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Research Article

The status of the leech fauna (Annelida, Hirudinea) at the eastern region of Azerbaijan

Shabnam Farzali, Naim Saglam*

Department of Aquaculture and Fish Diseases,
Fisheries Faculty, Firat University, 23119
Elazig, Turkey

*email: Nsaglam@firat.edu.tr

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Abstract

This study was carried out between May 2017 and December 2019 to determine leech species in some wetlands in the Eastern region of Azerbaijan. In the research, the leech samples were collected from 21 locations from six wetlands in the eastern part of Azerbaijan. As a result of field and laboratory studies, five species of leeches were determined (*Dina stschegolewi*, *Erpobdella* sp., *Haemopsis sanguisuga*, *Hirudo orientalis*, and *Placobdella costata*). In this research, Erpobdellid leech *Erpobdella* sp. are the first records from different three wetlands of Azerbaijan. In the freshwaters of Azerbaijan has been recorded 14 species of leeches. However, there are not detailed researches that these leech species are found in Azerbaijan. The freshwater leech fauna for the eastern region of Azerbaijan is determined for the first time in this research. *P. costata* and *H. sanguisuga* in two different, *Erpobdella* sp. in three various wetlands were found. However, *D. stschegolewi* and *H. orientalis* were determined only in one wetland. While *Erpobdella* sp coexists with *P. costata* in two water sources, it was observed

that lives with *H. orientalis* in one wetland. *H. sanguisuga* and *D. stschegolewi* could not be detected with different leech species in water sources.

Keywords: Biodiversity, Erpobdellids, *Haemopsis*, *Hirudo*, *Placobdella*

Introduction

The Azerbaijan Republic occupies a large area (86.6 thousand km²) in Europe and Asia, in the east part of the South Caucasus and the west of the Caspian Sea. Because of the geographical position of Azerbaijan can be found that there are many different new leech species. In the freshwaters of the Caucasia were found 23 species of leeches, but it has been written that 14 species can be found in Azerbaijan's wetlands (Memmedov *et al.* 2012, Musayev *et al.* 2002).

In Hydrofauna research of the Soyukhbulag, which a tributary of the Kura River in Azerbaijan found *Glossiphonia complanata*, *G. heteroclita*, *Helobdella stagnalis*, *Haemopsis sanguisuga*, *Hirudo medicinalis*, and *Piscicola geometra* (Gasimov and Likhodeeva 1962). This research is one of the first studies in which leech records were made in Azerbaijan. The later studies regarding the leech fauna of Azerbaijan were made by Gasimov (1965) and Gasimov (1972). In their research, the leech fauna of Azerbaijan has been included one subspecies and 14 species belonging to 4 families and 11 genera. Authors identified the following species: *Hemiclepsis marginata*, *G. complanata*, *G. heteroclite*, *G.*

heteroclita hyaline, *G. concolor* (apathy), *Batracobdella paludosa*, *H. stagnalis*, *Placobdella costata*, *Pisicola fasciata*, *P. geometra*, *H. sanguisuga*, *Erpobdella octaculata*, *Limnatis nilotica*, *H. medicinalis* (*orientalis*) and *Limnotrachelobdella turkestanica*.

There is only two detailed research on the specific leech species in Azerbaijan, such as *H. orientalis* (Utevsky and Trontelj 2005), and *Dina stschegolewi* (Khomenko *et al.* 2018). Until 2005 years in Azerbaijan, the medicinal leech species known as *H. medicinalis* was determined as *H. orientalis* by Utevsky and Trontelj (2005).

Despite increasing interest in the fauna and phylogenetic of leeches in the world (Aguado *et al.* 2008, Ben Ahmed *et al.* 2015, Kaygorodova and Fedorova 2016, Kuo and Lai 2019, Langer *et al.* 2018, Mabrouki *et al.* 2019, Nakano *et al.* 2018, Saglam *et al.* 2018), there are not enough studies on their biology, morphology, and ecology outside the classical book information and a limited number of research in which there are leech species in Azerbaijan (Gasimov 1972, Gasimov 1965, Gasimov and Likhodeeva 1962, Khomenko *et al.* 2018, Utevsky and Trontelj 2005).

The leech species are not investigated sufficiently in Azerbaijan, and for this reason, there is not enough information about its populations, current state, diversity, and distribution. This study was prepared to determine the fauna, diversity, and distribution of leech species in the Eastern Regions of Azerbaijan.

Material and methods

This study was carried out between May (2017) and December (2019) to determine leech fauna in some wetlands in the eastern region of Azerbaijan. To represent the east region of Azerbaijan, leech samples were collected from 21 locations from six wetlands, five from the northeast region (Fig. 1; Table 1).

