



## A Preliminary Research on the Trichoptera Fauna of the Kura-Aras River Basin and Eastern Black Sea Streams

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### ABSTRACT

The aim of this study is to determine the Trichoptera species distributed in the Kura-Aras river basin and Eastern Black sea coastal rivers within the borders of Turkey. For this purpose, samples were taken from a total of 51 stations, each individual was separated according to its morphological characteristics and species identification was completed. A total of 44 Trichoptera species were recorded as a result of the samplings made from two different river basins with flow within the borders of Turkey. Although Trichoptera species distributed in the Eastern Black Sea basin have been identified before, this study was conducted for the first time for the Kura-Aras river basin. Species identified from the Kura-Aras river system are new records for the basin.

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## Kura-Aras Nehir Havzası ve Doğu Karadeniz Akarsuları Trichoptera Faunası Üzerine Bir Ön Araştırma

### ÖZET

Bu çalışmanın amacı, Türkiye sınırları içinde Kura-Aras nehir havzası ve Doğu Karadeniz kıyı nehirlerinde yayılış gösteren Trichoptera türlerini belirlemektir. Bu amaçla toplam 51 istasyondan numuneler alınmış, her bir birey morfolojik özelliklerine göre ayrılmış ve tür tanımlaması tamamlanmıştır. Türkiye sınırları içerisinde akışı olan iki farklı nehir havzasından yapılan örneklemeler sonucunda toplam 44 Trichoptera türü kayıt altına alınmıştır. Kaydedilen türlerden 14'ü sadece Kura-Aras havzasında bulunurken, 20'si sadece Doğu Karadeniz havzasında bulunmuştur. 10 tür ise her iki havza için ortaktır. Doğu Karadeniz havzasında yayılış gösteren Trichoptera türleri daha önce tanımlanmış olmasına rağmen, bu çalışma Kura-Aras havzası için ilk kez yapılmıştır. Kura-Aras nehir sisteminden tespit edilen türler havza için yeni kayıttır.

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### INTRODUCTION

Türkiye, surrounded by seas on three sides and rich in freshwater resources, has 26 river basins within its drainage area. Of these basins, 14 are considered independent river basins and 12 are classified as tributary streams and lake basins. Some of these river systems (Euphrates, Tigris, Kura-Aras, and Coruh) originate from Turkish territories and then leave the country (Karşılı, 2011). Kura and Aras rivers are two river systems that originate within our country's borders and merge in Sabirabas city of

Azerbaijan, flowing into the Caspian Sea. Although a significant portion (35%) of the river basin is located in Azerbaijan, it passes through the borders of Türkiye, Georgia, Iran, and Armenia along its course. These rivers are used for agricultural and industrial purposes by the countries they flow through (Yeşilbaş & Kapan, 2021). The Eastern Black Sea basin covers 6 provinces from Artvin to Ordu. Rivers in the region have a regular regime and are fed by rainfall. Flow rates are normal during summer months, but increase with snowmelt. Some rivers flow directly into

the Black Sea after a short course, while others originate in central Anatolia and reach the sea by crossing the Black Sea Mountains (Selim, 2011).

Trichoptera is the largest order of insects that are entirely aquatic. They are important in aquatic systems as a food source for fish and for processing organic matter. Some species feed on algae and contribute to the control of primary production, while others filter particles, providing other groups with access to nutrients (Springer, 2010). The Trichoptera order is represented worldwide by 49 families, 616 genera, and nearly 15,000 species, and in Turkey by over 450 species from 22 families (Küçükbaşmacı & Fındık, 2020; Morse, 2018). In addition to its contribution to habitat trophics, it is also an important group preferred for determining water quality in freshwater ecosystems due to its species diversity and abundance (Barbour et al., 1999; Dohet, 2002; Rosenberg & Resh, 1993; Merritt & Cummins, 1996; Berlin & Thiele, 2002). Most species in this group are intolerant to organic pollution, and there is evidence that factors such as pollutants from agricultural areas, unplanned urbanization, and anthropogenic activities can reduce diversity (Barbour et al., 1999).

