

Faunistic Composition And Zoogeographical Analysis Of Passenged Molluscs (Mollusca: Gastropoda, Pulmonata) Of Some Cities Of Uzbekistan

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Abstract. As a result of the study, in the studied territories, 26 species of terrestrial and 10 species of aquatic gastropods were found. For the first time, four biotopes of molluscs have been identified on the territory of cities, among them parks and arboreal communities are the richest in terms of the number of mollusc species. Considering the limited number of reservoirs in cities, and depending on the water bodies, the malacofauna were divided into 3 groups. The frequency of occurrence and density of molluscs in water bodies of cities has been studied. According to the zoogeographic analysis, the urban terrestrial malacofauna species belong to the following species: Central Asia, Holarctic, Palaearctic, Europe, Western Asia and mountainous Asia. Aquatic malacofauna species: Western Asia, Central Asia, Palaearctic, Europe and Siberia and the Mediterranean Sea.

Key words: malacofauna, city, terrestrial molluscs, biotope, aquatic molluscs, reservoir, density, zoogeography

Today, the process of urbanization is rapidly developing all over the world. This leads to an increase in anthropogenic impact and a change in the species composition of gastropods in urban landscapes, as well as to a decrease in their diversity. Gastropods are an important component of aquatic and terrestrial biogeocenoses. Terrestrial gastropods are involved in soil formation, enriching it with minerals and organic matter. At the same time, some gastropods, feeding on vegetative and generative organs of plants, damage them, some species are intermediate hosts of helminths. In the world, scientific research is being carried out to determine the patterns of the formation of urban malacofauna, the direct impact of anthropogenic impact on the biodiversity of cities in the process of urbanization, as well as to identify the causes of changes in the species composition and prevent the extinction of species. In this regard, special attention is paid to the analysis of the distribution of gastropods in urban biotopes, the faunistic classification of gastropods, as well as to the fact that urban construction and environmental pollution are the main factors affecting changes in the species composition of the malacofauna and changes in some species characteristics.

Scientific data on the faunal composition, distribution, bioecological features of gastropods are displayed in the works of foreign authors such as Cetka T. et Cacany J. [24], Mienis H.K. et Rittner O. [26], I. Dedov, L. Penev [25]. In the CIS countries, information on the species composition, taxonomy, ecology, development and phylogeny of gastropods is presented in the works of I.M. Likhareva, E.S. Rammelmeyer [13], V.I. Zhadin [4], Ya.I. Starobogatova [19], A.A. Shileiko [22], K.K. Uvalieva [21],

Zemoglyadchuk [5,6], A.F. Ivankova, K.V. Zemoglyadchuk [7], K.V. N.V. Sverlova [17], E.A. Snegina [17], E.V. Shikova [23] and others. In Uzbekistan, information on the taxonomic composition, biology, zoogeography, economic significance and evolution of aquatic and terrestrial molluscs were published in the works of Z.I. Izzatullaev [11,12], A. Pazilov, I. Azimov [16], D. Daminova [3] and F. Gaybnazarova [2] and other authors. The urban malacofauna was studied by Z. Izzatullaev and R. Urazova [9], U. Toshplatova, Z. Izzatullaev [20], Z. Izzatullaev and G. Murtazaeva [10]. But the obtained given otrivny, does not give a complete description of the faunal composition of gastropods.

Research material and methodology. The collection and fixation of the collected material on terrestrial mollusks was carried out according to the methods of I.M. Likhareva, E.S. Rammelmeyer [13], I.M. Likhareva, A.Y. Victor [15]. Terrestrial molluscs were collected from plants, stones, soil, etc., by hand or with a landing net. When collecting small mollusks, soil samples were taken with a bedding area of 0.25 m² in cloth bags. Live slugs and shell molluscs were placed in a vessel, poured 1/4 with cold water up to the throat and closed tightly for a day. Then the mollusks were fixed with 70% ethyl alcohol for permanent preservation. Collection and fixation of aquatic mollusks was carried out according to the methods of V.I. Zhadin [4], N.N. Akramovsky [1], Ya.I. Starabogatov [19]. The collected material was immediately fixed with 70% ethyl alcohol for permanent preservation. The collection of material was carried out from 2016 to 2020. in four cities of Uzbekistan: Samarkand, Kattakurgan, Navoi and Zarafshan (Fig. 1).



