

FIRST RECORD OF *Micrasema cinereum* Mosely (TRICHOPTERA, BRACHYCENTRIDAE) IN TURKEY AND A LIST OF THE CADDISFLY FAUNA IN ARAÇ CREEK

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Abstract: Systematic studies on Trichoptera larvae in Turkey are very limited. The larval stage of the endemic species remains especially unknown. This study was carried out in Araç Creek between April and October 2013 and it is the first study to determine the caddisfly fauna in Araç Creek. Fourteen caddisflies taxa belonging to nine genera within eight different families (Brachycentridae, Hydropsychidae, Hydroptilidae, Lepidostomatidae, Leptoceridae, Limnephilidae, Psychomyiidae and Rhyacophilidae) were identified. Four of these taxa have previously been recorded from the creek and the other ten taxa are new records for the study area while *Micrasema cinereum* Mosely is the first record for the Trichoptera fauna of Turkey. As a result of the study, the number of caddisfly taxa in Turkey is now 501, with the addition of *M. cinereum*.

Key words: New record, larvae, description, benthic macroinvertebrates, Araç creek, Turkey.

Özet: Türkiye’de Trichoptera larvaları üzerindeki sistematik çalışmalar çok sınırlıdır ve özellikle endemik türlerin larva evresi bilinmemektedir. Çalışma Araç Çayı’nda 2013 yılı Nisan-Ekim ayları arasında gerçekleştirilmiştir ve Araç Çayı’nın Trichoptera faunasını belirleyen ilk çalışmadır. Sekiz farklı familyadan (Brachycentridae, Hydropsychidae, Hydroptilidae, Lepidostomatidae, Leptoceridae, Limnephilidae, Psychomyiidae ve Rhyacophilidae) 9 cinse ait 14 Trichoptera taksonu belirlenmiştir. Bu taksonlardan dördü daha önce Araç Çayı’ndan kaydedilmiş, diğer 10 takson ise Araç Çayı için yeni kayıttır. Buna ek olarak, *Micrasema cinereum* Mosely ise Türkiye Trichoptera faunası için ilk kayıttır. Çalışmanın sonucunda, Türkiye’deki Trichoptera takson sayısı yeni bir kayıtlarla birlikte 501 olmuştur.

Introduction

Brachycentridae larvae are characterized and distinguished from larval stages of other caddisfly families by (i) the absence of lateral and dorsal humps in the first abdominal segment, (ii) possessing transverse groove at midlength of pronotum, (iii) a pair of plates (that are often divided longitudinally by narrow sutures) on mesonotum, and (iv) either the absence of primary setal area or the presence of sclerotized setae on metanotum (Flint 1984, Vieira-Lanero *et al.* 1998, Pescador *et al.* 1995). Larvae, in general, live in cold lotic fresh-water springs, streams and rivers while some species can also live in the shores of lakes, as in the case of the genus *Micrasema* McLachlan (Pescador *et al.* 1995). *Micrasema* consists of only 23 species in the West Palearctic Region fauna (Malicky 2004) and their larvae, whose inhabitant area is mostly surrounded by mosses and other plants, can resist and therefore inhabit shallow streams (Hilsenhof 1985). The caddisfly fauna of Turkey is represented by

500 taxa (461 species and 39 subspecies) (Darılmaz & Salur 2015, Küçükbasmacı & Kıyak 2017, Sipahiler 2016, Sipahiler 2017a, b, Sipahiler 2018a, b) Most of the studies on caddisflies have been performed based on their adults, but taxonomic studies on their larval stages are limited in Turkey. In particular, there is a lackabout descriptive studies on larvae of endemic species. The lack of taxonomic and ecological data on benthic macroinvertebrates has been concluded to negatively affect their reliable use in biomonitoring related studies in Turkey, and studies at species level on key taxons one of which is Trichoptera in addition to Ephemeroptera, Odonata, Plecoptera, Simuliidae and are believed to contribute to improvement of such studies (Kazancı & Ertunç 2010). From this point of view, this study was performed in order to determine caddisfly fauna of Araç Creek (Kastamonu) as a contribution to Turkish caddisfly fauna.



