Acta Aquatica Turcica
E-ISSN: 2651-5474 17(1), 25-33 (2021) DOI:https://doi.org/10.22392/actaquatr.747911

Faunal Diversity and Distribution of Hygrobatidae Koch, 1842 Species (Acari: Hydrachnidia) of Turkey and Three Neighboring Countries

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Research Article

Received 04 June 2020; Accepted 24 September 2020; Release date 01 March 2021.

How to Cite: Gülle, P., Erman, O. & Boyacı, Y. Ö. (2021). Faunal diversity and distribution of Hygrobatidae Koch, 1842 species (Acari: Hydrachnidia) of Turkey and three neighboring countries. *Acta Aquatica Turcica*, *17*(1), 25-33. https://doi.org/10.22392/actaquatr.747911

Abstract

This study is aimed to determine the distributions, habitats, and endemism rates of Hygrobatidae species of Turkey and three neighboring countries. Similarity calculations were made between Turkey and three neighboring countries using the Bray-Curtis index. As a result, it has been determined that Turkey has a high of similarity with Greece and Bulgaria and a low index of similarity with Iran. Additionally, a new record, *Atractides* (*Tympanomegapus*) *lacustris* (Lundblad, 1925), has been given for the fauna of Turkey. The number of Hygrobatidae species has been reached 55 with *A. lacustris* and Hygrobatidae species have been recorded from 21 provinces in Turkey.

Keywords: Biodiversity, Hydrachnidia, Hygrobatidae, taxonomy, Turkey.

Türkiye ve Üç Komşu Ülkenin Hygrobatidae Koch, 1842 (Hydrachnidia: Acari) Türlerinin Faunal Çeşitliliği ve Dağılımı

Özet

Bu çalışmada, Türkiye ve üç komşu ülkenin Hygrobatidae türlerinin dağılımı, habitat tercihleri ve endemizm oranlarının belirlenmesi amaçlanmıştır. Türkiye ve üç komşu ülke arasındaki benzerlik hesapları Bray-Curtis indeksi kullanılarak yapılmıştır. Sonuç olarak Türkiye'nin Yunanistan ve Bulgaristan ile Hygrobatidae tür benzerliğinin yüksek, İran ile düşük olduğu belirlenmiştir. Ek olarak, Türkiye faunası için yeni kayıt *Atractides (Tympanomegapus) lacustris* (Lundblad, 1925) verilmiştir. Türkiye'de 21 ilden kaydedilmiş olan Hygrobatidae türlerinin sayısı *A. lacustris* ile 55'e ulaşmıştır.

Anahtar kelimeler: Biyolojik çeşitlilik, Hydrachnidia, Hygrobatidae, taksonomi, Türkiye.

INTRODUCTION

Water mites, also known as Hydracarina, Hydrachnidia, or Hydrachnellae, are one of the polyphilic groups in Acari subclass. The term Hydracarina was firstly coined. However, this nomenclature also includes Halacaridae. But the morphologies and life cycles of Halacaridae members are different from Hydrachnidia (Bartsch et al., 2007).

Up to date, 400 genera and more than 6000 species of water mites belonging to 57 families have been identified and 1642 species have been reported from the Palearctic region including Turkey (Bartsch et al., 2007; Di Sabatino et al., 2008). The latest water mite checklist has been-published by Erman et al., (2019). It has been recorded that 335 species and 62 genera belonging to 25 families from Turkey. In terms of the highest number of species, Arrenuridae ranks first with 58 species, and Hygrobatidae ranks second with 54 species.

Hygrobatidae species have a wide range of morphological adaptations and types of habitat preference. This family consists of five genera: *Atractides*, *Hygrobates*, *Iranobates*, *Mesobates*, and *Mixobates*. The genus *Atractides* has the highest number of species. Members of this genus probably have an ancestor in common with members of other genera with similarly modified I-L. The genus *Atractides* is probably of paraphyletic origin. The task of the characteristic I-L has not yet been clear (Pešić, et al., 2011; Gerecke et al., 2016). *Atractides* species were found only in clean water with well-

conserved substrates and in general, inhabit running water. They are probably sensitive to many anthropogenic factors (Gerecke, 2003). In the genus *Hygrobates*, the absence of modified I-L-5 is a plesiomorphy, but an importend requisite for defining this genus. In the genus *Mixobates*, the presence of a pair of distinctly shaped distoventral setae on I-L-5 indicates a relation with *Atractides*-like genera rather than with *Hygrobates* (Gerecke et al., 2016).

