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TERRESTRIAL MOLLUSK DISTRIBUTION IN CENTRAL UZBEKISTAN: RARE AND ENDANGERED SPECIES

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ABSTRACT: *The purpose of the research is to analyze the distribution, anatomical and morphological aspects of dryland mollusks found in the Central Uzbekistan region, and to provide information on their ecology, distribution, limiting factors, and conservation measures. The material collection was carried out according to the methodology of A.A. Shileyko. Based on the results of the collected research, it can be concluded that due to the necessity of moisture for mollusks in the ecological complex, they can be classified into three major groups: hygrophilous, mesophilous, xerophilous, and mesoxerophilous species. The research results indicate that out of the 7 species found in the Central Uzbekistan region, currently, 28.75 % are classified as critically endangered, approximately 42.85 % are considered vulnerable, and 28.75 % are endangered. The dryland mollusk species found in the Central Uzbekistan region are categorized ecologically into hygrophilous, xerophilous, and mesoxerophilous types. In order to conserve and monitor the population of dryland mollusk species in the Central Uzbekistan region, it is recommended to first protect their habitats, particularly by halting deforestation and degradation of habitats where mollusks reside, secondly, to restrict extraneous use of these areas as pastures, and thirdly, to undertake research on their habitat preferences and biology to prevent their extinction as a species.*

KEY WORDS: *Arid, ecological, habitat, material, mesoxerophilic.*

Introduction

Over the past few decades, significant attention has been paid to the diversity of the Uzbekistan nature, especially the Central Uzbekistan region(1,2,3). Many dry land mollusks, such as various types of terrestrial mollusks in Central Uzbekistan, have been significantly affected by anthropogenic influences, leading to a decrease in their habitats and population sizes. Some have completely disappeared, while others are on the verge of extinction(4,5,6). Therefore, studying the dry land mollusks that are both successful and declining from an ecologic-taxonomic perspective is considered one of the most important issues(7,8,9). Some literature and in the monograph "Dry land mollusks of Uzbekistan and adjacent territories," more than 170 dry land mollusks were analyzed from an anatomical and morphological perspective, and detailed information was provided on their historical development(10,11,12). However, information about species that are successful and declining was not mentioned (13,14,15).

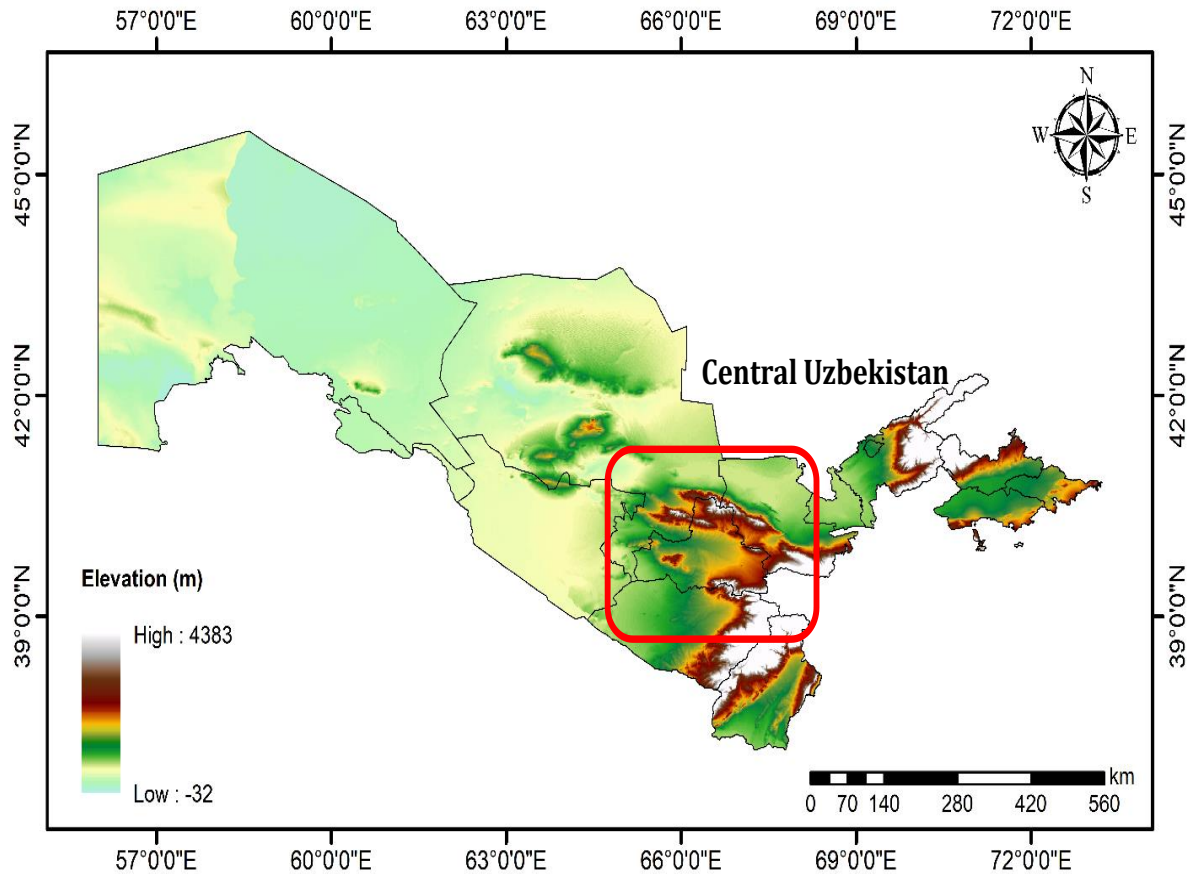
The second part of the "Red Book of the Republic of Uzbekistan" includes 184 animal species vulnerable to extinction, of which 14 are mollusks, with only 2 of them being dry land mollusks (16,17,18).

