

Article

# Comparative Analysis of Terrestrial Gastropod Molluscs of the Molguzar Mountains (Uzbekistan)

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**Abstract:** This article presents a comparative analysis of terrestrial gastropod molluscs recorded from the Molguzar Mountains (north-western Turkestan Range). Species composition, taxonomic structure, ecologic groups, biotopic distribution and altitudinal zonation were analyzed based on long-term field studies and literature data. The results show dominance of xerophilous and xeromesophilous species adapted to arid mountain conditions.

**Keywords:** Molguzar Mountains, terrestrial molluscs, Gastropoda, biodiversity, ecology

## Introduction

Mountain ecosystems represent some of the most biologically diverse environments on Earth, supporting a wide variety of flora and fauna adapted to specific climatic and ecological conditions. In Central Asia, mountainous regions play an important role in maintaining regional biodiversity and ecological stability. These areas often serve as refugia for many endemic and relict species, making them important centers for biological research and conservation studies [1].

Terrestrial gastropod molluscs (Gastropoda) constitute a significant component of mountain biodiversity [2]. They are highly sensitive to environmental factors such as humidity, temperature, vegetation cover, soil composition, and altitude. Due to this ecological sensitivity, terrestrial molluscs are widely used as bioindicators in environmental and ecological monitoring studies [3]. Their distribution patterns often reflect subtle environmental changes and habitat characteristics, making them valuable organisms for studying ecosystem dynamics [4].

The malacofauna of Central Asia has attracted scientific interest for several decades. Numerous studies have investigated the taxonomy, ecology, and distribution of terrestrial molluscs in different mountain ranges of Uzbekistan and neighboring regions. Previous research has demonstrated that species composition and ecological structure of mollusc communities are strongly influenced by climatic conditions, landscape features, and anthropogenic impacts [5].

Despite these efforts, many mountainous areas of Uzbekistan remain insufficiently studied from a malacological perspective. The Molguzar Mountains, located in the north-western part of the

Turkestan Range, represent one of such regions where the diversity and ecological characteristics of terrestrial molluscs have not been comprehensively investigated [6]. This region is characterized by arid climatic conditions, rocky substrates, and heterogeneous vegetation cover, which create unique ecological niches for terrestrial gastropods [7].

Understanding the species composition, ecological structure, and distribution patterns of terrestrial molluscs in the Molguzar Mountains is important not only for biodiversity assessment but also for understanding the ecological processes shaping mountain ecosystems. Moreover, such studies contribute to the development of conservation strategies aimed at preserving endemic and ecologically significant species [8].

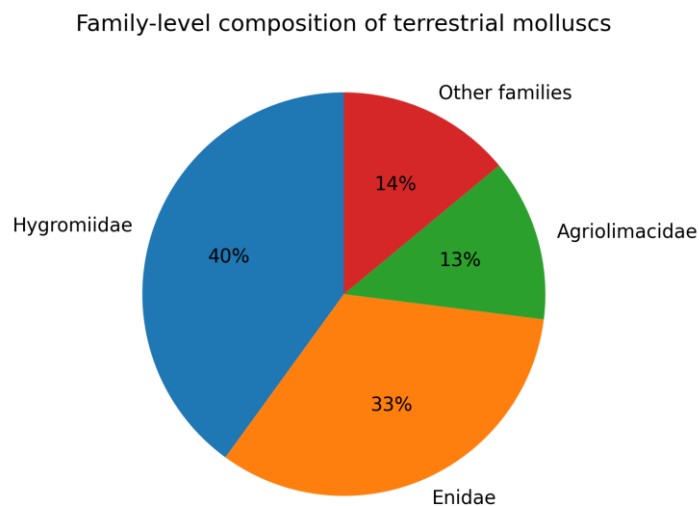
Therefore, the aim of this study is to conduct a comparative analysis of terrestrial gastropod molluscs inhabiting the Molguzar Mountains, focusing on species composition, taxonomic structure, ecological grouping, biotopic distribution, and altitudinal zonation based on field observations and available literature data [9].

### Materials and Methods

The study is based on materials collected in the Molguzar Mountains during 2024-2025 and published data. Species were identified using conchological and anatomical methods. Ecological grouping followed habitat humidity and biotope preferences. Statistical analysis was performed using relative frequency (percentage) calculations. Species were grouped by families and ecological categories (xerophilous, mesophilous, hygrophilous). Percentages were calculated as the ratio of species in each group to the total number of recorded species (n=15).