Our purpose in this study is to revise the species belonging to the family Hygrobatidae in Turkey and three neighboring countries and compare similarities between them. It also aims to give information on the endemism rate, habitats, and distributions of Hygrobatidae species in Turkey. Additionally, a new record, *Atractides* (*Tympanomegapus*) *lacustris* (Lundblad, 1925), was given for the fauna of Turkey.

MATERIALS and METHODS

Water mites were collected by hand-netting, sorted on the spot from the living material, preserved in Koenike's fluid, and dissected for slide-mounting in Hoyer's fluid. All measurements were given in μm. See Gerecke (2003) for a detailed description and discussion of the characteristics of the genus *Atractides* and a detailed methodological introduction. In this study, the Bray-Curtis index was calculated using the Past Program. The following abbreviations are used: Cx–I = first coxae, L = length, I–L–6 = Leg 1, sixth segment, P–1 = palp, first segment, S–1 = large proximal ventral seta at I–L–5, S–2 = large distal ventral seta at I–L–5, Vgl = ventroglandulare, W= width.

RESULT

Family Hygrobatidae Koch, 1842

Distribution of Hygrobatidae Species in Turkey

Atractides (39), *Hygrobates* (14), and *Mixobates* (2) species were recorded from 21 provinces of Turkey. While Erzurum province ranks first with 15 species, followed by Malatya with 12 species and Rize with 9 species and Afyonkarahisar and Antalya with 8 species. *Atractides nodipalpis* Thor, 1899 and *Atractides robustus* (Sokolow, 1940), are the most common species recorded from six provinces (Table 2). Six species and one subspecies of Hygrobatidae are endemic to Turkey. *Hygrobates* (*Hygrobates*) *turcicus* Pešić & Esen, 2017 was recorded from four provinces in Turkey. The other endemic species are only known from the type localities (Table 1). The endemism rate is found as 12.7.

Table1. Hygrobatidae species endemic to Turkey

ENDEMIC SPECIES	PROVINCES
Atractides (*Atractides*) *anatolicus* Pešić, Erman & Esen, 2010	Bingöl
Atractides (*Atractides*) *martini* Pešić, Erman & Esen, 2010	Erzurum
Atractides (*Atractides*) *oezkani* Pešić & Erman, 2006	Malatya
Atractides (*Atractides*) *reinhardi* Gülle, Gülle & Boyacı, 2015	Burdur
Hygrobates (*Hygrobates*) *anatolicus* Esen & Pešić 2013	Kahramanmaraş
Hygrobates (*Hygrobates*) *turcicus* Pešić & Esen 2017	Bayburt, Bingöl, Rize, Antalya
Mixobates (*Mixobates*) *brachypalpis ozkani* Pešić & Turan, 2006	Rize

Table 2. The distribution of Hygrobatidae species according to the provinces in Turkey

