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Biological peculiarities of Leucozonella retteri

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Abstract:

The aim of the research is to study the biology, life cycles, distribution and structure of the reproductive organ of Leucozonella retteri in natural conditions. Zoological and malacological methods are used in the work. The collection of the material was carried out according to A.A. Shileiko method. According to the results of the conducted studies, the differences between Leucozonella retteri and other species in the structure of the reproductive organ were manifested in the following. The lower part of the sperm is straight, the ovary is slightly curved. The paw pad is 8, located in 4x2 positions. The stylophore is large spherical. The vagina is cylindrical, its length is 5-6 times greater than the width. The penis is large and convex.

In natural conditions, egg laying of mollusks is observed at an average air temperature of 17-19° C, air humidity of 70-80%. In Leucozonella Retter, population variability was more pronounced than biotopic variability. The biology and distribution of the Leucozonella retteri species in the natural conditions of the territory of Uzbekistan was studied for the first time.

It was found that the species Leucozonella retteri has a significant variability in quantitative indicators, i.e. morphometric sizes, compared with the qualitative variability of morphological signs of blood

The results of the research showed that in arid climate, the variability of all the signs of the shell is manifested depending on the habitat.

Keywords: Copulation, life cycle, population, reproductive organ, variability, xerobiont.

Introduction:

In the Central Asian malacofauna, there are a number of issues related to the lifestyle of terrestrial mollusks, including representatives of the family Hygromiidae, which have not yet been fully studied. However, the lifestyle of some terrestrial mollusks common in Uzbekistan has been partially studied[1-5] and there is insufficient data on the lifestyle of widespread species.

In general, the study of the lifestyle of species widely distributed in Uzbekistan serves as the main source for the development of measures to combat ground fry, which participate as intermediate hosts in the spread of various parasitic diseases and cause various harm to agricultural crops.

The study of the variability processes occurring in land mollusks remains one of the topical issues of malacological science not only in Uzbekistan, but also in the countries of Central Asia. In general, the processes of variability occurring in the malacofauna of Central Asia have found their expression in a number of works [4,5]. However, the data on high variability in representatives of the Hygromiidae family are not sufficiently illuminated. Therefore, this section analyzes the processes of variability occurring in representatives of a widespread family, based on personal material.

The monograph, written by Sverlova N V, Khlus L N, Kramarenko S S[6], summarizes information about the species composition common in urbanized areas, about the distribution in biotopes, about conchological variability, parasitofauna, as well as about the physiology and

behavior of terrestrial mollusks in the ecosystems of cities in Ukraine and partly Belarus. The distribution of mollusk species distributed on the territory of Ukraine at the present time is described, the mechanisms of their adaptation to habitat conditions are analyzed. In parallel with this, a number of studies of the malacofauna of Ukraine were conducted: Sverlova NV[7]. Research on the systematics of mollusks has found expression in a number of works by Shileiko AA[8, 9], Feher Z [10].

It should be noted that the variability of morphological features of some species of representatives of the family Hygromiidae in recent years has been partially studied[11-13], however, the processes of variability occurring in a number of widespread species have not been fully studied.

The processes of variability occurring in representatives of the Hygromiidae family are observed in the shape of the shell, color, structure of the shell mouth and reproductive organ, a number of studies on this topic were conducted[14-16].

The dramatic changes in the ecological situation o bserved today all over the world are largely due to the influence of anthropogenic forces, which, along with many invertebrates, are the cause of the disappearance of terrestrial mollusk habitats. This, in turn, leads to the fact that populations of widespread species are reduced to rare species, while endemic and rare by nature species are on the verge of extinction. According to the literature[17], currently there are about 35 thousand species of land mollusks in the world fauna, of which 422 are completely extinct[18].

Therefore, information about their biology, ecology and distribution is of paramount importance when developing measures to combat harmful species, controlling the number of endemic species.

From the analysis of the above literature, it can be concluded that insufficient information about the biology, life cycle and patterns of variability of representatives of the family Higromiidae determined the relevance of this research work.

Material and Method:

Zoological and malacological methods are used in the work. The collection of the material was carried out according to A.A.Shileiko method.

