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Przyczynki do poznania rodziny *Lymnaeidae*. II i III.

Contributions to the study of the Family *Lymnaeidae*. II and III.

II.

O kilku błotniarkach ałtajskich.

Some new data to the knowledge of the Altai *Lymnaeae* [1]).

Mr B. N. Schwanwitsch has kindly delivered me for study the *Lymnaeae* collected by him in summer, 1916, from the lake Markokul in the Altai mountains. According to the information concerning the place, where they were captured, given by B. N. Shwanwitsch, „the lake Markokul is about 37 km. long and 16 km. wide. The depth is, according to Sapojnikov, about 80 feet (24,4 m) and according to Sedelnikov — 105 feet (32 m). The height above sea level, according to Sapojnikov, 2000 m., and according to Sedelnikov — 4616 ft. (1407 m.). The molluscs were taken on the western shore of the lake, some dozens of metres from the source of the riv. Kaldgir. The shore is at this place slopy, the bed stony with slime. A good

[1]) This paper was together with part I of these „Contributions" read 1917 before the Academy of Sciences of Petersburg by the late prof. V. Zalenskij member of Academy, and was to be published in the „Travaux d. Labor. zool. d'Acad. Sc. Petrogr.". The great events of those years greatly delayed the, printing; the publishers changed also. This paper appears as it was written in 1917.

many water plants. The capture was made near the very shore, at a depth not exceeding 2 feet" (0,61 m).

Although the material collected has suffered considerably during the voyage, the shell being intact only in one specimen, it presents a great value, as the animals were preserved in alcohol (not empty shells), on account of which they can be treated anatomically. I am deeply indebted to B. N. Schwanwitsch for providing me with this valuable material.

The animals collected belong to two species:

1. ***Lymnaea stagnalis*** L.

Two not quite adult specimens. Notwithstanding the fact that both specimens are not yet adult and both are broken, the elongation of their shells is seen at a glance; all their characteristic features are visible in the accompanying photographs, therefore I shall abstain from describing them [Plate XXIX, fig. 1].

According to B. N. Schwanwitsch, the shore at the point, where the animals were captured, is not protected by any bar from the waves breaking against it, whereas in such a large lake they must sometimes be rather strong. As it is known, in lakes, and especially in places open to the influence of waves, *L. stagnalis* assumes a very shortened form, morpha *lacustris* Stud. Therefore the elongated shape of our specimens is worthy of special consideration. It must, however, be borne in mind that B. N. Schwanwitsch found at this point only two specimens of this species, therefore it may be possible that they have arrived there occasionally, owing to passive, or active migration.

The radula presents no special features. I can only mark that the central tooth in one of them is provided, besides the usual cuttig point, laterally with a supplementary one [Pl. XXX, f. 8].

The first lateral tooth is in booth specimens tricuspid (what was established by Dybowski (2) for the European *L. stagnalis).* Baker (1) has found in the American representatives of this species that all the lateral denticles may be bicuspid. Personally I have found in *L. stagnalis* from lake Leman that both these views are correct, i. e. in this species are encountered radulae, the first lateral tooth of which may be provided with a well developped entocone, or be devoid of it, these forms also

being connected by transitions [cp. my paper 3]. The remaining teeth are normal. Both radulae are characterized by the following formulae:

1) $\frac{19}{5—1}\ \frac{3}{4}\ \frac{4}{3}\ \frac{13}{2}\ \frac{1}{3}\ \frac{c}{2}\ \frac{1}{3}\ \frac{13}{2}\ \frac{4}{3}\ \frac{3}{4}\ \frac{19}{5—1} = 40 — 1 — 40$

2) $\frac{23}{5—2}\ \frac{2}{4}\ \frac{5}{3}\ \frac{15}{2}\ \frac{1}{3}\ \frac{c}{1}\ \frac{1}{3}\ \frac{15}{2}\ \frac{5}{3}\ \frac{2}{4}\ \frac{23}{5—2} = 46 — 1 — 46$

The Genital apparatus. The male genital duct fully corresponds to the type of *L. stagnalis* described by many authors. The proximal part of prostata is flattened and dilated, whilst the distal portion widens into a very large pyriform formation from the middle of which the vas deferens is given off [Pl. XXX fig. 6]. Both penis-sacs also correspond to the existing description: their length is as follows:

I. Penis-sac.	II. Penis-sac.
10.0 mm.	2.75 mm.
8.5 mm.	2.5 mm.

The ratio of length of the first sac to the second is about $1 : {}^1/_3$ (the measurements taken on material preserved in alcohol can never be quite exact, on account of inevitable contraction of muscles of the penis-sacs). The musculature [Pl. XXXI, fig. 10—11] of this organ varies with in the usual limits.

