.214	**2,7**	5.337	1.824	**3,7**	23.719	5.382
4,1	18.717		**5,1**	12.348		**6,1**	0.873	
4,2	3.769	-7.474	**5,2**	1.129	-5.609	**6,2**	3.646	1.387
4,3	3.141	-7.788	**5,3**	4.236	-4.056	**6,3**	5.021	2.074
4,5	2.190	-8.264	**5,4**	3.364	-4.492	**6,4**	10.158	4.643
4,6	18.949	0.116	**5,6**	13.756	0.704	**6,5**	4.927	2.027
4,7	30.332	5.808	**5,7**	28.964	8.308	**6,7**	2.646	0.886
			7,1	5.520				
			7,2	10.214	2.347			
			7,3	10.762	2.621			
			7,4	17.432	5.956			
			7,5	10.664	2.572			
			7,6	2.409	-1.556			

Appendix C. 3. The result table of Specific Niche Overlap Analysis between ten ostracod species and electrical conductivity (EC).

	Resource Classes (EC)				
Spp	**0.00-249.9**	**250.0-499.9**	**500.0-749.9**	**>=750.0**	**Total**
Cn (1)	4	7	3	2	16
Cyv (2)	2	2	3	2	9
Hi (3)	3	18	10	4	35
Hs (4)	1	11	11	8	31
Ib (5)	3	24	13	5	45
Ig (6)	1	4	1	2	8
Ii (7)	3	6	3	3	15
Li (8)	4	3	2	3	12
Pof (9)	3	7	2	1	13
Po (10)	2	2	3	1	8
Total Tally	26	84	51	31	192

	Proportion			
1	0.250	0.438	0.188	0.125
2	0.222	0.222	0.333	0.222
3	0.086	0.514	0.286	0.114
4	0.032	0.355	0.355	0.258
5	0.067	0.533	0.289	0.111
6	0.125	0.500	0.125	0.250
7	0.200	0.400	0.200	0.200
8	0.333	0.250	0.167	0.250
9	0.231	0.538	0.154	0.077
10	0.250	0.250	0.375	0.125
Combined Proportion	0.135	0.438	0.266	0.161

	Specific Overlaps (SO)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	1.000	0.864	0.879	0.675	0.837	0.901	0.976	0.897	0.973	0.891
2	0.867	1.000	0.799	0.763	0.760	0.780	0.917	0.915	0.749	0.964
3	0.903	0.795	1.000	0.887	0.997	0.879	0.910	0.727	0.893	0.826
4	0.761	0.848	0.883	1.000	0.885	0.808	0.845	0.722	0.672	0.798
5	0.879	0.765	0.997	0.893	1.000	0.866	0.886	0.694	0.874	0.796
6	0.902	0.786	0.882	0.817	0.866	1.000	0.951	0.829	0.856	0.744
7	0.974	0.913	0.896	0.781	0.862	0.947	1.000	0.925	0.908	0.894
8	0.896	0.924	0.685	0.573	0.632	0.817	0.925	1.000	0.788	0.875
9	0.975	0.752	0.880	0.633	0.847	0.885	0.924	0.798	1.000	0.802
10	0.887	0.969	0.818	0.702	0.776	0.722	0.891	0.865	0.800	1.000

Appendix C. 3. (continued)