SPECIES	Adıyaman	A. karahisar	Antalya	Artvin	Bayburt	Bingöl	Burdur	Elazığ	Erzincan	Erzurum	Isparta	K. maraş	Kayseri	Konya	Malatya	Mersin	Rize	Siirt	Sivas	Trabzon	Van
Atractides (*Atractides*) *allgaier*			X														X				
Atractides (Atractides) anatolicus						X															
Atractides (Atractides) anellatus														X							
Atractides (Atractides) arcuatus														X							
Atractides (Atractides) dentipalpis											X										
Atractides (*Atractides*) *distans*			X																		
Atractides (*Atractides*) *fissus*														X							
Atractides(*Atractides*) *fluviatilis*															X						
Atractides (*Atractides*) *fonticolus*						X				X					X		X				
Atractides (*Atractides*) *gibberipalpis*										X					X						
Atractides (Atractides) glandulosus									X												
Atractides (Atractides) gomerae	X																				
Atractides (*Atractides*) *graecus*						X															
Atractides (*Atractides*) *inflatipalpis*										X											
Atractides (*Atractides*) *inflatipes*							X														
Atractides (*Atractides*) *inflatus*			X											X		X					
Atractides (*Atractides*) *lunipes*															X						
Atractides (Atractides) martini										X											
Atractides (*Atractides*) *nahavandii*									X												
Atractides (Atractides) nikooae																		X			
Atractides (*Atractides*) *nodipalpis*		X						X		X			X		X				X		
Atractides (Atractides) nodipalpoides														X							
Atractides (Atractides) oezkani															X						
Atractides (*Atractides*) *ovalis*										X											X
Atractides (*Atractides*) *panniculatus*		X						X		X					X						X
Atractides (*Atractides*) *pennatus*		X																			
Atractides (*Atractides*) *protendens*									X												
Atractides (Atractides) reinhardi							X														
Atractides (*Atractides*) *remotus*										X											
Atractides (Atractides) rivalis															X						
Atractides (*Atractides*) *robustus*			X							X					X	X	X			X	
Atractides (*Atractides*) *spinipes*										X											
Atractides (Atractides) turcicus																	X				
Atractides (*Polymegapus*) *orghidani*						X															
Atractides (Polymegapus) persicus											X										
Atractides (*Polymegapus*) *polyporus*							X														
Atractides (*Tympanomegapus*) *acutirostris*															X						
Atractides (*Tympanomegapus*) *lacustris*			X																		
Atractides (*Tympanomegapus) longirostris*			X			X															
Hygrobates (Hygrobates) anatolicus												X									
Hygrobates (*Hygrobates*) *angustipalpis*																		X			
Hygrobates (*Hygrobates*) *bucharicus*										X											
Hygrobates (*Hygrobates*) *calliger*								X								X	X				
Hygrobates (*Hygrobates*) *fluviatilis*				X				X		X			X				X				
Hygrobates (*Hygrobates*) *longipalpis*		X								X			X								
Hygrobates (*Hygrobates*) *longiporus*		X								X				X			X				
Hygrobates (*Hygrobates*) *nigromaculatus*		X						X		X					X						
Hygrobates (Hygrobates) persicus					X																
Hygrobates (*Hygrobates*) *porrectus*		X																			
Hygrobates (*Hygrobates*) *trigonicus*								X													
Hygrobates (Hygrobates) turcicus			X		X	X											X				
Hygrobates (*Dekabates*) *quanaticola*		X						X					X								
Hygrobates (*Rivobates*) *diversiporus*															X						
Mixobates (*Mixobates*) *incurvatus*			X																		
Mixobates (*Mixobates*) *brachypalpis ozkani*																	X				

Habitats of Hygrobatidae species determined from Turkey.

When we examined the habitat distributions of Hygrobatidae species in Turkey, streams ranked first with 62% (38 species), followed by springs with 22% (13 species), lentic and slow-flowing waters with 13% (8 species), and hyporheic with 3% (2 species) (Table 3, Figure 1). Our results are consistent with previous studies (Gerecke 2003; Gerecke et al., 2016).

Table 3. The habitats of Hygrobatidae species determined from Turkey.