As it is usual in *stagnalis*, the retractor of the second penis-sac presents a branch of the retractor of the first penis-sac. The only point that can be marked here, contradictory to the data of Baker, is the fact that the protractors on the right side of one specimen [fig. 11], although present in a smaller number than in the second specimen [fig. 10] are themselves smaller and finer than the corresponding muscles in fig. 10, whereas, according to Baker (1, p. 143), they ought to be larger.

But if we turn now to the female genital duct, we shall meet here with an interesting phenomenon, which I happened to see for the first time. Namely, in this case the pyriform body („first accessory albuminiparous gland" of Baker), instead of to form as usually one whole organ, is divided into

two distinct portions separated by a deep constriction, thus assuming the appearance of two separate glands. At the first glance I thought that the posterior part of the pyriform body presented the nidamental gland („second accessory albuminiparous gland" of Baker), but I was immediately undectived, as the latter gland was normally developed (in the figure 6, Pl. XXIX. these organs are, of course, not depicted *in situ*, but separated and extended in order to render them more demonstrative). Such a division of the pyriform body by means of constriction into two parts was observed in both specimens, although in the second the posterior part was considerably smaller than the anterior.

The remaining parts of the female genital ducts are normal.

I cannot definitely decide how to explain this deviation in the form of the pyriform body. Whether it is constant for the Altai *L. stagnalis* — or has appeared only occasionally in two specimens with an abnormal development of this organ — or whether this modification is peculiar only to young forms — all these questions must remain unanswered meanwhile, on account of scantiness of material. It must be noted, however, as I shall mention below, that I had already previously encountered a similar modification in one European specimen; it should also be borne in mind that this organ is in general very variable, as I have pointed out in one of my preceding works, and I have, therefore, never used it for systematic purposes.

2. ***Radix ovata*** Drap.

This species is represented by many specimens, most of which are, however, devoid of the shell, as it had been broken. Some more or less preserved shells are showed in the photograph [Pl. XXIX fig. 4]. The radula is normal. I am giving as example the following formulae:

1) $\frac{21}{6-2}\ \frac{1}{5}\ \frac{1}{4}\ \frac{13}{3}\ \frac{c}{1}\ \frac{13}{3}\ \frac{1}{4}\ \frac{1}{5}\ \frac{21}{6-2} = 36 - 1 - 36$

2) $\frac{19}{6-3}\ \frac{2}{5}\ \frac{1}{4}\ \frac{12}{3}\ \frac{c}{1}\ \frac{12}{3}\ \frac{1}{4}\ \frac{2}{5}\ \frac{19}{6-3} = 34 - 1 - 34$

3) $\frac{22}{6-2}\ \frac{2}{4}\ \frac{13}{3}\ \frac{c}{1}\ \frac{13}{3}\ \frac{2}{4}\ \frac{22}{6-2} = 37 - 1 - 37$

The genital apparatus is not developped in many specimens, owing to strong infection by *rediae*. In the presence of an enormous number of *rediae*, which sometimes literally fill up the entire body of the mollusc, the albuminiparous gland, uterus and nidamental gland bear the aspect of a thin platelet (usually strongly pigmented), whilst the prostata forms a narrow, long body of cylindrical shape. The dimensions of the whole genital apparatus in this case are insignificant (cp. in Pl. XXX the dimensions of the genital apparatus in fig. 9 with the normal apparatus in fig. 7 representig a form of the same size). It is obvious that such an apparatus cannot function. It would be interesting to compare the histological structure of such a reduced apparatus with the normal one. Of course, various gradations are to be found between such that are reduced extremely and the normal.

The structure of the genital apparatus of non-infected specimens has clearly demonstrated that all the specimens belong to the species *R. ovata* Drap. and present the form which I have named form *B* (4). This fact is very interesting for the following reasons: *R. ovata* named by me form *A* was taken from lake Leman in Switzerland. Afterwards, in Poland (in the former „government" of Radom and in the neighbourhood of Warsaw), later in the vicinity of Petersburg and in Crimea, I found only the form *B*. On account of this the question arises: may not form *A* be regarded as a mountain morpha[1]) of form *B*. Now this question can be solved. As form *B* lives in the lake Markokul on the Altai, it is obvious that form *A* cannot be regarded as the mountain morpha of form *B*. However, I have also found form *A*, on the North (on the Murman coast), and the question has again arisen: does not form *A* present a frigid morpha? The occurence of form *B* on the Altai again gives a negative answer to this question.