Pair	*U*	*W*	Pair	*U*	*W*	Pair	*U*	*W*	Pair	*U*	*W*	Pair	U	W
1,2	4.672		**2,1**	2.573		**3,1**	7.106		**4,1**	16.929		**5,1**	11.638	
1,3	4.131	-0.271	**2,3**	4.039	0.733	**3,2**	16.089	4.491	**4,2**	10.204	-3.363	**5,2**	24.147	6.254
1,4	12.586	3.957	**2,4**	4.874	1.151	**3,4**	8.374	0.634	**4,3**	7.680	-4.625	**5,3**	0.243	-5.697
1,5	5.679	0.503	**2,5**	4.945	1.186	**3,5**	0.203	-3.451	**4,5**	7.590	-4.670	**5,4**	10.142	-0.748
1,6	3.336	-0.668	**2,6**	4.472	0.949	**3,6**	9.022	0.958	**4,6**	13.208	-1.861	**5,6**	12.998	0.680
1,7	0.772	-1.950	**2,7**	1.557	-0.508	**3,7**	6.620	-0.243	**4,7**	10.407	-3.261	**5,7**	10.900	-0.369
1,8	3.467	-0.602	**2,8**	1.595	-0.489	**3,8**	22.337	7.615	**4,8**	20.166	1.619	**5,8**	32.904	10.633
1,9	0.862	-1.905	**2,9**	5.192	1.309	**3,9**	7.952	0.423	**4,9**	24.642	3.856	**5,9**	12.150	0.256
1,10	3.676	-0.498	**2,10**	0.652	-0.960	**3,10**	13.389	-2.284	**4,10**	13.992	-1.469	**5,10**	20.478	4.420

Pair	*U*	*W*	Pair	*U*	*W*	Pair	*U*	*W*	Pair	*U*	*W*	Pair	*U*	*W*
6,1	1.644		**7,1**	0.793		**8,1**	2.632		**9,1**	0.664		**10,1**	1.920	
6,2	3.846	1.101	**7,2**	2.724	0.966	**8,2**	1.885	-0.373	**9,2**	7.402	3.369	**10,2**	0.498	-0.711
6,3	2.007	0.182	**7,3**	3.286	1.246	**8,3**	9.078	3.223	**9,3**	3.318	1.327	**10,3**	3.207	0.643
6,4	3.239	0.798	**7,4**	7.415	3.311	**8,4**	13.369	5.369	**9,4**	11.881	5.608	**10,4**	5.672	1.876
6,5	2.309	0.333	**7,5**	4.460	1.833	**8,5**	10.995	4.182	**9,5**	4.328	1.832	**10,5**	4.057	1.068
6,7	0.798	-0.423	**7,6**	1.623	0.415	**8,6**	4.838	1.103	**9,6**	3.189	1.263	**10,6**	5.205	1.642
6,8	3.008	0.682	**7,8**	2.330	0.769	**8,7**	1.876	-0.378	**9,7**	2.060	0.698	**10,7**	1.844	-0.038
6,9	2.480	0.418	**7,9**	2.882	1.044	**8,9**	5.730	1.549	**9,8**	5.858	2.597	**10,8**	2.329	0.204
6,10	4.734	1.545	**7,10**	3.350	1.278	**8,10**	3.217	0.293	**9,10**	5.726	2.531	**10,9**	3.568	0.824

Appendix C. 4. The result table of Specific Niche Overlap Analysis between ten ostracod species and elevation (Elev.).

	Resource Classes (Elev.)					
Spp	**400-699**	**700-999**	**1000-1299**	**1300-1599**	**>=1600**	**Total**
Hi (1)	5	3	3	15	9	35
Hr (2)	3	4	1	3	1	12
Ib (3)	2	4	2	21	16	45
Ii (4)	2	3	1	5	4	15
Li (5)	2	1	3	3	3	12
Poa (6)	4	5	1	3	1	14
TotalTally	18	20	11	50	34	133

	Proportion				
1	0.143	0.086	0.086	0.429	0.257
2	0.250	0.333	0.083	0.250	0.083
3	0.044	0.089	0.044	0.467	0.356
4	0.133	0.200	0.067	0.333	0.267
5	0.167	0.083	0.250	0.250	0.250
6	0.286	0.357	0.071	0.214	0.071
Combined Proportion	0.135	0.150	0.083	0.376	0.256

	Specific Overlaps (SO)					
	1	**2**	**3**	**4**	**5**	**6**
1	1.000	0.721	0.905	0.944	0.881	0.657
2	0.697	1.000	0.523	0.838	0.684	0.992
3	0.926	0.557	1.000	0.887	0.751	0.493
4	0.933	0.814	0.863	1.000	0.843	0.759
5	0.861	0.693	0.669	0.813	1.000	0.635
6	0.635	0.992	0.458	0.786	0.630	1.000

