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THE NUMERICAL DYNAMICS OF THE HIRUDO ORIENTALIS UTEVSKY & TRONTELJ, 2005 SPECIES IN SOME REGIONS OF AZERBAIJAN

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Abstract

The medicinal leech, belonging to the phylum Annelida, is an ectoparasite that has been used by humans for various purposes since ancient times. This organism is primarily known as an ectoparasite that feeds on the blood of vertebrate animals and plays a significant role in the treatment of numerous diseases. Although global interest in this species has increased in recent years, there remains a need for comprehensive and systematic scientific research in Azerbaijan. As a result of our studies, water bodies in the Quba-Khachmaz and Lankaran-Astara regions of Azerbaijan where *Hirudo orientalis* Utevsky & Trontelj, 2005 is distributed have been identified. During our research conducted between 2018 and 2024, *H. orientalis* was detected in 12 water bodies in the Quba-Khachmaz region and 15 water bodies in the Lankaran-Astara region. The numerical dynamics of *H.orientalis* Utevsky & Trontelj, 2005 in these regions were determined using hydrobiological methods, and their distribution was mapped based on GPS coordinates using the ArcGIS software.
Keywords: H. orientalis, hydrobiological method, Red Book, hirudofauna, leech, Quba-Khachmaz, Lankaran-Astara

Introduction

Leeches are representatives of the genus ***Hirudo***, adapted to an ectoparasitic lifestyle, belonging to the phylum Annelida. According to historical sources, the medicinal leech has been used for centuries in China, India, Greece, Rome, and Egypt. Due to mass harvesting in various periods, since 1983 the medicinal leech has been included in the Red Data Book as a rare and endangered species. In 2017, it was also listed as a protected species under the international CITES agreement. In Azerbaijan, the export of this species is only allowed with the permission of the Ministry of Ecology and Natural Resources. Due to illegal commercial exploitation, the population of the species has significantly declined and it has been included in the editions of Azerbaijan's "Red Book" published in 1984 and again in 2023 [1].

In recent years, several studies related to the hirudofauna of Azerbaijan have been conducted by M. Guseynov and Shabnam Farzali. M. Guseynov investigated the population and distribution characteristics of various leech species across different regions of Azerbaijan [3]. Shabnam Farzali, in her dissertation titled *"Morphological and Molecular Identification of Leech Species in the Lankaran-Astara Region"*, studied the hirudofauna of that area [4].

Currently, there are eleven artificial leech farms operating in the country and individuals from these farms are mainly used in hirudotherapy. The species characteristic of Azerbaijan is the Eastern medicinal leech — *Hirudo orientalis* Utevsky & Trontelj, 2005. Although it was previously referred to in the literature as *Hirudo medicinalis* until 2005, research by Utevsky and Trontelj confirmed that the species is indeed *Hirudo orientalis* [7]. The distinguishing features between *Hirudo medicinalis* and *Hirudo orientalis* are presented in Table.1 [6].

Table 1. Comparison of *Hirudo orientalis* and *Hirudo medicinalis* species

Characteristic	Hirudo orientalis	Hirudo medicinalis
Taxonomic status	Medicinal leech	Traditional medicinal leech species
Genetic difference	Differs in mtDNA and nuclear DNA	Genetically distinct
Body color	Dark green or olive-colored	Light green background with red and black patterns
Dorsal patterns	Faint, in darker shades	Clearly visible reddish dorsal stripes
Body shape	Broader and shorter body	More slender and elongated body
Distribution area	Caucasus, Iran, Türkiye, Central Asia	Western and Central Europe
Medical use	Used for medical purposes	Most widely used in medicine
Scientific description	Siddall et al., 2007	Carl Linnaeus, 1758

The main objective of our research was to study the distribution and numerical dynamics of ***Hirudo orientalis*** in the water bodies of the Quba-Khachmaz and Lankaran-Astara regions.