As we know, every species that exists in nature has its own meaning, and shellfish are part of the food chain. Their disappearance, increasing or decreasing, has an impact on biodiversity. Therefore, without studying the distribution and biology of mollusk species, we will not be able to fully assess their significance. As can be seen from the above links, the study of the distribution and lifestyle of mollusks remains one of the biggest problems facing the science of malacology. Based on this problem, we studied materials on the northern slopes of the Turkestan ridge, near the village of Bakhmal of the Jizzakh region, the Kurama mountain range from the Rezaksai gorge and the Zarafshan mountain range from the Urgut gorge, and also studied the patterns of distribution, biology, life cycle, variability in morphological characteristics of Leucozonella retteri, common in this territory, and they are as follows.

Results and discussion:

One of the most common representatives of the Hygromiidae family is the species Leucozonella retteri, which lives in hilly and mountainous areas, among piles of stones in open spaces.

Leucozonella (Leucozonella) retteri Rosen, 1897, Fig. 1.

The material was collected in 50 copies along the Turkestan ridge: the basins of the Sangzor, Kukjar rivers and the vicinity of the village of Sartuz; Kuramin ridge: Rezaksay gorge, Left Bank, from under rocky boulders among shrubby vegetation.

Shell Dimensions: the height of the shell is 9-11 mm, the large diameter is 14-16 mm, the small diameter is 12-14 mm.

The shell is slightly flattened, the shell wrappers are 5.5 mm, with an imperceptible convex edge. The last wrapper is slightly pointed, bent towards the mouthpiece. The color is light brown. The peripheral white stripe is well developed. The mouth of the mollusk is rounded, the place of its articulation is not close to each other, the edges are thin.

The structure of the reproductive organ. The lower part of the sperm is straight, the ovary is slightly curved. The paw pad is 8, located in 4x2 positions. The stylophore is large spherical. The vagina is cylindrical, its length is 5-6 times greater than the width. The penis is large and convex. Papillae have a peculiar structure: the proximal part is cylindrical, then expands sharply, and the distal part has a cone-shaped structure. The flagellum is 1.5 times shorter than the epiphallum. The epiphallus is twisted 1-2 times. The seminal recipient has an oval structure and does not reach the protein gland.

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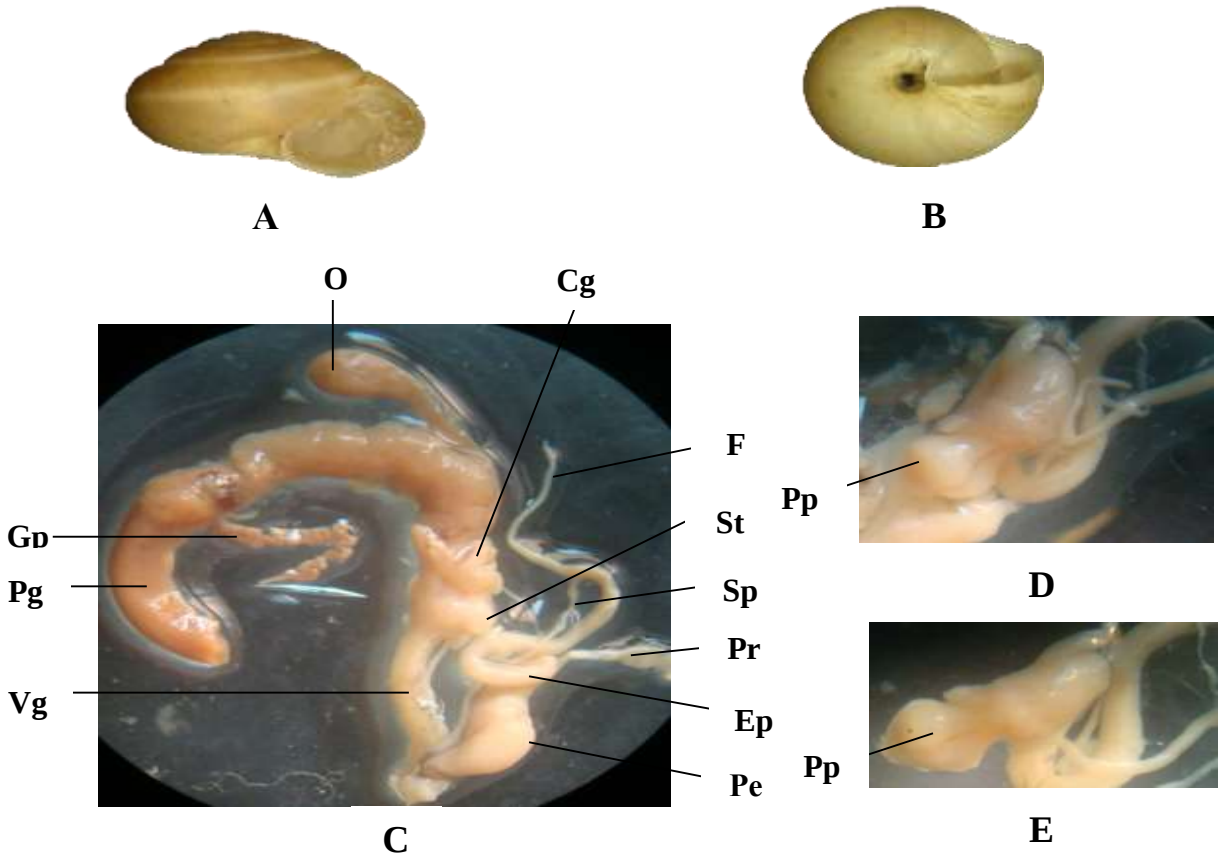