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Materials and Methods

Study area

The study was performed in Araç Creek located in northern part of Turkey (Fig. 1). Araç Creek, originating from the northern slope of İlgaz Mountains and passing through İhsangazi and Araç districts of Kastamonu province, merges with Soğanlı Creek to form Yenice River (Filyos River) with other tributaries. The creek is

affected by various human activities including city sewage systems, organic wastes, agricultural activities, hydroelectric power plants and sand quarries. Macroinvertebrate samplings were performed at 6 stations along the creek in April, August and October 2013 (Fig. 1). The coordinates and altitudes of the sampling stations as well as sampling dates and short descriptions of the localities where the stations were selected are given in Table 1.



Fig. 1. (A) Map of Turkey. (B) The general view of study area. (C) Sampling stations in Araç Creek (Google Earth 2019). The numbers denote the stations whose details are given in Table 1.

Table 1. Details of the stations from where the samples were collected.

Station No	Sampling date	Sampling station	Coordinate	Altitude (m)
1	28.04.2013	Kastamonu, İhsangazi, beyond 1 km from the Örencik village road junction	41°10'39.60"N 33°34'16.30"E	920
	15.08.2013			
	27.10.2013			
2	28.04.2013	Kastamonu, İhsangazi, İhsangazi–Araç road 7 th km, Akkaya village road junction, the bridge vicinity	41°13'6.70"N 33°28'57.50"E	784
	15.08.2013			
	27.10.2013			
3	28.04.2013	Kastamonu, Araç, end of the Araç county, vicinity to the gas station	41°14'21.13"N 33°19'19.80"E	632
	15.08.2013			
	27.10.2013			
4	28.04.2013	Kastamonu, Araç, Araç–Karabük road 7 th km, Tatlıca village road junction, the bridge vicinity	41°14'8.76"N 33°15'21.67"E	594
	15.08.2013			
	27.10.2013			
5	28.04.2013	Kastamonu, Araç, Araç–Karabük road 26 th km, Yeşilova village	41°13'52.24"N 33°00'22.95"E	432
	15.08.2013			
	27.10.2013			
6	28.04.2013	Karabük, Safranbolu, Navsaklar village	41°12'56.85"N 32°44'14.81"E	301
	15.08.2013			
	27.10.2013			

Sampling method

Benthic macroinvertebrates in each station were collected between the stones, pebbles and plants on the ground using a standard dip net with a transecting area of 100 m². Each sampling lasted 5 minutes. All samples were fixed in 80% ethanol immediately after collection, and then taken to the laboratory. The sampled material was investigated in the laboratory under a binocular stereomicroscope (Leica APO S8) and caddisfly larvae among the collected macroinvertebrates were transferred into tubes containing fresh 80% ethanol. The study material is deposited in the Entomology Laboratory of Biology Department of Faculty of Sciences and Arts, Kastamonu University, Turkey.

Identifications of the caddisflies

Caddisfly species, based on larvae, were identified under the binocular stereomicroscope using Trichoptera Families 2007 and Trichoptera 2005 package programmes (Lechthaler & Stockinger 2005, Lechthaler 2007) and literature (Brohmer 1979; Edington & Hildrew 1981, 1995; Hickin 1942, 1943, 1948, 1952, 1954, 1967, Ulmer 1909, Zamora-Muñoz *et al.* 1995). A general knowledge of morphological structures associated with caddisfly larvae is necessary for ease of identification. The head is dorsally divided by a Y-shaped ecdysial line referring to the frontoclypeal and coronal sutures, the frontoclypeus is bordered laterally by the frontoclypeal sutures, and the parietals extend posteromesally along the coronal suture. The anterolateral portion of the head contains the eyes and antennae, whose locations vary among the families. Mouthparts are among the essential structures for the identification of larvae, which include the labrum and labium that contain mandibles and maxillae. The position and view of these parts carry distinctive characteristics at family or genus levels. The posterior portion of the head often has a number of muscle scars which appear as dark or light spots. The shape and structure of the thorax segments are also important for identification of the larvae. The thorax segments -prothorax, mesothorax and metathorax- contain a dedicated pair of legs that are often a sclerotized notum. The prothorax generally has a finger-like prosternal horn and a lateral pair of trochantins, which can be distinctive for several families. The prothorax is always covered by dorsal sclerotized plates while the meso- and metathorax do not always have sclerotized notal plates but possess notal subdivisions. Setae, if arising on the meso- or metanota, reside in characteristic areas termed setal area 1 (sa1), setal area 2 (sa2) and setal area 3 (sa3). Arrangement of both setal areas and sclerites can be of taxonomic importance. Thoracic legs have a tarsal claw apically. Each tarsal claw usually has a basal seta, the size of which can be of taxonomic value. The first abdominal segment often bears a dorsal hump and a pair of lateral humps, which provide circulation of water through the case as well as in securing the larva in the case. Some families have abdominal segments with numerous tracheal gills that facilitate gas exchange. The tracheal gills may be single or more filamentous, finger-