Thus far, Trichoptera species have been identified in freshwater resources in various regions of Turkey in studies aimed at both biodiversity determination and water quality assessment (Özalp & Küçükbaşmacı, 2023; Küçükbaşmacı & Fındık, 2019; Girgin & Kazancı, 2008; Kayan, 2021; Sipahiler, 2000; 2010 a,b; 2013; 2017; Zeybek & Yıldız, 2019; Darılmaz & Salur, 2015; Küçükbaşmacı & Kıyak, 2017). Larval stages of these species have relatively limited information due to the fact that adult individuals have been predominantly used in these studies. There are also very few studies on the morphometric characteristics of endemic species. The aim of this study is to determine the Trichoptera fauna of two different river basins (Kura-Aras river basin and Eastern Black Sea coastal rivers).

## MATERIAL and METHODS

Trichoptera larvae samples subject to the study were collected from 27 stations determined in the parts of the Kura-Aras Basin within the borders of Turkey and 24 stations determined in the Eastern Black Sea Basin between 29 October-3 November 2020 and 20 October 2019, 5 September 2020 and 3 November 2021, respectively. Benthic macroinvertebrate samples were collected from each of the stations using the kicking method with a D-frame net (250 $\mu$  mesh size-30x30 cm dimensions). Samples were collected at all stations by kicking stones from downstream to upstream for 3 minutes in front of the D-frame network placed at the bottom to contain possible microhabitats. In slow-flowing or stagnant waters,

samples were collected with an Ekman grab (20x20 cm). The bottom material was taken in two repetitions with an Ekman grab suitable for sampling from the soft bottom, washed in a 500 $\mu$  mesh sieve and separated from the bottom mud, and benthic macroinvertebrates were collected (Anonim, 2019).

The collected samples were initially fixed using 70% alcohol and then brought to the laboratory. Individuals were identified under a stereomicroscope and a magnifying glass at the Fisheries Faculty of RTEU Benthology Laboratory. Species identifications were made at the Biology Department laboratories of Science Faculty of Kastamonu University. Caddisfly species, based on larvae, were identified under the binocular stereomicroscope using Trichoptera Families 2007 and Trichoptera 2005 package programs (Lechthaler & Stockinger 2005; Lechthaler 2007) and literature (Zamora-Muñoz et al., 1995; Waringer & Graf, 2013; Glime, 2017a, 2017b). Information about sampling stations is given in Table 1 and Table 2. The maps of the basins and stations are given in Figure 1.

## RESULTS AND DISCUSSION

Through the examination of samples collected from the Kura-Aras river basins, it has been determined that the Trichoptera fauna of the basin is represented by 24 species belonging to 10 families (Table 3). Additionally, through the examination of samples collected from the Eastern Black Sea Basin, 30 Trichoptera species belonging to 13 families were identified (Table 4).

The Trichoptera species living in the Kura-Aras are as follows:

### PHYLUM: ARTHROPODA

### SUBPHYLUM: HEXAPODA

### CLASSIS: INSECTA

### ORDO: TRICHOPTERA

#### Family: Rhyacophilidae

1. *Rhyacophila dorsalis* (Curtis, 1834)
2. *Rhyacophila fasciata* Hagen, 1859
3. *Rhyacophila nubila* Zetterstedt, 1840

#### Family: Polycentropodidae

4. *Polycentropus flavomaculatus* (Pictet, 1834)

#### Family: Psychomyiidae

5. *Psychomyia fragilis* (Pictet, 1834)
6. *Psychomyia pusilla* (Fabricius, 1781)
7. *Psychomyia* sp.