Species	Streams	Springs	Lentic and slow-flowing waters	Hyporheic
Atractides (*Atractides*) *allgaier*	X	X		
Atractides (Atractides) anatolicus	X			
Atractides (Atractides) anellatus	X			
Atractides (Atractides) arcuatus	X			
Atractides (Atractides) dentipalpis	X			
Atractides (*Atractides*) *distans*	X			
Atractides (*Atractides*) *fissus*	X			
Atractides (*Atractides*) *fluviatilis*	X			
Atractides (*Atractides*) *fonticolus*		X		
Atractides (*Atractides*) *gibberipalpis*	X			
Atractides (Atractides) glandulosus	X			
Atractides (Atractides) gomerae	X			
Atractides (*Atractides*) *graecus*		X		
Atractides (*Atractides*) *inflatipalpis*	X			
Atractides (*Atractides*) *inflatipes*	X			
Atractides (*Atractides*) *inflatus*	X			
Atractides (*Atractides*) *lunipes*	X			
Atractides (Atractides) martini	X			
Atractides (*Atractides*) *nahavandii*	X	X		
Atractides (Atractides) nikooae	X			
Atractides (*Atractides*) *nodipalpis*	X			
Atractides (Atractides) nodipalpoides	X			
Atractides (Atractides) oezkani	X			
Atractides (*Atractides*) *ovalis*			X	
Atractides (*Atractides*) *panniculatus*		X		
Atractides (*Atractides*) *pennatus*		X		
Atractides (*Atractides*) *protendens*		X		
Atractides (Atractides) reinhardi		X		
Atractides (*Atractides*) *remotus*	X			X
Atractides (Atractides) rivalis	X	X		
Atractides (*Atractides*) *robustus*	X			
Atractides (*Atractides*) *spinipes*	X			
Atractides (Atractides) turcicus	X			
Atractides (*Polymegapus*) *orghidani*	X			X
Atractides (Polymegapus) persicus		X		
Atractides (*Polymegapus*) *polyporus*		X		
Atractides (*Tympanomegapus*) *acutirostris*	X			
Atractides (*Tympanomegapus*) *lacustris*			X	
Atractides (*Tympanomegapus) longirostris*	X			
Hygrobates (Hygrobates) anatolicus	X			
Hygrobates (*Hygrobates*) *angustipalpis*			X	
Hygrobates (*Hygrobates*) *bucharicus*			X	
Hygrobates (*Hygrobates*) *calliger*	X			
Hygrobates (*Hygrobates*) *fluviatilis*	X	X		
Hygrobates (*Hygrobates*) *longipalpis*			X	
Hygrobates (*Hygrobates*) *longiporus*			X	
Hygrobates (*Hygrobates*) *nigromaculatus*			X	
Hygrobates (Hygrobates) persicus	X			
Hygrobates (*Hygrobates*) *porrectus*	X			
Hygrobates (*Hygrobates*) *trigonicus*	X			
Hygrobates (Hygrobates) turcicus	X			
Hygrobates (*Dekabates*) *quanaticola*		X		
Hygrobates (*Rivobates*) *diversiporus*	X			
Mixobates (Mixobates) incurvatus			X	
Mixobates (Mixobates) brachypalpis ozkani	X			

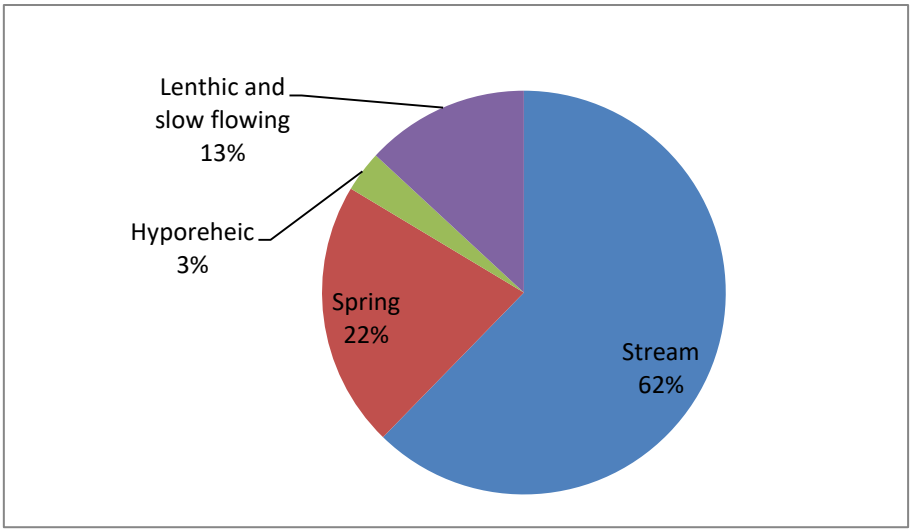

Figure 1. Percentages of habitat distribution of Hygrobatidae in Turkey

A comparison of Turkey with three neighboring countries in terms of the similarity of Hygrobatidae species