It is worth noting that although the Central Uzbekistan fauna comprises a significant portion of the dry land mollusks vulnerable to extinction, detailed information about them is insufficient (19,20,21).

Material and Method

Malacological methods (Shileyko, 1978) were mainly used in the cleaning and study of mollusks. In this study, dry land mollusks collected from various regions of Uzbekistan between 2008 and 2023 were utilized (Map. 1)

This information will be useful for understanding how mollusks adapt to changing environmental conditions, and for predicting the effects of human activities on their habitats. Additionally, the study can be used to inform conservation efforts to protect mollusk species.



Map (1): Location map. Collection points for material. *Archaica eleorika*-39°28'1 N, 66°45'4 E, *Candaharia (Levanderia) langarika*-40°14'43.85"N, 67° 03'36.34"E, *Pseudonapaeus (Pseudonapaeus) zeravschanicus*-38°42'20.37" N, 67°50'15.42"E, *Pseudonapaeus (Pseudonapaeus) sinistrorsa*-38°02'25.07" N, 67°15'04.52"E, *Pseudonapaeus (Pseudonapaeus) shahristanikus* 39°36'48.1"N 68°26'58.3"E, *Leucozonella (Leucozonella) schileykoi*-38°14'16.53" N, 67°10'52.05"E

Results and Discussion

Archaica eleorika Schileyko et Pazilov, 2003. (Fig. 2).

The material consisted of 30 specimens collected from around the village Miroqi, northern-western part of Jovuz village (Shahrisabiz district), harvested from the lower and middle parts of semi-shrub vegetation.

The shell of it is moderately thick, subcircular, and dome-shaped, with the height of the shell equal to the width of the aperture.



Figure 1. *Archaica eleorika*: A - general view of the shell; B - view from the posterior side of the shell

The whorls of the shell are 5.5 in number, gradually increasing in size, with the final whorl descending abruptly towards the aperture. The color of the shell is liver-colored, with a pale ochre band present at the lower part. The sculpture on the shell surface is well-developed, consisting of fine spiral grooves. The apex is sometimes covered with mossy vegetation, which gradually disappears over time. The aperture of the shell is slightly oblique, with the lip of the aperture variably thickened. The lip of the aperture does not approach closely to each other. The columellar part of the aperture is slightly twisted, forming a partial barrier to the cylindrical body whorl.

Measurements of the mullusk: height of the shell 10-11 mm, maximum diameter 13-14 mm, minimum diameter 11-11.5 mm.

Reproductive organ structure. The distal portion of the sperm duct is coiled. The pancreas is located in a 3X2 position. A pair of stylophores are situated on one side of the vagina, with one larger than the other. The penis is oval-shaped and its papillae are also adapted to the oval structure, with well-developed papilla lacunae. The flagellum is thicker than the cylindrical epiphallus 2.5 times. The genital retractor is positioned above the penis. The urethra acceptance gland is oval-shaped and does not extend beyond the osseous border. Ecology. It resides at a depth of 1200-1300 m from the sea surface, among abundant vegetation.

