

Regularities of Vertical Distribution of Landscaped Mollusks of the Northwestern Pamir-Alay Mountain System (By the Example of the Turkestan Range)

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ABSTRACT

The paper discusses the vertical distribution of terrestrial mollusks in the North-Western part of the Pamir-Alai mountain system using the example of the Turkestan ridge, which is unevenly distributed over belts and biotopes. As a result of studies of the malacofauna of the Turkestan ridge, regularities have been revealed that are inherent in the formation, distribution and interpenetration of faunas, which are characteristic, perhaps, not only of the studied ridge, but in general for the Pamir-Alai mountain systems.

KEYWORDS

Altitudinal Limits, Vertical Distribution, Terrestrial Mollusks.

Introduction

Pamir-Alai mountain system, which includes the highest mountains in Tajikistan, Kyrgyzstan, Uzbekistan. Most of it is located within Tajikistan; the northeastern part belongs to Kyrgyzstan, and the north-western part to Uzbekistan.

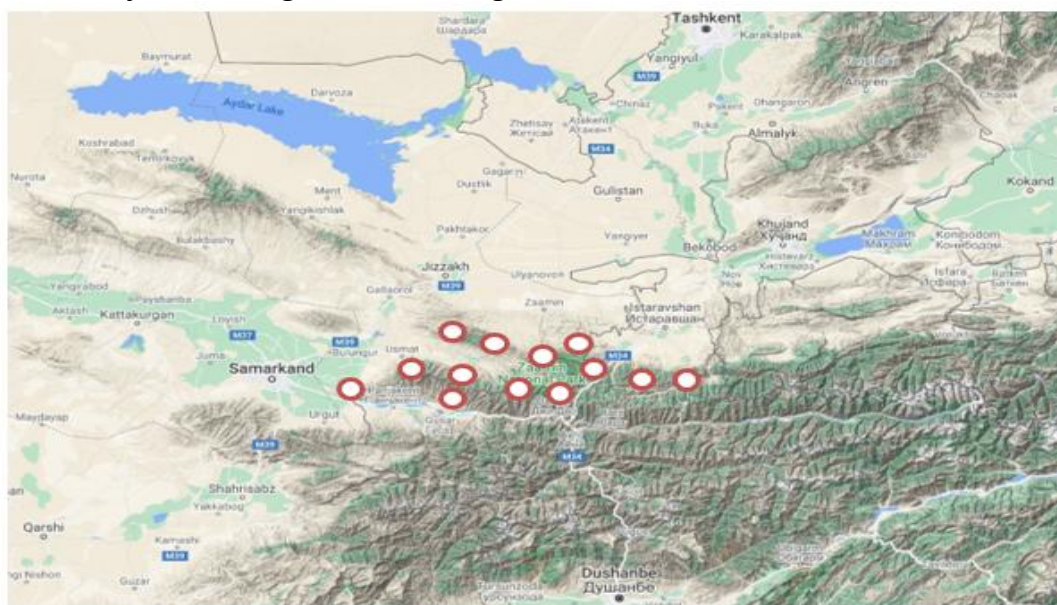
Terrestrial mollusks in the northwestern part of the Pamir-Alai mountain system, more precisely the Turkestan mountain range, is one of the least studied objects in Central Asia.

In the literature (Pazilov, 1992; Daminova, Pazilov, 1994; Pazilov, Azimov, 2003), one can find information on the species composition and distribution of terrestrial mollusks of the Turkestan ridge. The authors provide data on 31 species of mollusks from 15 families. However, the information available on the distribution of terrestrial mollusks is very fragmented, and the distribution over landscape zones and biotopes actually remains unknown.

Material and Methods

The materials for this work were the collection of terrestrial mollusks carried out on the Turkestan ridge (Fig. 1): Bulbul gorge, near the village of Kara-Kamar, not far from the river, among the grasses; the vicinity of the village of Isfana, among the thickets of grasses; the surroundings of Khuzhamushkent, not far from the spring waters, among the grasses; middle course of the Ettikechuu-suu river (environs of the village of Dugaba) among thickets of grasses; Archali tract, under stones along irrigation ditches; Shahrstan pass among grasses, under juniper; the Karatau Upland not far from the spring waters under the stones; Katta-Kul gorge, northern slope under the fir tree; the vicinity of the Zamin reservoir, under the stones; pass Zamin, under the juniper; environs of Bakhmalsay village (Jizzakh region), among semi-shrubs, under stones; Ak-Tangi gorge among bushes, under stones; not far from the Bakhmal boarding house, among

the bushes; valley of the Sangzar river, among the shrubs, under the stones.