During the wetlands study, the leeches were

collected by hand, forceps, hand strainers, and scoop-net (mesh-size 1mm) from under of objects (e.g., hard objects such as rocks, stones, submerged vegetation, and similar substrates) in freshwater. The leeches collected were transported to the laboratory in 0.5-1.0 L plastic and glass jars with water as alive. The sampled leeches were examined alive and then euthanized. Leech samples for euthanasia were firstly narcotized in 10% ethanol for 20 minutes. Then the anesthetized leeches were fixed in 70% ethyl alcohol, and the pictures were taken and identified according to morphological characters. Morphological data were obtained using model SNZ745T of the Nikon stereomicroscope. The viewing of leech samples was done with Kameram5. The identification of leech specimens was carried out following the keys presented by Govedich *et al.* (2019), Govedich *et al.* (2010), Lukin (1976), Sawyer (1986), Sağlam (2004).

Results

In this study, two leech species belonging to the Erpobdellidae family and one leech species belonging to every family of Glossiphoniidae, Haemopidae, and Hirudinidae were identified. As a result of field and laboratory studies, five species of leeches were determined (*Erpobdella* sp., *Dina stschegolewi*, *Placobdella costata*, *Haemopsis sanguisuga*, and *Hirudo orientalis*). *D. stschegolewi* (Korchay Brook, Masally) and *H. orientalis* (Nohurlar Lake, Shabran) were determined in one locality. *Erpobdella* sp. (Ambil and Nohurlar Lake, Shabran), *H. sanguisuga* (Nabran sources, Khudat and Khynalig Brook, Quba), and *P. costata* (Aghzibirchala and Nohurlar Lake, Shabran) were found in two localities (Table 1).

Phylum: **Annelida** Lamarck 1809

Class: **Clitellata** Michaelsen 1919

Subclass: **Hirudinea** Lamarck 1818

Infraclass: **Euhirudinea** Lukin 1956

Order: **Arhynchobdellida** Blanchard 1894

Suborder: **Erpobdelliformes** Sawyer 1986

Family: **Erpobdellidae** Blanchard 1849

Genus: *Dina* Blanchard 1892

Dina stschegolewi (Lukin et Epstein 1960)

Records: Korchay Brook is a slow-flowing stream with a length of approximately 15 km and a slope of no more than 1 m, located at an altitude of -26 to -27 m. Its stagnation constitutes an essential location for leeches to focus and live. *D. stschegolewi* was found at three points, as a result of the collection study from five points in the Korchay Brook near the village of Serchubar village, Masally. A total of 13 specimens of this leech were collected from five different aspects of this wetland (Fig. 1, Table 1).

Morphology: *D. stschegolewi* is a slender leech and a body length of between 25-50 mm. The body is cylindrical and dorsoventrally flattened. The dorsum side (Fig. 2A) is dark brown and contains irregular papillae. There are light spots on the papillae that are hard to see with the naked eye. The ventral surface is light brown (Fig. 2B). This species has for pair

eyes, which are often reduced (Fig. 2C). Two pairs of these pairs of eyes are buccal, and two are located labially on the dorsal surface. In some collected samples of this species, it was determined that the eyes are not fully developed and show irregularity. The distance between the genital pores is two annuli (Fig. 2D).

Habitat and distribution: *D. stschegolewi* lives in all kinds of flowing water, small streams, and slow-flowing parts of rivers, in the underparts of stone and plant remains that come into contact with the ground. It is also found in very weak flowing parts of some fountains.

D. stschegolewi was recorded from the Crimean Peninsula, Azerbaijan, Georgia, Ukraine, the eastern coast of the Black Sea of the South Caucasus, and Israel, Lebanon, Syria, Turkey, and Iran in the Middle East (Khomenko *et al.* 2018).

Table 1. List of freshwater leeches in the studied wetlands of Azerbaijan

Wetlands	Leech species	No. of samples	Coordinate		Altitude (m)	Total area/length
		(1-2)	Latitude	Longitude		
Aghzibirchala Lake, Shabran	<i>1-Erpbodella sp.</i> <i>2-Placobdella costata</i>	5-2	41°14'35.25"N	49°5'33.80"E	-26	1500 ha
		1-3	41°14'9.09"N	49°6'37.25"E		
		3-3	41°15'38.38"N	49°6'53.61"E		
		2-4	41°16'32.22"N	49°4'43.45"E		
		3-2	41°15'14.56"N	49°5'24.31"E		
Ambil Lake, Shabran	<i>1-Erpbodella sp.</i> <i>2-Placobdella costata</i>	6-2	41°9'30.95"N	48°44'4.92"E	940	1.5 ha
		8-1	41°9'31.83"N	48°44'7.85"E		
		9-4	41°9'33.68"N	48°44'7.43"E		
		8-2	41°9'34.24"N	48°44'4.48"E		
Khynalig Brook, Quba	<i>Haemopsis sanguisuga</i>	3	41°10'53.60"N	48°7'5.70"E	2060	162 km
		5	41°10'49.92"N	48°7'14.29"E	2055	
		1	41°10'35.46"N	48°7'22.18"E	2035	
		3	41°10'22.27"N	48°7'26.62"E	1999	
		2	41°10'15.04"N	48°8'45.36"E	1949	
Korchay Brook, Masalli	<i>Dina stschegolewi</i>	5	38°55'47.35"N	48°46'8.46"E	-27	15 km
		2	38°55'47.26"N	48°45'50.74"E	-26	
		1	38°56'12.55"N	48°46'23.14"E	-26	
		3	38°56'16.98"N	48°46'26.21"E	-27	
		2	38°56'6.40"N	48°46'42.08"E	-27	
Nabran sources-Khudat	<i>Haemopsis sanguisuga</i>	6	41°38'15.46"N	48°43'55.46"E	5	11 km
Nohurlar Lake,	<i>1-Erpbodella sp.</i>	10-5	40°58'3.80"N	48°54'50.58"E	722	0.15 ha