Figure. 1: Leucozonella retteri, Rezaksoy gorge (Kurama ridge). A-a general view of the shell; B-a view of the shell from below; C-a general view of the reproductive organ; D-the internal structure of the penis; E-a general view of the papilla of the penis; Pe-penis; Ep-epiphallus; F-flagellum; St-stylophore; Vg-vagina; O-ovum; Sp-seminal pathway; Pp-penis papilla; Pr-prostate; Pg-protein gland; Cg-claw gland Gp-germophrodite pathway (Original.).

Ecology. It is found in foothill and mountainous areas, lives among piles of boulders on the southern slopes (petorbiont).

Distribution. It is widespread in the Kurama, Turkestan, Zarafshan, and Hissar mountain ranges.

Reproduction of the Leucozonella retteri species in natural conditions was studied in 2017, 2018 and 2019 on the northern slope of the Turkestan ridge near the village of barkhat at an altitude of 1500-1600 m above sea level [19].

On the northern slopes of the Turkestan ridge, near the village of velvet, L. retteria comes out of hibernation in the first decade of April, remaining in active motion for a week, eating only, and uses the green part of plants and partially residual leaves as food.

After an active diet for a week, in mid-April, ready for the copulation process, he begins to look for a mate. In the search for their mate in land mollusks, mucus plays an important role, which separates from their body as a result of movement. In 2017, the first copulation was registered on April 12, and it lasted until the first days of May. In 2018, the first copulation was registered on April 9 and ended at the end of April. In 2019 (when the air temperature dropped lower than in previous years, i.e. in mountainous areas it did not exceed +15°C) the first copulation began on April 15 and lasted until May 10 [6].

After they are ready to breed and find a mate, they begin mating activities. This process, as with all land mollusks, begins mainly at dawn.

In the species Leucozonella retteri, “mating" games take place in two stages: acquaintance and observation. The dating stage lasts about a minute, at which time they begin to affect each other's body in different ways with the help of their tentacles, and also eat the mucus secreted from their body.

At the end of the movement, they cling to each other with their copulatory organs and strongly compress their body, as a result of which it is loaded.

They begin to lay eggs 15-16 days (at the end of April) after attachment. It should be particularly noted here that the incubation period, egg laying, its development and the release of shellfish from eggs directly depend on external factors: air temperature, precipitation. According to the conducted studies,

egg laying of mollusks is observed in natural conditions at an average air temperature of 17-19°C, air humidity of 70-80%.

Leucozonella retteri lays eggs under rocks, in a place that is not too deep under the vessels of the plant (a nest made by himself). The number of eggs in the nest varies, that is, if the eggs are small, then up to 20-30 pieces, if big, then 10-20 pieces. The size of the eggs is 1.5-2.7 mm, and the color is pale yellowish or dark white.

The rate of egg development also directly depends on external factors, when the average air temperature is 18-19°C, the humidity is 70-80%, after 17-18 days, at the beginning of the second decade of May, the first mollusks begin to hatch from the eggs. Mollusks that hatch from eggs have distinctive shells that have 1.5 packages that are dark brown in color. The mollusks hatched from eggs live here until the period of summer hibernation (end of May) and fall into summer hibernation.

At the end of October, in the middle of rainy years, it first comes to the surface from summer rest and begins to actively feed. This activity persists in them until the first snow. With the fall of the first snow, when the soil temperature drops below + 5ºC, they fall into hibernation. When mollusks hibernate, their shell wrappers become 3.5– 4. They spend their winter hibernation 15-20 cm, sometimes even deeper. The hardness-friability of the soil directly depends on how deep or on the surface the place of their wintering will be. Therefore, mollusks make their winter "dwellings" in more porous soils under stones or in places close to the veins of trees.