○- Collection points for land mollusks

Fig. 1. Map of collection points for terrestrial mollusks in Turkestan mountain ranges

In addition, they used materials from more than 150 years from the largest malacological collections: the Zoological Institute of the Russian Academy of Sciences (St. Petersburg) and the Zoological Museum of Moscow State University.

In total, more than 12 thousand copies of terrestrial mollusks were collected and processed.

The collection of material was carried out according to the method of A.A. Shileiko (1978, 1984). The material was collected manually for the purpose of the densest and uniform study of the territory, covering the maximum diversity of landscapes and biotopes. When performing the work, the following unified methodology was used, which made it possible to compare the fauna of individual ridges and regions. Vertical profiles were taken in accordance with the diagram of the vertical zonation of vegetation in Uzbekistan (Central Asia), given by M.M. Arifkhanov (1967).

During the survey, the belts were taken from the foot up the slopes to the uppermost belt; in each of them all biotopes were examined. To determine the number of species, quantitative counts were carried out. At the same time, large species, more than 10 mm in size, were counted from an area of 1 to 3 sq. m, small species were counted from an area of 0.25 sq. m.

Results and Discussion

The regularities of the vertical distribution of terrestrial mollusks are determined by a combination of certain factors: temperature and humidity conditions, vegetation peculiarities. It should be noted that vegetation plays an important role in the life of terrestrial mollusks; therefore, the distribution of terrestrial mollusks along vertical belts was studied against the background of plant communities.

Turkestan ridge from the Machai pass stretches to Jizzak for 320 km, its height decreases from east to west. The eastern part is high, so there are many glaciers in these places. The climate is varied, precipitation mainly falls in spring, eternal snows and glaciers lie on the high mountains. Compared with the Alai, the Turkestan ridge has a more xerophytic appearance. The vegetation mainly consists of desert-steppe plants; in addition, juniper and mountain-xerophytic plants are widespread.

According to the research of M. Arifkhanov (1967), the following soil-faunistic vertical belts can be traced in the area of interest to us: desert; a belt of low foothills; the belt of the upper foothills; a belt of juniper forests and woodlands, tragacanth and tragacantoid steppes; highland belt.

The desert is located at an altitude of 350-900 m above sea level, which occupies the entire flat part of the Turkestan ridge.

In the desert belt, the malacofauna has been studied in two biotopes: gardens, vegetable gardens and along irrigation ditches, under the canopy of tree plantations.

In the biotopes of orchards and gardens, the following types of terrestrial mollusks were found: *Xeropictacandaharica* (15); *Candacharialevanderi* (5); *Deroceraslaeve* (4); *D. caucasicum* (5); *D. sturanyi* (6).

The following species were found in biotopes along irrigation ditches, under the canopy of tree plantations and under stones: *Cochlicopanitens* (13); *Valloniacostata*(15); *V. puchella* (11); *Pupillamuscorum* (20); *Angiomphaliaregeliana* (8); *Derocerassturanyi* (6); *Zonitoidesnitidus* (6).

In general, 11 terrestrial mollusks were found in two biotopes in the desert zone.

A belt of low foothills, located at an altitude of 700-1500 m above sea level, which is covered mainly with ephemeral sedge-bluegrass or ephemeral-wormwood vegetation with a predominance of *Carexpachystylis*, *Poabulbosa* var. *vivipara*, *Artemisia ferganensis*. Among this vegetation, there is also a number of long-growing perennials, for example: semi-shrub bindweed, zopnik, ak-kurai, whole-leaved, etc.

In the foothill belt, the malacofauna of the following biotopes was studied: along the river banks, among plants, the following were found: *Cochlicopalubricella* (12); *Valloniacostata* (9); *Pupillamuscorum* (18); *Zonitoidesnitidus* (10); *Candacharialevanderi* (5); *Oxylomaeleganus* (3).

On the outskirts of the slopes, under the stones live: *Gibbulinopsissignata* (8); *Pupillatriplicata* (5); *Chondrulopsinaintumescens* (5).

In the low foothills, 9 species of terrestrial mollusks, characteristic species for these zones, were not found.