Materials and methods

The materials for this study were collected between 2018 and 2024. The collection of *Hirudo orientalis* was carried out using the following hydrobiological methods, which are of great importance in terms of detecting the species in its natural ecosystems, assessing numerical dynamics, and evaluating biodiversity [2]. The research was conducted on a seasonal basis throughout the study years. During the period from October to May leeches remained in hibernation due to the low temperature of both water and air. Therefore, the majority of the leech specimens were collected between June and September. The highest number of smaples was obtained in July. Quantitave indicators were determined based on the calculation of the total number of collected individuals.

During the study, a comparative analysis of the distribution of *H.orientalis* species in different water bodies was conducted, and a certain sequence was taken as a basis in this process:

1. Selection of water biotopes.

For the purpose of the study, water bodies were first classified according to their geomorphological structure, hydrological characteristics and vegetation cover (Ceratophyllum, Potamogeton, Carex). *H. orientalis* species was mainly found in shallow water areas with weak currents or stagnant, swampy and rich in aquatic plants. The materials were collected from pre-determined permanent points throughout the year.

2. Collection of benthic samples.

H. orientalis is mainly found in the benthic zone - at the bottom of the water. For this reason, special hydrobiological tools, dredges and nets were used to collect samples. The samples taken from the bottom with these tools are placed in plastic containers and a preliminary examination is carried out. The size of the nets is usually 0.5-1 mm, which allows for the collection of leeches without damaging them.

3. Visual observation and manual search.

In field conditions, the visual observation method is very effective and accessible. The search for *H. orientalis* individuals was carried out mainly in coastal zones, in shallow and vegetated parts of the water. At this time, it was possible to enter the water and collect leeches manually or by skimming between the aquatic plants and silt layers. The collected samples were collected in vials.

4. Research with plant associations.

Since leeches often live in association with aquatic plants (especially reeds), macrophytes in water bodies were also studied by us. These plants were collected and brought to the laboratory, and when leeches were found, they were separated and placed in containers.

5. İrritating stimulus method.

The irritating stimulus method used in the collection of *H. orientalis* species and leeches in

general is one of the methods that increases the efficiency of leeches detection and observation. This method mainly stimulates the behavioral reactions of leeches when they are passive and ensures their emergence to the surface. During hunting, 5 strong blows are made to the smooth surface of the water with a 1 m stick at a distance of 2 seconds. Then, leeches are collected within 3 minutes. This process is repeated several times within 10 minutes. After the hunting is over, the leeches are counted and released into the water body.

6. Labeling of samples.

A part of the collected leeches was fixed in a 95% ethanol solution. Each sample container was provided with a special label and brought to the laboratory. These labels recorded the date of collection of the samples, the study area, GPS coordinates, weather conditions and the method used. Some of the leeches were placed in transparent jars and used for reproduction.

7. Recording geographical coordinates via GPS.

The geographical coordinates of the water bodies under study were accurately determined via GPS. This approach played an important role in the preparation of the leech distribution map. The map-scheme of the study area was compiled in a digital information database using geographic spatial analysis using the ArcGIS 10.3 (Geographic Information System) program. The method applied in the map compilation was selected in accordance with the purpose of the study. The map was prepared at a scale of 1: 100,000. The areas surveyed and the areas where the H. orientalis species was detected were placed on the land use / land cover (Seninel-2 B; Land use / Land cover - 2024) map, based on geographical coordinates.

When using the main method of collecting material - the irritating stimulus method, leeches have shown high sensitivity to changes in the environment, especially vibrations and chemical signals. Mechanical impact or irritation applied to the water surface activates their behavioral mechanisms associated with danger or food search. Blood or food supplements (liver, spleen) awaken the hunting instinct in leeches. This method is also important in terms of revealing the functional activity of their sensory structures.