#### Family: Hydropsychidae

8. *Cheumatopsyche lepida* (Pictet, 1834)
9. *Cheumatopsyche* sp.
10. *Hydropsyche botosaneanui* Marinkovic-Gospodnetic, 1966
11. *Hydropsyche bulbifera* McLachlan, 1878

- 12 *Hydropsyche dinarica* Marinkovic-Gospodnetic, 1979  
13 *Hydropsyche instabilis* (Curtis, 1834)  
14 *Hydropsyche pellucidula* (Curtis, 1834)  
15 *Hydropsyche* sp.  
16 *Hydropsyche tenuis* Navás, 1932  
**Family: Phryganeidae**  
17. *Agrypnia varia* (Fabricius, 1793)  
**Family: Lepidostomatidae**  
18. *Lepidostoma* sp.  
**Family: Goeridae**  
19. *Silo piceus* (Brauer, 1857)  
**Family: Sericostomatidae**  
20. *Sericostoma personatum* (Kirby & Spence, 1826)  
**Family: Limnephilidae**  
21. *Grammotaulius nigropunctatus* (Retzius, 1783)  
22. *Limnephilus decipens* (Kolenati, 1848)  
23. *Micropterna* sp.  
**Family: Leptoceridae**  
24. *Athripsodes* sp.  
The Trichoptera species living in the Eastern Black Sea are as follows;  
**Family: Rhyacophilidae**  
1. *Rhyacophila dorsalis* (Curtis, 1834)  
2. *Rhyacophila fasciata* Hagen, 1859  
3. *Rhyacophila hirticornis* McLachlan, 1879  
4. *Rhyacophila nubila* Zetterstedt, 1840  
5. *Rhyacophila obliterated* McLachlan, 1863  
6. *Rhyacophila pubescens* Pictet, 1834  
7. *Rhyacophila* sp.  
**Family: Glossosomatidae**  
8. *Glossosoma boltoni* Curtis, 1834  
**Family: Ptilocolepidae**  
9. *Ptilocolepus* sp.  
**Family: Philopotamidae**  
10. *Wormaldia subnigra* McLachlan, 1865  
**Family: Polycentropodidae**  
11. *Plectrocnemia geniculata* McLachlan, 1871  
**Family: Psychomyiidae**  
12. *Psychomyia pusilla* (Fabricius, 1781)  
**Family: Hydropsychidae**  
13. *Cheumatopsyche lepida* (Pictet, 1834)  
14. *Cheumatopsyche* sp.  
15. *Hydropsyche botosaneanui* Marinkovic-Gospodnetic, 1966  
16. *Hydropsyche instabilis* (Curtis, 1834)  
17. *Hydropsyche pellucidula* (Curtis, 1834)  
18. *Hydropsyche* sp.

**Family: Uenoidae**

19. *Thremma* sp.

**Family: Goeridae**

20. *Silo pallipes* (Fabricius, 1781)

21. *Silo piceus* (Brauer, 1857)

**Family: Lepidostomatidae**

22. *Crunoecia* sp.

23. *Lepidostoma basale* (Kolenati, 1848)

24. *Lepidostoma hirtum* (Fabricius, 1775)

25. *Lepidostoma* sp.

**Family: Limnephilidae**

26. *Chaetopteryx* sp.

27. *Stenophylax* sp.

**Family: Sericostomatidae**

28. *Sericostoma personatum* (Kirby & Spence, 1826)

**Family: Beraeidae**

29. *Beraea* sp.

30. *Ernodes* sp.

This text provides information about the diversity of Trichoptera families and species in Turkey in the Kura-Aras and East Black Sea basins. The Hydropsychidae (9 species) family has the highest species diversity in the Kura-Aras river system, followed by Limnephilidae (3 species), Rhyacophilidae (3 species) and Psychomyiidae (3 species) families. The Toros stream/Yalnızçam station has the highest number of species in this river system (Figure 2). In the Eastern Black Sea basin, Rhyacophilidae (7 species) and Hydropsychidae (6 species) families have the highest species diversity and the Kaptanpaşa/Çayeli station has the highest number of species (Figure 3).