The type of Leucozonella retteri, along with all other mollusks, forms an epiphragm in the mouth of the mollusk when it falls into winter or summer sleep. The function of the epiphragm is to maintain the normal evaporation of water from the body of the mollusk. The winter epiphragm will be thicker than the summer one, since there will always be a possibility of an extreme decrease in winter air temperatures.

Having risen from summer hibernation at the end of October, he begins to move actively, and before winter hibernation, his shells are fully formed, and he reaches puberty.

Thus, according to the conducted studies, the life cycle of the adult species Leucozonella retteri consists of the following stages:

1. Awakening from winter hibernation-The first decade of April.
2. Actively eating, preparing for copulation, and the copulation stage is the second decade of April.
3. Egg laying and its development – end of April-beginning of May.
4. Summer hibernation and summer hibernation–from the end of May to mid-October.
5. Awakening from summer sleep-the end of October.
6. Winter sleep-November-end of March.

In Leucozonella retteri, population variability was more pronounced than biotopic variability. For example, the Kurama ridge is located in the Rezaksai gorge (Fig. 2: A, B) living among shrubby plants under rocky boulders, the shell is strongly flattened, the shell wrappers are 5.5 cm, slightly convex, the shell is brown, the peripheral stripe is poorly developed, the muzzle of the Shell is rounded-oblique, the edges are pointed. The navel is cylindrical in shape.

The Zarafshan mountain range is located in the Urgut gorge (Fig. 2: C, D). Although the morphological features of representatives of the genus living among rocks in the open ground generally coincide with those of mollusks from the first population, but have the following differences: the peripheral stripe is well developed, the color of the underside of the shell is dark, in the mouth of the shell is well the labial notch is developed.

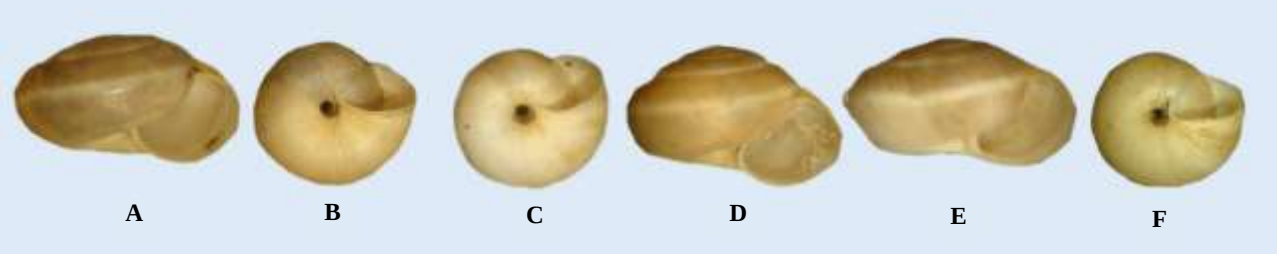

Figure 2. Leucozonella retteri: A, B –Rezaksai gorge (Kurama ridge); C, D – Urgutsoy (Zarafshan ridge); E, F – Bakhmal surroundings (Turkestan ridge).

On the northern slopes of the Turkestan ridge, near the village of Bakhmal (Fig. 2: E, F), in a mollusk living among shrubby vegetation, the shell cover is cone-shaped, the peripheral stripe is well developed, the place of articulation of the edges of the shell mouth is strongly close to each

other, the labial notch is developed subconsciously. The navel is wide. According to the results of the study, qualitative indicators of hematological signs of blood in the studied populations; variability in shape, color, sculpture were not strongly expressed.

It was found that the species Leucozonella retteri has a significant variability in quantitative indicators, i.e. morphometric sizes, compared with the qualitative variability of morphological signs of blood (Table. 1).