27 January 1917.

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[1]) Under the term „morpha" I mean here, according to Semenov-Tjan-Šanskij (5), a taxonomical unit differing from the type in bearing non-hereditary characters.

III.

Błotniarki z Okręgu Wojska Dońskiego.

Lymnaea stagnalis and *Radix auricularia* from the Province of the Don Cossacks.

On my request Mr. B. V. Vlastov collected in summer of 1916 some *Lymnaeae* in the vicinity of Novocherkassk and delivered them to me for study, for which I am very grateful to him.

I gladly set myself to the study of two of the species delivered to me by B. Vlastov. I wished to ascertain, whether there existed any difference in the structure of the genital organs of these forms, as compared with the same forms from Middle Europe. The study of representatives of the family *Lymnaeidae* taken from as far as possible various regions gives material for the solution of the question as to how far these forms are variable in their essential characters — as such I consider the structure of the genital apparatus — and produces a stronger foundation for the limitation of the different species of this family, which is exceedingly variable as regards its shell.

All the *Lymnaeae* obtained by B. V. Vlastov belong to two species: *Lymnaea stagnalis* and *Radix auricularia*.

1. *Lymnaea stagnalis* L.

This species is represented in the collection by two conchological forms. On one hand, there are very large specimens (2 specimens measured 64 and 56 mm. in height, with 7 windings cp. Pl. XXIX fig. 5), on the other hand,—small ones (40 and 35 mm. in height, with 7 windings (Pl. XXIX fig. 2).

The former, large specimens (fig. 5) were taken from lake Borisovo, lying 3—4 km. from Novocherkassk in the floodable parts of the rivers Don, Aksai and Tuzlow. The lake is about 2 kilometers in diameter, on the bank there are overgrowths of macrophyta *Thypha, Scirpus, Sagittaria, Alisma, Ceratophyllum)*, extending from the shore to the middle of the lake on about $^1/_4$ km. The slime is black, viscous.

This kind of lake presents an ideal habitat for our species; taking into account the abundant vegetation and absence of undulation, therefore, there is nothing surprising in the fact that *L. stagnalis* reaches considerable dimensions in this lake.

The second, small form (fig. 2) was taken in an inundated pool in the floodable parts of the same rivers in the vicinity of Novocherkassk This pool is about $^1/_2$ km. long and about 12 metres wide. The depth reaches 25 cm. The bottom is covered with black slime. The water is usually turbid, owing to cattle, children etc.

The shell of these small molluscs is covered exteriorly with a black efflorescence, which is, probably, due to the turbid state of the water.

The radula in general resembles that of the same species in Middle European forms.

The following are the formulae of the radula of two large specimens:

$$1)\ \frac{22}{5—2}\ \frac{6}{3}\ \frac{21}{2}\ \frac{1}{3}\ \frac{c}{1}\ \frac{1}{3}\ \frac{21}{2}\ \frac{6}{3}\ \frac{22}{5—2} = 50 — 1 — 50$$

$$2)\ \frac{17}{5—2}\ \frac{6}{4}\ \frac{3}{3}\ \frac{21}{2}\ \frac{1}{3}\ \frac{c}{1}\ \frac{22}{2}\ \frac{3}{3}\ \frac{6}{4}\ \frac{17}{5—2} = 48 — 1 — 48$$

The following are the formulae of two small specimens:

$$3)\ \frac{20}{5—1}\ \frac{4}{3}\ \frac{15}{2}\ \frac{1}{3}\ \frac{c}{1}\ \frac{1}{3}\ \frac{2}{2}\ \frac{2}{3}\ \frac{11}{2}\ \frac{4}{3}\ \frac{20}{5—1} = 40 — 1 — 40$$

$$4)\ \frac{27}{5—2}\ \frac{1}{3}\ \frac{20}{2}\ \frac{1}{3}\ \frac{c}{1}\ \frac{1}{3}\ \frac{20}{2}\ \frac{1}{3}\ \frac{27}{5—3} = 49 — 1 — 49$$

In the formulae given above the following particulars are noteworthy: all the central teeth are monocuspid; the first lateral teeth are all tricuspid, with the exception of one tooth on one side in the second specimen, in which a certain asymmetry is obtained, as the corresponding tooth on the other side is provided with three cusps; an asymmetry is also visible in the dental formula of the third specimen, in which on one side all the lateral teeth, except the first one, are bicuspid, whereas on the

opposite side amongst them are found two tricuspid teeth; another striking feature is the great difference in the total number of teeth between the two small specimens, notwithstanding the small difference in the size of the animal itself (40—1—40 and 49—1—49), and the absence of such a difference between the second small specimen and both large ones. All this facts again confirm my opinion of the great variability of the radula in the same species.