The text also highlights the tolerance of Hydropsychidae family to pollution and mentions some of the species' sensitivity and tolerance to organic pollution (Pirvu & Pacioğlu, 2012; Küçükbasmacı & Fındık, 2020).

In previous studies, *C. lepida* species was determined from betamesosaprobic (DIN38410, 2004) and oligosaprobic (Kayan, 2021) areas with an altitude of 54-245 m. Some Hydropsychidae species [*H. fulvipes*, *H. instabilis*, *H. botosaneanui*, *H. dinarica*, *H. pellucidula*] are defined as cosmopolitan in the literature and it is stated that their distribution is affected by factors such as Dissolved oxygen, temperature, flow rate (Wiggins & Mackay, 1978; Williams & Feltmate, 1992).

*R. dorsalis* and *R. obliterated* species were detected from betamesosaprobic regions in different studies (Keşir, 2016; DIN 38410, 2004), while *S. personatum* was determined from oligomesosaprobic regions (DIN 38410, 2004).



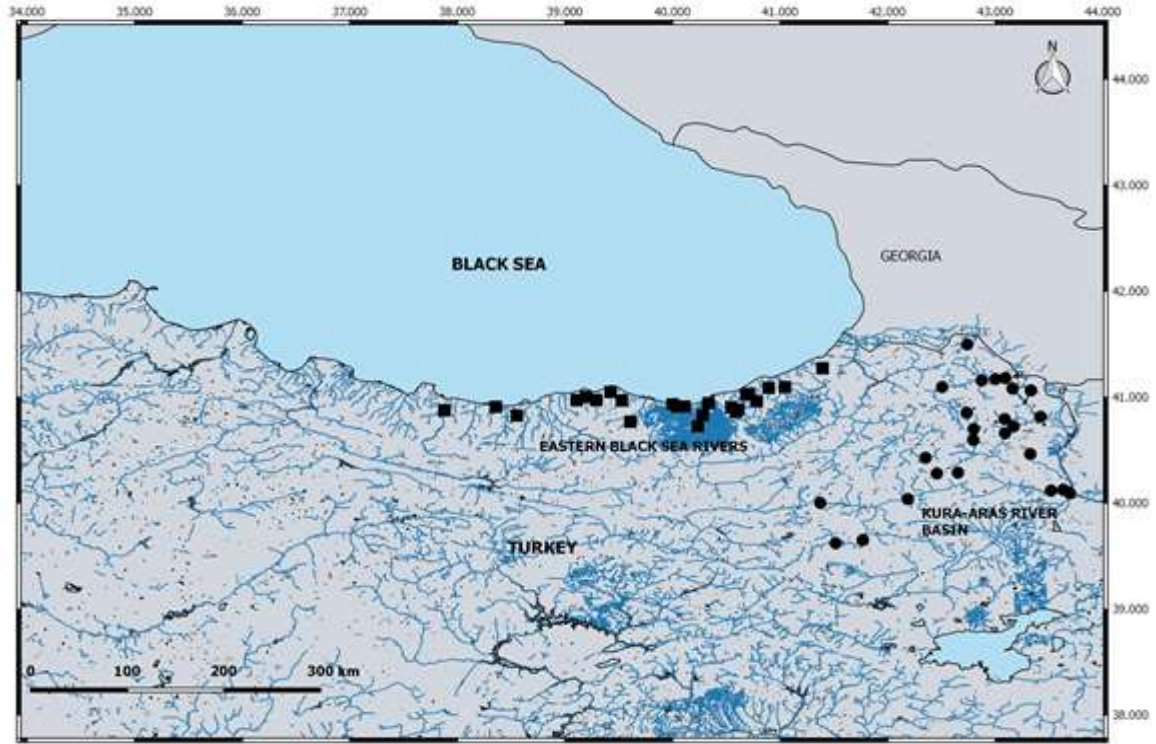


Figure 1. Maps of stations from Kura-Aras River basin and Eastern Black Sea basin (● Kura-Aras River basins and ■ Eastern Black Sea basins)