Checklists of the Hygrobatidae species recorded from Turkey, Bulgaria, Greece, and Iran have been revised and similarity calculations have been made. Turkey has 55 Hygrobatidae species, Bulgaria, Greece, Iran, 35, 25, and 37 respectively. Turkey has to same 18 species with Bulgaria, 20 with Greece, and 17 with Iran (Table 4). Similarity calculations between Turkey and three neighboring countries were made using the Bray-Curtis index. As a result, it was determined that Turkey had a high rate of similarity with Bulgaria and Greece while having a low rate of similarity with Iran. Similarities between Bulgaria and Greece were also found to be higher (Figure 2). Common species, such as *Atractides* (*Atractides*) *gibberipalpis* Piersig, 1898, *Atractides* (*Atractides*) *nodipalpis* Thor, 1899, *Atractides* (*Atractides*) *robustus* (Sokolow, 1940), *Atractides* (*Tympanomegapus*) *acutirostris* (Motaş & C. Angelier, 1927), *Hygrobates* (*Hygrobates*) *calliger* Piersig, 1896, *Hygrobates* (*Hygrobates*) *fluviatilis* (Ström, 1768), *Hygrobates* (*Hygrobates*) *longipalpis* (Hermann, 1804), *Hygrobates* (*Hygrobates*) *longiporus* Thor, 1898, *Hygrobates* (*Hygrobates*) *trigonicus* Koenike, 1895, have been recorded from all mentioned countries.

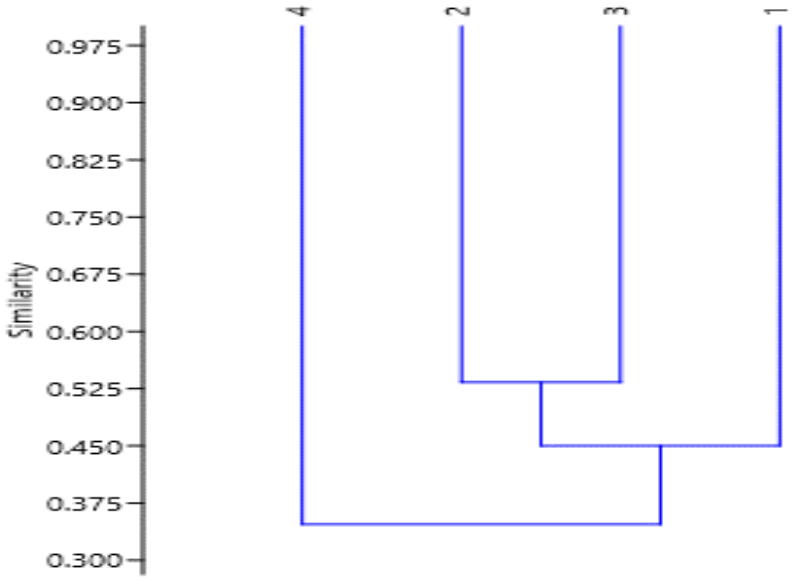

Figure 2. Similarity diagram of Hygrobatidae species of Turkey and three neighboring countries (1. Turkey, 2. Bulgaria, 3. Greece, 4. Iran)

Table 4. The Hygrobatidae species recorded from Turkey and neighboring countries. (Turkey: Erman et al., 2010, 2019; Iran: Pešić and Saboori 2007; Pešić et al., 2014; Greece and Bulgaria: Pešić et al., 2010, 2018)