Shabran 2-*Hirudo*
orientalis



Figure 1. Locations of wetlands where leech samples were collected in Azerbaijan. 1, Aghzibirchala Lake (Shabran), 2, Ambil Lake (Shabran), 3, Khynalig Brook (Quba), 4, Korchay Brook (Masally), 5, Nabran sources (Khudat), 6, Nohurlar Lake (Shabran).

2- Family: **Erpobdellidae** Blanchard 1849

Genus: *Erpobdella* Blainville 1918

***Erpobdella* sp.**

Records: The total of 55 specimens of *Erpobdella* sp. were collected with the inclusion of 14 specimens from different five locations of Aghzibirchala Lake, 31 specimens from the other four locations of Ambil Lake, and ten specimens from one location of Nohurlar Lake (Fig. 1, Table 1). These lakes are located in Shabran province. *Erpobdella* sp. was the first record for Azerbaijan. This leech species was collected from free-living samples attached to the underside of various stones and rocks in the benthos.

Morphology: The length of preserved small leeches (Ambil Lake) are 10-15 mm and 0.5-1 mm in width. The big size (Aghzibirchala Lake and Nohurlar Lake) leeches are 34 mm in length and 3

mm in width. The dorsal surface of the live *Erpobdella* sp. specimens were observed to carry colored areas irregularly spotted from dark brown to black on the greenish-brown ground (Fig. 3). The caudal sucker of preserved specimens is smaller (0.3 mm) than the anterior sucker (3 mm). The head is provided with four pairs of eyes (Fig. 3C). The genital pores are separated by two annuli (Fig. 3D). This species is a predator on invertebrates. This species is thought to be a new leech species because its morphological features do not resemble other leech species belonging to the Erpobdellidae family, which is present in the Palearctic region. More comprehensive, both morphologic and molecular research is needed to identify this species exactly.

Habitat and distribution: Mentioned species is abundant in lentic habitats. Most of the time, after feeding, they are localized in parts of hard objects

such as stones in stagnant freshwater that come into contact with the ground. *Erpobdella* sp. prefers

stagnant freshwaters in an extensive elevation (-26 - 922 m) in Azerbaijan.