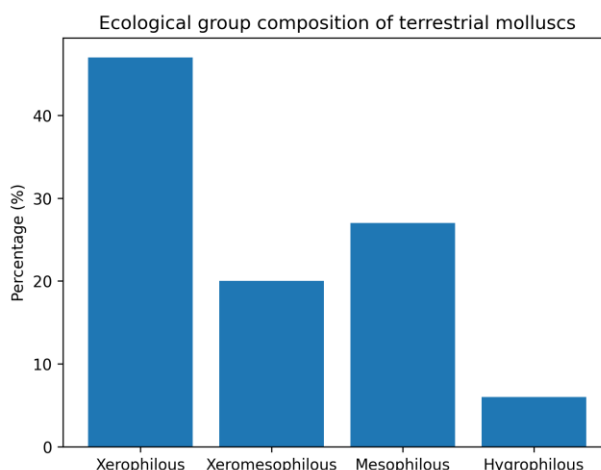
### Result and discussion

Quantitative analysis of the terrestrial mollusc fauna of the Molguzar Mountains demonstrated clear dominance patterns at both family and ecological group levels. Statistical evaluation conducted based on 15 species recorded exclusively from this region [10].



**Figure 1.** Family-level composition of terrestrial molluscs of the Molguzar Mountains. Hygromiidae represents the largest proportion (40%), followed by Enidae (33%), Agriolimacidae (13%) and other families (14%).

As shown in Figure 1, the dominance of Hygromiidae and Enidae the prevalence of arid-adapted taxa typical for rocky and semi-desert mountain habitats [11].



**Figure 2.** Ecological group composition of terrestrial molluscs of the Molguzar Mountrains.

Xerophilous species dominate (47%), followed by mesophilous (27%), xeromesophilous (20%) and hygrophilous species (6%). Figure 2 demonstrates that xerophilous and xeromesophilous species together comprise more than two-thirds of the malacofauna, indicating strong adaptation to dry and semi-arid mountain environments. Mesophilous species and hygrophilous taxa are limited to areas near water sources.

Overall, the statistical patterns confirm that environmental aridization, altitude and substrate type play a decisive role in shaping the terrestrial mollusk assemblages of the Molguzar Mountains [12].

**Table 1.** presents a comparative analysis of terrestrial molluscs recorded exclusively from the Molguzar Mountains.

№	Species	Family	Biotope	Altitude zone	Ecological group	Distribution type	Notes
1	<i>Xeropicta candaharica</i>	Hygromiidae	Steppe, fields	Foothill-lower mountain	Xerophilous	Widespread	Dominant species
2	<i>Chondrulopsis intumescens</i>	Enidae	Rocky slopes	Niddle mountain	Xeromesophilous	Local	Shell variability
3	<i>Pseudonapaeus miser</i>	Enidae	Dry rocky habitats	Foothill	Xerophilous	Restricted	Low density
4	<i>Candaharia izzatullaevi</i>	Hygromiidae	Mountain slopes	Lower-middle mountain	Xeromesophilous	Endemic-like	Regional taxon
5	<i>Leucozonella mesoleuca</i>	Hygromiidae	Shrubs, forests	Middle mountain	Mesophilous	Rare	Moist habitats
6	<i>Monacha cartusiana</i>	Hygromiidae	Gardens, grasslands	Foothill	Mesophilous	Introduced	Expanding range
7	<i>Deroceras agrestee</i>	Agriolimacidae	Agricultural lands	Foothill	Mesophilous	Synanthropic	Crop pest
8	<i>Deroceras caucasiacum</i>	Agriolimacidae	Humid soils	Lower mountain	Mesophilous	Regional	Slug species
9	<i>Phenacolimax annularis</i>	Vitrinidae	Shaded slopes	Middle mountain	Mesophilous	Rare	Forest element
10	<i>Vitrea contracta</i>	Pristilomatidae	Leaf litter	Middle mountain	Mesophilous	Scattered	Small-size

11	Gibbulinopsis nanosignata	Enidae	Stony habitats	Lower mountain	Xerophilous	Local	Arid-adapted
12	Chondrula tridens	Enidae	Open dry areas	Foothill	Xerophilous	Widespread	Steppe element
13	Turkmenica sp.	Enidae	Rocky slopes	Lower mountain	Xerophilous	Local	Taxonomically complex
14	Fruticicola rubens	Hygromiidae	Srubs	Middle mountain	Mesophilous	Rare	Vegetation-dependent
15	Succinea putris	Succineidae	Moist grasslands	Lower mountain	Hygrophilous	Limitet	Nerar water