SPECIES	Turkey	Bulgaria	Greece	Iran
Atractides (*Atractides*) *allgaier* Gerecke, 2003	X		X	
Atractides (Atractides) anatolicus Pešić, Erman & Esen, 2010	X			
Atractides (Atractides) anellatus Lundblad, 1956	X			
Atractides (Atractides) arcuatus Thor, 1904	X			
Atractides (*Atractides*) *asticae* Petrova, 1968		X		
Atractides (Atractides) balneatoris Pešić & Saboori, 2007				X
Atractides (Atractides) biscutatus Cook, 1967				X
Atractides (*Atractides*) *caspicus* Pešić, Dinipour, Vafaei & Saboori, 2007				X
Atractides (*Atractides*) *cisternarum* (K. Viets, 1935)		X		
Atractides (*Atractides*) *denticulatus* (Walter, 1947)		X		X
Atractides (Atractides) dentipalpis (Walter, 1935)	X			
Atractides (*Atractides*) *distans* (K. Viets, 1914)	X	X	X	
Atractides (Atractides) elburzensis Pešić, Smit & Saboori, 2014				X
Atractides (*Atractides*) *fissus* (Walter, 1927)	X			
Atractides fluviatilis (Szalay, 1929)	X	X		X
Atractides (*Atractides*) *fonticolus* (K. Viets, 1920)	X	X	X	
Atractides (*Atractides*) *gereckei* Pešić, 2004				X
Atractides (*Atractides*) *gibberipalpis* Piersig, 1898	X	X	X	X
Atractides (Atractides) glandulosus (Walter, 1918)	X			
Atractides (Atractides) gomerae Lundblad, 1962	X			
Atractides (*Atractides*) *gorgani* Pešić, Jabaleh & Saboori, 2009				X
Atractides (*Atractides*) *graecus* K. Viets, 1950	X	X	X	
Atractides (Atractides) hormozganus Pešić, Smit & Saboori, 2012				X
Atractides (*Atractides*) *hyrcaniensis* Pešić, Jabaleh & Saboori, 2009				X
Atractides (*Atractides*) *inflatipalpis* K. Viets, 1950	X	X	X	
Atractides (*Atractides*) *inflatipes* Lundblad, 1956	X			
Atractides (*Atractides*) *inflatus* (Walter, 1925)	X		X	X
Atractides (*Atractides*) *iranicus* Pešić & Asadi, 2002				X
Atractides (*Atractides*) *kermanensis* Pešić, 2005				X
Atractides (*Atractides*) *latipalpis* (Motaş & Tanasachi, 1946)		X		
Atractides (*Atractides*) *latipes* (Szalay, 1935)				
Atractides (*Atractides*) *longiporus* Petrova, 1968		X		
Atractides (*Atractides*) *lunipes* Lundblad, 1956	X		X	X
Atractides (*Atractides*) *markaziensis* Pešić, 2004				X
Atractides (Atractides) martini Pešić, Erman & Esen	X			
Atractides (*Atractides*) *mirkopesici* Pešić, 2004				X
Atractides (*Atractides*) *mossahebii* Pešić, 2004				X
Atractides (*Atractides*) *nahavandii* Schwoerbel & Sepasgozarian, 1976	X			X
Atractides (Atractides) nikooae Pešić, 2004	X			X
Atractides (*Atractides*) *nodipalpis* Thor, 1899	X	X	X	X
Atractides (Atractides) nodipalpoides Aşçı, Boyacı & Özkan 2011	X			
Atractides (*Atractides*) *oblongus* (Walter, 1944)		X	X	
Atractides (Atractides) oezkani Pesic & Erman, 2006	X			
Atractides (*Atractides*) *ovalis* Koenike, 1883	X			
Atractides (*Atractides*) *panniculatus* (K. Viets, 1925)	X		X	
Atractides (*Atractides*) *pennatus* (K. Viets, 1920)	X			
Atractides (*Atractides*) *phreaticus* (Motaş & Tanasachi, 1948)		X		
Atractides (*Atractides*) *protendens* K.O. Viets, 1955	X		X	
Atractides (*Atractides*) *pumilus* (Szalay, 1946)		X		
Atractides (*Atractides*) *pygmaeus* (Motaş & Tanasachi, 1948)		X		
Atractides (Atractides) reinhardi Gülle, Gülle & Boyacı 2015	X			
Atractides (*Atractides*) *remotus* Szalay, 1953	X	X		
Atractides (Atractides) rivalis Lundblad, 1956	X			
Atractides (*Atractides*) *robustus* (Sokolow, 1940)	X	X	X	X
Atractides (*Atractides*) *sokolowi* (Motaş & Tanasachi, 1948)		X		
Atractides (*Atractides*) *spinipes* Koch, 1837	X	X		
Atractides (*Atractides*) *subterraneus* (K. Viets, 1932)		X		
Atractides (*Atractides*) *tener* Thor, 1899		X	X	
Atractides (Atractides) turcicus Aşcı, 2009	X			
Atractides (*Atractides*) *walteri* (K. Viets, 1925)		X		