The belt of the upper foothills, absolute height 1500-2000 m. On the Turkestan ridge, the belt is represented by a complex of natural deserts, formed under various outcrops, stony-gravelly, gravelly and woody slopes. Among the vegetation, there are ephemera and ephemerooids, finely dissected wormwood and Persian wormwood, Perovian capers, etc. On the slopes there are iron

trees, wild rose, almonds, pistachio.

In a complex with outcrops on the slopes, areas of southern (savanna) steppes are formed with hairy wheatgrass, bluegrass (smooth-flowered, spreading), etc. In this belt, terrestrial mollusks have been studied in the following biotopes: at the foot of the slopes among vegetation inhabited by: *Sphyradiumdoliolum* (13); *Pupillatriplicata* (8); *Chondrulopsinaintumescens* (6); *Leucozonellaretteri* (5); *Xeropictacandacharica* (13); *Candacharialevandery* (3).

The following species were found in tree-shrubs on gravelly areas: *Sphyradiumdoliolum* (13); *Gibbulinopsissignata* (31); *G. nanosignata* (10); *Pupillamuscorum* (9); *P. triplicata* (10); *Pseudonapaeussogniana* (14); *Ps. miser* (6); *Ps. chodschendicus* (6); *Chondrulopsinaintumescens* (7); *Laevozobrenuseremita* (6); *Bradybaenafedtschenkoi* (1); *Leucozonellaretteri* (11); *Xeropictacandacharica* (13); *Macrochlamyskasnakovi* (8); *Candacharialevandery* (2). A total of 22 species were found.

The belt of juniper forests and woodlands, tragacanth and tragacantoid steppes, an absolute height of 2500-3000 m. Significant areas of the belt are represented by xeromorphic light juniper forests and woodlands. Birch groves grow in river gorges. The steppes and meadow-steppes of the belt are diversely represented, forming almost along all exposures of the slopes (Kononov, 1966).

In this belt, mollusks were studied in the following biotopes: among plant remains from juniper and various xerophilic grasses: *Gibbulinopsissignata* (13); *G. nanosignata* (8); *Chondrulopsinaintumescens* (5); *Ponsadeniasemenovi* (1).

In biotopes on the slopes, among the stony steppes, there are: *Sphyradiumdoliolum* (14); *Truncatellinacallicratis* (12); *Pseudonapaeusasiatica* (4); *Leucozonellacaryodes* (5); *L. crassicosta* (3); *L. retteri* (5); *Macrochlamysfogdiana* (3); *M. kasnakovi* (3); *Candacharialevandery* (6); *Deroceraslaeve* (3).

The following species were found in biotopes along river banks, along springs, among vegetation: *Valoniacostata* (9); *V. pulchella* (13); *Pupillamuscorum* (18); *Monachacarthusiana* (15); *Oxuloma elegans* (5).

In total, 19 species are recorded in the belt of the lower mountains, mainly psychro- and mesophilic mollusks.

Highland belt, absolute altitude 2500-4000 m.

The vegetation cover consists of cereals - oats, foxtail, fescue, tricetae, and from forbs - cuffs, geraniums, buttercups and many other species.

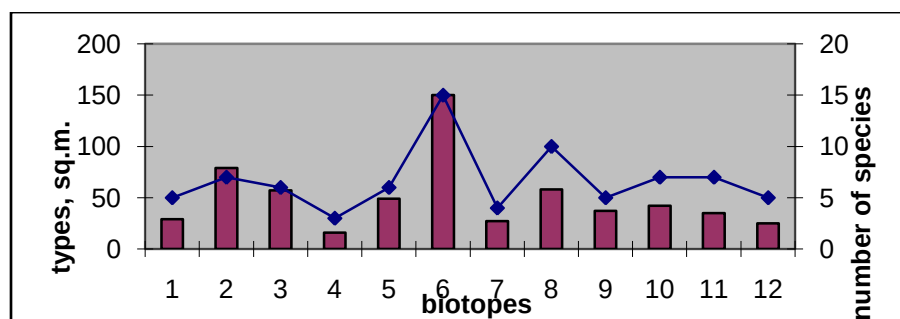
The following biotopes have been studied in the high-altitude belt: in subalpine meadows in the grass and on the soil: *Cochicopanitens* (8); *C. lubrica* (11); *Valloniacostata* (5); *Pupillatriplicata* (6); *Pseudonapaeus miser* (2); *Monachacarthusiana* (5); *Angiomphaliaregeliana* (5). The biotopes of rocks and talus are inhabited by: *Sphyradiumdoliolum* (2); *Gibbulinopsissignata* (8); *G. nanosignata* (13); *Truncatellinacallicratis* (5); *Chondrulopsinaintumescens* (1); *Leucozonellaretteri* (3); 7. *Pseudonapaeussecalinus* (3).