When using the impact method, the use of the following stimulations led to higher results when collecting material:

1. Mechanical stimulation - rhythmic blows are made to the bottom of the water with a foot or a long stick.

2. Biological stimulation - blood, a piece of liver or crushed fish tissue is added to the water.

3. Chemical stimulation - a small amount of salt water solution is used (half a teaspoon per 1 liter of water).

4. Temperature stimulation — leeches are more active during the hot hours of the day or by applying artificial heat.

In the Lankaran-Astara region, when using the impact method in wetlands rich in vegetation, mechanical and biological stimulation was more effective. In the Guba-Khachmaz region, when this method was applied, a combination of temperature and mechanical stimuli was used, since leeches mainly hide in cool flowing waters with a stable bottom.

Results and discussion

Hirudo orientalis differs from other representatives of the ***Hirudo*** genus in both morphological and genetic characteristics. Figures 1 and 2 show the posterior sucker and segments of ***H. orientalis***. The posterior sucker of ***H. orientalis*** is notably larger in size compared to that of ***H. medicinalis***. The number of segments is thirty-four. The images were captured using a Nikon STZ 8000 microscope (Figure 1, 2).

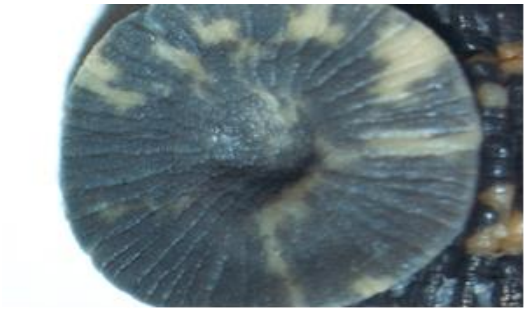

Figure 1. Posterior sucker of hirudo orientalis

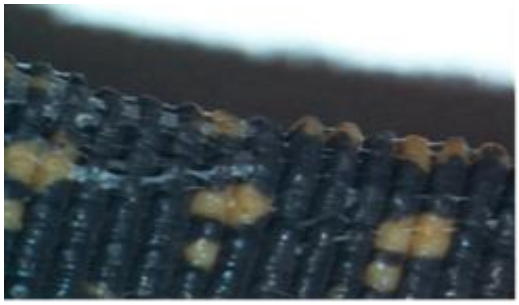

Figure 2. Segments of hirudo orientalis

Based on the research conducted between 2018 and 2024, a total of 954 leech specimens were collected from the Quba-Khachmaz region. Specifically, 92 individuals were collected from the Ağzıbirçala port, 54 from Khanlar port, 61 from Ambilgol, 200 from Qusarçay, 162 from the Nohur lakes, 55 from Davachichay, 35 from Afurca waterfall, 183 from the Nohur lakes (Quba), 59 from Quruçay, and 53 from Qarachay. Out of the total specimens collected in this region, 61 individuals were brought to the laboratory for morphological analysis.