Atractides (*Polymegapus*) *orghidani* Motaş & Tanasachi, 1960	X		X	
Atractides (Polymegapus) persicus Pešić & Asadi, 2010	X			X
Atractides (*Polymegapus*) *polyporus* (K. Viets, 1922)	X	X		X
Atractides (*Tympanomegapus*) *acutirostris* (Motaş & C. Angelier, 1927)	X	X	X	X
Atractides (*Tympanomegapus*) *lacustris* (Lundblad, 1925)			X	
Atractides (*Tympanomegapus) longirostris* (Walter, 1925)	X			
Atractides (*Tympanomegapus*) *omanensis* Smit & Pešić, 2010				X
Atractides (*Tympanomegapus*) *pavesii* Maglio, 1905				
Hygrobates (Hygrobates) anatolicus Esen & Pešić 2013	X			
Hygrobates (*Hygrobates*) *angustipalpis* K.O. Viets, 1982	X			X
Hygrobates (*Hygrobates*) *bucharicus* Sokolow, 1928	X			X
Hygrobates (*Hygrobates*) *calliger* Piersig, 1896	X	X	X	X
Hygrobates (*Rivobates*) *diversiporus* Sokolow, 1927	X			
Hygrobates (*Hygrobates*) *fluviatilis* (Ström, 1768)	X	X	X	X
Hygrobates (*Hygrobates*) *foreli* (Lebert, 1874)		X	X	
Hygrobates (*Hygrobates*) *hamatus* K. Viets, 1935				X
Hygrobates (*Hygrobates*) *longipalpis* (Hermann, 1804)	X	X	X	
Hygrobates (*Hygrobates*) *longiporus* Thor, 1898	X	X	X	X
Hygrobates (Hygrobates) marezaensis Pešić & Dabert, 2017				
Hygrobates (*Hygrobates*) *nigromaculatus* Lebert, 1879	X			X
Hygrobates (Hygrobates) persicus Pešić & Asadi 2017	X			
Hygrobates (*Hygrobates*) *porrectus* Koenike, 1908	X	X		
Hygrobates (*Hygrobates*) *properus* Láska, 1954		X		
Hygrobates (*Dekabates*) *quanaticola* Schwoerbel & Sepasgozarian, 1976	X			X
Hygrobates (*Hygrobates*) *setosus* Besseling, 1942				X
Hygrobates (*Hygrobates*) *trigonicus* Koenike, 1895	X	X	X	X
Hygrobates (Hygrobates) turcicus Pešić & Esen 2017	X			
Hygrobates (*Rivobates*) *diversiporus* Sokolow, 1927		X		
Hygrobates (*Rivobates*) *norvegicus* (Thor, 1897)		X		
Hygrobates (Rivobates) zawali Pešić, 2015				
Mesobates forcipatus Thor, 1901			X	
Mixobates (Mixobates) incurvatus (Láska, 1954)	X		X	
Mixobates (Mixobates) brachypalpis ozkani Pešić & Turan, 2006	X			
Iranobates hesabii Pešić, Smit & Asadi, 2011				X

***Atractides* (*Tympanomegapus*) *lacustris* (Lundblad, 1925)**

Female. Idiosoma L/W 796/550 and integument striated (Figure 3A). P-1 is about the length of P-2. P-4 has the shape of a bulging cylinder and is long. The sword seta on P-4 is closer to the distoventral seta (Figure 3C).

Dorsal L of palp segments are L 54-75-75-118-33=355, Cx-I-IV L 79-80-88-200, respectively. I-L-5, L/W 165/36, I-L-6, L/W 124/32 (Fig. 3B). S-1 and S-2 on I-L-5 short and with narrow interspace. Leg segments L (in respective order I-IV): 53-60-95-136-165-124 = 633, 51-65-98-151-112-101 = 578, 52-53-100-158-151-136 = 650, 99-102-198-197-224-200 = 1020.

Vgl-1 fused to Vgl-2. The genital plate is in the form of beans. Genital plate L/W 51/24 (Figure 3A).

Studied Material and Habitat: Slow flowing stream, reed area, 36° 85,006' N, 31° 29,024' E, 10.04.2010, 1♀, Sarısu, Manavgat, Antalya.

Distribution. Sweden, Ireland, Netherlands, France, Germany, Switzerland, Russia (Gerecke et al., 2016).

New records for the fauna of Turkey.