Alpine meadows are found only in the form of small areas along the bottoms of ancient glacial carts, near melting snowfields, along the banks of springs. The most common plants here are:

mountaineer, alpine basil, shulzia, violet, etc.

The following mesophilic interzonal species of mollusks were found in alpine meadows: *Cochlicopalubricella* (4); *Valioniapulchella* (6); *Pupillamuscorum* (10); *Deroceraslaeve* (2); *Oxuloma elegans* (3).

In total, 16 species of terrestrial mollusks were found in the highland belt. Research shows that the density of terrestrial mollusks differs by biotopes (data on the total density of terrestrial mollusks of the Turkestan ridge are shown in Figure 2.).



Note: The graph reflects the number of species, the graph is density

1- Gardens and vegetable gardens among herbs; 2 - along the irrigation ditches, under the canopy of tree plantations; 3 - along river banks, among plants; 4 - on the outskirts of the slopes under stones; 5 - at the foot of the slopes among the vegetation; 6 - tree-shrubs on gravelly areas; 7 - among plant remains from juniper; 8 - on the slopes, among the rocky steppes; 9 - along springs, among vegetation; 10- in subalpine meadows in grass and soil; 11- on slopes and talus; 12- in alpine meadows

Figure 2. Density and number of species of terrestrial mollusks in different biotopes of the Turkestan ridge

The highest density of terrestrial mollusks is distinguished by biotopes: along irrigation ditches, under the canopy of tree plantations and tree-shrubs on gravelly areas, they vary from 79 to 150 specimens to square meters. The lowest density of mollusks is observed in the biotope on the outskirts of slopes under rocks and in alpine meadows, where from 16 to 25 specimens were found. square meters.

As for species diversity, this indicator reaches its maximum value in biotopes of tree-shrubs on gravelly areas and on slopes, among stony steppes, where 10-15 species live.

It should be noted that the bulk of the species of mollusks of the Turkestan Ridge live in shrubs and juniper forests. This is due to the fact that under the canopy of bushes and juniper there is a five to six centimeter litter that serves as food and shelter for terrestrial mollusks. A very small number of species have a distribution strictly confined to only one altitudinal belt.

In all landscape belts, a few Palaearctic and Holarctic species are found in interzonal (river banks, the vicinity of spring waters and streams) biotopes. Here, mollusks are in the same conditions at all altitudinal zones.

Thus, the data obtained on the vertical distribution of terrestrial mollusks of the Turkestan ridge allows us to establish a number of general regularities.

One of the general patterns observed in mountain conditions is the gradual depletion of the malacofauna as it moves down and up from the tau belt.

It has been established that the tau malacofauna is the richest and most diverse. This is directly related to a large variety of natural landscapes, highly dissected relief, abundant moisture and a more moderate temperature regime. In addition, under the canopy of shrubs and tree-shrub vegetation, there is a five to six centimeter bedding that serves as food and nesting material for terrestrial mollusks, which creates optimal conditions for the life of terrestrial mollusks.

It should be noted that with climate change - high temperature and great dryness of the lower belt (adyr, chul) and, conversely, - low temperature with sufficient humidity in the upper belt (yailau), the diversity of the malacofauna decreases.

It has also been established that the diversity of mollusks decreases at the expense of Central Asian species. For example, 23 species of terrestrial mollusks were found on the Turkestan ridge in the adyr belt, 8 of them are Central Asian. In the Yailau belt, out of 13 species, 4 are Central Asian (such regularities are typical for all ranges of the Pamir-Alai mountain systems).

Another common pattern is the finding of Palaearctic and Holarctic species in all high-altitude landscape belts. This is due to the fact that mollusks live in interzonal biotopes (river banks, streams, spring waters), which mollusks find the same conditions in all altitudinal zones.

Other patterns include the fact that a number of species are found in at least two - *Pupillasterrii*, *Ps. subobscura*, *Ps. asiatica*, *Br. plectotropis*, *L. caruodes*, or three- *L. mesoleuca*, *A. regeliana*, *Ps. sogdiana*, *D. reticulatum* - high-altitude zones. This is due to the fact that natural biotopes inhabited by mollusks, due to the complex mosaic structure of altitudinal belts, are not strictly confined to certain altitudinal limits.

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