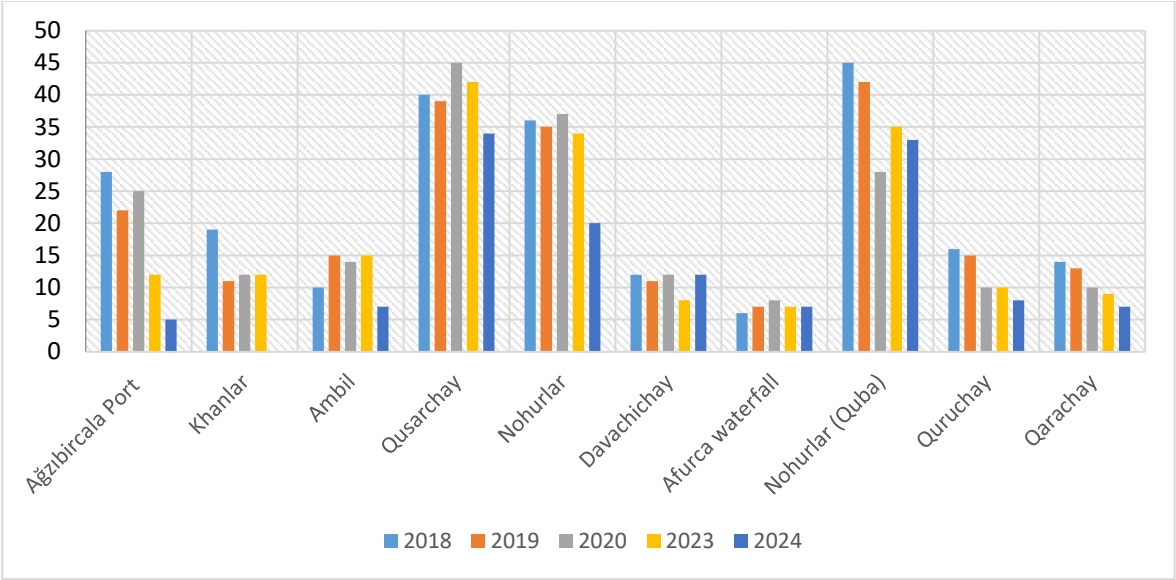

Diagram 1. Numerical dynamics of *Hirudo orientalis* collected from water bodies in the Quba-Khachmaz region.

During our research conducted between 2018 and 2024 in the water bodies of the Quba-Khachmaz region, *Hirudo orientalis* was recorded in 12 locations: Ağzıbirçala near Shabran Port, Khanlar, Ambil Lake, Nohurlar (Shabran), Davachichay, Afurja Waterfall, Nohurlar (Quba), Qusarchay (Quba and Qusar), Quruchay, and Qarachay. Diagram 1 illustrates the numerical dynamics of H. orientalis in the water bodies of the Quba-Khachmaz region where it was detected, shown by year (Diagram 1).

Based on this diagram, it can be stated that the abundance of *Hirudo orientalis* was highest in Nohurlar (Quba) in 2018 and 2019, and in Qusarchay in 2020, 2023, and 2024. The lowest abundance of *Hirudo orientalis* was recorded in 2024 at Ağzıbirchala Port. In Khanlar, no *Hirudo orientalis* was observed in 2024, primarily due to the complete drying of the water body and the influence of seawater salinity. It should also be noted that leeches are highly sensitive to saline water, which causes them to quickly leave such areas.

Another part of our research was conducted in the water bodies of the Lankaran-Astara re-

gion between 2018 and 2024. In total, 42 water bodies in the Lankaran-Astara region were studied, and *Hirudo orientalis* was found in only 15 of them.

The water bodies where *Hirudo orientalis* was detected include Kazımabad, Kazımabad 1, Goytapa, Misharchay, Mollaoba Lake, Vilashchay, Alvadi, Luran, Tatyan River, ponds in Babaser village, Khanbulan Lake, Boladi River, Qizilagac Bay, Lakar River, and Lerik Waterfall. Diagram 2 illustrates the numerical dynamics of *Hirudo orientalis* observed in these water bodies by year (Diagram 2).

In the Lankaran-Astara region — 627 individuals were collected from fifteen water bodies: 66 from Kazımabadchay, 29 from Kazımabad-1 reservoir, 25 from Goytepechay, 15 from Misharchay, 74 from Mollaoba lake, 30 from Vileshcay, 15 from Alvadi, 9 from Lurenchay, 54 from Tatyan River, 86 from the ponds located in Babaser village, 10 from Khanbulan lake, 52 from Boladi river, 157 from the Gizilaghaj Bay, 3 from Lekerchay, and 2 from Lerik waterfall. From this region, 52 specimens were transferred to the laboratory for morphological studies.

