



BIOLOGICAL PROPERTIES OF THE TERRESTRIAL MOLLUSK XEROPICTA CANDAHARICA (L.PFEIFFER, 1846)

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ABSTRACT

*The article analyzes data on the general, seasonal and sexual activity of the terrestrial mollusk *Xeropicta candaharica*. As a result of studying the activity of this species of mollusk in natural and laboratory conditions, the following was determined. The general activity of *X. candaharica* mollusks in the spring period was observed at air temperatures from +5°C to +23°C and relative humidity from 45% to 100%, sexual activity was observed at air temperatures from +5°C to +19°C, relative humidity from 55% to 95%, and the egg-laying process was observed at air temperatures from +1°C to +21°C, relative humidity from 63% to 90%. The development period of eggs in the natural environment lasted 11-16 days and depended on air temperature. At an average daily air temperature of +12°C, the eggs developed for 15-16 days, and at +14°C for 11-13 days. In laboratory conditions, at an average daily air temperature of +15.5°C, the eggs developed for 18-20 days.*

Introduction: Data on the biology, ecology and variability of conchological characters of the terrestrial mollusk *Xeropicta candaharica* were first presented in the works of K.S.Samadov [14], later A.A.Schileyko [15], A.Pazilov, M.Saidov, Z.Pazilova [13]. Despite the fact that this species has been studied by many scientists, some of its biological, ecological and ethological features have not yet been sufficiently studied. In particular, the developmental characteristics of this species in the laboratory and natural environment in relation to climatic factors have not yet been determined. For this purpose, the biological characteristics of *X. candaharica* were studied simultaneously in the laboratory and in the natural environment.

Research object and applied methods

The terrestrial mollusk *Xeropicta candaharica*, which is widespread in Central Asia, was selected as the research object for this work.

The methods of I.M.Likharev and E.S.Rammelmeyr [11], A.A.Schileyko [15, 16] were used to collect terrestrial mollusks *Xeropicta candaharica*, and the methods of I.M.Likharev and A.Ya.Viktor [12] were used to fix them. The methods of I.M. Likharev [10] and A.A.Schileyko [15] were used to study the anatomical structure of mollusks.

Anatomical tweezers were used for individuals with large shells, and soft tweezers were used for mollusks with small shells.

In the field, the usual fixation of *Xeropicta candaharica* terrestrial mollusks takes 24-48 hours. Of course, this is somewhat inconvenient. Therefore, in order to save time, we used the method of R.Ya.Bratchik [1]. In this method, the mollusks are placed in a water bath for 40-50 minutes and the temperature is gradually increased to 70°C. After that, the mollusks are transferred to 70% alcohol. That is, using this method, it is possible to completely fix the mollusks within 1-1.5 hours.

The fixed material was then morphologically and anatomically studied in the laboratory under an MBS-9 binocular microscope. The dimensions of the shells were measured using a caliper with an accuracy of 0.1 mm, and in some cases, an ocular ruler was used.

Results and their analysis

As a result of our many years of scientific research, a number of important data on the terrestrial mollusk *Xeropicta candaharica* were obtained [2-9].

In particular, despite living in an arid environment, *X. candaharica*, like all terrestrial mollusks, is hygrophilous. This can be explained by the fact that it is active during rainy periods, that is, in early spring and late autumn. During rainy periods, they not only lead an active life, but also lay eggs and reproduce. The general period of activity of mollusks can be divided into two: spring and autumn periods. The intervals between these periods are occupied by summer and winter hibernation periods.

In this article, we will focus only on the spring period of activity. The spring period of activity begins in the last month of winter, mid-February. At this time, the snow melts and the air temperature rises. When the air temperature reaches +5°C, the mollusks begin to emerge from hibernation (Figure 1).



Figure 1. Moving *Xeropicta candaharica* mollusk

Like all xerobiont mollusks, *Xeropicta candaharica* is nocturnal. For this reason, in their general and sexual activity, the air temperature after 19⁰⁰ late is the main place. Paired mollusks usually come in different sizes and dimensions. The largest of them has a shell with 5 whorls, a large diameter of 11.2 mm, and a weight of 262 mg. The smallest has 4.25 whorls, a large diameter of 7.5 mm, and a weight of 93 mg.

Thus, *Xeropicta candaharica* mollusks are considered sexually mature when their shell has 4.25 whorls and a weight of 90 mg. At this time, the weight of paired mollusks can differ from each other by up to 3 times. Usually, paired mollusks are found on the surface of the earth or on the leaves of various plants, with their shell mouths tightly attached to each other (Figure 2).