The analysis shows that the malacofauna of the Molguzar Mountain is dominated by Hygromiidae and Enidae families. Xerophilous species prevail due to arid climatic and rocky substrates [13]. The results of this study provide important insights into the structure and ecological characteristics of terrestrial gastropod communities in the Molguzar Mountains. The dominance of species belonging to the families **Hygromiidae** and **Enidae** indicates that the malacofauna of this region is largely composed of taxa adapted to dry and semi-arid environmental conditions. These families are known to include species that are well adapted to rocky substrates, sparse vegetation, and relatively low humidity levels, which are typical for the mountain landscapes of Central Asia [14].

The predominance of **xerophilous and xeromesophilous species** revealed in the ecological analysis further confirms the strong influence of climatic aridity on the formation of terrestrial mollusc communities in the study area. Similar ecological patterns have been observed in other mountain systems of Uzbekistan and neighboring regions, where mollusc assemblages are often dominated by species capable of tolerating significant fluctuations in temperature and humidity.

The distribution of species across different **altitudinal zones** also reflects the role of environmental gradients in shaping malacofaunal diversity. Foothill and lower mountain areas provide suitable habitats for xerophilous species that prefer open, dry environments such as steppe landscapes and rocky slopes. In contrast, mesophilous species tend to occur in relatively humid microhabitats such as shrub communities, forest patches, and shaded mountain slopes. Hygrophilous species were found only in limited areas associated with moist grasslands or near water sources, indicating their dependence on higher humidity conditions.

Another important factor influencing the composition of terrestrial mollusc fauna is the **structure of vegetation and substrate characteristics**. Rocky substrates and thin soil layers typical of the Molguzar Mountains favor species with morphological and physiological adaptations to drought conditions. At the same time, areas with more developed vegetation cover provide microhabitats that support greater ecological diversity of mollusc species.

Comparative analysis of the recorded species also shows that some taxa have **wide geographical distribution**, while others appear to be more localized or regionally restricted. This pattern highlights the importance of mountainous areas as potential centers of biodiversity and emphasizes the need for further malacological studies in poorly investigated regions of Uzbekistan.

Overall, the observed ecological structure of the terrestrial mollusc fauna reflects the combined influence of **climatic conditions, altitude, vegetation cover, and substrate type**, which together determine the distribution and diversity of gastropod species in the Molguzar Mountains [15].

## Conclusion

The present study provides a comparative analysis of terrestrial gastropod molluscs inhabiting the Molguzar Mountains located in the north-western part of the Turkestan Range. Based on field observations and available literature data, fifteen species of terrestrial molluscs belonging to several families were identified and analyzed in terms of taxonomic structure, ecological grouping, biotopic distribution, and altitudinal zonation.

The results demonstrate that the malacofauna of the Molguzar Mountains is characterized by the dominance of the families **Hygromiidae** and **Enidae**, which together represent the largest proportion of the recorded species. These families are widely known for their adaptation to arid and semi-arid mountain environments, which are typical for the studied region.

Ecological analysis revealed a clear predominance of **xerophilous and xeromesophilous species**, indicating strong adaptation of the terrestrial mollusc fauna to dry climatic conditions, rocky substrates, and sparse vegetation cover. Mesophilous species were found mainly in relatively humid habitats such as shrub communities and shaded mountain slopes, while hygrophilous species were restricted to areas located near water sources.

The distribution of mollusc species also shows a clear dependence on **altitudinal zonation and biotope characteristics**. Foothill and lower mountain zones support a higher diversity of xerophilous taxa, whereas middle mountain zones contain species associated with relatively humid microhabitats.

Overall, the obtained results confirm that **environmental factors such as arid climate, substrate type, vegetation structure, and altitude play a decisive role in shaping the species composition and ecological structure of terrestrial mollusc communities in the Molguzar Mountains**.

The findings of this study contribute to the understanding of **malacofaunal diversity in Central Asian mountain ecosystems** and provide important baseline data for future ecological, taxonomic, and conservation studies of terrestrial molluscs in Uzbekistan. Further research involving long-term monitoring and expanded geographical surveys will help to clarify species distribution patterns and assess the potential impact of environmental changes on mountain mollusc communities.

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