like, comb-like, etc. The shape of the abdominal gills provide important taxonomic characters in diagnosis. Each of the anal prolegs has an anal claw, which can be simple or complex, that bear accessory spines. The anal prolegs, in terms of sclerites and nature and extension of setation, vary from family to family in degree of separation from the body. The case structure and form are among the distinguishing characters for the larvae of caddisflies. Some larvae have a case while others can survive without. The case can be made out of a variety of materials including sand grains, small pebbles, vegetal fragments and secretions. The shape of the larval case and the type of the materials used are utilized for taxonomic characterization.

Results

A total of 1223 larvae belonging to the order of Trichoptera were collected from the Araç Creek. 14 taxa belonging to nine genera within eight families (Brachycentridae, Hydropsychidae, Hydroptilidae, Lepidostomatidae, Leptoceridae, Limnephilidae, Psychomyiidae and Rhyacophilidae) were identified (Table 2). The systematic list of the identified trichopterans is given in Table 2. Among the determined taxa *Micrasema cinereum* is the first record for Trichoptera fauna of Turkey.

Morphometric, biological and ecological characteristics and the distribution of new record for the fauna of Turkey are as follows:

Brachycentridae Ulmer

Micrasema cinereum Mosely, 1930

Description of the larva

Materials examined: 1 larva, (Station 1); 1 larva, (Station 2).

Head capsule: Mean head width 0.67 mm, mean head length 0.7 mm. Head round (Fig. 2A); chestnut in color with Y-shaped patterned in yellowish along dorsal ecdysial line.

Head with a dorsolateral supraocular ridge are clear on each side, and one extra lateral infraocular ridge present that is shorter and less conspicuous. The frontoclypeal apotome (Fig. 2A) follows broadening view from the starting point.

Profile view of the head capsule (Fig. 2B) has a curved dorsal edge view. Periocular area is light yellowish. Ventral side of the head capsule (Fig. 2C) has similar color-toned to dorsum; ventral apotome is more of rectangular viewed with a narrowing end towards the anterior section that separates the genae completely. Sclerites of cardo brown in color, median margin with a slightly sharp anterior process. Submental sclerites have extended view, possessing seta as the ventral side of the head along with possessing long seta on each (Fig. 2C).

Legs (Figs. 2D, E, F) have same but paler colored as seen for meso- and metanotum. Prothoracic legs are

shorter and stouter (Fig. 2D). Meso- and metathoracic legs are approximately same in size (Fig. 2E, F). Distal part of tibia of leg II and leg III show thin small tubercles (Fig. 2G). Tarsal claws of 3 legs have similar structure.

Thorax (Fig. 2H): One half of the posterior pronotum is uniformly brown, and anterior section is obviously paler. Pronotum has an obvious curved transverse ridge view, one half of anterior and ridge does not show sparse view. Mesonotum has greenish islands in brown colored surface while the metanotum has bluish view. Tergite on each half of mesonotum is consisting of one single plate with the total number of tergite plates 2 (Fig. 2H). Metanotum is membranous, and has 2 pairs of small sclerites.

Abdomen is nearly cylindrical and posterior section is gradually tapered while segment IX is clearly thinner (Fig. 2K). Dorsal hump is absent and lateral humps are indistinct in segment I. Abdominal gills and lateral lines are absent.

Mid dorsal sclerite of segment IX (Fig. 2I) is weakly sclerotized, elliptical, with *ca.* 12 setae that are different in size along posterior margin.

Anal prolegs (Fig. 2I) are nearly sclerotized at dorsal view. Lateral sclerite is strongly sclerotized at dorsal view. Anal claw is stout and with 3 accessory hooks (Fig. 2J), for which one of them is poorly developed and often unobtrusive.