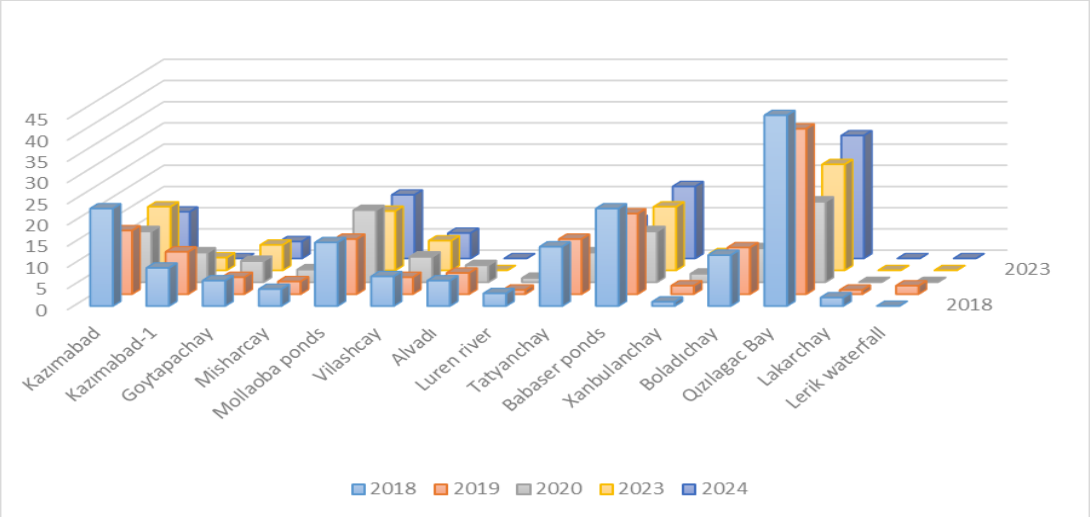

Diagram 2. Numerical dynamics of *Hirudo orientalis* collected from water bodies in the Lankaran-Astara region.

Based on Diagram 2, it can be stated that the highest abundance of *H.orientalis* was observed in Qizilagac Bay. This is attributed to the fact that Qizilagac Bay is a protected area and is not directly exposed to anthropogenic impacts. In 2020 and 2023, no *H.orientalis* was found in Lakarchay, and in 2024, none were observed in Kazımabad-1, Lakarchay, and Alvadi water bodies.

At Lerik Waterfall, *H. orientalis* was only recorded in 2019, on leaves in an area covered with moss. The Kazımabad-1 water body, located near a potato cultivation field, has been affected by chemical fertilizers seeping into the soil and water, resulting in the destruction of not only the leech fauna but also the characteristic biotopes of their habitats. In the Alvadi water body, following a flood caused by heavy rainfall in March 2022, no *H. orientalis* was observed during the studies conducted in 2023 and 2024. Another contributing factor is the establishment of fishponds in this area, which has subjected it to direct anthropogenic impacts

Conclusion

Based on the research conducted between 2018 and 2024, a total of 954 leech specimens were collected from the Quba-Khachmaz region. In the other research area — the Lankaran-Astara region — 627 individuals were collected from fifteen water bodies.

The results of the studies showed that the main habitats of the *H. orientalis* species are the water basins of Nohurlar (Shabran area), Gusarchay (Guba, Gusar area) and Lake Nohurlar in the Guba region, and we determined the percentage of the total mass of the *H. orientalis* species recorded in these water basins.

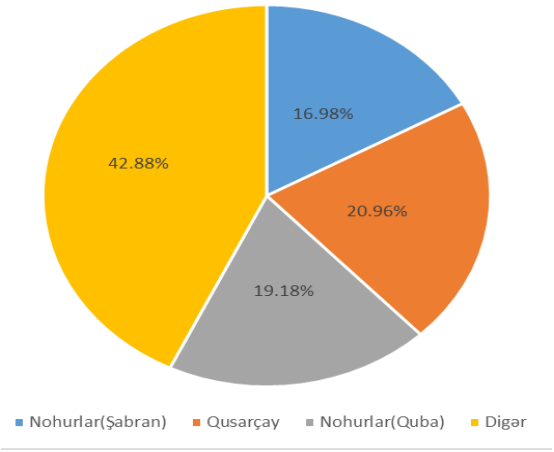

Diagram 3. Percentage of the mass of *H. orientalis* species in water bodies in the Guba-Khachmaz region.