Şekil 1. Kura-Aras ve Doğu Karadeniz nehir havzalarındaki istasyonlara ait harita (● Kura-Aras nehir havzaları and ■ Doğu Karadeniz nehir havzaları)

Table 1. Name, coordinate and location information of the stations sampled from the Kura-Aras River Basin  
Çizelge 1. Kura-Aras nehir havzasındaki istasyonlara ait isim, koordinat ve lokasyon bilgileri

Stations code İstasyon Kodu	Stations name İstasyon Adı	Province-Town İl-İlçe	Coordinates/Koordinatlar
S1	Süngütaşı Stream	Kars/Sarıkamış	40.2785N 42.4561 E
S2	Tozlukomu Stream	Erzurum/Karayazı	39.6512N 41.7685 E
S3	Çığırın Stream	Kars/Merkez	40.6990N 42.7977 E
S4	Tuzluca (Aras River)	Iğdır/Tuzluca	40.1247N 43.6300 E
S5	Karaman Stream	Ardahan/Posof	41.4976N 42.7388 E
S6	Çamçavuş Dam	Kars/ Çamçavuş	40.7230N 43.1700 E
S7	Toros Stream	Ardahan/Yalnızçam	41.0950N 42.5050 E
S8	Kars Stream	Kars/Çamçavuş	40.6601N 43.0903 E
S9	Bozkuş Stream	Kars/Selim	40.5948N 42.7952 E
S10	Kura River (Çakır River)	Ardahan/Göle	40.8511N 42.7341 E
S11	Doğruyol Stream	Ardahan/Damal	41.0630N 43.3306 E
S12	Endek Stream	Erzurum/Horasan	40.0375N 42.1856 E
S13	Fehmiharabesi Stream (Susuz Waterfall)	Kars/Susuz	40.7920N 43.0870 E
S14	Keklik Stream	Kars/Sarıkamış	40.2865N 42.6517 E
S15	Kızılgeçit Stream	Erzurum/Tekman	39.6213N 41.5146 E
S16	B-20 Channel	Iğdır/ Tuzluca	40.0923N 43.6926 E
S17	Tavşan Stream	Kars/Arpaçay	40.8496N 43.3404 E
S18	Gaziler Stream	Erzurum/ Şenkaya	40.4276N 42.3505 E
S19	Derinöz Stream	Kars/Digor	40.4622N 43.3237 E
S20	Çöt Stream	Ardahan/Hanak	41.1704N 43.0000 E
S21	Ölçek Stream	Ardahan/Altaş	41.1575N 42.8739 E
S22	Aras River (Ağabey Village)	Iğdır/Tuzluca	40.1172N 43.5182 E
S23	Kaplıca Stream	Erzurum/Tekman	40.0000N 41.3733 E
S24	Kara Stream (Şeytan Kalesi Stream)	Ardahan/Çıldır	41.1790N 43.0935 E
S25	Köprüçay Stream	Erzurum/ Köprüçay	39.9721N 41.8706 E
S26	Carci Stream	Kars/Arpaçay	40.8141N 43.4184 E
S27	Çıldır Lake	Ardahan/Çıldır	41.0800N 43.1600 E

Table 2. Name, coordinate and location information of the stations sampled from the Eastern Black Sea River Basin  
*Çizelge 2. Doğu Karadeniz nehir havzasındaki istasyonlara ait isim, koordinat ve lokasyon bilgileri*