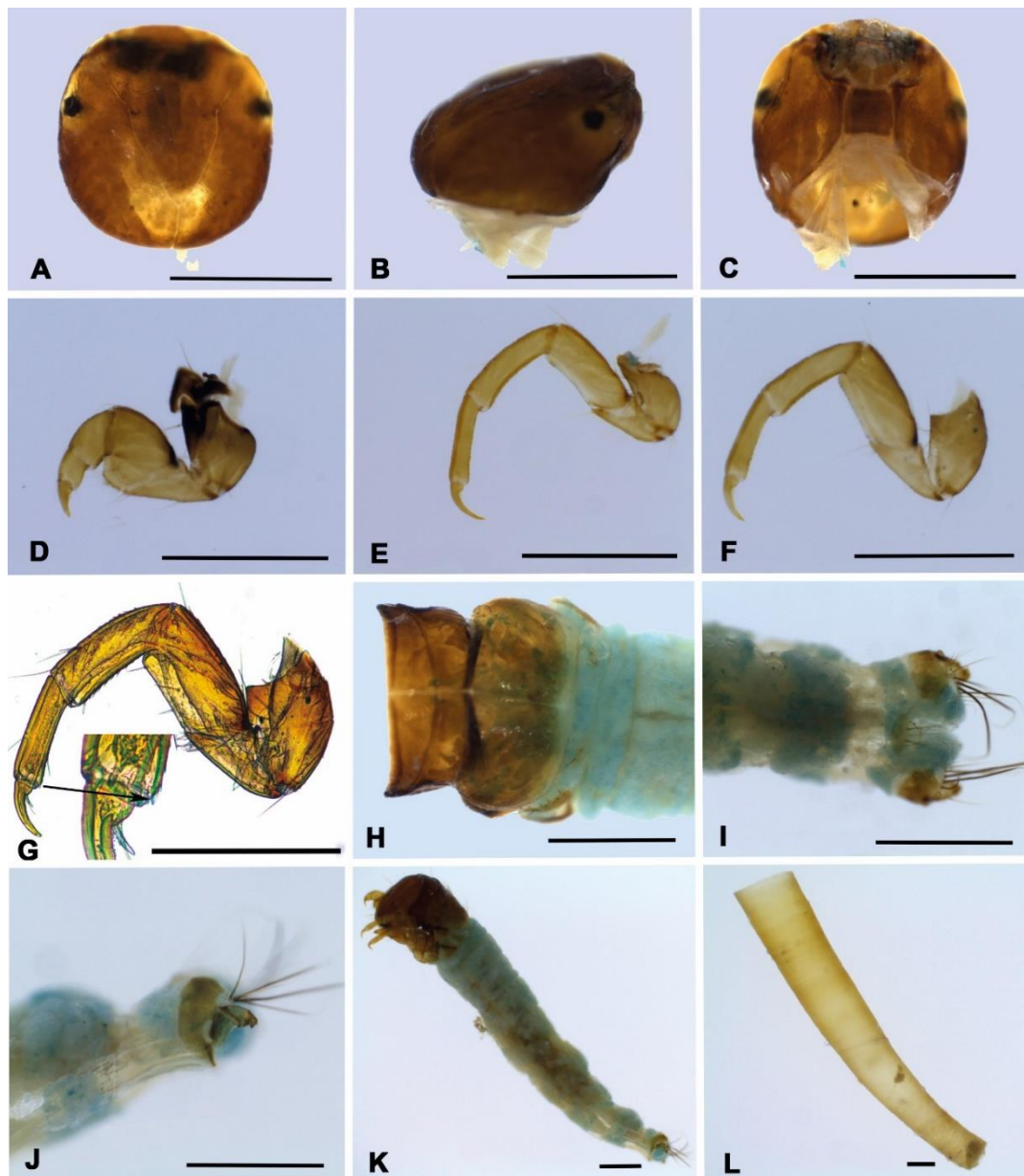


Fig. 2. Larva and case of *M. cinereum* (A) Head in dorsal view, (B) Head in lateral view, (C) Head in ventral view, (D) Prothoracic leg, (E) Mesothoracic leg, (F) Metathoracic leg, (G) Distal part of tibia of leg II and leg III, (H) Thorax in dorsal view, (I) 9th abdominal segment and anal prolegs in dorsal view, (J) 9th abdominal segment and anal prolegs in lateral view, (K) Larvae in lateral view, (L) Case in lateral view. Scale bars: 0.5 mm.

Table 2. Trichopteran taxa identified from the Araç Creek.