The bodies of mollusks mating on the surface of the earth are completely retracted into the shell. Mated mollusks on plant leaves, on the other hand, cling to it with the tip of one of their legs. In some cases, we observed mated mollusks hanging on a thread of mucus on plants. This phenomenon was more pronounced during the autumn period of activity. Mating while hanging was also observed in some representatives of the subgenus *Limax* s. str. of the slime molds [7]. Considering that naked slugs originated from shelled slugs, it can be concluded that this feature was also inherited from shelled slugs.

After 1–2 days of mating, the egg-laying period begins. Of course, such a short period is not enough for the formation of eggs. Therefore, it can be assumed that the initial mating process of these mollusks occurred in the autumn of the previous year. This could also be based on the lacquer marks placed on the shells the previous year.

Before laying eggs, the mollusks dig an “egg chamber” with a depth of 0.5–1 cm using their legs and lay from 15 to 55 eggs in it. The egg-laying process depends on the number of eggs and lasts 5–6 hours. The newly laid eggs are round, white, translucent, and have an elastic shell. Their dimensions and weight were determined to be as follows: diameter 1.3–1.6 mm; weight 1.8–2.5 mg.



Figure 2. Paired case of *Xeropicta candaharica* mollusks.

During the spring activity period, the first spawning mollusks were detected in the first decade of March, and the last spawning mollusks were detected at the end of the second decade of April. At this time, the air temperature ranged from +1°C to +21°C. Often, a second spawning was observed some time after the first spawning (5-6 days). However, a smaller number of eggs were always laid (4-9). After the spawning process was completed, the mouth of the “egg chamber” was closed with the mollusk’s excrement. At this time, the mollusk’s excrement consisted mainly of soil. That is, it can be concluded that the mollusk ingested a

large amount of soil during the digging of the “egg chamber”. Excrement consisting of soil, compared to ordinary excrement, completely blocks sunlight and creates better conditions for the development of eggs.

The development period of eggs lasts 11-16 days and depends on the air temperature. At an average daily air temperature of +12°C, the eggs developed for 15-16 days, and at +14°C for 11-13 days. In laboratory conditions (in an unheated room) at an average daily temperature of +15.5°C, the eggs developed for 18-20 days. It is clear that the embryonic development of eggs in laboratory conditions lasted 3-4 days longer than in the natural environment. This is due to the daytime air temperature in both environments. While in laboratory conditions the daytime air temperature did not rise above +20°C, in the natural environment it reached +27°C on some days. The average daily high temperature in laboratory conditions is explained by a difference between day and night temperatures of 1°C to 3°C, and in natural environments by a difference of 3°C to 13°C.

After the first decade of April, no sexual activity was observed in mollusks. The general activity of mollusks continued until the end of May. From this time on, they begin to hibernate by climbing the stems and leaves of various grasses, trees (1.5-2 m). During this period, they form “bunches” of 20 to 40 pieces on the stems of various plants (Fig. 3).

Before hibernation, these mollusks form a multi-layered epiphragm membrane. Often, the epiphragm membranes are 2-layered, both of which are white in color, that is, saturated with CaCO₃. The epiphragm membrane is the main means of protecting the mollusk’s body from drying out and ensuring its breathing during hibernation. In addition, the first epiphragm membrane firmly adheres the mollusk to the stems, branches and leaves of plants. In some cases, mollusks with a 3-layered epiphragmatic membrane saturated with CaCO₃ are also found. In this case, the inner 3rd membrane is often hardened by the mollusk’s excrement. That is, as the mollusk is pulled into the inner part of the shell during the formation of the 3rd membrane, its body is compressed to a certain extent and any excrement residues in its intestines are expelled. In addition, some mollusks have thin, transparent one- or two-layer epiphragmatic membranes between the 1st and 2nd epiphragmatic membranes. These membranes also prevent the mollusk's body from drying out to a certain extent.





Figure 3. *Xeropicta candaharica* mollusc “bunch” at the base of the plants

As a result of our observations, it became clear that the mollusks of this species climb up the stems of plants and form “bunches” for two reasons. In the first case, under the influence of long-term rains, they climb up the stems of plants to avoid the strong moisture formed on the surface of the earth, and in the second case, they form “bunches” on the stems of plants to avoid the strong heating of the earth’s surface during the drought season. The first case is short-term, and the mollusks do not form epiphragm curtains, but after a while they return to the surface. In the second case, the mollusks form epiphragm curtains and go into a long-term summer hibernation.

Conclusion

In conclusion, it can be said that the general activity of *X. candaharica* mollusks in the spring period was manifested in the range of air temperatures from +5°C to +23°C and relative humidity from 45% to 100%. The sexual activity of mollusks was observed in the air temperature range from +5°C to +19°C, relative humidity from 55% to 95%, and the egg-laying process was observed in the air temperature range from +1°C to +21°C, relative humidity from 63% to 90%.

Based on the above data, it can be said that the most favorable period for the reproduction, egg-laying and development of *Xeropicta candaharica* mollusks is the period of spring activity.

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