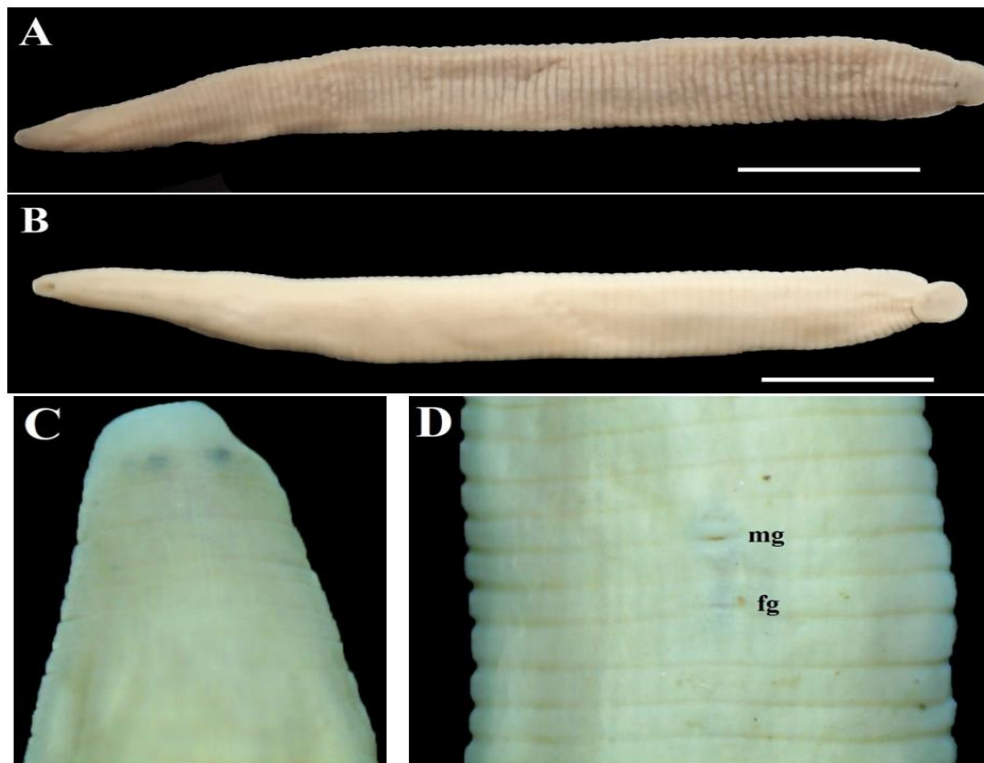


Figure 2. *Dina stschegolewi*. A. Dorsal view, B. Ventral view, C. Eyes, D. Male and female gonopors
Scale bar: 10 mm

3- Suborder: **Hirudiniformes** Caballero 1952

Family: **Haemopidae** Richardson 1969

Genus: **Haemopsis** Savigny 1822

Haemopsis sanguisuga (Linnaeus 1758)

Synonyms: *Hirudo sanguisuga* (Linnaeus 1758); *Hirudo gulo* Braun, 1805; *Hirudo vorax* Johnson 1816; *Hirudo sanguisorba* De Blainville 1818; *Hirudo carnivore* Brossat, 1822; *Hirudo lacertina* Savigny 1822; *Hirudo luctuosa* Savigny 1822; *Hippobdella nigra* Savigny 1822; *Aulastoma nigrescens* Moquin-Tandon 1826; *Pseudobdella nigra* De Blainville 1827; *Hippobdella sanguisorba* De Blainville, 1827; *Pseudobdella vorax* Gervais 1836; *Aulastoma ornata* De Filippi 1837; *Aulastoma gulo* Moquin-Tandon 1846; *Haemopsis nigra* Johnston 1846; *Haemopsis vorax* Johnston 1846; *Aulostomum gulo* Diesing, 1850; *Typhlobdella kovatsi* Diesing 1850; *Aulacostomum gulo* Grube 1851.

Records: The total of 20 specimens of *H. sanguisuga* was collected from the leaf-bases of the reeds with the inclusion of 14 specimens from different five locations of Khynalig Brook (Quba), and six specimens from one location of Nabran sources (Khudat) (Fig. 6, Table 1).

Morphology: This leech species can be up to 165 mm long. The dorsal surface (Fig.4A) of the leech is smooth; papillae are always absent and have unstable small dark dots. At the same time, the dorsum has a pair of dark, wavy lines. *Its three jaws can most readily identify H. sanguisuga.* The leech's ventral surface is usually light yellowish colored with large irregularly scattered and dark-colored spots (Fig. 4B). The anterior sucker has five pairs of eyes (Fig. 4C). The male and female genital pores are separated by five annuli (Fig. 4D). In preserved specimens, the penis is often visible.

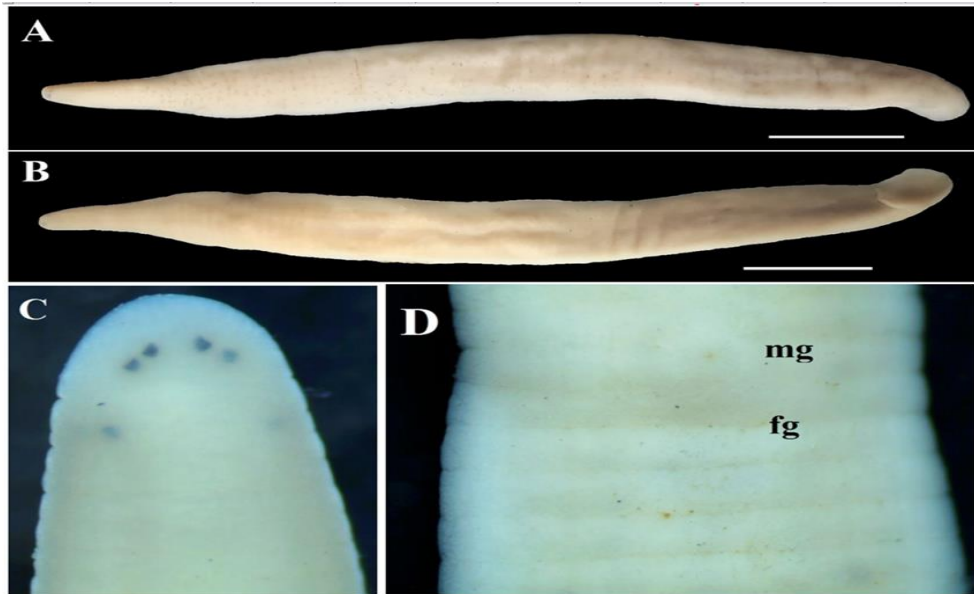


Figure 3. *Erpobdella* sp. A. Dorsal view, B. Ventral view, C. Eyes, D. Male and female gonopors. Scale bar: 5 mm

Habitat and distribution: *H. sanguisuga* is widespread and can be attributed even to transpalearctic group and Inhabits Palaearctic waters. This leech is a predator of small vertebrates and invertebrates. It likes waters containing organic matter and lives in very stagnant parts of rivers and marshes.