DISCUSSION

Atractides lacustris, which is found in stagnant or slow-flowing waters, does not show sexual dimorphism in palp. It is separated from similar species; P-1 approximately P-2 in length, P-4 resembles a bulging cylinder, I-L-5 narrow and short, S-1 and S-2 on I-L-5 short and with narrow interspace and Vgl-1-2 are fused (Gerecke, 2003; Gerecke et al., 2016).

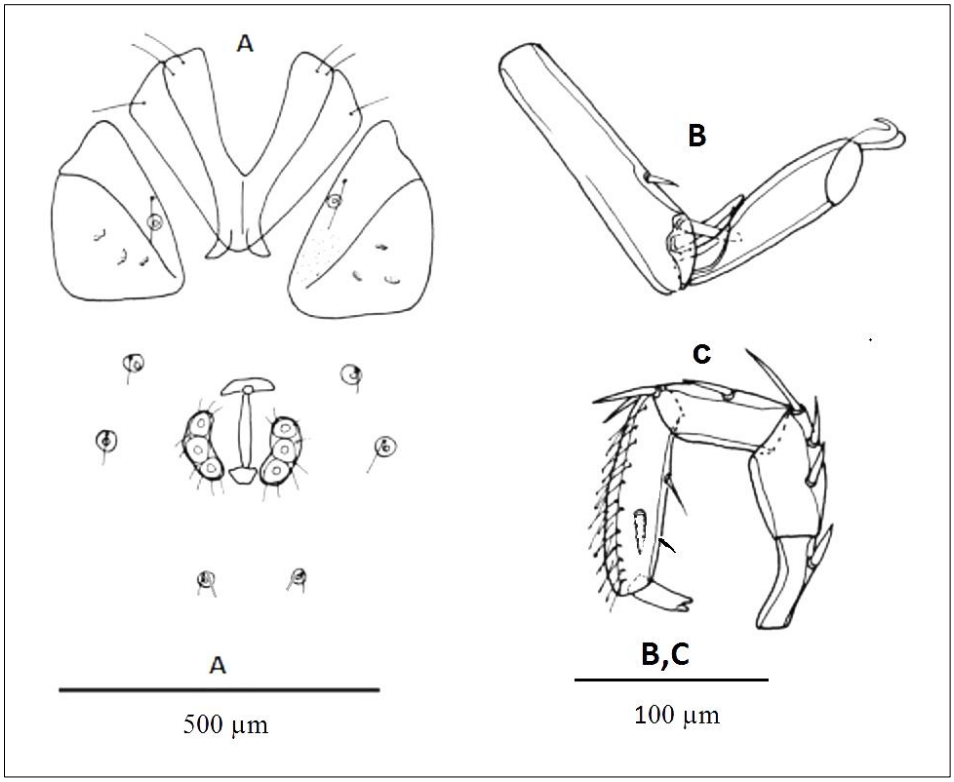

Figure 3. *Atractides* (*Tympanomegapus*) *lacustris* A) Idiosoma ventral, B) I-L-5-6, C) Palp

CONCLUSION

Erman et al., (2019) has recently reported that Hygrobatidae was the second family in water mite species number found in Turkey. The number of Hygrobatide species reached to 55 with *A. lacustris*. The Hygrobatidae species were recorded from 21 provinces in Turkey. The province with the highest number of records was Erzurum (15), followed by Malatya (12) and Rize (9). Six species and one subspecies of Hygrobatidae are endemic to Turkey. The endemism rate is found as 12.7.

The Hygrobatidae species preferred stream habitats with 62% (38 species), followed by spring habitats with 22% (13 species), lentic and slow-flowing waters with 13% (8 species), and hyporheic with 3% (2 species). Our results are consistent with previous studies (Gerecke, 2003; Gerecke et al., 2016).

Bray-Curtis similarity index was calculated between Turkey and three neighboring countries. Turkey had a high rate of similarity with Bulgaria and Greece while having a low rate of similarity with Iran. Similarities between Bulgaria and Greece were also found to be high.

Aşçı et al., (2011) reported *Atractides (Atractides) arcuatus* as a new record for the fauna of Turkey. Due to insufficient drawing and description and being a little-known species, we suspect in the diagnosis of this species.

Acknowledgements: Part of this study was supported by Süleyman Demirel University Scientific Research Projects Coordination Unit (Project no: 1656–D–08)

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