Fig. 1. Map of the study area (collection site)

Samarkand is located in the southwestern part of Uzbekistan, in the middle part of the Zarafshan Valley (39 ° 39'15 " 66 ° 57'34 "), at an altitude of 695 m above sea level. Its area is 120 km². Kattakurgan is a city of the Samarkand region, located in the valley of the Zarafshan River on the left bank of the Narpai Canal, located 88 km from Samarkand in the north-west (39.903504 ° ; 66.265035 °), at an altitude of 485 m above sea level. Its area is 43 km². The Kattakurgan reservoir is located in the southern part of the city. The city of Navoi is located in the valley of the Zarafshan River, in the south of the Navoi region (40 ° 5.0664 ' 65 ° 22.7502 '), 360 km south-west of Tashkent, at an altitude of 347 m above sea level. Its area is 60 km². The city of Zarafshan is also located in the Navoi region, 200 km away from the center of the region, in the central part of the Kyzylkum desert (41 ° 34'00 " 64 ° 10'14 "), at an altitude of 397 m above sea level.

Research results and discussion. Purposeful and comprehensive studies of the urban malacofauna were carried out by us in 2007-2020. As a result of the research in the city of Samarkand, 26 species of terrestrial gastropods belonging to 13 families and 16 genera were found, in Kattakurgan - 11 species belonging to 7 families and 9 genera, in Navoi - 10 species belonging to 9 families and 9 genera, in Zarafshan - 5 species belonging to 5 families and 5 genera (table 2). It has been established that in the formation of the urban malacofauna, the main place is occupied by local species (*Macrohlamys sogdiana*, *Candaharia levanderi*, *Candaharia izzatullaevi*, *Xeropicta candaharica*, *Succinea putris*, *Oxyloma elegans*, *Cochlicopa lubrica*, *Leucozonella synoptica*), synanthropic species (*Lytopelte maculata*, *Candaharia levanderi*, *Candaharia izzatullaevi*, *Zonitoides nitidus*) and introduced species (*Deroceras sturanyi*, *Deroceras caucasicum*, *D. reticulatum*, *Oxychilus transilicidus*). Taking into account the high influence of the anthropogenic factor on urban biotopes and the degree of occurrence of these species, urban areas were studied by dividing them into 4 biotopes: recreation parks and squares, gardens, crop fields, anthropogenic meadows (lawns, grassy meadows with high humidity). The largest number of species of terrestrial mollusks by biotopes is found in parks and squares, as well as in gardens, and one of the reasons for this is the presence of shelters and deciduous litter that serves as food for mollusks. The area of the vegetable gardens is small, mainly tomatoes, cucumbers, cabbage and greens are grown here. Mainly pest species live here - *Deroceras reticulatum*, *D. caucasicum*, *Lytopelte maculata*, *Candaharia levanderi*, *C. izzatullaevi*. Anthropogenic meadows include lawns, cereal and herb meadows. They are widespread in cities and along the streets. The malacofauna is very poor and the dominant species are *Xeropicta candaharica*, *Zonitoides nitidus* and *Cochlicopa lubrica*.

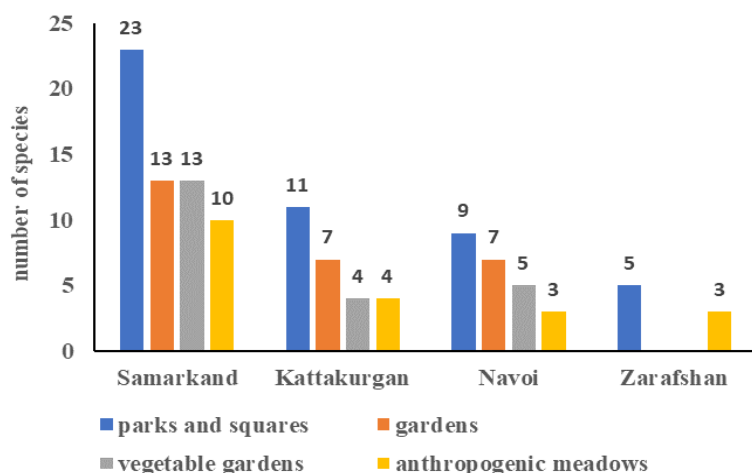


Fig. 2. Distribution of terrestrial gastropods by biotopes in some cities of Uzbekistan