H. sanguisuga is a common leech species, especially in European countries. *H. sanguisuga* has been recorded from Austria,

Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, France, Germany, Greece, Hungary, India, Ireland, Italy, Kaliningrad Region, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Russia, Sardinia, Sicily, Slovakia, Slovenia, Spain, Sweden, The Netherlands, Turkey, and Ukraine (Nesemann and Neubert 1999).

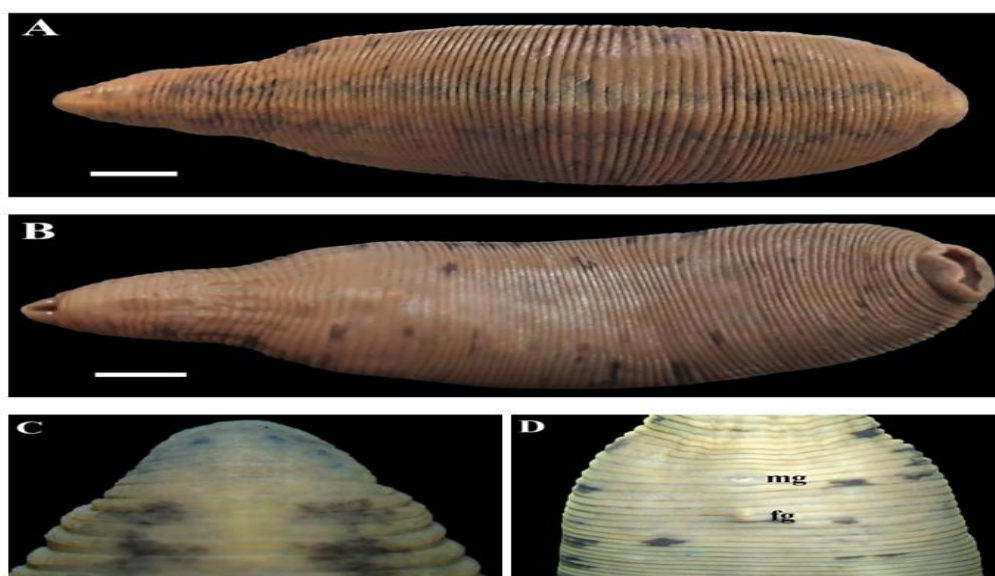


Figure 4. *Haemopsis sanguisuga*. A. Dorsal view, B. Ventral view, C. Eyes, D. Male, and female gonopors. Scale bar: 10 mm.

4-Family: **Hirudinidae** Whitman 1886

Genus: **Hirudo** Linnaeus 1758

Hirudo orientalis (Utevsky and Trontelj 2005)

Records: The total of five specimens of the Palearctic medicinal leech species *H. orientalis* were found in the Nohurlar Lake in Shabran province (Fig. 1, Table 1). This species was collected by scooping as it moved towards the collector entering the water.

Morphology: The identifier body color of the *Hirudo orientalis* is grass green. The length is 82 mm, and the width 12 mm. They have thin, deep orange-colored paramedian stripes. The dorsal surface of the leech has segmentally arranged pairs of black quadrangular or rounded dots on its paramarginal dorsal stripes (Fig.5A). The ventral coloration pattern (Fig.5B) of *H. orientalis* is more regular with metameric pairs of light-colored markings. Five pairs of eyes located on the anterior-dorsal of

the body forming a parabolic arc on annuli of II, III, IV a1, V a1, and VI a2 (Fig. 5C). The male gonopore is larger than the female gonopore. Five annuli separate both genital openings in the clitellum region. The male pore and female pore are located in the furrow XI b5/b6, and XII b5/b6 (Fig.5D).

Habitat and distribution: *H. orientalis* widely uses in medicinal purposes for human treatment in Azerbaijan. There is a decrease in *H. orientalis* in some habitats due to intensive use, climatic changes, and environmental pollution in Azerbaijan. This species of medicinal leech prefers small and mesotrophic freshwater lakes in high mountainous areas in Azerbaijan. It is noteworthy that there are frogs and water snakes in the lakes. The populations of *H. orientalis* are present in Azerbaijan, Kazakhstan, Uzbekistan, and Iran.