Stations code İstasyon Kodu	Stations name/İstasyon Adı	Province-Town/İl-İlçe	Coordinates/Koordinatlar
S1	Orçi Stream	Artvin/Arhavi	41.2730 N 41.3932 E
S2	Fırtına Stream	Rize/Ardeşen	41.0944 N 41.0442 E
S3	Kaptanpaşa Stream	Rize/Çayeli	40.9606 N 40.7820 E
S4	Büyükköy Stream	Rize/Çayeli	41.0243 N 40.6844 E
S5	Balat Stream	Rize/Çayeli	41.0309 N 40.7090 E
S6	Paşacıur Stream	Rize/Merkez	40.8822 N 40.6075 E
S7	Yeşildere Stream	Rize/Yeşildere	40.9052 N 40.5457 E
S8	Taşlı Stream	Rize/Güzelyurt	40.8595 N 40.5868 E
S9	Hemşin Stream	Rize/Pazar	41.0878 N 40.8923 E
S10	Coşandere Stream	Trabzon/Maçka	40.7680 N 39.6068 E
S11	Cumapazarı- Bölümlü Stream	Trabzon/Of	40.8292 N 40.2800 E
S12	Ağasar Stream	Trabzon/Beşikdüzü	41.0028 N 39.1950 E
S13	İskefiye Stream	Trabzon/Çarşıbaşı	41.0483 N 39.4232 E
S14	Karadere Stream	Trabzon/Araklı	40.9092 N 40.0426 E
S15	Yanbolu Stream	Trabzon/Arsin	40.9315 N 40.0018 E
S16	Çataklı Stream (Çaykara horse farm)	Trabzon/Çaykara	40.7252 N 40.2336 E
S17	Fol Stream	Trabzon Vakfikebir/	40.9708 N 39.2887 E
S18	Manahoz Stream	Trabzon/Sürmene	40.9110 N 40.1094 E
S19	Söğütlü Stream	Trabzon/Akçaabat	40.9676 N 39.5270 E
S20	Yeniköy Stream	Trabzon/Hayrat	40.9427 N 40.3335 E
S21	Yalakoda Stream	Giresun/Çavuşlu	40.9704 N 39.1072 E
S22	Batlama Stream	Giresun/ Merkez	40.9079 N 38.3553 E
S23	Büyükdere Stream	Giresun/Keşap	40.8261 N 38.5522 E
S24	Melet tributary Stream	Ordu/Kabadüz	40.8739 N 37.8790 E

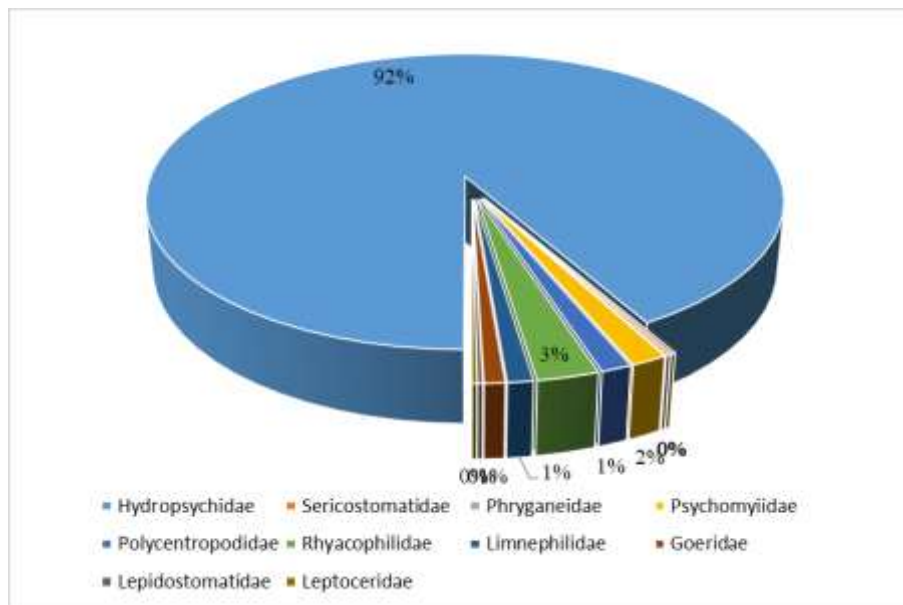


Figure 2. Dominance rates of families distributed in the Kura Aras river basin  
*Şekil 2. Kura-Aras nehir havzasında dağılım gösteren familyaların baskınlık oranı*

The genus *Ryacophila* in Turkey is represented by about 25 taxa (species and subspecies), although most of them are distributed in northeastern regions (Sipahiler, 2010b). It was stated that *R. obliterata*, *H. instabilis* species are very sensitive to organic pollution, *C. lepida* species are sensitive, *H. fulvipes* species are tolerant (Zeybek & Yıldız, 2019).