According to the diagram, we can say that Nohurlar-Shabran accounted for 16.98%, Gusarchay in the Guba-Gusar area for 20.96% and Nohurlar in the Guba area for 19.18%. That is, 57.12% of the total mass was collected or settled in these 3 water bodies. The remaining 42.88% of the total mass falls on the share of the other 8 water bodies, which varies between 3.67-9.64%. Among these eight water bodies, Lake Agzibirchala is relatively dominant (Diagram 3).

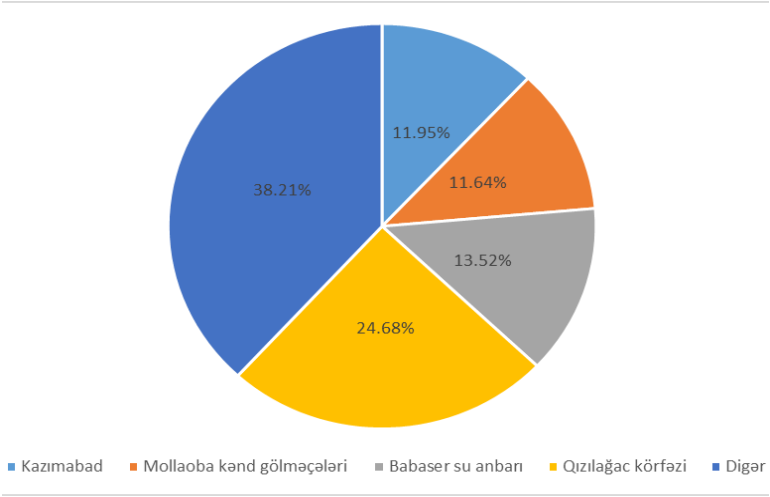

Diagram 4. Percentage of *H. orientalis* species mass in water bodies in the Lankaran-Astara region.

When studying the water bodies of the southern region of the republic, it was determined that in 15 water bodies inhabited by the species *H. orientalis*, the main mass was collected in only four locations. The percentage of the total mass of the species *H. orientalis* recorded in these water bodies was determined by us and presented in the form of a diagram

These locations are Kazimabad 11.95%, Mollaoba village ponds 11.64%, Babaser reservoir 13.52% and Qizilaghaj bay 24.68%, which constitute 61.79% of the total recorded mass. The remaining 38.21% of the mass is distributed in the range of 0.31-8.18% in the territory of other eleven water bodies.

Of the 15 water bodies inhabited by the species *H. orientalis*, Qizilaghaj bay should be specially noted. Thus, 24.68% of the total mass was recorded to be inhabited in this location. Probably, the protection of the territory is one of the main reasons for this situation.

The reason for the high number of *H. orientalis* individuals in some water bodies is the low water flow rate, the not very high banks of the water bodies, the abundance of vegetation and the

optimal water temperature (+22-25°C).

As a rule, the number of *H. orientalis* individuals in water bodies located close to human settlements was very low. The reason for this is undoubtedly the wild hunting of medical leeches by people (poachers). Such water bodies are brought to a state where there is no need to look for leeches there. Thus, for the first time during the research years (2018-2024), we determined the number dynamics of the *H. orientalis* species in the water bodies of the Guba-Khachmaz and Lankaran-Astara regions, mapped the studied water bodies by regions, and calculated the percentage of the mass of the *H. orientalis* species in water bodies by regions.

When assessing the numerical dinamics of the *Hirudo orientalis* species, it was determined that the number of this species in the water bodies of the Guba-Khachmaz region decreased by 1.73 times over a period of 3 years, and in the water bodies of the Lankaran-Astara region by 1.41 times.