Table 1. Taxonomic composition of terrestrial mollusks in some cities of Uzbekistan

| Families | Genus | Views | Samarkand | Kattakurgan | Navoi | Zarafshan |
|----------------|----------------------------------|--|-----------|-------------|-------|-----------|
| Succineidae | Succinea Draparnaud, 1801 | Succinea putris (L.1758) | + | | | |
| | Oxyloma Westerlund, 1885 | Oxyloma elegans (Risso, 1826) | + | + | | |
| Cochlicopidae | Cochlicopa A.E.I. Ferussac, 1821 | Cochlicopa lubrica (Müller, 1774) | + | + | + | + |
| Pupillidae | Pupilla Turton, 1831 | Pupilla muscorum (L.,1758) | + | + | + | + |
| Orculidae | Sphyradium Charpintier, 1837 | Sphyradium doliolum (Brugiere, 1792) | + | | | |
| Valloniidae | Vallonia Risso, 1826 | Vallonia pulchella (Müller, 1774) | + | | + | |
| | | V. costata (Müller, 1774) | + | | | |
| Agriolimacidae | Deroceras Rafinesque, 1820 | Deroceras sturanyi (Simroht, 1894) | + | | | |
| | | D. caucasicum (Simroth, 1901) | + | | | |
| | | D. reticulatum (Müller, 1774) | + | | | |
| | | D. laevi (Müller, 1774) | + | + | | |
| | | D. agreste (L, 1758) | + | | | |
| | Lytopenelte Boettger, 1886 | Lytopenelte maculate (Koch et Heynemann, 1874) | + | + | + | |

| | | | | | | |
|------------------|--------------------------------------|---|-----------|-----------|-----------|----------|
| Parmacellidae | Candacharia Gudwin - Austen, 1888 | Candaharia levanderi (Simroht, 1901) | + | + | + | |
| | | C. izzatulaevi et Wiktor 1980 | + | + | | |
| | | C. rozeni | + | | | |
| Zonitidae | Oxychilus Fitzinger, 1831 | Oxychilus translicidus (Mortillet, 1854) | + | | | |
| Gastrodontidae | Zonitodes Lehmann, 1862 | Zonitoides nitidus(Müller,1774) | + | + | + | + |
| Ariophantidae | Macrochlamys Benson, 1832 | Macrochlamys sogdiana (Martens, 1871) | + | + | + | + |
| | | M. turanica (Martens, 1784) | + | | + | |
| Vitrinidae | Phenacolimax Stabile, 1859 | Phenacolimax annularis (Studer,1820) | + | | | |
| Hygromidae | Leucozonella Lindhol, 1927 | Lencozonella mesoleuca (Martens, 1882) | + | + | + | |
| | | L.rubens (Martens, 1882) | + | | | |
| | | L.rufispira (Martens, 1874) | + | | | |
| | Xeropicta Montirosato, 1892 | Xeropicta candaharica (L. Pfeiffer, 1846) | + | + | + | + |
| Helicidae | Helix Linnaeus, 1758 | Helix lucorum | + | | | |
| Bcero: 13 | 16 | | 26 | 11 | 10 | 5 |

As a result of the study, 10 species of aquatic gastropods belonging to 5 families and 6 genera were found in the study area, namely, in the city of Samarkand, 10 species belonging to 4 families and 6 genera were found, in the city of Kattakurgan 3 species belonging to 3 families and 3 genera, in the city of Navoi 3 species belonging to 2 families and 2 genera. Given the limited number of water bodies in cities, and depending on the water bodies in which they are found, mollusks were divided into 3 groups: 1) species living in canals, lakes and reservoirs (*Lymnaea auricularia* (L.,1758), *L. truncatula* (Müller,1774), *Anisus ladacensis* (Nevill, 1878), *Planorbis tangitarensis* (Germain, 1918) and *Costatella acuta* (Draparuand, 1805)); 2) species living in different ponds and small water bodies: ditches, springs (*Lymnaea auricularia*, *Lymnaea truncatula*, *Lymnaea thiesseae* (Clessin,1879), *Lymnaea schirasensis* (Kuster,1862)); 3) found in greenhouse ponds and introduced adventive species (*Seminolina eudiscus* (Pilsbry,1934), *Seminolina boucardi* (Fisch et Crobse, 1880)). During the study, the frequency of occurrence and density of aquatic molluscs in water bodies was determined (Fig. 3: table 2). In water bodies, the species with the highest density index are *Lymnaea auricularia*, *Costatella acuta*, *Planorbis tangitarensis*, *Anisus ladacensis*.