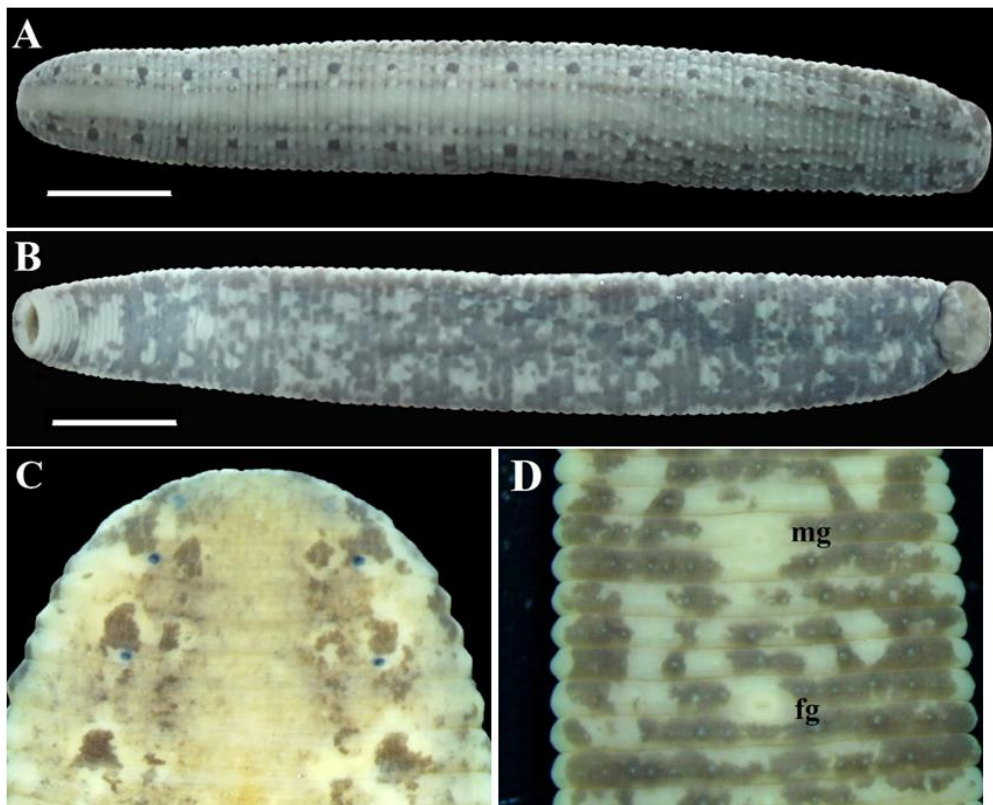


Figure 5. *Hirudo orientalis*. A. Dorsal view, B. Ventral view, C. Eyes, D. Male and female gonopors. Scale bar: 10 mm.

5-Order: **Rhynchobdellida** Blanchard 1894

Family: **Glossiphoniidae** Vaillant 1890

Genus: **Placobdella** Blanchard 1893

Placobdella costata (Fr. Müller 1846)

Synonyms: *Clepsine costata* Fr Müller 1846; *Glossiphonia catenigera* Moquin-Tandon 1846; *Haementeria costata* Fr. Müller 1846; *Clepsine affinis* Diesing 1850; *Placobdella raboti* Blanchard 1893; *Placobdella guernei* Blanchard 1894; *Placobdella catenigera* Blanchard 1894; *Haementeria nusbaumi* Gedroyc 1913; *Placobdella roszkowskii* Oka 1932.

Records: A total of 23 specimens of *P. costata* were collected from the inclusion of 14 specimens from different five locations of Aghzibirchala Lake and nine specimens from Ambil Lake's location Shabran province (Fig. 5, Table 1). Although this leech species is a parasitic species in freshwater turtles, the free-living samples were collected from under hard objects such as the stone in the water.

Morphology: The shape of the leech is dorsoventrally flattened. The color of the body of the living specimen is dark greenish and brown. On the dorsal surface, there is a median bright stripe with four black dots in the posterior part of the body (Fig.6A). The crop has seven pairs of caeca. Mouse pore is positioned toward the middle of the oral sucker (Fig.6B). Preserved small specimens, reaching a body length of 17 mm and width of 9 mm. *P. costata* have two pairs of simple eyes with the compound of one large and one small pair (Fig.6C). The genital pores are separated by two annuli.

Habitat and distribution: *P. costata* is a Mediterranean species, and they are fed with the blood of freshwater turtles as temporary parasites. This leech species abundantly lives in freshwaters, where densely populated turtles. In addition, they are stuck on freshwater turtles and are transported long distances with them. These leech species can also be found in each aquatic environment where freshwater turtles live.

P. costata is a common leech species,

especially in the Mediterranean countries and in the Palaearctic region. *P. costata* has been recorded from Algeria Belarus, Bosnia and Herzegovina, Britain, Bulgaria, Croatia, Estonia, Germany, Greece, Hungary, Iberian Peninsula, Italy, Iran, Kaliningrad Region, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Slovakia, Slovenia, Sicily, Russia, Spain, The Netherlands, Turkey, and Ukraine.