Nitrogen and Phosphorus loads in the Kura and Aras basins come from factors such as livestock, agricultural land and sewage water (Yontar, 2009). The diversity of Trichoptera families, including Hydropsychidae was found in many different branches of rivers with varying concentrations of pollutants. The East Black Sea basin has over 60

Trichoptera species with Rhyacophilidae and Hydropsychidae families being the most commonly encountered families (Darılmaz & Salur, 2015). During the study sampling from coastal rivers and not sampling special habitats such as highland sampling prevented access to all species.

So far, 6 species of Chaetopteryx genus (*C. bosniaca*, *C. abchazica*, *C. bektasensis*, *C. nalanae*, *C. sinopica*, *C. akgolensis*) have been identified in Turkey

(Sipahiler, 2010a). During this study individuals belonging to the *Chaetopteryx* genus were identified and the species could not be identified. The genus *Ernodes* is known with 8 species most of which are endemic in Turkey, while the genus *Beraea* is known with only 3 species (Sipahiler, 2008). In the samples taken from Kura-Aras and Eastern Black Sea coastal rivers individuals belonging to these genera were obtained, but the species could not be identified.

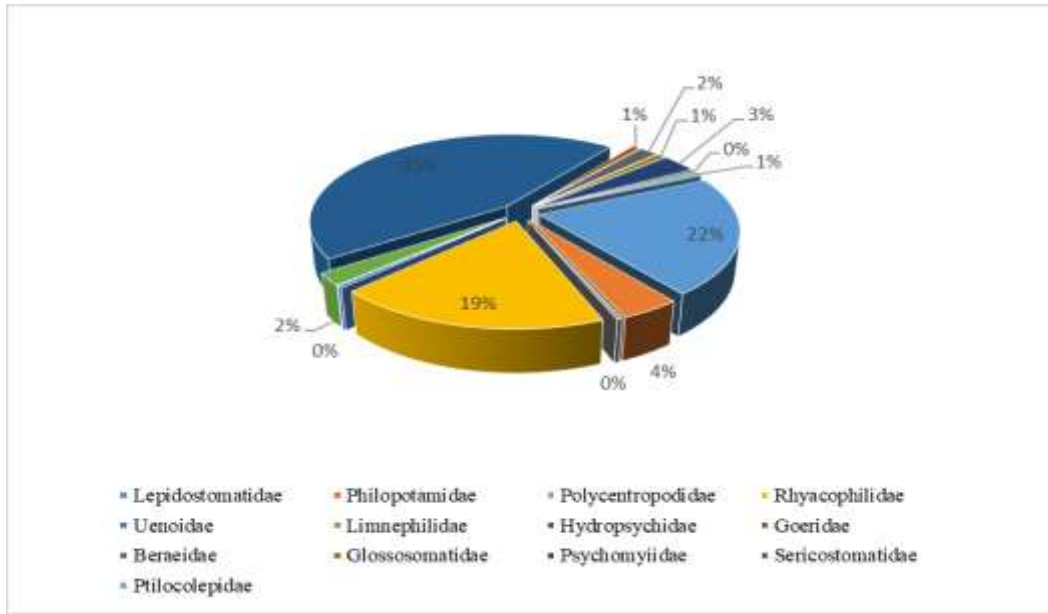


Figure 3. Dominance rates of families distributed in the Eastern Black Sea coastal rivers

Şekil 3. Doğu Karadeniz nehir havzasında dağılım gösteren familyaların baskınlık oranı