The genital apparatus both of the small and large specimens is typical for the species *L. stagnalis*, therefore I shall not describe it. I should only mention that in one of the large specimens I have found a weakly expressed constriction in the middle of the pyriform body, resembling the constriction described in the preceding chapter in the Altai representatives of this species. In this case however, the constriction was much weaker expressed.

The following is the length of the penis-sacs in the large specimens:

I	II
22 mm.	5,5 mm.
17 mm.	5,0 mm.

In the small specimen the length of the I-st was 9 mm., II — 3,25 mm.

The variation of the muscles of both penis-sacs is represented in the accompanying figures Plate XXXI, fig. 12—13, referring to the large forms, and fig. 14 to the small.

2. ***Radix auricularia*** L.

All the specimens of this species were collected in the river Grushevka, near the Persianovka farm of Novocherkassk district. The river is at this point 6,5 m. wide, the depth near the end of the overgrowth is 1,75 m. The bottom is covered with black, viscous slime with a slight smell of hydrogen sulphite. Near the shore there are overgrowths of *Phragmites* and some *Ceratophyllum*. The water in the overgrowths is nearly stagnant. The molluscs were taken from the weeds [Pl. XXIX, fig. 3].

The radula is characteristic of *R. auricularia*. The formulae of two radulae examined are as follows:

$$1)\ \frac{22}{4-1}\ \frac{12}{3}\ \frac{c}{1}\ \frac{12}{3}\ \frac{22}{4-1} = 34 - 1 - 34.$$

$$2)\ \frac{25}{5-1}\ \frac{11}{3}\ \frac{c}{1}\ \frac{11}{3}\ \frac{25}{5-1} = 36 - 1 - 36.$$

It must be noted that in the lateral teeth there are rarely more than 4 cusps, and 5 are met only in few.

The structure of the genital apparatus is so typical for *R. auricularia*, that I could not find any deviations from the structure of this apparatus in *R. auricularia* from lake Leman and from Poland.

February 27 1917.

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EXPLANATION OF PLATES.

Plate XXIX.

Figure 1. *Lymnaea stagnalis* L. Lake Markokul (Altai Mountains).
„ 2. *Lymnaea stagnalis* L. Pool in the vicinity of Novocherkassk.
„ 3. *Radix auricularia* L. River Grushevka (Novocherkassk district).
„ 4. *Radix ovata* Drap. Lake Markokul (Altai Mountains).
„ 5. *Lymnaea stagnalis* L. Lake Borisovo (Novocherkassk district).

Plate XXX.

Figure 6. Genital apparatus of *Lymnaea stagnalis* L. (Lake Markokul). BC = bursa copulatrix; C = canal of the bursa; CP = pyriform body; NG = nidamental gland; P = prostata; U = uterus; V = = vagina; VD = vas deferens.

Figure 7. Genital apparatus of *Radix ovata* Drap. (Lake Markokul). A = albuminiparous gland.
„ 8. Teeth of Radula of *Lymnaea stagnalis* (Lake Markokul) c = = central tooth; 1—2 = first resp. second lateral tooth.
„ 9. Reduced (infection by *rediae*) genital apparatus of *Radix ovata* Drap. (lake Markokul).

Plate XXXI.

Figure 10—14. *Lymnaea stagnalis* L. Variation in muscles of male organ.
„ 10—11. Specimens from the lake Markokul.
„ 12—13. „ „ „ Borisovo.
„ 14. Specimen from the pool in the vicinity of Novocherkassk.

STRESZCZENIE.

W pracy № II autor rozpatruje muszlę, budowę tarki i narządów płciowych dwóch egzemplarzy *Lymnaea stagnalis* i wielu osobników *Radix ovata* forma *B*, pochodzących z jeziora Markokul (Ałtaj); w pracy № III omawia przedstawicieli pierwszego z wymienionych gatunków i *Radix auricularia* z okolic Nowoczerkaska.