Distribution. It is distributed in the remote areas of Shakhrisabz district of Kashkadaryo province.

Number. It has always been scarce and is sharply decreasing in recent years. Lifestyle. Undefined.

Threatening factors. As a result of encroachment on living spaces and excessive exploitation of natural resources, its numbers are dwindling. Conservation measures. Preserving untouched natural landscapes and studying its biology.

Candaharia (Levanderia) langarika (Pazilov and Daminova 2001).

Specimens were collected from the southern slope of Zarafshan Range, ten copies in total. During locomotion, their bodies contract slightly, with the mantle comprising one-fourth of their total length. The body is black, with sides slightly open in a particular shade, and the mantle portion is fleshy. During motion, the body length ranges from 75 to 95 mm, while it contracts to 35–45 mm when at rest. The shell is oval-shaped, with a length of 7.5–8 mm and a width of 5–5.2 mm. The nucleus is slightly curved, yellowish, with a length of 3.5–4 mm and a width of 3–3.5 mm. Habitat: Weak: found in partially covered areas.

Distribution: Zarafshan Range.

Habitat: Inhabiting the area between 1200 m above sea level, dwelling among plants on the slopes.

Population: Found in low numbers, currently approximately 100 individuals per 100 square meters.

Lifestyle: Undetermined.

Contributing Factors: Intense rise in the preparation of shell-building materials by scavenging mollusks.

Conservation Measures: Formation of shell-building materials by mollusks during the period of entry into a dormant state and studying their biology.

Cochlicopa (Cochlicopa) starobogatovi (Pazilov et Azimov, 2003).

Ten specimens were collected from the Nurota ridge. The shell of is characterized by a monomorphic structure. Its whorls are clockwise coiled, with one whorl detached and slightly tilted towards the mouth. The shell colour is ochre-yellowish and is distinct from other species belonging to this group. The shell resembles a small snail, with its sculpture formed by delicate ribs. The aperture of shell is elongated and palatal, with a single parietal callus. Its margins are unflanged, except for one that is slightly thickened. The height of shell ranges from 6.9 to 7.4 mm, with a large diameter ranging from 2.5 to 3.1 mm.

Habitat. Fragile, naturally rare.

Distribution: Found in the Nurota canal system.

Habitat. Inhabits biotopes with diverse vegetation among various grasses in the foothills.

Population. Finally, a small number of 10 individuals per square meter or 1 or 2 individuals are possible.

Lifestyle. Undocumented. Threatening factors. Their population is declining due to anthropogenic influences.

Conservation measures. Understanding their habitats, numbers, and lifestyle is essential for comprehensive conservation efforts.

Leucozonella (Leucozonella) schileykoi (Pazilov et Daminova, 2001).

Material consisting of 20 specimens was collected from the Turkistan ridge. The shell of it is depressed, strongly compressed from the top, with a conical embryonic portion, and the aperture height of the shell is equal. The whorls of the shell are 5 – 5.5, not much expanded. The final whorl is relatively broader than its own axis by 1.5 turns, with the shell's aperture turned to one side under a small angle. The color of shell is ochre-yellowish, the embryonic portion is open-sharply. The peripheral groove is obscure. Its sculpture consists of fine spiral grooves. The aperture of shell is elongated lip-like, with its edges brought closer together at one attached point and interconnected by fine ridges, with its lips thin. The labial sinus is not well developed. The columellar part is slightly twisted. The height of shell ranges from 7.5 to 9.5 mm, with a large diameter of 13.5 – 15.5 mm, and a small diameter of 12 – 13.2 mm.

Habitat. Naturally rare, locally distributed.

Distribution. Turkiston canal system. Living place. Roaming in the foothills and foothill areas, living under stones among debris.

Number. Previously abundant, but in the last 20 years, their number has decreased.

Lifestyle. Undocumented.

Threatening factors. Utilization of their habitats for settlement and use as building materials.

Conservation measures. Preservation of the remaining natural landscapes and study of their biology.

Pseudonapaeus (Pseudonapaeus) shahristanikus (Pazilov et Azimov, 2003).

Material collected from 25 specimens from the Turkistan ridge. The shell of it is oval-cylindrical, depressed. It consists of 6 whorls, coiled tightly, connected to each other through shallow sutures. The final whorl is characterized by a sharp increase towards the aperture, forming $\frac{3}{2}$ of the height of the shell. The shell exhibits a uniform, ochre-yellowish color, with various degrees of development in the spiral sculpture, shiny and glossy. Its sculpture is composed of fine, unbroken grooves. The aperture of the shell is lip-like, slightly tilted, with its attaching point not close to each other, its edges slightly thickened, attached with a parietal callus. The height of the shell ranges from 6 to 7 mm, with a large diameter of 3 to 3.5 mm.