Pair	***U***	***W***	**Pair**	***U***	***W***	**Pair**	***U***	***W***
1,2	22.876		2,1	8.679		3,1	6.940	
1,3	7.011	-7.933	2,3	15.548	3.435	3,2	52.644	22.852
1,4	3.999	-9.439	2,4	4.252	-8.300	3,4	10.834	1.947
1,5	8.882	-6.997	2,5	9.129	0.225	3,5	25.806	9.433
1,6	29.451	3.287	2,6	0.188	-4.245	3,6	63.581	28.321
Pair	***U***	***W***	**Pair**	***U***	***W***	**Pair**	***U***	***W***
4,1	2.083		5,1	3.580		6,1	12.731	
4,2	6.156	2.037	5,2	8.789	2.604	6,2	0.217	-6.257
4,3	4.405	1.161	5,3	9.663	3.042	6,3	21.863	4.566
4,5	5.110	1.513	5,4	4.959	0.689	6,4	6.748	-2.992
4,6	8.291	3.104	5,6	10.891	3.656	6,5	12.929	0.099

Appendix D The list of Ostracoda species with reproduction mode from Turkey. (Abbrevation: Repr.: reproduction mode, B: bisexual species, *: male individuals of species were found from this study.

	Species	Repr.		Species	Repr.
1	*Darwinula stevensoni* (Brady & Robertson, 1870)		72	*Bradleystrandesia parva* (Hartmann, 1964)	
2	*Vestalenula boteai* (Danielopol, 1970)		73	*Herpetocypris brevicaudata* Kaufmann, 1900	
3	*Vestalenula cuneata* (Klie, 1939)		74	*Herpetocypris chevreuxi* (Sars, 1896)	
4	*Candona angulata* Müller, 1900	B*	75	*Herpetocypris helenae* G.W. Müller, 1908	
5	*Candona candida* (O.F. Müller, 1776)	B	76	*Herpetocypris intermedia* Kaufmann, 1900	
6	*Candona improvisa* Ostermeyer, 1937	B	77	*Herpetocypris reptans* (Baird, 1835)	
7	*Candona lactea* Baird, 1850		78	*Psychrodromus fontinalis* (Wolf, 1920)	B*
8	*Candona lindneri* Petkovski, 1969	B*	79	*Psychrodromus olivaceus* (Brady & Norman, 1889)	B*
9	*Candona muelleri* Hartwig, 1899	B	80	*Psychrodromus robertsoni* (Brady & Norman, 1889)	B*
10	*Candona neglecta* Sars, 1887	B*	81	*Psychrodromus turcicus* (Hartmann, 1964)	B
11	*Candona sanociensis* Sywula, 1971	B*	82	*Stenocypria fischeri* (Lilljeborg, 1883)	B*
12	*Candona weltneri* Müller, 1900	B	83	*Stenocypris* spp.	
13	*Candonopsis kingsleii* (Brady & Robertson, 1870)	B	84	*Stenocypris malcolmsoni* (Brady, 1886)	
14	*Candonopsis scourfieldi* Brady, 1910	B	85	*Humphcypris subterranea* (Hartmann, 1964)	
15	*Fabaeformiscandona angusta* (Ostermeyer, 1937)		86	*Chrissia ousmana* Ghetti, 1972	
16	*Fabaeformiscandona balatonica* (Daday, 1894)	B	87	*Heterocypris barbara* (Gauthier & Brehm, 1928)	B
17	*Fabaeformiscandona breuili* (Paris, 1920)		88	*Heterocypris incongruens* (Ramdohr, 1808)	B
18	*Fabaeformiscandona brevicornis* (Klie, 1925)		89	*Heterocypris reptans* (Kaufmann, 1900)	
19	*Fabaeformiscandona caudata* (Kaufmann, 1900)		90	*Heterocypris rotundata* (Bronshtein, 1928)	
20	*Fabaeformiscandona fabaeformis* (Fischer, 1851)	B	91	*Heterocypris sabirae* Gülen, 1985	B
21	*Fabaeformiscandona holtzkampfi* (Hartwig, 1900)	B	92	*Heterocypris salina (1rady, 1868)*	B
22	*Fabaeformiscandona latens* (Klie, 1940)	B	93	*Hemicypris* spp.	
23	*Fabaeformiscandona protzi* (Hartwig, 1898)	B	94	*Dolerocypris fasciata* (O.F. Müller, 1776)	
24	*Fabaeformiscandona subacuta* (Okubo, 1990)		95	*Dolerocypris pellucida* Klie, 1932	
25	*Pseudocandona albicans* (Brady, 1864)	B	96	*Dolerocypris sinensis* (Sars, 1903)	