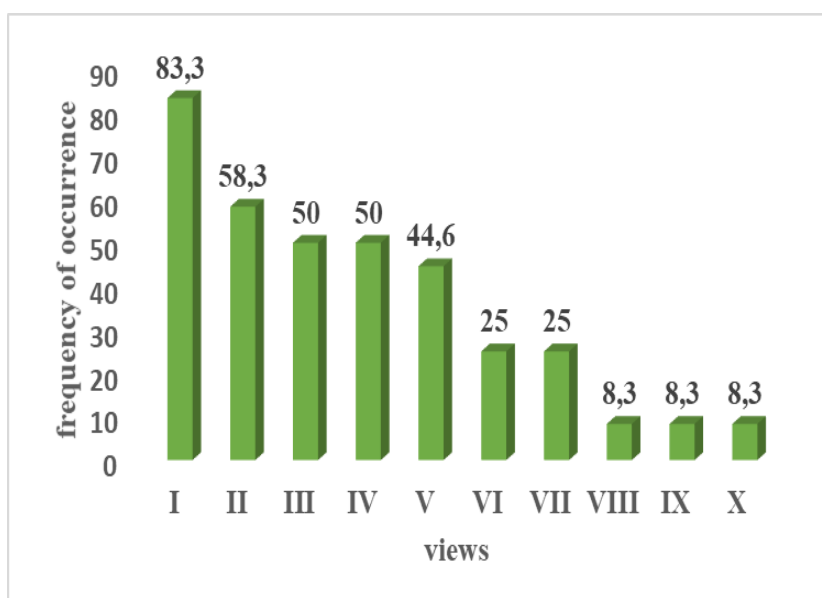


Fig. 3. Frequency of occurrence of aquatic molluscs in urban water bodies: I-*Lymnaea auricularia*; II-*Costatella acuta*; III-*L. truncatula*; IV-*Anisus ladacensis*; V-*Planorbis tangitarensis*; VI-*Lymnaea schirasensis*; VII-*L. thiesseae*; VIII-*Seminolina boucardi*; IX-*S. eudiscus*; X- *Biomphalaria tenagophila*

The main reasons for the low prevalence of mollusk species are the number of reservoirs is small, the mosaic nature of natural reservoirs, the small size of existing artificial reservoirs, and their pollution.

Table 2. Density of aquatic gastropods in cities of Uzbekistan

| № | Views | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|----|---------------------------------|---|-------|-------|-------|-----|--------|---------|-------|-------|------|-------|-------|
| | | Density of individuals, pieces/m ² | | | | | | | | | | | |
| 1 | <i>Lymnaea thiesseae</i> | - | - | 5-10 | 5-7 | - | - | - | -- | - | 5-10 | - | - |
| 2 | <i>L. schirasensis</i> | 5-10 | 5-10 | - | - | - | - | -- | - | - | 7-10 | - | - |
| 3 | <i>L. truncatula</i> | 10-15 | 10-15 | 10-20 | 10-15 | - | - | 40-60 | - | 5-10 | - | - | 20-30 |
| 4 | <i>L. auricularia</i> | 10-30 | 10-20 | 10-15 | - | 5-7 | 30-35 | 80-100 | - | 50-70 | - | 10-30 | 10-20 |
| 5 | <i>Costatella acuta</i> | 15-20 | 20-22 | - | 5-6 | - | 80-100 | 150-170 | - | - | - | 30-60 | 20-30 |
| 6 | <i>Seminolina boucardi</i> | - | - | - | - | - | 15-25 | - | - | -- | - | - | -- |
| 7 | <i>S. eudiscus</i> | - | - | - | - | - | 10-20 | - | - | - | - | - | - |
| 8 | <i>Biomphalaria tenagophila</i> | - | - | - | - | - | 10-30 | - | - | - | -- | -- | - |
| 9 | <i>Planorbis tangitarensis</i> | 5-10 | 5-10 | 20-50 | - | - | - | 60-70 | - | 30-45 | - | - | - |
| 10 | <i>Anisus ladacenis</i> | 10-20 | 10-20 | 15-20 | - | 5-8 | - | 50-70 | 15-30 | 5-10 | - | 10-20 | - |

Note: I - Siab irrigation ditch, II - Obi Mashgat ditch, III - channel near the holy place Khazrati Daniyar, IV - springs near holy place Khazrati Daniyar, V-irrigation ditches of the regional hospital, VI - pond of the biological faculty, VII - fishing lake Khishrava, VIII - lake military town, IX - ditches of the Zeravshan National Park, X-springs of Zerafshan, XI - Katakurgan water storage, XII - Lake Navoi

The study area belongs to the Turanian province, and for the urban terrestrial malacofauna, species characteristic of: Central Asia - *Candaharia levanderi*, *C. izzatullayevi*, *C. rozeni*, *Macrochlamus sogdiana*, *M. turanica*, *Leucozonella mezoleuca* (28,5%), Holarctic - *Cochlicopa lubrica*, *Vallonia pulchella*, *Vallonia costata*, *Deroceras leave*, *D. agreste*, *Pupilla muscorum* (28,5%), Palearctic - *Oxyloma elegans*, *Succinea putris*, *Zonitoides nitidus* (14,2%), Europa - *Sphyradium doliolum*, *Phenacolimax annularis* (9,5%), Western Asia- *Lytopelte maculata*, *Xeropicta candaharica* (9,5%) and species characteristic of mountainous Asia - *Leucozonella rubens*, *L. rufispira* (9,5%) (Fig. 4).