Family	Taxa	Number of larvae	Sampling Station					
			1	2	3	4	5	6
Rhyacophilidae	<i>Rhyacophila nubila</i> Zetterstedt	13	*	*			*	
	<i>Rhyacophila</i> sp.	2		*				*
Hydroptilidae	<i>Hydroptila</i> sp.	3					*	
Psychomyiidae	<i>Psychomyia pusilla</i> (Fabricius)	4					*	*
Hydropsychidae	<i>Cheumatopsyche lepida</i> (Pictet)	4				*	*	
	<i>Hydropsyche botosaneanui</i> Marinkovic-Gospodnetic	665	*	*	*	*	*	*
	<i>Hydropsyche bulbifera</i> McLachlan	250	*	*	*	*	*	*
	<i>Hydropsyche exocellata</i> Dufour	93				*	*	*
	<i>Hydropsyche instabilis</i> (Curtis)	64		*	*	*		
	<i>Hydropsyche pellucidula</i>	119	*		*	*	*	*
Brachycentridae	<i>Micrasema cinereum</i>	2	*	*				
Lepidostomatidae	<i>Lepidostoma hirtum</i> (Fabricius)	2		*				
Limnephilidae	<i>Limnephilus lunatus</i> Curtis	1					*	
Leptoceridae	<i>Setodes viridis</i> (Fourcroy)	1					*	

Table 3. The zoogeographical distribution of trichopteran taxa in Araç Creek. WP; West Palearctic, EP; East Palearctic, OL; Oriental, NA; Nearctic (Morse, 2018).

Family	Taxa	Zoogeographical distribution
Rhyacophilidae	<i>Rhyacophila nubila</i>	EP and WP
	<i>Rhyacophila</i> sp.	-
Hydroptilidae	<i>Hydroptila</i> sp.	-
Psychomyiidae	<i>Psychomyia pusilla</i>	WP
Hydropsychidae	<i>Cheumatopsyche lepida</i>	EP and WP
	<i>Hydropsyche botosaneanui</i>	EP and WP
	<i>Hydropsyche bulbifera</i>	WP
	<i>Hydropsyche exocellata</i>	WP
	<i>Hydropsyche instabilis</i>	WP
	<i>Hydropsyche pellucidula</i>	EP, WP, NA and OL
Brachycentridae	<i>Micrasema cinereum</i>	WP
Lepidostomatidae	<i>Lepidostoma hirtum</i>	EP and WP
Limnephilidae	<i>Limnephilus lunatus</i>	WP
Leptoceridae	<i>Setodes viridis</i>	EP and WP

Body (Fig. 2K) length up to 3.6 mm, mean body width up to 0.5 mm.

Case (Fig. 2L) is about 6.9 mm long with yellow to orange color. It has a narrowing tubular shape from anterior to posterior with a curved ending (1/3 of the size). The case is made of secretion by the larvae.

Habitat and distribution

Giudicelli & Orsini (1987) reported that *M. cinereum* inhabit one of the 3 sub-branches of Restonica river (Corsica), whose altitude is between 400-800 m. Décamps (1970) reported the presence of *M. cinereum* in low- and mid-altitudes of the rivers in mountainous areas, where *M. longulum* McLachlan, and *M. minimum* McLachlan were also found. We sampled *M. cinereum* at the proximity of the spring, where altitudes were recorded as 920 and 784 m for the stations 1 and 2, respectively. Station 1

resembles the area described elsewhere (Décamps 1970) and is located 1 km south of İhsangazi in a place relatively far from the settlements in the forest area. The depth is approximately 30 cm with sediment mostly composed of rubbles and pebbles that are 2–20 mm in size. Station 2, with a similar flow and habitat pattern as Station 1, is located at the 7th km of Kastamonu, İhsangazi, İhsangazi-Araç road, Akkaya village road junction, in the bridge vicinity. The depth is approximately 25-30 cm and with a base structure mostly composed of small rocks.

The distribution range of *M. cinereum* has been given from France (Corsica) and Spain (Mosely 1930, Décamps 1970, García de Jalón 1982, Casado *et al.* 1990).

From the zoogeographical point of view, the Trichoptera fauna of Turkey is strongly related to the European fauna. The Trichoptera fauna of northeastern

Turkey is related to the Caucasian/Transcaucasian fauna. The zoogeographical evaluation of caddisfly taxa in Araç Creek showed that 6 (42,85%) species belong to West Palearctic, 5 (35,71%) species belong to East-West Palearctic, and 1 (7,14%) species belongs to East-West Palearctic, Nearctic, and Orientalic (Table 3). The zoogeographic distribution of the two taxa which were identified as *Rhyacophila sp.* and *Hydroptila sp.* are not shown here.