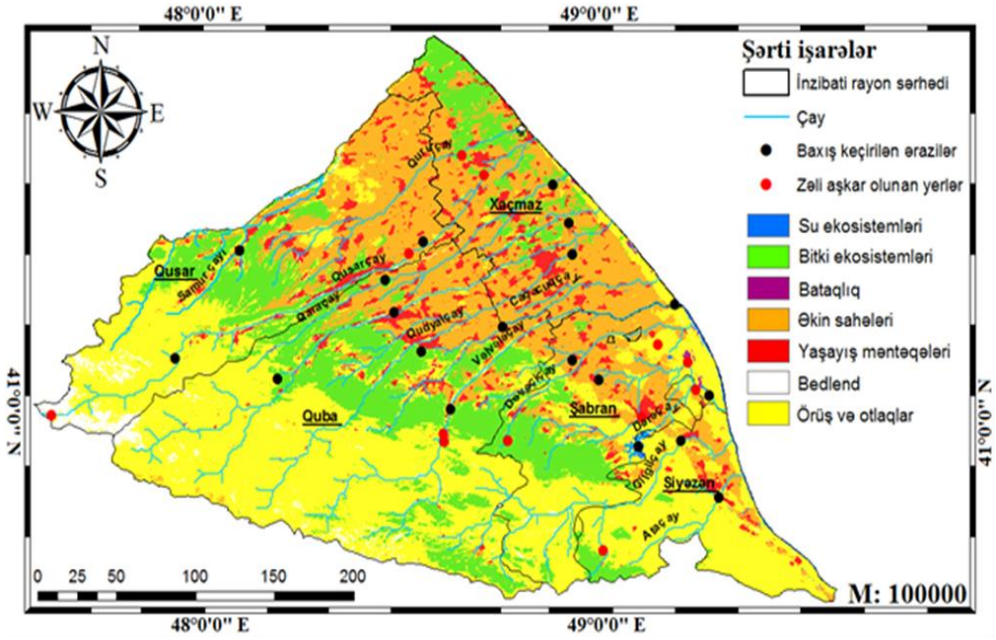

Figure 3. Water bodies surveyed and leech specimens detected in the Quba-Khachmaz region

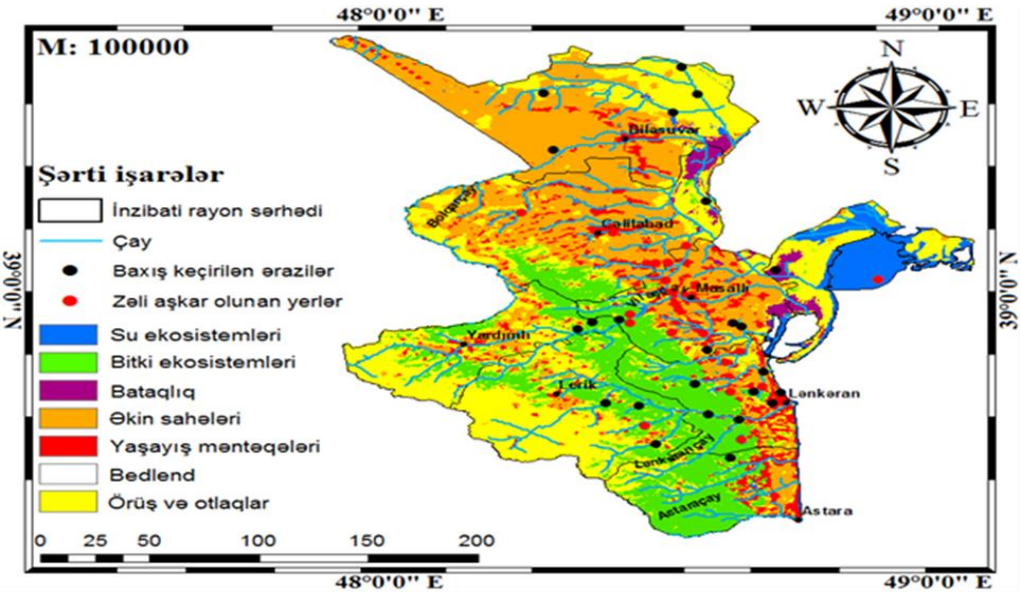

Figure 4. Water bodies surveyed and leech specimens detected in the Lankaran-Astara region.

Based on the results of the research carried out in the water bodies of the Quba-Khachmaz and Lankaran-Astara regions of Azerbaijan, the water bodies observed using GPS coordinates and the areas where ***H. orientalis*** was detected were mapped for the first time by us using the ArcGIS software (Figures 3, 4).