Appendix D (Continued)

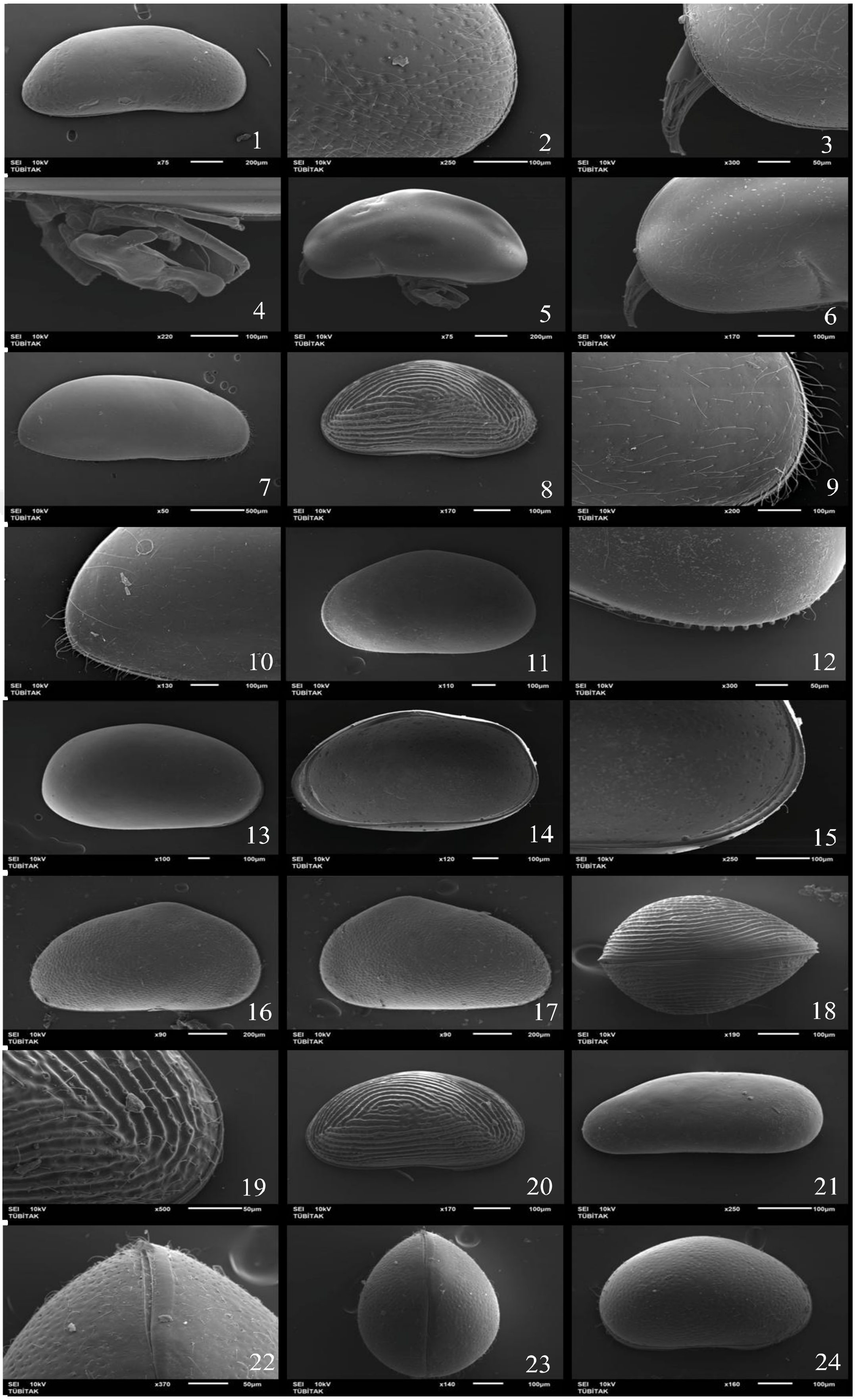
	Species	Repr.		Species	Repr.
26	*Pseudocandona compressa* (Koch, 1838)	B	97	*Isocypris beauchampi* (Paris, 1920)	
27	*Pseudocandona dispar* (Hartmann, 1964)		98	*Scottia pseudobrowniana* Kempf, 1971	B
28	*Pseudocandona eremita* (Vejdovsky, 1882)	B	99	*Hungarocypris madaraszi* (Örley, 1886)	B
29	*Pseudocandona hartwigi* (G.W. Müller, 1900)	B	100	*Cypridopsis elongata* (Kaufmann, 1900)	
30	*Pseudocandona marchica* (Hartwig, 1899)	B	101	*Cypridopsis hartwigi* G.W. Müller, 1900	
31	*Pseudocandona semicognita* (Schäfer, 1900)	B	102	*Cypridopsis vidua* (O.F. Müller, 1776)	
32	*Pseudocandona sucki* (Hartwig, 1901)	B	103	*Plesiocypridopsis newtoni* (Brady & Robertson, 1870)	B
33	*Schellencandona belgica* (Klie, 1937)	B	104	*Sarscypridopsis aculeata* (Costa, 1847)	
34	*Schellencandona insueta* (Klie, 1938)	B	105	*Zonocypris costata* (Vávra, 1897)	B*
35	*Cyclocypris laevis* (O.F. Müller, 1776)	B	106	*Zonocypris inconspicua* Schäfer, 1952	
36	*Cyclocypris ovum* (Jurine, 1820)	B	107	*Potamocypris arcuata* (Sars, 1903)	B