Discussion

The present study has been performed as the first study aiming to determine the Trichoptera fauna in Araç Creek where 14 caddisfly taxa were identified (Table 2). The sampled material was found to be represented with 12 species while two taxa could be identified at genus level. *Rhyacophila sp.* is different from *R. fasciata* Hagen with that the muscle attachment spots within the dark triangular patch on the frontoclypeus are paler than the surrounding pattern and clearly discernible. Besides, it is different from *R. nubila* Zetterstedt by possessing the dark pattern on frontoclypeus that is not extended to the anterior margin. Although it may seem different from the previously recorded *R. nubila* and *R. fasciata*, identification of the species was confined to genus level of the *Rhyacophila sp.* samples due to the fact that the diagnostic characters were not completely clear in our samples. Hydroptilidae family is distinguished from other caddisfly families with its characteristic life cycle where the first four larval instars live freely without having case while the fifth larval instar builds a case to live in. Case type and the construction material are distinguishing parameter among Hydroptilidae members (Pescador *et al.* 1995). The Hydroptilidae larvae were not at their 5th instar, where the taxonomic characters are not clear enough, and we therefore preferred to use *Hydroptila sp.*

Although *M. cinereum* has been given as an endemic species from Corsica (Décamps 1970, Giudicelli & Orsini 1987, Botosaneanu & González 2006), its presence in Spain was also reported (García de Jalón 1982, Casado *et al.* 1990). According to the inventory given by Darılmaz & Salur (2015), three species of genus *Micrasema* (*Micrasema anatolicum* Botosaneanu, *M. bifoliatum* Martynov and *M. mencilis* Sipahiler) have been reported from Turkey. However, the larval stages of these three species are not known, because these species were reported as adult samples.

Micrasema cinereum, which is distinguished from the other species with the following key characteristics is

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given as a new record in this study. *Micrasema cinereum* and *M. longulum* possess fully secretion-based case structures which is not seen in other *Micrasema* species. The case is constructed from natural minerals for *M. moestum* (Hagen) and *M. minimum*. In contrast to this, the case is made of plant materials for *M. tristellum* McLachlan and *M. togatum* (Hagen) and of plant material and secretion for *M. morosum* (McLachlan). Structurally, the case of *M. cinereum* and *M. longulum* has curving view at posterior side (Décamps 1970). The structural characteristic of mesothorax is one of the key parameters used to distinguish these species. *Micrasema minimum*, *M. setiferum* (Pictet) and *M. moestum* have four sclerotized plates. In contrast to this, *M. longulum*, *M. cinereum*, *M. difficile* Mosely, *M. tristellum*, *M. togatum* and *M. morosum* possess two sclerotized plates (Decampas 1970; Vieira-Lanero *et al.* 1998). The distal point of the tarsial ventral side of meso- and metathoracic legs possess conic tubercles in *M. longulum*, which are thinner for *M. cinereum*. While mesothorax has two chitinized plates with latero-anterior angles that are extending forward, those are not present in *M. cinereum*. Mesotonum is slightly less-colored in plain brown for *M. cinereum* in comparison to *M. longulum*. Dorsal view of cephalic capsule possesses protuberances in the eyes for *M. longulum* (Décamps 1970) while the protuberances are absent for *M. cinereum*.

Conclusion

In conclusion, 14 taxa belonging to nine genera within eight families (Brachycentridae, Hydropsychidae, Hydroptilidae, Lepidostomatidae, Leptoceridae, Linnephilidae, Psychomyiidae, Rhyacophilidae) were identified in six stations along Araç Creek. *Rhyacophila nubila*, *P. pusilla*, *H. bulbifera* and *H. pellucidula* have previously been recorded in the creek by Küçükbaşmacı & Kıyak (2017), while *Rhyacophila sp.*, *Hydroptila sp.*, *C. lepida*, *H. botosaneanui*, *H. exocellata*, *H. instabilis*, *M. cinereum*, *L. hirtum*, *L. lunatus* and *S. viridis* are new records for the creek. Among *M. cinereum* was recorded for the first time in Turkey. The present records increased the number of caddisflies taxa in Turkey fauna to 501.

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