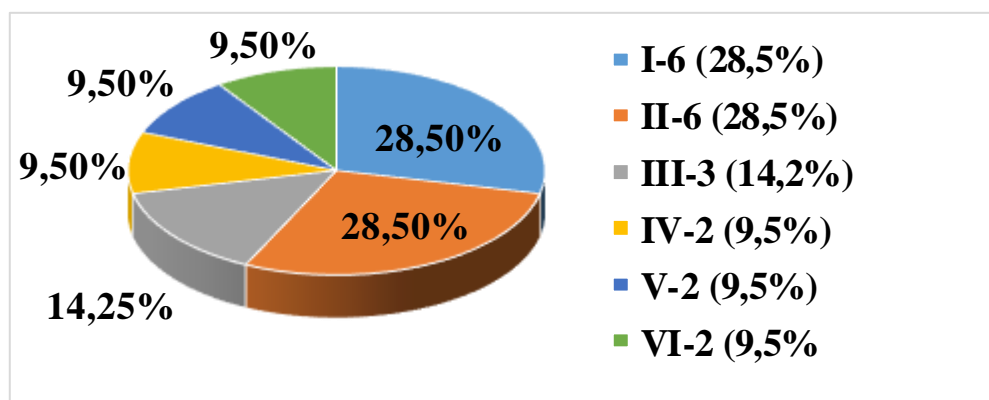


Fig. 4. Zoogeographic groups of terrestrial molluscs widespread in the study region: I-species of Central Asia, II-Holarctic species, III-Palearctic species, IV-European species, V-species of Asia Minor, VI-species of mountainous Asia.

According to the zoogeographic analysis of aquatic molluscs, the study area is included in the Sogd province, the Sogd-Tibet province of the Euro-Central Asian subregion of the Palaearctic. It has been established that the malacofauna of this region includes the following species: Western Asia - *Lymnaea schirazensis*, *Lymnaea thisseae* (28,5%), Central Asia - *Anisus ladacensis*, *Planorbis tangitarensis* (28,5%), Palearctic - *Lymnaea auricularia* (14,2%), Europe and Siberia - *Lymnaea truncatula* (14,25%), as well as in the Mediterranean Sea - *Costatella acuta* (14,55%) (Fig. 5).

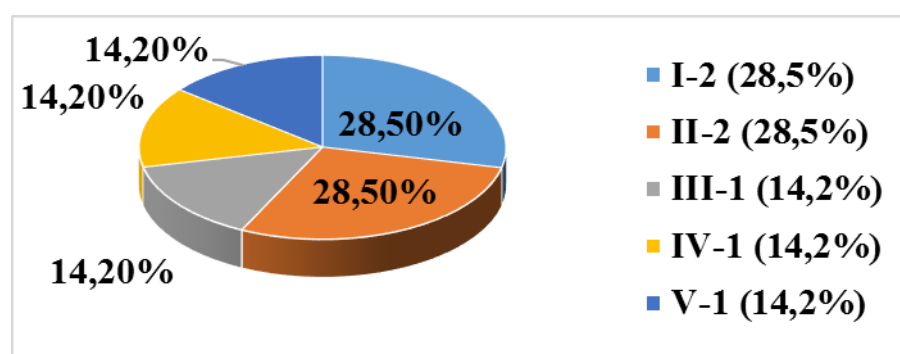


Fig. 5. Zoogeographic groups of aquatic mollusks widespread in the study region: I-species of Asia Minor, II-species of Central Asia, III-species of the Palearctic, IV-species of Europe and Siberia, V-Mid-water species.

In the studied cities, the species composition of Malocafauna has a relative average degree of faunistic similarity. In the conditions of the urban landscape in certain areas, the distribution of terrestrial molluscs primarily depends on the formed plant communities and their condition. Lawns are the poorest in terms of the number of

species, and tree communities are the richest. The number of aquatic molluscs is increasing due to introduced species. The zoogeographic analysis of the urban malacofauna in the study area did not take into account the introduction-adventive species. Central Asian species play a key role in the formation of urban terrestrial malacofauna, and in the formation of aquatic malacofauna - ancient Asian and Central Asian species.

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