Table 3. The distribution of the Trichoptera species at the stations in Kura Aras river basin

Çizelge 3. Kura-Aras nehir havzası istasyonlarında Trichoptera türlerinin dağılımı

Species/stations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
<i>R. dorsalis</i>										*																	
<i>R. fasciata</i>								*														*					
<i>R. nubila</i>											*																
<i>P. flavomaculatus</i>			*							*																	
<i>P. fragilis</i>						*																					
<i>P. pusilla</i>								*							*												
<i>Psychomyia</i> sp.																											*
<i>C. lepida</i>			*												*							*	*				
<i>Cheumatopsyche</i> sp.										*																	
<i>H. botosaneanui</i>	*						*												*								*
<i>H. bulbifera</i>		*		*																			*				*
<i>H. dinarica</i>							*			*											*						
<i>H. instabilis</i>	*									*		*	*					*	*						*		
<i>H. pellucidula</i>			*																		*					*	
<i>Hydropsyche</i> sp.	*									*		*	*			*						*			*	*	*
<i>H. tenuis</i>											*																
<i>A. varia</i>																											*
<i>Lepidostoma</i> sp.													*														
<i>S. piceus</i>							*																				
<i>S. personatum</i>					*																						
<i>G. nigropunctatus</i>							*																				
<i>L. decipens</i>										*																	
<i>Micropterna</i> sp.															*												
<i>Athripsodes</i> sp.														*													

Table 4. The distribution of Trichoptera species in Eastern Black Sea coastal river basin stations  
 Çizelge 4. Doğu Karadeniz nehir havzası istasyonlarında Trichoptera türlerinin dağılımı

Species/stations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
<i>R. dorsalis</i>																*	*							*	
<i>R. fasciata</i>								*				*			*		*								
<i>R. hirticornis</i>			*																						
<i>R. nubila</i>																			*				*		
<i>R. obliterated</i>					*	*	*	*		*															
<i>R. pubescens</i>					*																				
<i>Rhyacophila</i> sp.	*		*	*										*											
<i>G. boltoni</i>							*																		
<i>Ptilocolepus</i> sp.		*																							
<i>W. subnigra</i>			*	*		*																			
<i>P. geniculata</i>			*																						
<i>P. pusilla</i>																	*					*			
<i>C. lepida</i>																								*	
<i>Cheumatopsyche</i> sp.																								*	
<i>H. botosaneanui</i>											*	*		*		*	*	*					*		
<i>H. instabilis</i>			*						*		*		*	*									*		
<i>H. pellucidula</i>																							*		
<i>Hydropsyche</i> sp.								*																	
<i>Thremma</i> sp.			*																						
<i>S. pallipes</i>						*																			
<i>S. piceus</i>							*																		
<i>Crunoecia</i> sp.			*																						
<i>L. basale</i>			*													*									
<i>L. hirtum</i>	*		*								*			*			*		*	*	*	*		*	
<i>Lepidostoma</i> sp.							*																		
<i>Chaetopteryx</i> sp.			*																						
<i>Stenophylax</i> sp.			*																						
<i>S. personatum</i>																		*							
<i>Beraea</i> sp.															*										
<i>Ernodes</i> sp.		*															*	*							

Adult individuals are generally used in the diagnosis of Trichoptera species. Information on larvae is limited or incomplete. There are also morphological deficiencies related to endemic species. For this reason, some individuals obtained in this study could not be identified at the species level, and some endemic species could not be reached. Supporting this situation with detailed identification keys as well as studies at the molecular level will enable accurate and efficient species identification.

#### Statement of Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

#### Author's Contributions

Dr. Hazel BAYTAŞOĞLU have designed the study

and collected the data. Laboratory analyzes made by Dr. Ibrahim KÜÇÜKBASMACI and the text of the article written by Dr. Ibrahim KÜÇÜKBASMACI and Dr. Hazel BAYTAŞOĞLU

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