Discussion

Although leeches are widely distributed all over the world, some species are regionally focused. While some leech species are located as Palaearctic, some of them are settled as Nearctic. Although there are focuses in various regions on a species basis, it can be seen that leeches are spread worldwide on a genus basis (e.g., *Erpobdella*, *Placobdella*, and *Helobdella*, etc.). It is also possible to see that some genus of leech focus on regional or continents. The *Hirudo* genus (except for the Far Eastern origin *H. nipponia*) is found primarily in the west of Europe and Asia. In contrast, the *Hirudinaria* genus lives in the Far East. *Macrobodella* genus, which is also a medical leech genus, has been located in North America.

The family Erpobdellidae has a worldwide distribution, and most species are predators on freshwater or terrestrial invertebrates that can usually be swallowed completely. *Erpobdella* sp. has morphological similarities with *E. obscura*, a Palaearctic species of erobdellids. *E. obscura* is a predatory and a relatively large leech species in freshwater habitats in temperate regions of North America and commonly used as bait in angling (Linton and Davies 1987). Mentioned *Erpobdella* sp. was found in Aghzibirchala Lake, Ambil Lake, and Nohurlar Lake (Shabran district) in Azerbaijan. This species differs from the *E. obscura* because it was collected from the Palaearctic region and the differences in the eyes' placement. The first two pairs of eyes of *Erpobdella* sp. are located as the parabolic in frontend. However, the first two pairs of eyes

of *E. obscura* has been located in line up approximately in alignment. At the same time,

the adult individuals of *Erpobdella* sp. are smaller from *E. obscura*.

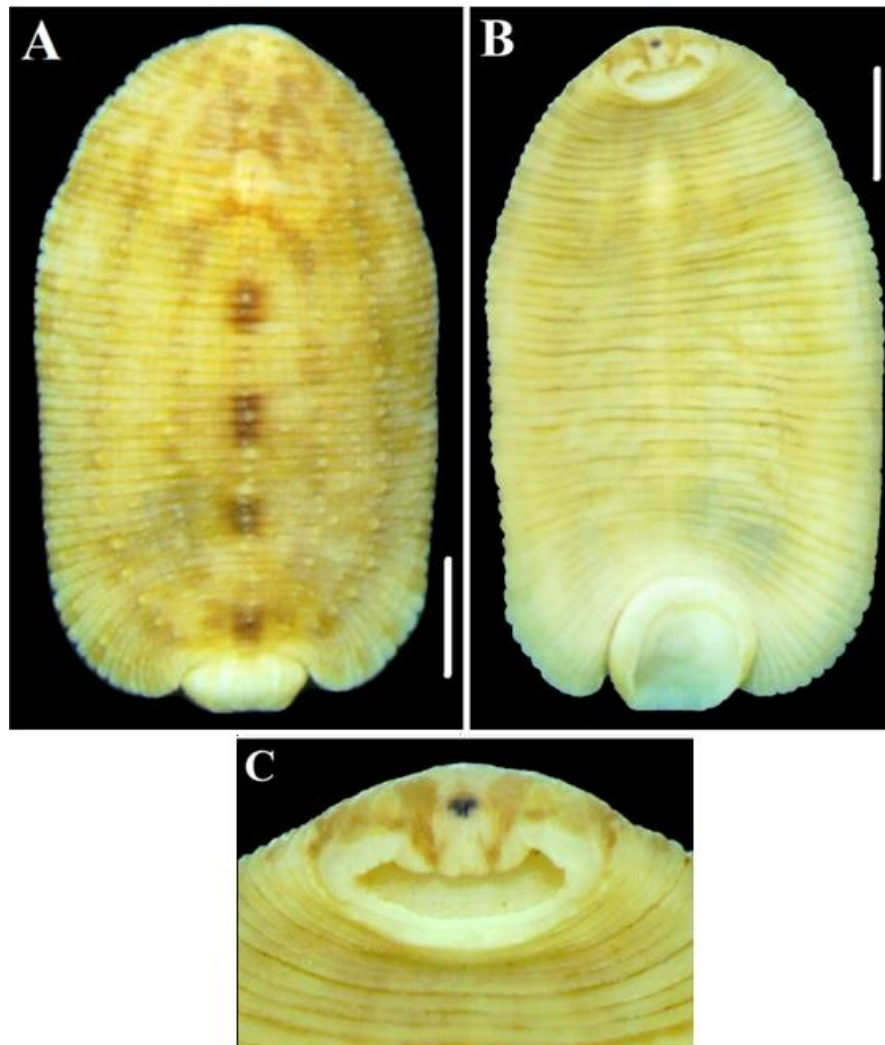


Figure 6. *Placobdella costata*. A. Dorsal view, B. Ventral view, C. Eyes. Scale bar: 5 mm.