37	*Cyclocypris serena* (Koch, 1838)	B	108	*Potamocypris fallax* Fox, 1967	
38	*Cypria lata* Dubowsky, 1929		109	*Potamocypris fulva* (Brady, 1868)	
39	*Cypria ophthalmica* (Jurine, 1820)	B	110	*Potamocypris pallida* Alm, 1914	
40	*Cypria sywulae* (Meisch, 2000)	B	111	*Potamocypris producta* (Sars, 1924)	
41	*Physocypria kraepelini* G. W. Müller, 1903	B	112	*Potamocypris similis* G.W. Müller, 1912	
42	*Ilyocypris bradyi* Sars, 1890		113	*Potamocypris smaragdina* (Vávra, 1891)	B
43	*Ilyocypris brehmi* Schäfer, 1952		114	*Potamocypris steueri* Klie, 1935	
44	*Ilyocypris biplicata* Koch, 1838	B	115	*Potamocypris unicaudata* Schäfer, 1943	
45	*Ilyocypris decipiens* Masi, 1905	B	116	*Potamocypris variegata* (Brady & Norman, 1889)	
46	*Ilyocypris divisa* Klie, 1926	B	117	*Potamocypris villosa* (Jurine, 1820)	B
47	*Ilyocypris getica* Masi, 1906	B	118	*Potamocypris zschokkei* (Kaufmann, 1900)	
48	*Ilyocypris gibba* (Ramdohr, 1808)	B*	119	*Cavernocypris subterranea* (Wolf, 1920)	
49	*Ilyocypris hartmanni* Lerner-Seggev, 1968		120	*Cypretta rotunda* Ghetti, 1972	
50	*Ilyocypris inermis* Kaufmann, 1900	B*	121	*Cypretta seurati* Gauthier, 1929	