Habitat. It is disappearing.

Distribution. Currently only found in the Turkiston canal system.

Living place. It inhabits areas at an altitude of 2500-2800 meters, living on large limestone rocks.

Number. Sharply declining.

Lifestyle. Undocumented.

Threatening factors. The destruction of habitats by limestone mining and the elimination of habitats as a result of quarrying.

Conservation measures. Understanding the habitats, numbers, and lifestyles comprehensively and establishing protection in their habitats.

Pseudonapaeus (Pseudonapaeus) sinistrorsa (Pazilov, 2004).

Material collected from 15 specimens from the Turkiston ridge. The shells of it are left-coiled, somewhat conical with a slightly depressed apex. They consist of 5.5-6 whorls, closely coiled and connected to each other through shallow sutures. Its final whorl is directed towards the aperture. The color of the shell is dull yellow. Its sculpture is composed of fine grooves formed by axial ribs. The aperture of the shell is oval-shaped, slightly thickened, with its edges raised. The portion of the aperture where the lips join is not close, joined with a smooth callus. The height of the shell ranges from 10 to 12.5 mm; with a large diameter of 4-5 mm.

Habitat. It is disappearing.

Distribution. It occurs only in the northern-eastern part of the Turkiston canal system.

Living place. *Pseudonapaeus sinistrorsa* inhabits at an altitude of 2500 meters above sea level, living on various types of limestone rocks and in the vegetation of limestone outcrops.

Number. Sharply declining. Lifestyle. Undocumented.

Threatening factors. Elimination of habitats due to limestone mining and quarrying activities.

Conservation measures. Comprehensive study of habitats, population size, and lifestyle, and establishment of protection in habitats.

Pseudonapaeus (Pseudonapaeus) zeravschanicus (Pazilov et Daminova, 2001).

Material from 15 specimens. Collected from the Zarafshan ridge. The shell is tall, minorly curved, slightly oblique, with thick walls. The whorls number 10.5, slightly overlapping, with minor wrinkles between them. The last whorl is sharply elevated at the mouth of the shell, constituting $\frac{3}{2}$ of the shell's height. The color is mainly liverish, with variously developed glossy ridges. The sculpture is formed of evenly distributed wrinkles. The aperture of the shell is slightly oval, with adjacent margins connected by ridges, creating a lobed impression. The edges of the aperture are slightly turned back. The angularity of the lip is well developed. The shell height is 13.0 – 15 mm, with a major diameter of 4.9 mm.

Habitat. Vulnerable, gradually decreasing.

Distribution. Found in the southern-western part of the Zarafshan ridge.

Habitat. Inhabits the foothill area, living among shrubs on the slopes.

Number. Counted 2–3 per 5 square meters.

Habitat. Not studied.

Limiting factors. The transformation of the foothill area.

Preservation measures. Preserving the natural landscapes in the habitat and studying their biology. According to the information obtained, the mentioned 7 species mentioned above are currently considered endangered. According to research results: naturally viable species constitute 40%, gradually decreasing species 40%, and extinct species account for 20%.

According to A. Pazilov and J. Azimov's data, currently, the snail mollusks found in Uzbekistan and its neighboring regions have been classified into 8 zoogeographic groups: Palaearctic and Golarctic species, European species, Eastern Asian species, Trans-Altai species, Central Asian species, Old Asian species, Central Eurasian sea species, and Turkmen-Khorasan species.

All the species found in Uzbekistan are included in the Central Asian endemic species composition from a zoogeographic perspective, and they are considered autochthonous species in terms of their emergence (22,23,24,25).

The range of autochthonous species is delimited by the Central Asian mountainous regions, and it is estimated that they emerged within the region during the late Pleistocene or the end of the Pliocene, independently from the European-Caucasian Hygromiidae and Euamphaliinae families, with which representative(s) of the Trichiinae might have been associated.