The predatory leech species *D. stschegolewi* has been identified primarily in parts of the Middle East, Asia, and Europe. *D. stschegolewi* has been recorded mainly for the Middle East (Israel, Lebanon, Syria (Bromley 1994), Turkey (Nesemann and Neubert 1999), Iran (Darabi-Darestani *et al.* 2016, Grosser and Pešić 2006, Salimi *et al.* 2011), the South Caucasus (Eastern coast of the Black Sea) (Kvavadze 2002, Lukin 1976) and Eastern Europe (Poland (Bielecki *et al.* 2011), and Romania (Cristea and Manoleli 1977), and Georgia (Khomenko *et al.* 2018). The first record of *D. stschegolewi* was previously made

in Azerbaijan in the Masally District, in a small stream in the village of Arkivan and in the Korchay Brook near the village of Serchuvar (Khomenko *et al.* 2018). In this study also, we were found the same leech species in the same brook in near the village of Serchuvar of Azerbaijan.

H. sanguisuga, which called horse leech devours a wide range of prey that includes earthworms, mollusks, insects, tadpoles, small or wounded fish and frogs, leeches of its own and other species, and almost any carrion (Elliott and Mann 1979, Shikov 2011). This species widely distributed naturally in the wild

in most countries in western Europe, throughout from Anatolia to Israel of the Middle East region, countries of the East Mediterranean region, North Africa, and Norway (Nesemann and Neubert 1999). *H. sanguisuga* was described in the Soyugbulag river, which a tributary of the Kura River in Azerbaijan (Gazakh region), the lakes of Lesser Caucasus, and in the Astara region (Gasimov and Likhodeeva 1962, Musayev *et al.* 2002). In this study, *H. sanguisuga* was found in new localities (Khynalig village, Quba, and Nabran sources, Khudat) of Azerbaijan outside the wetlands defined by the researchers above.

Many leech species live as temporary parasites by sucking the blood of various aquatic and terrestrial animals. *H. orientalis* belongs to the *Hirudo* genus and has also been adapted to suck blood from mammals, including humans. This medicinal leech species also deliver some bioactive substances in their saliva that prevent blood clotting that benefit mammals while sucking blood. For this reason, the medical leech species in the *Hirudo* genus are also exported and imported for commercial to use in traditional and complementary medicine applications due to their benefits to humans. Despite medicinal leech *H. orientalis* in Azerbaijan, no export has been made from the country so far. Although the classic books of Azerbaijan contained medicinal leech species as *H. medicinalis* until 2005, it was determined by Utevsky and Trontelj (2005) that this species is a different species of the medicinal leeches belonging to *Hirudo* genus.

H. orientalis is known from Transcaucasia, Iran, and Uzbekistan. *H. orientalis* was found in Georgia, Azerbaijan, Iran (Lukin 1976, Utevsky and Trontelj 2005). It was identified firstly in Azerbaijan by Utevsky and Trontelj (2005). Unfortunately, like the other leech species, there is no information about the ecology and distribution of *H. orientalis* in Azerbaijan. Due to the use in traditional and

complementary medicine practices of *H. orientalis*, more detailed research on the ecology and cultivation of this leech species is required in Azerbaijan.

In the literature records, *P. costata* was found in the freshwater of Sharur district (NAR), Lankaran, and Astara district in Azerbaijan (Musayev *et al.* 2002). *P. costata* is primarily ectoparasites on freshwater turtles, and this leech can be densely observed as an adherent to the plastron shell of freshwater turtles. This species was recorded from countries around the Mediterranean, the Black Sea, and the Caspian Sea, widely distributed in Europe and North Africa (Elliott *et al.* 1979, Mabrouki *et al.* 2019). Recent years' research involved Turkey and Slovenia, which represents the first records for the country (Saglam 2001, Vamberger and Trontelj 2007). *P. costata* was described on freshwater turtles as a temporary ectoparasite (Bielecki *et al.* 2012, Fediras *et al.* 2017, Marrone *et al.* 2016, Mishra and Gonzalez 1978). By contrast, Saglam (2001) and de Carle *et al.* (2017) found *P. costata* on the underside of stones, rocks, and other solid substrates in the shallow water zone. In this study also, *P. costata* samples were collected from under hard objects in shallow waters of Aghzibirchala and Ambil Lakes of Azerbaijan in their free life cycle as similar to Saglam (2001) and de Carle *et al.* (2017).

Conclusion

In conclusion, the leech fauna of Azerbaijan is inadequately studied until at present. This study is the detailed first research of recent years on freshwater leech fauna, specifically in the northeast and southeast region of Azerbaijan. The five leech species belonging to four genera (*Dina*, *Erpobdella*, *Haemopsis*, *Hirudo*, and *Placobdella*) from three families (Erpobdellidae, Glossiphoniidae, and Hirudinidae) of two orders (Rhynchobdellida and Arhynchobdellida) were determined in the different six wetlands of Azerbaijan.

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