In order to protect the natural populations of *H. orientalis*, the ecological state of the lakes, rivers and swamps where they live should be constantly monitored. The stability of the environment should be ensured by regularly monitoring the chemical and biological parameters of water bodies. The mixing of pesticides, fertilizers and industrial waste into water should be prevented, and ecological buffer zones should be created in agriculture. An ecological assessment should be carried out during the construction of new reservoirs and canals, and damage to the natural habitat of leeches should be excluded.

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AZƏRBAYCANIN BƏZİ BÖLGƏLƏRİNDƏ *HİRUDO ORİENTALİS* UTEVSKY & TRONTELJ, 2005 NÖVÜNÜN SAY DİNAMİKASI

Ləman Dadaşova
Azərbaycan Respublikası Elm və Təhsil Nazirliyi Zoologiya İnstitutu

Xülasə

Həlqəvi qurdlar tipinə aid olan tibb zəlisi qədim zamanlardan insanlar tərəfindən müxtəlif məqsədlər üçün istifadə edilən ektoparazitdir. Bu orqanizm ilk növbədə onurğalı heyvanların qanı ilə qidalanan və çoxsaylı xəstəliklərin müalicəsində mühüm rol oynayan ektoparazit kimi tanınır. Son illərdə bu növə dünyada maraq artsa da, Azərbaycanda hərtərəfli və sistemli elmi tədqiqatlara ehtiyac qalmaqdadır. Apardığımız tədqiqatlar nəticəsində *Hirudo orientalis* Utevsky & Trontelj, 2005-in yayıldığı Azərbaycanın Quba-Xaçmaz və Lənkəran-Astara bölgələrində su hövzələri müəyyən edilmişdir. 2018-2024-cü illər arasında apardığımız tədqiqatlar zamanı Quba-Xaçmaz bölgəsində 12, Lənkəran-Astara bölgəsində isə 15 su hövzəsində *H.orientalis* aşkar edilmişdir. *H.orientalis* Utevsky & Trontelj, 2005-in bu regionlarda say dinamikası hidrobioloji üsullarla

müəyyən edilmiş və onların paylanması ArcGIS proqram təminatından istifadə etməklə GPS koordinatları əsasında xəritələşdirilmişdir.

Açar sözlər: şərq tibb zəlisi, hidrobioloji metodlar, qırmızı kitab, hirudofauna, zəli, Quba-Xaçmaz, Lənkəran-Astara

ЧИСЛЕННАЯ ДИНАМИКА ВИДОВ *HIRUDO ORIENTALIS* UTEVSKY & TRONTELJ, 2005 В НЕКОТОРЫХ РЕГИОНАХ АЗЕРБАЙДЖАНА

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Реэюме

Медицинская пиявка (*Hirudo orientalis* Utevsky & Trontelj, 2005), относящаяся к типу кольчатых червей (Annelida), является эктопаразитом, питающимся кровью позвоночных животных и с древних времён используемым человеком в лечебных целях. Несмотря на возрастающий мировой интерес к данному виду, в Азербайджане всё ещё не хватает комплексных и систематических научных исследований. Целью настоящего исследования было изучение распространения *H. orientalis* в регионах Куба-Хачмаз и Лянкяран-Астара в период с 2018 по 2024 годы. В результате применения стандартных гидробиологических методов *H. orientalis* была выявлена в 12 водоёмах региона Куба-Хачмаз и в 15 водоёмах региона Лянкяран-Астара. Были проанализированы динамика популяции и составлены карты распространения с использованием GPS-координат и программного обеспечения ArcGIS. Полученные результаты способствуют охране данного вида и могут послужить основанием для включения *H. orientalis* в Красную книгу Азербайджана, подчёркивая необходимость сохранения уникальной гирудофауны страны.

Ключевые слова: hirudo orientalis, гидробиологический метод, красная книга, гирудофауна, пиявка, Куба-Хачмаз, Лянкяран-Астара

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