Table 1. Variability of morphological features of the Leucozonella retteri species in various mountain ra nges (dimensions in mm)

№	Population	HSh	LaD	SmD	HMSh
1.	Rezaksai gorge (Kurama ridge)	7,15±0,5 CV % 2,85	11,09±0,5 CV % 2,04	10,18 ±0,7 CV % 3,13	6,64±0,4 CV % 3,14
2.	Urgutsoy (Zarafshan ridge)	8,16±0,5 CV % 2,84	12,55±0,1 CV % 3,25	11,15±0,5 CV % 1,83	8,05±0,2 CV % 1,23
3.	Surroundings of Bakhmal village (Turkestan ridge)	10,19±0,5 CV % 5,42	15,15±0,5 CV % 1,62	13,15±0,5 CV % 1,93	7,56±0,1 CV % 1,16

Note. In this table and further: HSh-height of the shell; LaD-large diameter; SmD-small diameter; HMSh-height of the mouth of the shell.

As can be seen from the data of Table.1, the shells of mollusks living in 3 populations are much larger than in other populations, with a coefficient of variability-CV equal to 5.42%.

Table.1, as can be seen from the data, the shells of mollusks living in 3 populations are much larger than in other populations, with a coefficient of variability-CV of 5.42%.

The results of the study showed that in arid climate, the variability of all the signs of the shell is manifested depending on the habitat.

Conclucion:

1. The biology and distribution of the Leucozonella retteri species in the natural conditions of the territory of Uzbekistan is studied for the first time.
2. L. It has been shown that the optimal temperature for the development of the rhetoric is from 19°C to 80% humidity.
3. For the first time it is noted that the life cycle of Leucozonella retteri takes place in 6 stages.
4. It has been established that the species Leucozonella retteri has a significant variability in quantitative indicators, that is, morphometric sizes, compared with the qualitative variability of morphological signs of blood.

Authors' declaration:

- Conflicts of Interest: None.
- We hereby confirm that all the Figures and Tables in the manuscript are ours. Besides, the Figures and images, which are not ours, have been given the permission for re-publication attached with the manuscript.
- Ethical Clearance: The project was approved by the local ethical committee in Gulistan State University.

Author's contributions statement:

Affiliation of corresponding author: Z.M.M- came up with the presented idea. Z.M.M., K.B.K., N.A.M., S.R.N., S.S.A. carried out expeditions in the specified direction and delivered materials. Z.M.M and K.B.K observed the lifestyle of objects in natural conditions. Z.M.M, N.A.M and S.R.N studied the anatomical properties of the materials. Z.M.M, K.B.K and S.S.A performed the statistical analysis of the biological and conchological data collected in the research. C.B.E voluntarily disclaimed authorship of the manuscript. All other authors discussed the results and contributed to the final manuscript.

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الخصائص البيولوجية لLeucozonella retteri

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سيتفيلي س.عبدوراشيتوف

قسم الأحياء ، كلية العلوم الطبيعية ، جامعة ولاية جولستان ، جولستان ، أوزبكستان.

الخلاصة:
الهدف من البحث هو دراسة علم الأحياء ودورات الحياة وتوزيع وهيكل العضو التناسلي لـ Leucozonella retteraفي الظروف الطبيعية . يتم استخدام طرق علم الحيوان والمالاكولوجيا في العمل .تم جمع المواد وفقًا لـ .A.Aطريقة شيليكو .وفقًا لنتائج الدراسات التي تم إجراؤها ، تجلت الاختلافات بين Leucozonella retteriوالأنواع الأخرى في بنية العضو التناسلي في ما يلي .الجزء السفلي من الحيوانات المنوية مستقيم ، والمبيض منحني قليلاً .وسادة المخلب هي 8، وتقع في 2 × 4أوضاع .القلم هو كروي كبير .المهبل أسطواني ، طوله 6-5مرات أكبر من العرض .القضيب كبير ومحدب.
في الظروف الطبيعية ، لوحظ وضع بيض الرخويات عند متوسط درجة حرارة هواء 19-17درجة مئوية ، رطوبة هواء 80-70٪ .في Leucozonella Retter، كان التباين السكاني أكثر وضوحًا من التباين الحيوي .تمت دراسة علم الأحياء وتوزيع أنواع Leucozonella retteriفي الظروف الطبيعية لإقليم أوزبكستان لأول مرة.
وجد أن الأنواع Leucozonella retteriلها تباين كبير في المؤشرات الكمية ، أي الأحجام المورفومترية ، مقارنة بالتنوع النوعي للعلامات المورفولوجية للدم.
أظهرت نتائج البحث أنه في المناخ الجاف ، تتجلى تقلبات جميع علامات القشرة اعتمادًا على الموطن.

الكلمات المفتاحية: الجماع ، دورة الحياة ، السكان ، الأعضاء التناسلية ، التباين ، الزيروبيونت.