Uzbekistan is home to a number of species that are abundant as well as species that are scarce, and these species differ from one another in terms of their ecological characteristics. For example, *Cochlicopa starobogatovi* and *Candaharia langarika* are considered hygrophilic species, living in humid habitats. *Ps.zeravshanicus* belongs to xerophilic species, while *L. schieykoi*, *Archaica eleorika*, *Ps.shahristanicus*, and *Ps.sinistrorsa* are mesoxerophilic species. Species that are abundant and those that are scarce have not been distributed uniformly across altitude zones. For instance, *S.starobogatovi* and *L. schieykoi* are found only in the foothill region, while *Candaharia langarika*, *Archaica eleorika*, and *Ps.zeravshanicus* occur both in the foothill and mountainous areas, and *Leucozonella caria* and *Ps.shahristanicus* are found exclusively in mountainous regions. Fig. 3

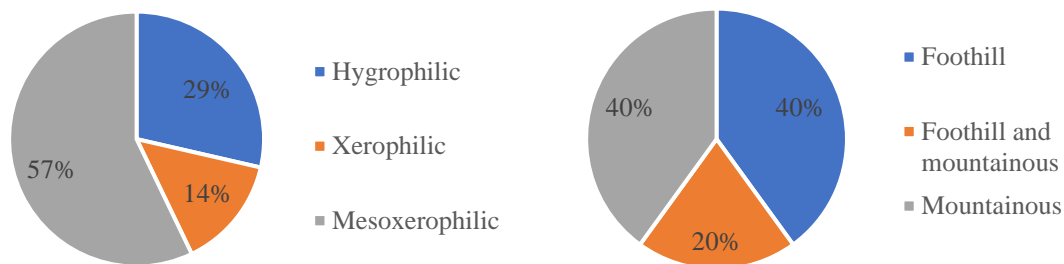


Figure 2. Ecology and altitudinal distribution of rare and endangered land mollusk species

Until the 1990s (during the former Soviet Union period), large-scale agricultural and industrial projects implemented without considering their impact on the environment and social surroundings had significantly disrupted the diversity of Uzbekistan's nature. For example, the expansion of cotton monoculture, the reclamation of lands for irrigation purposes, and the degradation of unique biological communities in these areas led to the decline and disappearance of some species, resulting in the overall decline of the population of the local fauna (26,27,28).

It is well known that agricultural settlements form the basis for irrigation-dependent agriculture in Uzbekistan. Foothill regions were developed to expand crop fields. As a result, ecological conditions have significantly changed in developed areas. As a consequence of these conditions, the number of dryland mollusks not adapted to such conditions sharply decreased, with some of them disappearing altogether. For example, *S.starobogatovi* and *L. schieykoi*, which were considered abundant species in nature, 20-30 years ago, with a density of 3-5 individuals per m², are now only possible to find 1 individual per 10-15 m².

The rapid development of the textile industry, deforestation, and extensive use of pastures beyond the limit of utilization by livestock in the highlands have led to the disappearance of habitats that are very useful in terms of ecology, the adaptation of recreational activities – all of these contribute to the disappearance of local habitats of mountain ecotourism. For example, due to the regular grazing by mountain goats, the habitats where *Leucozonella schileykoi* and *Leucozonella caria* species live have disappeared (29,30,31).

In order to preserve and increase the number of species of mollusks that are rare and disappearing in Uzbekistan, first of all, it is necessary to protect living spaces, namely, to sharply reduce deforestation of trees and shrubs in areas where mollusks live, to limit the use of pastures beyond the norm in mountainous areas for grazing, secondly,

to restrict the use of overgrazing in the mountains, thirdly, to take measures to study their habitat and biology in order to prevent them from disappearing as species.

Conclusion

In Central Uzbekistan, there are seven species of dryland mollusks that are rare and disappearing, which belong to 5 genera and 3 families.

In Central Uzbekistan, the rare and disappearing species can be classified into 3 categories according to the risk of their disappearance in the Red Book of the Republic of Uzbekistan: Weak: naturally rare species - *Cochlicopa starobogatovi*, *Leucozonella caria*; Weak: threatened species - *Archaica eleorika*, *Pseudonapaeus zeravschanicus*, *Candaharia langarika*; Endangered: species in danger of extinction - *Leucozonella schileykoi*, *Pseudonapaeus shahristanikus*, *Pseudonapaeus sinistrorsa*.

The rare and disappearing species found in Central Uzbekistan are classified ecologically into hygrophilic, xerophilic, and mesoxerophilic types.

The main reason for the rarity and disappearance of a certain species in Central Uzbekistan is, firstly, the lack of protection of their habitats, meaning the sharp deforestation of trees and shrubs in areas where mollusks live, secondly, the overuse of habitats where mollusks live as pastureland beyond the norm, leading to their disappearance as a result of overgrazing.

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