Appendix D (Continued)

	Species	Repr.		Species	Repr.
51	*Ilyocypris monstrifica* (Norman, 1862)	B	122	*Cypretta turgida* Sars, 1896	
52	*Ilyocypris salebrosa* Stepanaitys, 1960		123	*Limnocythere dubiosa* Daday, 1903	
53	*Ilyocypris turca* Ghetti, 1972		124	*Limnocythere inopinata* (Baird, 1843)	B
54	*Notodromas monacha* (O.F. Müller, 1776)	B	125	*Limnocythere stationis* Vávra, 1891	
55	*Notodromas persica* Gurney, 1921	B	126	*Paralimnocythere compressa* (Brady & Norman, 1889)	B
56	*Cypris bispinosa* Lucas, 1849	B	127	*Paralimnocythere psammophila* (Flössner, 1965)	B
57	*Cypris pubera* O.F. Müller, 1776	B	128	*Paralimnocythere relicta* (Lilljeborg, 1863)	B
58	*Eucypris elliptica* (Baird, 1846)		129	*Leucocythere mirabilis* Kaufmann, 1892	B
59	*Eucypris hamadanensis* Hartmann, 1964		130	*Kovalevskiella bulgarica* (Danielopol, 1970)	
60	*Eucypris kerkyrensis* Stephanides, 1937		131	*Kovalevskiella phreaticola* (Danielopol, 1965)	
61	*Eucypris lilljeborgi* (G.W. Müller, 1900)	B	132	*Gomphocythere besni* Külköylüoğlu et al. 2015	B
62	*Eucypris mareotica* (Fischer, 1855)	B	133	*Metacypris cordata* Brady & Robertson, 1870	B
63	*Eucypris pagasti* Schäfer, 1952	B	134	*Cytherissa lacustris* (Sars, 1863)	
64	*Eucypris pigra* (Fischer, 1851)	B	135	*Cyprideis torosa* (Jones, 1850)	B
65	*Eucypris virens* (Jurine, 1820)	B	136	*Loxoconcha elliptica* Brady, 1868	
66	*Koencypris ornata* (O.F. Müller, 1776)		137	*Loxoconcha immodulata* Stepanaitys, 1958	B
67	*Prionocypris zenkeri* (Chyzer & Toth, 1858)	B*	138	*Leptocythere castanea* (Sars, 1866)	
68	*Tonnacypris lutaria* (Koch, 1838)	B	139	*Leptocythere histriana* Caraion, 1964	
69	*Trajancypris clavata* (Baird, 1838)	B*	140	*Leptocythere lacertosa* (Hirschmann, 1912)	
70	*Trajancypris laevis* (G.W. Müller, 1900)		141	*Tyrrhenocythere amnicola* (Sars, 1888)	B
71	*Trajancypris serrata* (G.W. Müller, 1900)	B	142	*Tyrrhenocythere donetziensis* (Dubowsky, 1926)	B

Appendix E. SEM photos of some ostracods in this study.

1-6	*Psychrodromus* cf. robertsoni,
7,9,10	*Stenocypria fischeri*
8, 18-20	*Zonocypris* cf. *costata*
11-15	*Hemicypris inversa*
16,17	*Prionocypris zenkeri*
21	*Vestalenula* cf. *boteai*
22-24	*Cypretta* sp.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Appendix F. Photos of some sampling sites in the study.

1	Sampling site 1. in Mardin
2	Sampling site 4. in Mardin
3	Sampling site 10. in Mardin
4	Sampling site 14. in Mardin
5	Sampling site 16. in Mardin
6	Sampling site 28. in Mardin
7	Sampling site 31. in Mardin
8	Sampling site 42. in Mardin
9	Sampling site 2. in Muş
10	Sampling site 9. in Muş
11	Sampling site 15. in Muş
12	Sampling site 28. in Muş
13	Sampling site 42. in Muş
14	Sampling site 56. in Muş
15	Sampling site 80. in Muş
16	Sampling site 92. in Muş


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